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NUREG-1437
Supplement 49

# Generic Environmental Impact Statement for License Renewal of Nuclear Plants

# Supplement 49

# Regarding Limerick Generating Station, Units 1 and 2

Draft Report for Comment

Office of Nuclear Reactor Regulation

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NUREG-1437
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# Generic Environmental Impact Statement for License Renewal of Nuclear Plants

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## Regarding
## Limerick Generating Station, Units 1 and 2

Draft Report for Comment

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For any questions about the material in this report, please contact Leslie Perkins, NRC Environmental Project Manager, at 1-800-368-5642, extension 2375, or by e-mail at leslie.perkins@nrc.gov

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# ABSTRACT

This draft supplemental environmental impact statement has been prepared in response to an application submitted by Exelon Generation Company, LLC (Exelon) to renew the operating license for Limerick Generating Station, Units 1 and 2 (LGS) for an additional 20 years.

This draft supplemental environmental impact statement includes the preliminary analysis that evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include natural gas combined-cycle (NGCC); supercritical pulverized coal; new nuclear; wind power; purchased power; and not renewing the license (the no action alternative).

The U.S. Nuclear Regulatory Commission's preliminary recommendation is that the adverse environmental impacts of license renewal for LGS are not great enough to deny the option of license renewal for energy planning decisionmakers. This recommendation is based on the following:

- the analysis and findings in NUREG-1437, Volumes 1 and 2, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*;
- the environmental report submitted by Exelon;
- consultation with Federal, state, and local agencies;
- the NRC's environmental review; and
- consideration of public comments received during the scoping process.

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# EXECUTIVE SUMMARY

## BACKGROUND

By letter dated June 22, 2011, Exelon Generation Company, LLC (Exelon) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue renewed operating licenses for Limerick Generating Station, Units 1 and 2 (LGS) for an additional 20-year period.

Pursuant to Title 10, Part 51.20(b)(2) of the *Code of Federal Regulations* (10 CFR 51.20(b)(2)), the renewal of a power reactor operating license requires preparation of an environmental impact statement (EIS) or a supplement to an existing EIS. In addition, 10 CFR 51.95(c) states that the NRC shall prepare an EIS, which is a supplement to the Commission's NUREG-1437, *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants*.

Upon acceptance of Exelon's application, the NRC staff began the environmental review process described in 10 CFR Part 51 by publishing a Notice of Intent to prepare a supplemental EIS (SEIS) and conduct scoping. In preparation of this SEIS for LGS, the NRC staff performed the following:

- conducted public scoping meetings on September 22, 2011, in Pottstown, Pennsylvania,
- conducted a site audit at the plant on November 7–10, 2011,
- reviewed Exelon's environmental report (ER) and compared it to the GEIS,
- consulted with other agencies,
- conducted a review of the issues following the guidance set forth in NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*, and
- considered public comments received during the scoping process.

## PROPOSED ACTION

Exelon initiated the proposed Federal action—issuing renewed power reactor operating licenses—by submitting an application for license renewal of LGS, for which the existing licenses (NPF-39 and NPF-85) will expire on October 26, 2024, and June 22, 2029, respectively. The NRC's Federal action is the decision whether or not to renew the license for an additional 20 years.

## PURPOSE AND NEED FOR ACTION

The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decisionmakers, such as state, utility, and, where authorized, Federal (other than NRC). This definition of purpose and need reflects the NRC's recognition that, unless there are findings in the safety review required by the Atomic Energy Act or findings in the National Environmental Policy Act (NEPA) environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy planning decisions of whether a particular nuclear power plant should continue to operate.

If the renewed licenses are issued, the appropriate energy-planning decisionmakers, along with Exelon, will ultimately decide if the plant will continue to operate based on factors such as the need for power. If the operating licenses are not renewed, then the facility must be shut down on or before the expiration dates of the current operating licenses, October 26, 2024, and June 22, 2029.

## ENVIRONMENTAL IMPACTS OF LICENSE RENEWAL

The SEIS evaluates the potential environmental impacts of the proposed action. The environmental impacts from the proposed action are designated as SMALL, MODERATE, or LARGE. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

- The environmental impacts associated with the issue is determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.
- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts, except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal.
- Mitigation of adverse impacts associated with the issue is considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

**SMALL:** Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

**MODERATE:** Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

**LARGE:** Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

For Category 1 issues, no additional site-specific analysis is required in this draft SEIS unless new and significant information is identified. Chapter 4 of this report presents the process for identifying new and significant information. Site-specific issues (Category 2) are those that do not meet one or more of the criteria for Category 1 issues; therefore, an additional site-specific review for these non-generic issues is required, and the results are documented in the SEIS.

Recently, the NRC approved a revision to its environmental protection regulation, 10 CFR Part 51, which governs environmental impact reviews of nuclear power plant operating license renewals. The NRC, through its rulemaking process, has completed an update and re-evaluation of the potential environmental impacts associated with the renewal of an operating license for a nuclear power reactor for an additional 20 years. A revised GEIS, which updates the 1996 GEIS, provides the technical basis for the revised rule. The revised GEIS specifically supports the revised list of NEPA issues and associated environmental impact findings for license renewal contained in Table B–1 in Appendix B to Subpart A of the revised 10 CFR Part 51. The revised rule consolidates similar Category 1 and 2 issues, changes some Category 2 issues into Category 1 issues, and consolidates some of those issues with existing Category 1 issues. The revised rule also adds new Category 1 and 2 issues.

The revised rule is expected to be published in 2013; it will become effective 30 days after publication in the *Federal Register*. Compliance by license renewal applicants will not be required until 1 year from the date of publication (i.e., license renewal environmental reports submitted later than 1 year after publication must be compliant with the new rule). Nevertheless, under NEPA, the NRC must now consider and analyze, in its license renewal SEISs, the potential significant impacts described by the revised rule's new Category 2 issues, and to the extent there is any new and significant information, the potential significant impacts described by the revised rule's new Category 1 issues.

The NRC staff has reviewed Exelon's established process for identifying and evaluating the significance of any new and significant information on the environmental impacts of license renewal of LGS. Neither Exelon nor the NRC identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. This conclusion is supported by NRC's review of the applicant's ER, other documentation relevant to the applicant's activities, the public scoping process and substantive comments raised, and the findings from the environmental site audit that the NRC staff conducted. Further, the NRC staff did not identify any new issues applicable to LGS that have a significant environmental impact. The NRC staff, therefore, relies upon the conclusions of the GEIS for all Category 1 issues applicable to LGS.

Table ES-1 summarizes the Category 2 issues applicable to LGS, if any, as well as the NRC staff's findings related to those issues. If the NRC staff determined that there were no Category 2 issues applicable for a particular resource area, the findings of the GEIS, as documented in Appendix B to Subpart A of 10 CFR Part 51, stand.

**Table ES–1. Summary of NRC Conclusions Relating to Site-Specific Impacts of License Renewal**

| Resource Area | Relevant Category 2 Issues | Impacts |
|---|---|---|
| **Land Use** | Not applicable | SMALL |
| **Air Quality** | Not applicable | SMALL |
| **Surface Water Resources** | Water use conflicts | SMALL |
| **Groundwater Resources** | Groundwater use conflicts<br>Radionuclides released to groundwater | SMALL<br>SMALL |
| **Aquatic Resources** | Not applicable | SMALL |
| **Terrestrial Resources** | Not applicable | SMALL |
| **Protected Species** | Threatened or endangered species | SMALL |
| **Human Health** | Electromagnetic fields—acute effects (electric shock)<br>Microbiological organisms (public health) | SMALL |
| **Socioeconomics** | Housing impacts<br>Public services (public utilities)<br>Offsite land use<br>Public services (public transportation)<br>Historic and archaeological resources | SMALL |
| **Cummulative Impacts** | Aquatic resources<br>Terrestrial resources<br>All other resource areas | SMALL to MODERATE<br>MODERATE<br>SMALL |

With respect to environmental justice, the NRC staff has determined that there would be no disproportionately high and adverse impacts to these populations from the continued operation of Exelon during the license renewal period. Additionally, the NRC staff has determined that no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of water, local food, fish, and wildlife.

## SEVERE ACCIDENT MITIGATION ALTERNATIVES

The NRC staff previously considered Severe Accident Mitigation Alternatives (SAMAs) for the applicant's plant in the Final Environmental Statement Related to Operation of Limerick Generating Station, Units 1 and 2, in NUREG-0974, Supplement 1. The analysis was based on the licensee's analysis in the updated probabilistic risk assessment. Because the NRC staff previously considered SAMAs for LGS, NRC regulations do not require the NRC staff to reconsider SAMAs for this license renewal proceeding. Nonetheless, the NRC must consider whether new and significant information impacts this determination in the NRC regulations, as it must for all environmental issues the NRC addresses through a generic determination in its regulations. The NRC staff has not identified any new and significant information regarding the determination in the regulations to not reconsider SAMAs for facilities that have already considered them once.

## ALTERNATIVES

The NRC staff considered the environmental impacts associated with alternatives to license renewal. These alternatives include other methods of power generation and not renewing the LGS operating license (the no action alternative). Replacement power options considered were as follows:

- natural-gas-fired combined-cycle (NGCC),
- supercritical pulverized coal (SCPC),
- new nuclear,
- wind power, and
- purchased power.

The NRC staff initially considered a number of additional alternatives for analysis as alternatives to license renewal of LGS; these were later dismissed because of technical, resource availability, or commercial limitations that currently exist and that the NRC staff believes are likely to continue to exist when the existing LGS license expires. The no action alternative by the NRC staff, and the effects it would have, were also considered.

Where possible, the NRC staff evaluated potential environmental impacts for these alternatives located both at the LGS site and at some other unspecified alternate location. Alternatives considered, but dismissed were as follows:

- solar power,
- combination alternative of wind, solar, and NGCC,
- combination alternative of wind and compressed-air energy storage (CAES),
- wood waste,
- conventional hydroelectric power,
- ocean wave and current energy,
- geothermal power,
- municipal solid waste (MSW),
- biofuels,
- oiled-fired power,
- delayed retirement,
- fuel cells,
- coal-fired integrated gasification combined-cycle (IGCC), and
- demand-side management (DSM).

The NRC staff evaluated each alternative using the same impact areas that were used in evaluating impacts from license renewal.

## RECOMMENDATION

The NRC's preliminary recommendation is that the adverse environmental impacts of license renewal for LGS are not great enough to deny the option of license renewal for energy-planning decisionmakers. This recommendation is based on the following:

- analysis and findings in the GEIS,
- ER submitted by Exelon,
- consultation with Federal, state, and local agencies,
- NRC staff's own independent review, and
- consideration of public comments received during the scoping process.

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| °C | degree(s) Celsius |
| °F | degree(s) Fahrenheit |
| AADT | average annual daily traffic |
| ac | acre(s) |
| AC | alternating current |
| ACHP | Advisory Council on Historic Preservation |
| ADAMS | Agencywide Documents Access and Management System |
| AEA | Atomic Energy Act of 1954 [Also: UK Atomic Energy Authority] |
| AEC | U.S. Atomic Energy Commission |
| AEPS | alternative energy portfolio standard |
| ALARA | as low as is reasonably achievable |
| ANSI | American National Standards Institute |
| APE | area of potential effect |
| AQCR | air quality control region |
| ATWS | anticipated transient without scram |
| BHP | Bureau of Historic Preservation |
| BMP | best management practice |
| BOL | Bureau of Laboratories |
| BTU | British thermal unit(s) |
| BTU/kWh | British thermal unit(s) per kilowatt-hour |
| BTU/lb | British thermal unit(s) per pound |
| BWR | boiling water reactor |
| CAA | Clean Air Act, as amended through 1990 |
| CAES | compressed air energy storage |
| CCS | carbon capture and storage |
| CDF | core damage frequency |
| $C_{eq}$/kWh | carbon equivalent per kilowatt-hour |
| CEQ | Council on Environmental Quality |
| CFR | *Code of Federal Regulations* |
| cfs | cubic feet per second |
| cm | centimeter(s) |
| cm/s | centimeter(s) per second |
| CO | carbon monoxide |

| | |
|---|---|
| $CO_2$ | carbon dioxide |
| CPI | Containment Performance Improvement |
| CRGIS | Cultural Resources Geographic Information System |
| CS | candidate species |
| CSAPR | Cross-State Air Pollution Rule |
| CSP | concentrated solar power |
| CT | combustion turbine |
| CWA | Clean Water Act of 1972 |
| dB | decibels |
| dBA | decibels adjusted |
| DBA | design basis accident |
| DC | direct current |
| DMR | Discharge Monitoring Report |
| DOE | U.S. Department of Energy |
| DRBC | Delaware River Basin Commission |
| DSEIS | draft supplemental environmental impact statement |
| DSM | demand-side management |
| DVRPC | Delaware Valley Regional Planning Commission |
| DWS | drinking water standard |
| EO | Executive Order |
| EFH | Essential Fish Habitat |
| EIA | Energy Information Administration (of DOE) |
| EIS | environmental impact statement |
| ELF EMF | extremely low-frequency electromagnetic field |
| EMS | environmental management system |
| EPA | U.S. Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right-to-Know Act of 1986 |
| EPRI | Electric Power Research Institute |
| EPT | Ephemeroptera, Plecoptera, and Trichoptera |
| ER | Environmental Report |
| ESA | Endangered Species Act of 1973, as amended |
| Exelon | Exelon Generation Company, LLC |
| FE | Federally endangered |
| FENOC | First Energy Nuclear Operating Company |
| FES | final environmental statement |

| | |
|---|---|
| fps | feet per second |
| FR | *Federal Register* |
| FSAR | final safety analysis report |
| FT | threatened |
| ft | foot (feet) |
| $ft^3$ | cubic foot (feet) |
| FW | feedwater |
| FWCA | Fish and Wildlife Coordination Act |
| FWS | U.S. Fish and Wildlife Service |
| g | gram(s) |
| gal | gallon(s) |
| GE | General Electric |
| GEIS | *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG–1437 |
| GHG | greenhouse gas |
| GIC | Green-is-Clean |
| gpd | gallons per day |
| gpm | gallons per minute |
| GW | groundwater |
| ha | hectare(s) |
| Hg | mercury |
| HLSA | high-level storage area |
| Hz | hertz |
| IAEA | International Atomic Energy Agency |
| IEEE | Institute of Electrical and Electronics Engineers, Inc. |
| IGCC | integrated gasification combined-cycle |
| in. | inch(es) |
| IPE | Individual Plant Examination |
| IPEEE | Individual Plant Examination of External Events |
| ISFSI | Independent Spent Fuel Storage Installation |
| ISO | International Organization for Standardization |
| kg | kilogram(s) |
| km | kilometer(s) |
| $km^2$ | square kilometer(s) |
| kV | kilovolt(s) |

| | |
|---|---|
| kW | kilowatt(s) |
| kWh | kilowatt-hour(s) |
| L/min | liter(s) per minute |
| lb | pound(s) |
| LEFM | Leading Edge Flow Meter |
| LGS | Limerick Generating Station, Units 1 and 2 |
| LLMW | low-level mixed waste |
| LLRW | low-level radioactive waste |
| m | meter(s) |
| m/s | meter(s) per second |
| $m^2$ | square meter(s) |
| $m^3$ | cubic meter(s) |
| $m^3/s$ | cubic meters per second |
| mA | milliampere(s) |
| MACCS2 | MELCOR Accident Consequence Code System 2 |
| MAIS | macroinvertebrate aggregated index for streams |
| MassDEP | Massachusetts Department of Environmental Protection |
| MATS | Mercury and Air Toxics Standards |
| MBTA | Migratory Bird Treaty Act of 1918 |
| MCPC | Montgomery County Planning Commission |
| MDPH | Massachusetts Department of Public Health |
| MF | migratory fishes |
| mg/L | milligrams per liter |
| mgd | million gallons per day |
| mGy | million gallons per year |
| mi | mile(s) |
| $mi^2$ | square mile(s) |
| min | minute(s) |
| mm | millimeter(s) |
| MMI | Modified Mercalli Intensity |
| MMPA | Marine Mammal Protection Act of 1972 |
| mph | mile(s) per hour |
| mrad | milliradiation absorbed dose |
| mrem | milliroentgen equivalent man |

| | |
|---|---|
| MSA | Magnuson–Stevens Fishery Conservation and Management Act, as amended through 2006 |
| MSL | mean sea level |
| mSv | millisievert |
| MSW | municipal solid waste |
| MUR | measurement uncertainty recapture |
| MT | metric ton(s) |
| MW | megawatt(s) |
| MWd | megawatt-day(s) |
| MWd/MTU | megawatt-day(s) per metric ton of uranium |
| MWe | megawatt(s) electrical |
| MWt | megawatt(s) thermal |
| NA | not applicable |
| NAAQS | National Ambient Air Quality Standards |
| NASS | National Agricultural Statistics Service |
| NAS | National Academy of Sciences |
| NEPA | National Environmental Policy Act of 1969 |
| NERC | North American Electric Reliability Corporation |
| NESC | National Electrical Safety Code |
| NETL | National Energy Technology Laboratory |
| NGCC | natural-gas-fired combined-cycle |
| NHPA | National Historic Preservation Act of 1966, as amended |
| NIEHS | National Institute of Environmental Health Sciences |
| NMFS | National Marine Fisheries Service (of NOAA) |
| NOAA | National Oceanic and Atmospheric Administration |
| $NO_x$ | nitrogen oxide(s) |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | National Park Service |
| NRC | U.S. Nuclear Regulatory Commission |
| NRCS | National Resources Conservation Service |
| NRHP | National Register of Historic Places |
| NRR | Office of Nuclear Reactor Regulation |
| NUREG | NRC technical report designation (Nuclear Regulatory Commission) |
| NWS | National Weather Service |

| | |
|---|---|
| $O_3$ | ozone |
| OCA | Owner-Controlled Area |
| ODCM | Offsite Dose Calculation Manual |
| PADEP | Pennsylvania Department of Environmental Protection |
| PAH | polycyclic aromatic hydrocarbon |
| Pb | lead |
| PBAPS | Peach Bottom Atomic Power Station |
| PCBs | polychlorinated biphenyl |
| pCi/L | picocuries per liter |
| PDCNR | Pennsylvania Department of Conservation and Natural Resources |
| PE | Pennsylvania endangered |
| PECO | PECO Energy Company, the energy delivery subsidiary of Exelon Corporation serving retail customers in southeastern Pennsylvania (also used in this report as an acronym for Philadelphia Electric Company or PECO Energy Company, predecessors of Exelon Generation) |
| PFBC | Pennsylvania Fish and Boating Commission |
| PGA | peak ground acceleration |
| PGC | Pennsylvania Game Commission |
| PJM | PJM Interconnection, LLC |
| PM | particulate matter |
| $PM_{10}$ | particulate matter >2.5 microns and ≤10 microns in diameter |
| $PM_{2.5}$ | particulate matter ≤2.5 microns in diameter |
| PNDI | Pennsylvania Natural Diversity Inventory |
| PNHP | Pennsylvania Natural Heritage Program |
| PNNL | Pacific Northwest National Laboratory |
| POST | Parliamentary Office of Science and Technology |
| PPC | Preparedness, Prevention, and Contingency |
| PR | rare |
| PSD | Prevention of Significant Deterioration |
| psia | pounds per square inch absolute |
| PV | photovoltaic |
| PWR | pressurized water reactor |
| RCA | radiological control area |
| RCRA | Resource Conservation and Recovery Act of 1976, as amended |
| REMP | radiological environmental monitoring program |

| | |
|---|---|
| REOP | Radiological Environmental Operation |
| RERS | reactor enclosure recirculation system |
| RGPP | Radiological Groundwater Protection Program |
| RKm | river kilometer |
| RM | river mile |
| RMC | RMC-Environmental Services |
| ROI | region of influence |
| ROW(s) | right(s)-of-way |
| RPS | renewable portfolio standard |
| RSP | radwaste storage pad |
| RWCU | reactor water cleanup |
| SAMA | Severe Accident Mitigation Alternative |
| SAMDA | Severe Accident Mitigation Design Alternative |
| SAMGs | Severe Accident Mitigation Guidelines |
| SAR | safety analysis report |
| SCR | selective catalytic reduction |
| SCPC | supercritical pulverized coal |
| SE | state endangered |
| SEIS | supplemental environmental impact statement |
| SER | safety evaluation report |
| SGTS | standby gas treatment system |
| SHPO | State Historic Preservation Officer |
| SIP | State Implementation Plan |
| $SO_2$ | sulfur dioxide |
| $SO_x$ | sulfur oxide(s) |
| SPCC | Spill Prevention Control and Countermeasure |
| SR | State rare |
| SSCs | structures, systems, and components |
| SSC | species of special concern |
| SSE | safe-shutdown earthquake |
| ST | state threatened |
| STG | steam turbine generator |
| State | Commonwealth of Pennsylvania (or other state if specified) |
| Stroud | Stroud Water Research Center |
| Sv | sievert |

| | |
|---|---|
| SW | surface water |
| SWPPP | Stormwater Pollution Prevention Plan |
| TLD | thermoluminescent dosimeters |
| TMDL | total maximum daily upload |
| TMI | Three Mile Island |
| tpy | ton(s) per year |
| TSF | stocked trout |
| TSP | total suspended particles |
| TWh | terawatt-hour(s) |
| U | uranium |
| U.S. | United States |
| U.S.C. | United States Code |
| UFSAR | updated final safety analysis report |
| USACE | U.S. Army Corps of Engineers |
| USCB | U.S. Census Bureau |
| USDA | U.S. Department of Agriculture |
| USGCRP | United States Global Change Research Program [or GCRP] |
| USGS | U.S. Geological Survey |
| VOC | volatile organic compound |
| WEC | wave energy conversion |
| WHC | Wildlife Habitat Council |
| WWF | warm water fishes |

# 1.0 PURPOSE AND NEED FOR ACTION

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51)—which carry out the National Environmental Policy Act (NEPA)—renewal of a new nuclear power plant operating license requires the preparation of an environmental impact statement (EIS).

The Atomic Energy Act of 1954 (AEA) originally specified that licenses for commercial power reactors be granted for up to 40 years. The 40-year licensing period was based on economic and antitrust considerations rather than on technical limitations of the nuclear facility.

The decision to seek a license renewal rests entirely with nuclear power facility owners and, typically, is based on the facility's economic viability and the investment necessary to continue to meet NRC safety and environmental requirements. The NRC makes the decision to grant or deny license renewal based on whether the applicant has demonstrated that the environmental and safety requirements in the agency's regulations can be met during the period of extended operation.

## 1.1. Proposed Federal Action

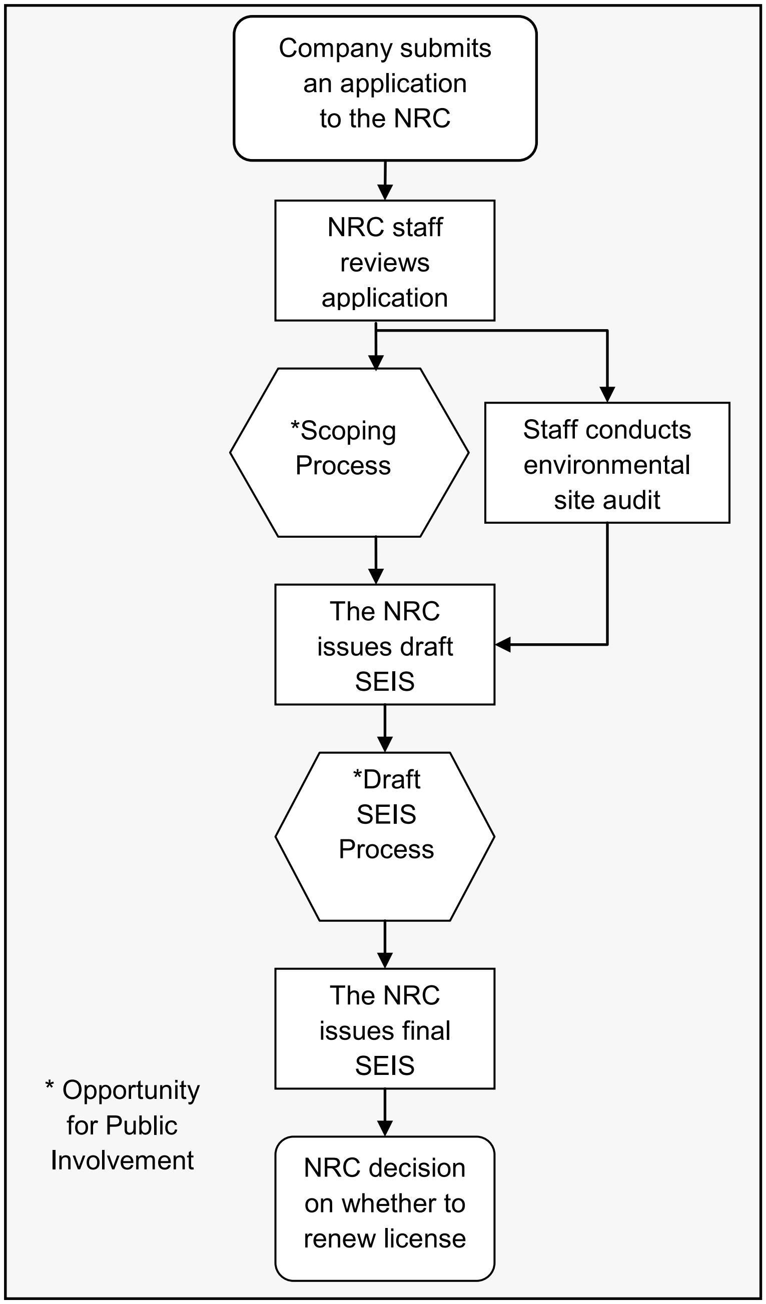
Exelon Generation Company, LLC (Exelon) initialized the proposed Federal action by submitting an application for license renewal of Limerick Generating Station, Units 1 and 2 (LGS), for which the existing licenses (NPF-39 and NPF-85) expire on October 26, 2024, and June 22, 2029. The NRC's Federal action is to decide whether to renew the license for an additional 20 years.

## 1.2. Purpose and Need for the Proposed Federal Action

The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by other energy-planning decisionmakers. This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of state regulators and utility officials as to whether a particular nuclear power plant should continue to operate.

If the renewed license is issued, state regulatory agencies and Exelon will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the state's jurisdiction or the purview of the owners. If the operating license is not renewed, then the facility must be shut down on or before the expiration date of the current operating licenses—October 26, 2024, and June 22, 2029.

**Figure 1–1. Environmental Review Process**




## 1.3. Major Environmental Review Milestones

Exelon submitted an Environmental Report (ER) (Exelon 2011b) as part of its license renewal application (Exelon 2011a) on June 22, 2011. After reviewing the application and ER for sufficiency, the staff published a *Federal Register* Notice of Acceptability and Opportunity for Hearing (76 FR 52992) on August 24, 2011. Then, on August 26, 2011, the NRC published another notice in the *Federal Register* (76 FR 53498) on the intent to conduct scoping, thereby beginning the 60-day scoping period.

Two public scoping meetings were held on September 22, 2011, in Pottstown, Pennsylvania (NRC 2011). The comments received during the scoping process are presented in “Environmental Impact Statement, Scoping Process, Summary Report,” published in February 2013 (NRC 2013). The scoping process summary report presents NRC responses to comments that the NRC staff considered to be out-of-scope of the environmental license renewal review. The comments considered to be within the scope of the environmental license renewal review and the NRC responses are presented in Appendix A of this supplemental environmental impact statement (SEIS).

To independently verify information provided in the ER, NRC staff conducted a site audit at LGS in November 2011. During the site audit, NRC staff met with plant personnel, reviewed specific documentation, toured the facility, and met with interested Federal, state, and local agencies. A summary of that site audit and the attendees is contained in “Summary of Site Audit in Support to the Environmental Review of the License Renewal Application for Limerick Generating Station, Units 1 and 2,” published May 21, 2012 (NRC 2012a).

Upon completion of the scoping period and site audit, NRC staff compiled its findings in a draft SEIS (Figure 1–1). This document is made available for public comment for 75 days. During this time, NRC staff will host public meetings and collect public comments. Based on the information gathered, the NRC staff will amend the draft SEIS findings, as necessary, and publish the final SEIS.

The NRC has established a license renewal process that can be completed in a reasonable period of time with clear requirements to ensure safe plant operation for up to an additional 20 years of plant life. The safety review, which documents its finding in a safety evaluation report, is conducted simultaneously with the environmental review. The findings in both the SEIS and the safety evaluation report are factors in the Commission’s decision to either grant or deny the issuance of a renewed license.

## 1.4. Generic Environmental Impact Statement

The NRC performed a generic assessment of the environmental impacts associated with license renewal to improve the efficiency of the license renewal process. The *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants*, NUREG-1437 (GEIS) documented the results of the NRC staff’s systematic approach to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. NRC staff analyzed in detail and resolved those environmental issues that could be resolved generically in the GEIS.

The GEIS establishes 92 separate issues for NRC staff to independently verify. Of these issues, NRC staff determined that 69 are generic to all plants (Category 1) while 21 issues do not lend themselves to generic consideration (Category 2). Two other issues remained uncategorized; environmental justice and chronic effects of electromagnetic fields, and must be evaluated on a site-specific basis. A list of all 92 issues can be found in Appendix B.

For each potential environmental issue, the GEIS:

(1) describes the activity that affects the environment,

(2) identifies the population or resource that is affected,

(3) assesses the nature and magnitude of the impact on the affected population or resource,

(4) characterizes the significance of the effect for both beneficial and adverse effects,

(5) determines if the results of the analysis apply to all plants, and

(6) considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants.

The NRC's standard of significance for impacts was established using the Council on Environmental Quality (CEQ) terminology for "significant." The NRC established three levels of significance for potential impacts: SMALL, MODERATE, and LARGE, as defined below.

**SMALL**: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

**MODERATE**: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

**LARGE**: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

**Significance** indicates the importance of likely environmental impacts and is determined by considering two variables: **context** and **intensity**.

**Context** is the geographic, biophysical, and social context in which the effects will occur.

**Intensity** refers to the severity of the impact, in whatever context it occurs.

The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted (Figure 1–2). Issues are assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet the following criteria:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics.

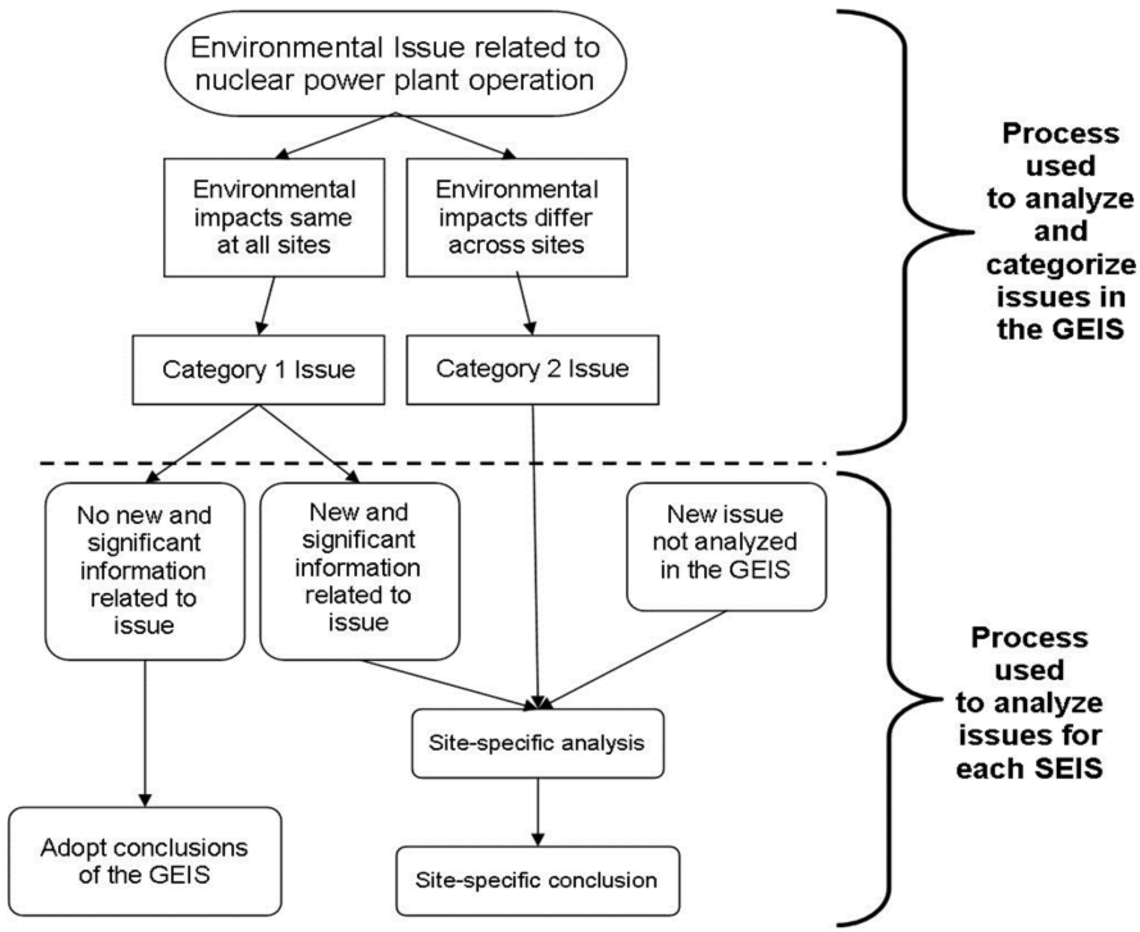
(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

For generic issues (Category 1), no additional site-specific analysis is required in this SEIS unless new and significant information is identified. The process for identifying new and significant information is presented in Chapter 4. Site-specific issues (Category 2) are those that do not meet one or more of the criteria of Category 1 issues, and therefore, additional site-specific review for these issues is required. The results of that site-specific review are documented in the SEIS.

**Figure 1–2. Environmental Issues Evaluated during License Renewal**

*The NRC staff initially evaluated 92 issues in the GEIS. Based on the findings of the GEIS, a site-specific analysis is required for 23 of those 92 issues.*




On December 6, 2012, the Commission affirmed a decision to publish in the *Federal Register* an amendment that would revise its environmental protection regulation, 10 CFR Part 51, which governs environmental impact reviews of nuclear power plant operating license renewals (NRC 2012b). Specifically, the revised rule will update and reevaluate the potential environmental impacts associated with the renewal of an operating license for a nuclear power reactor for an additional 20 years. A revised GEIS, which updates the 1996 GEIS, provides the technical basis for the revised rule. The revised GEIS specifically supports the revised list of NEPA issues and associated environmental impact findings for license renewal contained in Table B–1 in Appendix B to Subpart A of the revised 10 CFR Part 51. The revised GEIS and rule reflect lessons learned and knowledge gained during previous license renewal environmental reviews. In addition, public comments received on the draft revised GEIS and rule and during previous license renewal environmental reviews were reexamined to validate existing environmental issues and identify new ones.

The revised rule identifies 78 environmental impact issues, of which, 17 will require plant-specific analysis. The revised rule consolidates similar Category 1 and 2 issues, changes some Category 2 issues into Category 1 issues, and consolidates some of those issues with existing Category 1 issues. The revised rule also adds new Category 1 and 2 issues. The new

Category 1 issues include geology and soils, exposure of terrestrial organisms to radionuclides, exposure of aquatic organisms to radionuclides, human health impact from chemicals, and physical occupational hazards. Radionuclides released to groundwater, effects on terrestrial resources (non-cooling system impacts), minority and low-income populations (i.e., environmental justice), and cumulative impacts were added as new Category 2 issues.

The revised rule is expected to be published in 2013, and it will become effective 30 days after publication in the *Federal Register*. Compliance by license renewal applicants will not be required until 1 year from the date of publication (i.e., license renewal environmental reports submitted later than 1 year after publication must be compliant with the new rule). Nevertheless, under NEPA, the NRC must now consider and analyze, in its license renewal SEISs, the potential significant impacts described by the revised rule's new Category 2 issues and, to the extent there is any new and significant information, the potential significant impacts described by the revised rule's new Category 1 issues.

## 1.5. Supplemental Environmental Impact Statement

The SEIS presents an analysis that considers the environmental effects of the continued operation of LGS, alternatives to license renewal, and mitigation measures for minimizing adverse environmental impacts. Chapter 8 contains analysis and comparison of the potential environmental impacts from alternatives while Chapter 9 presents the staff's preliminary recommendation to the Commission on whether or not the environmental impacts of license renewal are so great that preserving the option of license renewal would be unreasonable. The recommendation includes consideration of comments received during the public scoping period.

In the preparation of this SEIS for LGS, the staff:

- reviewed the information provided in Exelon's ER,
- consulted with other Federal, state, and local agencies,
- conducted an independent review of the issues during a site audit, and
- considered the public comments received during the scoping process.

New information can be identified from a number of sources, including the applicant, the NRC, other agencies, or public comments. If a new issue is revealed, then it is first analyzed to determine if it is within the scope of the license renewal evaluation. If it is not addressed in the GEIS, then the NRC determines its significance and documents its analysis in the SEIS.

> **New and significant information** either:
>
> (1) identifies a significant environmental issue not covered in the GEIS, or
>
> (2) was not considered in the analysis in the GEIS and leads to an impact finding that is different from the finding presented in the GEIS.

## 1.6. Cooperating Agencies

During the scoping process, no Federal, state, or local agencies were identified as cooperating agencies in the preparation of this SEIS.

## 1.7. Consultations

The *Endangered Species Act of 1973*, as amended; the *Magnuson–Stevens Fisheries Management Act of 1996*, as amended; and the *National Historic Preservation Act of 1966* require that Federal agencies consult with applicable state and Federal agencies and groups prior to taking action that may affect endangered species, fisheries, or historic and archaeological resources, respectively. Below are the agencies and groups with whom the NRC consulted; Appendix D to this report includes copies of consultation documents.

- Advisory Council on Historic Preservation
- National Marine Fisheries Service
- U.S. Environmental Protection Agency, Region 3
- U.S. Fish and Wildlife Service, State College, Pennsylvania
- Absentee-Shawnee Tribe of Oklahoma
- Cayuga Nation
- Delaware Nation
- Delaware Tribe
- Eastern Shawnee Tribe of Oklahoma
- Oneida Indian Nation
- Oneida Nation of Wisconsin
- Onondaga Nation
- Seneca Nation of Indians
- Seneca-Cayuga Tribe of Oklahoma
- St. Regis Mohawk Tribe
- Shawnee Tribe
- Stockbridge-Munsee Band of the Mohican Nation of Wisconsin
- Tonawanda Seneca Nation
- Tuscarora Nation

## 1.8. Correspondence

During the course of the environmental review, the NRC staff contacted the Federal, state, regional, local, and tribal agencies listed in Section 1.7, as well as the following:

- Pennsylvania Fish & Boat Commission
- Pennsylvania Game Commission
- Pennsylvania Historical and Museum Commission
- Pennsylvania Department of Conservation and Natural Resources

Appendix E contains a chronological list of all the documents sent and received during the environmental review.

A list of persons who received a copy of this SEIS is provided in Chapter 11.

## 1.9. Status of Compliance

Exelon is responsible for complying with all NRC regulations and other applicable Federal, state, and local requirements. A description of some of the major Federal statutes can be found in Appendix H of the GEIS. Appendix C to this SEIS includes a list of the permits and licenses issued by Federal, state, and local authorities for activities at LGS.

## 1.10. References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulator Activities."

76 FR 52992. U.S. Nuclear Regulatory Commission, Washington, DC, "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for Hearing Regarding Renewal of Facility Operating License Nos. NPF-39 and NPF-85 for an Additional 20-Year Period, Exelon

Generation Company, LLC, Limerick Generating Station." *Federal Register* 76(164):52992-52994, August 24, 2011.

76 FR 53498. U.S. Nuclear Regulatory Commission, Washington, DC, "Exelon Generation Company, LLC; Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process for Limerick Generating Station, Units 1 and 2." *Federal Register* 76(166):53498–53500, August 26, 2011.

Atomic Energy Act of 1954. 42 U.S.C. §2011, et seq.

Endangered Species Act of 1973, as amended. 16 U.S.C. §1531, et seq.

[Exelon] Exelon Generation Company, LLC, 2011a*. Limerick Generating Station, Units 1 and 2—License Renewal Application*. June 2011. Agencywide Documents Access and Management System (ADAMS) Accession No. ML11179A101.

[Exelon] Exelon Generation Company, LLC, 2011b*. License Renewal Application, Limerick Generating Station, Units 1 and 2, Appendix E, Applicant's Environmental Report, Operating License Renewal Stage.* ADAMS Accession No. ML11179A104.

Magnuson–Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996. 16 U.S.C 1855, et seq.

National Environmental Policy Act of 1969, as amended. 42 U.S.C. §4321, et seq.

National Historic Preservation Act of 1966. 16 U.S.C. §470, et seq.

[NRC] U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Volumes 1 and 2. Washington, DC. May 1996. ADAMS Accession Nos. ML040690705 and ML040690738.

[NRC] U.S. Nuclear Regulatory Commission. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report, "Section 6.3–Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants*, Final Report, NUREG-1437, Volume 1, Addendum 1. Washington DC. August 1999. ADAMS Accession No. ML04069720.

[NRC] U.S. Nuclear Regulatory Commission. 2011. "Summary of Public Scoping Meetings Conducted on September 22, 2011, Related to the Review of the Limerick Generating Station, Units 1 and 2, License Renewal Application." September 2011. ADAMS Accession No. ML04069720.

[NRC] U.S. Nuclear Regulatory Commission. 2012a. "Summary of Site Audit Related to the Environmental Review of the License Renewal Application for Limerick Generating Station, Units 1 and 2." May 21, 2012. ADAMS Accession No. ML12124A127.

[NRC] U.S. Nuclear Regulatory Commission. 2012b. Staff Requirements, SECY-12-0063 – Final Rule: Revisions to Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (10 CFR Part 51; RIN 3150–AI42). December 6, 2012. ADAMS Accession No. ML12341A134.

[NRC] U.S. Nuclear Regulatory Commission. 2013. "Environmental Impact Statement, Scoping Process, Summary Report," March 2013. ADAMS Accession No. ML12131A499.

# 2.0 AFFECTED ENVIRONMENT

Limerick Generating Station, Units 1 and 2 (LGS) is located in Limerick Township of Montgomery County, Pennsylvania, 1.7 miles (2.7 kilometers [km]) southeast of the Borough of Pottstown. The City of Reading is about 19 miles (30.6 km) northwest of the site and the Borough of Phoenixville is about 9.3 miles (15 km) southeast of the site. Other nearby population centers are the Municipality of Norristown, about 11 miles (17.7 km) southeast of the site, and the City of Philadelphia, the city limits of which are about 21 miles (33.8 km) southeast from the site. Figure 2–1 and Figure 2–2 present the 6-mile (10-km) and 50-mile (80-km) vicinity maps, respectively.

For the purposes of the evaluation in this supplemental environmental impact statement (SEIS), the “affected environment” is the environment that currently exists at and around LGS. Because existing conditions are at least partially the result of past construction and operation at the plant, the impacts of these past and ongoing actions and how they have shaped the environment are presented here. Section 2.1 of this SEIS describes the facility and its operation, and Section 2.2 discusses the surrounding environment.

## 2.1. Facility Description

LGS is a two-unit nuclear-powered steam electric generating facility that began commercial operation in February 1986 (Unit 1) and January 1990 (Unit 2). The nuclear reactor for each unit is a General Electric Mark II boiling water reactor (BWR) producing a reactor core rated thermal power of 3,515 megawatts (MWt). The nominal net electrical capacity is 1,170 megawatts electric (MWe). Figure 2–3 provides a general site layout of LGS.

### 2.1.1. Reactor and Containment Systems

The nuclear reactor system for each Limerick unit includes a single-cycle, forced circulation, General Electric Mark II BWR. The reactor core heats water that is dried by steam separators and dryers located in the upper portion of the reactor vessel. The steam is then directed through four main steam lines to the main turbine where it turns the turbine generator to produce electricity.

Fuel enrichment and average peak rod burnup conditions are no more than 5 percent uranium-235 and 62,000 megawatt-days per metric ton of uranium (MWd/MTU), respectively. LGS operates on a 24-month refueling cycle.

The reactor and related systems are enclosed in primary and secondary containments. The primary containment surrounds the reactor vessel and also houses the reactor coolant recirculation pumps and piping loops. The secondary containment is the structure that encloses the reactor’s primary containment and spent fuel storage pool areas. The primary containment is a steel-lined reinforced concrete pressure-suppression system of the over-and-under configuration. The secondary containment system is a reinforced concrete building and is designed to minimize the release of airborne radioactive materials under accident conditions.

### 2.1.2. Radioactive Waste Management

The radioactive waste systems collect, treat, and dispose of radioactive and potentially radioactive wastes that are byproducts of LGS operations. The byproducts are activation products associated with nuclear fission, reactor coolant activation, and noncoolant material activation. Release of liquid and gaseous effluents are controlled to meet the limits specified in

Title 10, *Code of Federal Regulations* (CFR) Part 20 and 10 CFR Part 50, Appendix I, through the Radioactive Effluent Controls Program defined in the LGS technical specifications (Exelon 2011a). Operation procedures for the radioactive waste system ensure that radioactive wastes are safely processed and discharged from the LGS. The systems are designed and operated to ensure that the quantities of radioactive materials released from LGS are as low as is reasonably achievable (ALARA) and within the dose standards set forth in 10 CFR Part 20, "Standards for protection against radiation," and Appendix I to 10 CFR Part 50, "Domestic licensing of production and utilization facilities." The LGS Offsite Dose Calculation Manual (ODCM) contains the methods and parameters used to calculate offsite doses resulting from radioactive effluents. These methods are used to ensure that radioactive material discharges from the LGS meet regulatory dose standards.

Radioactive wastes resulting from LGS operations are classified as liquid, gaseous, and solid. The design and operation objectives of the radioactive waste management systems are to limit the release of radioactive effluents from LGS during normal operation and anticipated operation.

Reactor fuel that has exhausted a certain percentage of its fissile uranium content is referred to as spent fuel. Spent fuel assemblies that are removed from the reactor core are replaced with fresh fuel assemblies during routine refueling outages. Spent nuclear fuel from the reactor is stored on site in a spent fuel pool and an independent spent fuel storage installation (ISFSI) located west of the Turbine Buildings. Under 10 CFR Part 50, LGS has a general license to store spent fuel from both units in pre-approved dry storage casks in accordance with the requirements in 10 CFR Part 72, Subpart K (Exelon 2011b).

#### *2.1.2.1. Radioactive Liquid Waste*

The liquid waste-management system collects, segregates, stores, and disposes of radioactive liquid waste. The system is designed to reduce radioactive materials in liquid effluents to levels that are ALARA and reduce the volume of waste through recycling. Liquid wastes that accumulate in radwaste drain tanks or in sumps at locations throughout each LGS unit are transferred to collection tanks in the common radwaste enclosure based on the classification of waste: equipment drain, floor drain, chemical drain, or laundry drain waste. The liquid wastes are processed for packaging and offsite shipment, returned to the condensate system, or mixed with cooling-tower blowdown and released from the plant.

Wastes from the equipment drains and floor drains are processed through separate precoat filters and mixed resin bed demineralizers. The processed waste is collected in one of two sample tanks. Usually, the water from these tanks is sent to the condensate tank for reuse, but if necessary, it will be treated or discharged into the Schuylkill River with radionuclide concentrations below 10 CFR Part 20 limits.

Laboratory wastes, decontamination solutions, and other wastes that may be corrosive are collected and chemically neutralized before being sent to the floor drain system for processing.

Waste from decontamination laundry facilities is processed through the laundry filter and then collected in a sample tank.

The contamination in the liquid wastes is concentrated in filters and ion exchange resins and then sent to solid waste management for processing. The waste is stored and eventually shipped to a licensed waste disposal facility. The processed liquids are either recycled or discharged from the plant in the cooling-tower blowdown into the Schuylkill River with radionuclide concentrations below 10 CFR Part 20 limits.

1 **Figure 2–1. Location of LGS, 6-mile (10-km) vicinity**

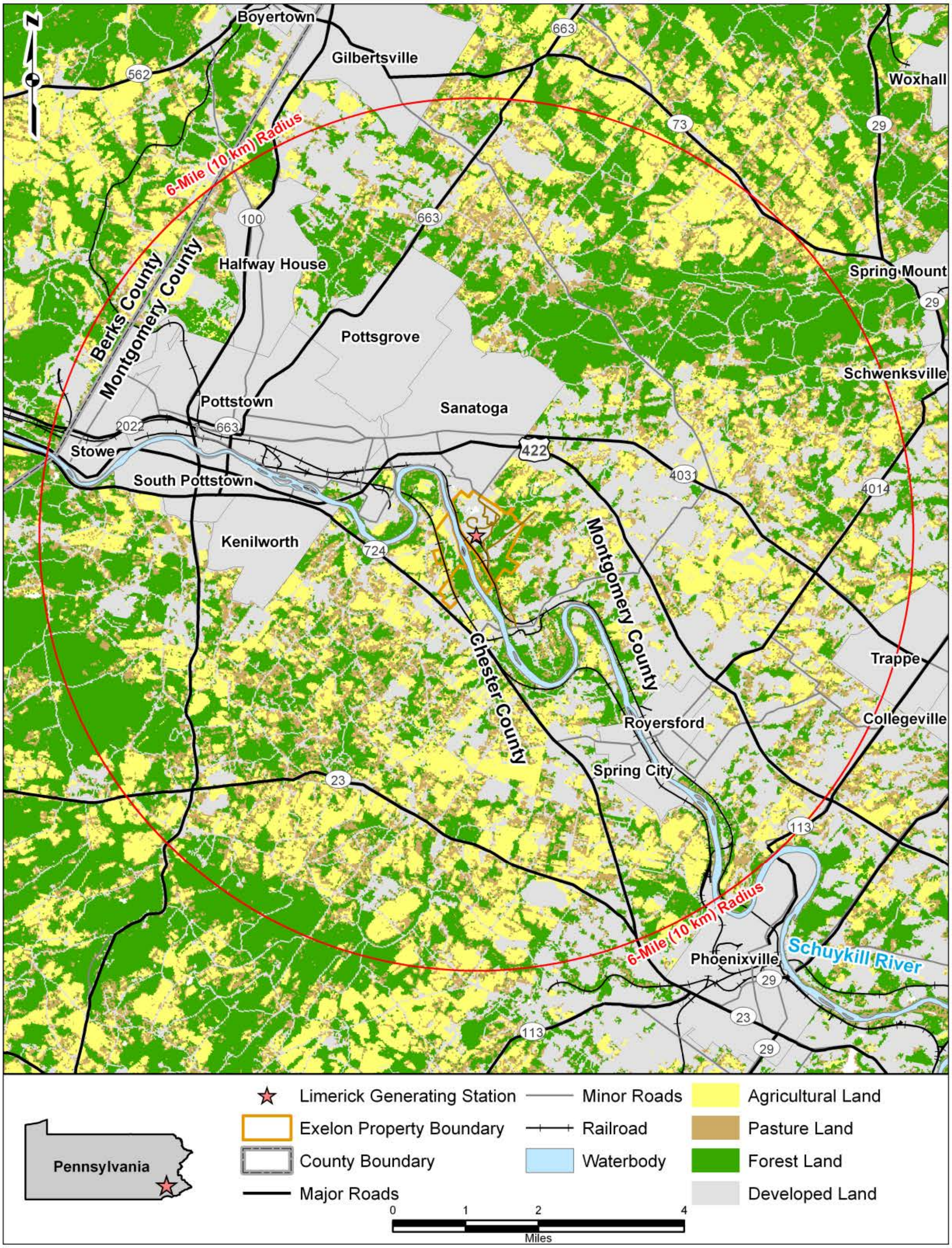
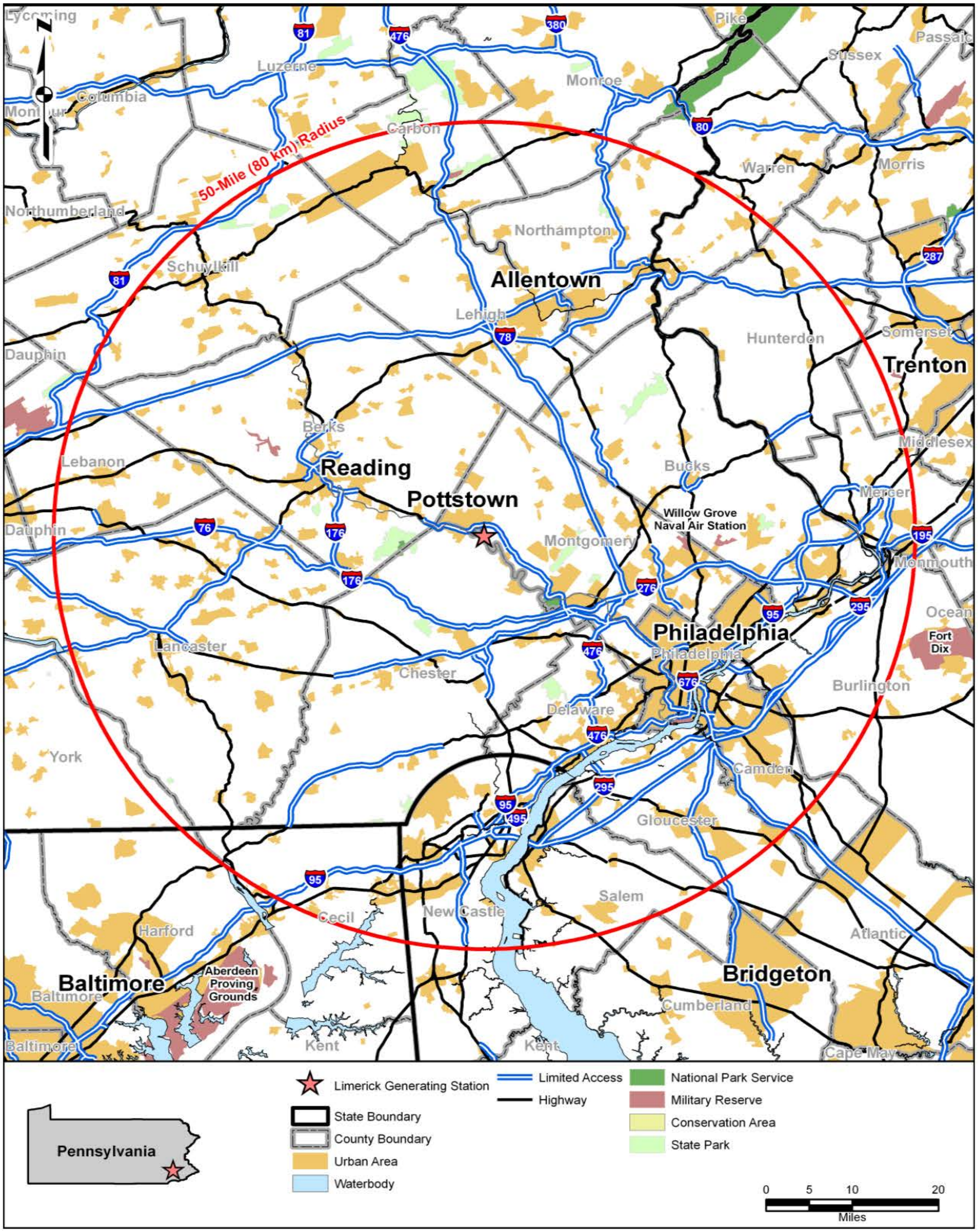
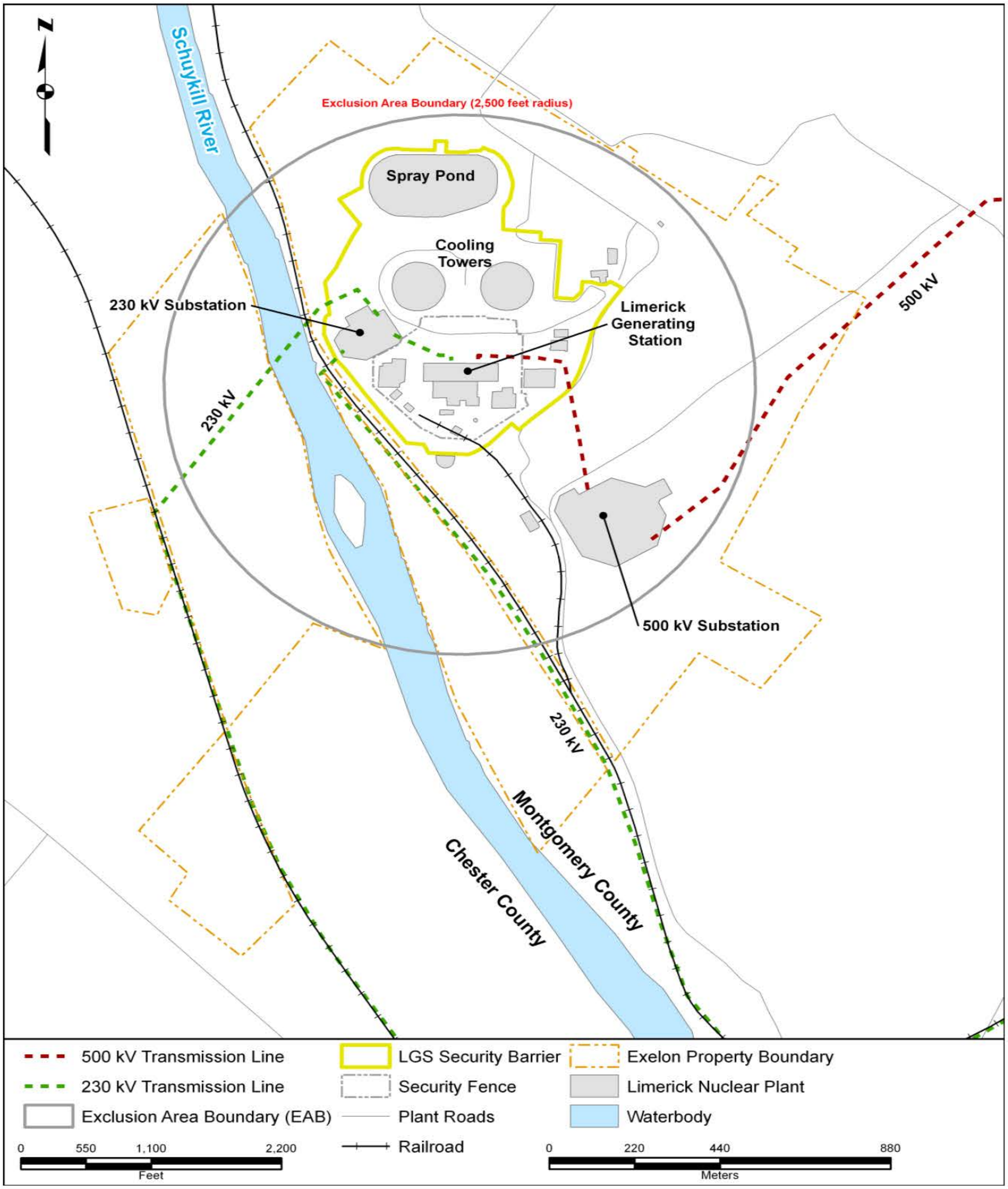


**Figure 2–2. Location of LGS, 50-mile (80-km) region**



1 **Figure 2–3. LGS site boundary and facility layout**



*2.1.2.2. Radioactive Gaseous Waste*

Gaseous waste management systems process and control the release of gaseous radioactive effluents to the atmosphere. Sources of radioactive gases from LGS include condenser offgases, sources from the reactor enclosure, containment systems, and the “hot” maintenance shop.

The condenser offgases are the largest source of radioactive gaseous waste. The offgas system collects the noncondensable radioactive gases that are removed by the air ejectors from the main condensers. The release of the offgas is delayed to allow for radioactive decay. The stream is released to the turbine enclosure vent stack and diluted with air and monitored upon release through the north stack.

Other sources of radioactive gases are from the reactor enclosures, the turbine enclosures, and radwaste buildings. Discharge of these gases are planned, monitored, controlled, and discharged through the south stack.

The standby gas treatment system (SGTS) and the reactor enclosure recirculation system (RERS) are used to reduce radioactive levels before being discharged into the environment.

*2.1.2.3. Radioactive Solid Waste*

The solid waste management system collects, processes, and packages solid radioactive wastes for storage and offsite shipment and permanent disposal. To ensure compliance with applicable regulations in 10 CFR Parts 20, 61, and 71, characterization, classification, processing, waste storage, handling, and transportation are controlled by the LGS Process Control Program.

Dry wastes (mostly Class A low-level radioactive wastes [LLRWs]) are collected throughout the plant. Compressible and noncompressible wastes are packaged and temporarily stored until they are sent to Duratech in Tennessee for processing or final disposal.

Wet wastes, generally Class A LLRWs, are collected, dewatered, packaged, and stored prior to offsite shipment. Wastes from the reactor water cleanup (RWCU) system floor drains, equipment drains, and fuel pool system usually exceed the criteria for LLRW or low specific activity material and are packaged in containers and stored in the high level storage area (HLSA), which is located in the Radwaste Enclosure. Exelon Generation Company, LLC (Exelon) transports Class A LLRWs to EnergySolutions, LLC, in Clive, Utah, for disposal.

LGS has a “Green-is-Clean” (GIC) waste program that collects noncontaminated waste from the radiological control area (RCA) from the different controls streams. This waste is packaged separately and shipped to Duratech in Tennessee for processing and disposal. Any waste sent to Duratech that is found to be contaminated is repackaged and sent to the offsite LLRW facility in Clive, Utah. Exelon’s corporate policy is to minimize the generation of radioactive wastes by following corporate waste minimization procedures.

There is an onsite radwaste storage pad (RSP) for temporary storage of radioactive waste containers. The RSP is located west of the spray pond and has a fenced-in holding area and another area surrounded by a concrete shell. Contaminated reusable equipment is stored here as well as Class A wastes. Higher activity Class B/C wastes are not stored in this area.

Since closure of the Barnwell Facility to LGS in 2008, there has been no licensed facility that accepts Class B/C LLRW shipments. Exelon has been temporarily storing the Class B/C wastes in the HLSA. In May 2011, the NRC approved transport and temporary storage of LGS Class B/C wastes at Exelon’s Peach Bottom Atomic Power Station (PBAPS). Class B/C LLRW stored at LGS or packaged in the future will be sent to PBAPS to be stored at the LLRW storage facility at that site. The storage capacity for LGS Class B/C wastes at PBAPS is expected to be sufficient through the extended operating license for both LGS units.

#### *2.1.2.4. Low-Level Mixed Wastes*

Low-level mixed wastes (LLMW) are wastes that contain both low-level radioactive waste and RCRA hazardous waste (40 CFR 266.210). LLMW is handled in accordance with Exelon guidance and procedures. There is currently no LLMW stored at LGS. It is rare that LGS generates LLMW; however, if it were necessary to treat and dispose of LLMW during the license renewal period, Exelon would store it on site, in compliance with the 1976 Resource Conservation and Recovery Act (RCRA) storage and treatment conditional exemption. RCRA regulations are administered in the State by the Pennsylvania Department of Environmental Protection (PADEP) (25 Pa. Code 260a). Transportation and disposal of LLMW would also follow RCRA requirements.

When necessary, LLMW is shipped off site to Perma-Fix of Florida, which is licensed and permitted to treat a variety of mixed waste, solids, liquids, sludges, and debris. Treated wastes are then sent to EnergySolutions, LLC, disposal facility located near Clive, Utah. LLMW are generated at LGS on occasion. LLMW are wastes that contain both low-level radioactive waste and RCRA hazardous waste (40 CFR 266.210).

### 2.1.3. Nonradiological Waste Management

The LGS site generates nonradioactive wastes as part of routine plant maintenance, cleaning activities, and plant operations. RCRA governs the disposal of solid and hazardous waste. RCRA waste regulations are contained in 40 CFR Parts 239–299. In addition, 40 CFR Parts 239–259 contain regulations for solid (nonhazardous) waste, and 40 CFR Parts 260–279 contain regulations for hazardous waste. RCRA Subtitle C establishes a system for controlling hazardous waste from “cradle to grave,” and RCRA Subtitle D encourages States to develop comprehensive plans to manage nonhazardous solid waste and mandates minimum technological standards for municipal solid waste landfills. RCRA regulations are administered in the State by the Pennsylvania Department of Environmental Protection (PADEP) (25 Pa. Code 260a). PADEP further classifies solid waste as either municipal waste (25 Pa. Code 271) or residual waste (25 Pa. Code 287).

#### *2.1.3.1. Nonradioactive Waste Streams*

LGS generates solid nonradioactive waste, defined by RCRA, as part of routine plant maintenance, cleaning activities, and plant operations. Exelon manages these wastes, including waste minimization, using corporate procedures that meet applicable regulations (Exelon 2011b). RCRA regulations are administered in the state by the PADEP (25 Pa. Code Article 260a).

EPA classifies certain nonradioactive wastes as hazardous based on characteristics including ignitability, corrosivity, reactivity, or toxicity (hazardous wastes are listed in 40 CFR Part 261). State-level regulators may add wastes to the EPA’s list of hazardous wastes. RCRA supplies standards for the treatment, storage, and disposal of hazardous waste for hazardous waste generators (regulations are available in 40 CFR 262).

EPA recognizes the following main types of hazardous waste generators based on the quantity of the hazardous waste produced (EPA 2012d):

- large quantity generators that generate 2,200 pounds (lb) (1,000 kg) per month or more of hazardous waste, more than 2.2 lb (1 kg) per month of acutely hazardous waste, or more than 220 lb (100 kg) per month of acute spill residue or soil,

- small quantity generators that generate more than 220 lb (100 kg) but less than 2,200 lb (1,000 kg) of hazardous waste per month, and
- conditionally exempt small quantity generators that generate 220 lb (100 kg) or less per month of hazardous waste, 2.2 lb (1 kg) or less per month of acutely hazardous waste, or less than 220 lb (100 kg) per month of acute spill residue or soil.

LGS, based on past and current generation of hazardous waste is classified as a small quantity generator of hazardous waste, according to 40 CFR 262 and given in Pa. Code 264a, with hazardous wastes between 220 lb (100 kg) and 2,200 lb (1,000 kg) per month. The quantities of hazardous waste and nonhazardous wastes are annually reported to PADEP (Exelon 2011b).

The EPA classifies several hazardous wastes as universal wastes; these include batteries, pesticides, mercury-containing items, and fluorescent lamps (25 Pa. Code 266b). Exelon has and expects to continue to generate universal waste such as discarded batteries, pesticides, thermostats, and mercury-containing devices. Other wastes that are not classified as hazardous waste but require regulation in Pennsylvania are (1) residual wastes such as discarded solid, liquid, semi-solids from industrial operations, waste treatment system sludges, and laboratory chemicals; (2) infectious waste; (3) regulated asbestos-containing material; and (4) municipal waste. LGS is considered a Large Quantity Generator of universal wastes (greater than 2,200 lb [1,000 kg] per month) (Exelon 2011b).

National Pollutant Discharge Elimination System (NPDES) permits that provide limits and conditions for wastewater discharge are held by Exelon for industrial wastewater discharges and storm water discharges from the LGS site into the Schuylkill River (No. PA0051926) and discharges to the Bradshaw Reservoir to the East Branch Perkiomen Creek (No. PA0052221) (Exelon 2011b). Radioactive liquid waste is addressed in Section 2.1.2.1 of this SEIS. Section 2.2.4.2 gives more information about the LGS NPDES permit and permitted discharges.

The Emergency Planning and Community Right-to-Know Act (EPCRA) requires applicable facilities to supply information about hazardous and toxic chemicals to local emergency planning authorities and the EPA (42 USC 11001). On October 17, 2008, the EPA finalized several changes to the Emergency Planning (Section 302), Emergency Release Notification (Section 304), and Hazardous Chemical Reporting (Sections 311 and 312) regulations that were proposed on June 8, 1998 (63 FR 31268).

Exelon does not expect its generation rates of nonradiological waste to increase significantly during the extended period of operation (Exelon 2011b).

#### *2.1.3.2. Pollution Prevention and Waste Minimization*

In compliance with PADEP requirements, Exelon has implemented a Preparedness, Prevention and Contingency (PPC) Plan as well as a Spill Prevention Control and Countermeasure (SPCC) Plan compliant with 40 CFR 112, "Oil Pollution Prevention."

In support of nonradiological waste-minimization efforts, EPA's Office of Prevention and Toxics has established a clearinghouse that supplies information about waste management and technical and operational approaches to pollution prevention (EPA 2012a). The EPA clearinghouse can be used as a source for additional opportunities for waste minimization and pollution prevention at LGS, as appropriate. EPA also encourages the use of environmental management systems (EMSs) for organizations to assess and manage the environmental impacts associated with their activities, products, and services in an efficient and cost-effective manner. EPA defines an EMS as "a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency." EMSs help organizations fully integrate a wide range of environmental initiatives, establish environmental goals, and create a continuous monitoring process to help meet those goals. The EPA Office of Solid Waste especially advocates the use of EMSs at RCRA-regulated facilities to improve environmental performance, compliance, and pollution prevention (EPA 2012b). Exelon has implemented an EMS.

### 2.1.4. Plant Operation and Maintenance

Various types of maintenance activities are conducted at LGS, including inspection, testing, and surveillance to maintain current licensing basis of the facility and to ensure compliance with environmental and safety requirements. Various programs currently exist at LGS to maintain, inspect, test, and monitor performance of facility equipment. These maintenance activities include inspection requirements for reactor vessel materials, boiler and pressure vessel inservice inspection and testing, a maintenance structures monitoring program, and maintenance of water chemistry.

Additional programs include those carried out to meet technical specification surveillance requirements, those implemented in response to NRC generic communications, and various periodic maintenance, testing, and inspection procedures. Certain program activities are performed during operation of the plant, while others are carried out during scheduled refueling outages. Nuclear power plants must periodically discontinue production of electricity for refueling, periodic inservice inspection, and scheduled maintenance. LGS refuels on a 24-month interval.

### 2.1.5. Power Transmission System

Four 230-kilovolt (kV) lines were constructed specifically to connect LGS Unit 1 to the regional power grid, and one 500-kV line was constructed to connect LGS Unit 2 to the regional electric grid. Philadelphia Energy Company (PECO), an energy delivery subsidiary of Exelon Corporation, owns and operates these lines. The LGS site also includes two switchyards—one for each reactor unit. The Unit 1 switchyard is a 230-kV substation, and the Unit 2 switchyard is a 500-kV substation. Unless otherwise noted, the discussion of the power transmission system is adapted from the Environmental Report (ER) (Exelon 2011b) or information gathered at NRC's November 2011 environmental site audit (NRC 2012a).

#### *2.1.5.1. Description of the Lines*

<u>220-60 and 220-61 Lines</u>

These lines extend southeast from the plant to the Cromby Substation in East Pikeland Township, Chester County (see Figure 2–4). The two lines run parallel to the Schuylkill River within two separate pre-existing railroad corridors on opposite sides of the river for about 12.9 km (8 miles). The 220-60 line traverses the Montgomery County side of the river, and the 220-61 line traverses the Chester County side of the river. The 220-60 line crosses the river into Chester County before terminating at the Cromby Substation in East Pikeland Township, Chester County. The 220-60 corridor is 18.3 m (60 ft) wide for the first 10.1 km (6.3 miles), at which point the line leaves the railroad corridor and joins with an existing 76.2-m (250-ft)-wide PECO corridor for 1.8 km (1.1 miles). The 220-60 line travels through the 220-61 corridor once it crosses the river. The 220-61 corridor is 18.3 m (60 ft) wide for the entire length of the corridor. The 220-61 line is within the Schuylkill River National and State Heritage Area and parallels a planned portion of the Schuylkill River Trail.

220-62 Line

This line spans a total of 25.7 km (16 miles) from the Cromby Substation (the termination point of the 220-60 and 220-61 lines) to north and then east to the North Wales Substation in Upper Gwynedd Township, Montgomery County (see Figure 2–5). When constructed, the line was routed through an existing PECO transmission line corridor. The corridor varies from 45.7 m (150 ft) to 137.2 m (450 ft) wide and traverses the Evansburg State Park in Skippack Township.

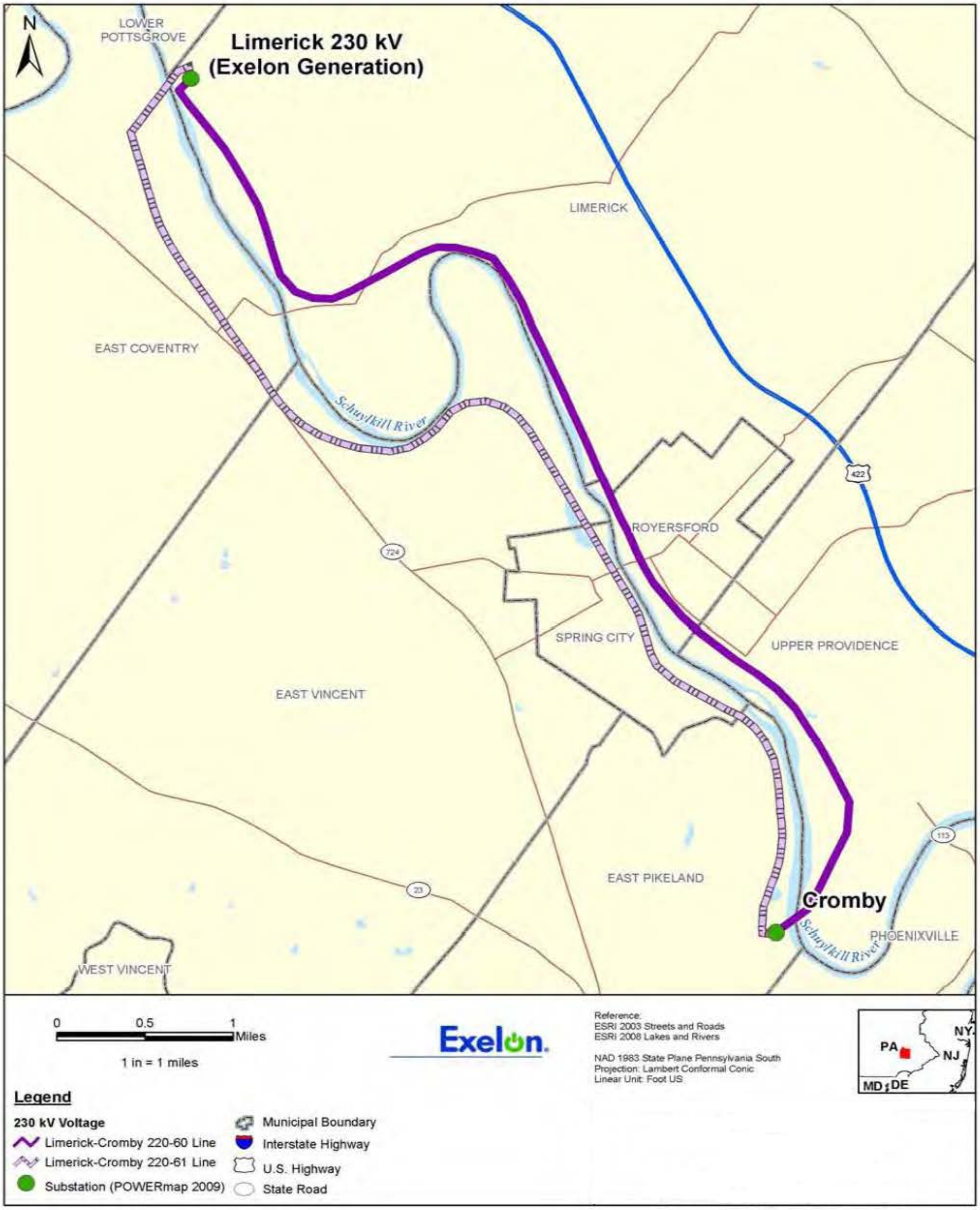
220-63 and 220-64 Lines

The 220-63 and 220-64 lines span a total of 16.1 km (10 miles) and 5.6 km (3.5 miles), respectively, from the Cromby Substation southeast and then south to their respective termination points at Barbadoes Substation in West Norristown Township and Plymouth Meeting Substation in Plymouth Township, Montgomery County (see Figure 2–6). The lines cross the Schuylkill River in five locations and parallel an open portion of the Schuylkill River Trail between Phoenixville Borough and Philadelphia. The lines also traverse the Valley Forge National Park. When constructed, the lines were routed through a combination of existing PECO transmission line corridors and railroad corridors. The corridor width varies from 45.7 m (150 ft) to 137.2 m (450 ft).

5031 Line

This line spans a total of 27.4 km (17 miles) from the Limerick 500-kV substation east to the Whitpain Substation in Whitpain Township, Montgomery County (see Figure 2–7). The line crosses the Schuylkill River in Limerick Township and Evansburg State Park in Skippack Township. When constructed, the line was routed along an existing transmission line corridor associated with a 500-kV line originating from Peach Bottom Atomic Power Station in Delta, Pennsylvania. The line also merges with the 220-62 line corridor for about 4.8 km (3 miles). The corridor width varies from 91.4 m (300 ft) to 137.2 m (450 ft).

**Figure 2–4. Limerick to Cromby 230-kV Transmission Line Route**

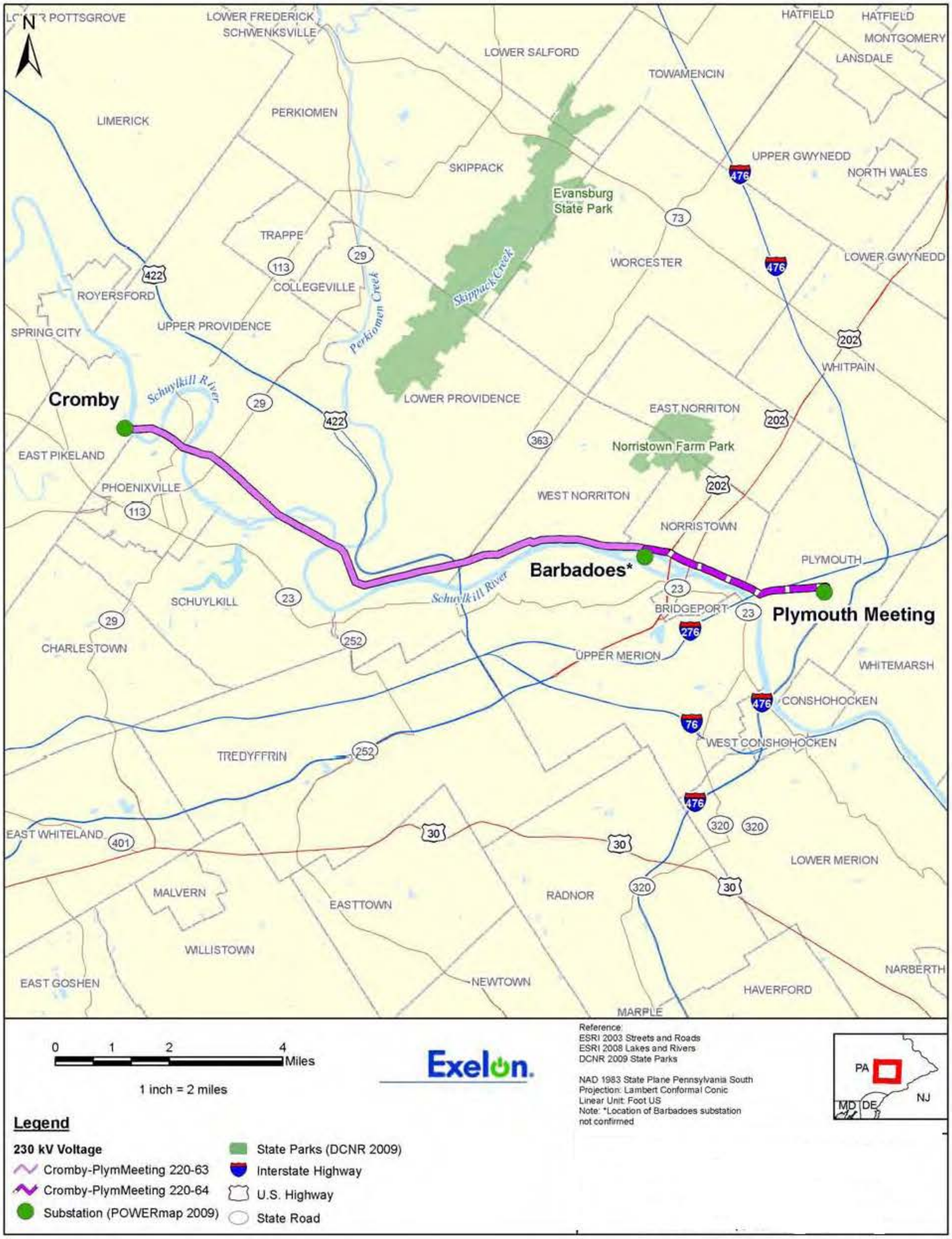



Source: Exelon 2011b

**Figure 2–5. Cromby to North Wales 230-kV Transmission Line Route**


Source: Exelon 2011b

1 **Figure 2–6. Cromby to Plymouth Meeting 230-kV Transmission Line Route**




Source: Exelon 2011b

1 **Figure 2–7. Limerick to Whitpain 500-kV Transmission Line Route**


Source: Exelon 2011b

*2.1.5.2. Transmission Line Corridor Vegetation Maintenance*

> Transmission line corridors (or right-of-ways) are strips of land used to construct, operate, maintain, and repair transmission line facilities. The transmission line is usually centered in the corridor. The width of a corridor depends on the voltage of the line and the height of the structures. Transmission line corridors typically must be clear of tall-growing trees and structures that could interfere with a power line.

The majority of the transmission line corridors associated with LGS lines traverse suburban areas and agricultural lands. PECO follows an integrated vegetation management program that combines manual, mechanical, biological, and chemical control techniques to maintain proper clearance from transmission lines and structures. PECO maintains vegetation on a 5-year cycle, and the degree and type of clearance varies by line voltage and the type, growth rate, and branching characteristics of trees and vegetation. PECO contracts with Asplundh Tree Expert Company to perform the majority of maintenance work, and the Davey Resources Group, part of the Davey Tree Expert Company, oversees quality assurance.

Workers follow the current American National Standards Institute (ANSI) guideline document, *A300 Standards for Tree Care Operations*, which contains requirements and recommendations for tree care practices, including pruning, lightning protection, and integrated vegetation management. These standards describe a wire-border zone management approach in which the wire zone (the section of the corridor directly under the wires and extending outward about 10 ft [3 m]) is managed to promote low-growing plant communities dominated by grasses, herbs, and small shrubs (Miller 2007). The border zone (the remainder of the corridor on either side of the lines) is managed to promote small shrubs and lower growing trees (Miller 2007).

PECO has also followed the North American Electric Reliability (NERC) FAC-003, *Vegetation Management*, since 2003. This guidance document recommends that all transmission line owners have a specific vegetation maintenance plan that addresses vegetation inspections, clearances, qualifications of workers, and environmental impact mitigation.

*2.1.5.3. PECO's Environmental Stewardship and Partnerships with State and Local Agencies*

As part of its environmental stewardship effort, PECO maintains a program to protect birds and comply with applicable Federal and state bird regulations, and that promotes native vegetation, maintains an environmental management certification, and partners with Federal and state agencies for specific mitigation or restoration projects.

PECO's avian management program provides guidance to workers on how to deal with bird nests or dead birds when encountered during field operations and how it complies with applicable Federal and state bird regulations, including the Migratory Bird Treaty Act, the Endangered Species Act, and the Bald and Golden Eagle Protection Act.

As part of its maintenance procedures, PECO favors native warm season grass mixtures and native flower mixtures that include species such as little blue stem (*Schizachyrium scoparium*), big blue stem (*Andropogon gerardi*), Indian grass (*Sorghastrum nutans*), goldenrod (*Solidago* spp.), milkweed (*Asclepias* spp.), and aster (*Aster* spp.).

PECO maintains an International Organization for Standardization (ISO) 14001 certification, which provides a framework for environmental management systems to help companies manage the environmental impact of their activities and demonstrate sound environmental management (ISO 2009).

When the National Park Service (NPS) acquired an additional 65 acres (ac) (26 hectares[ha]) parcel of land for the Valley Forge National Park that coincided with the 220-63 and 220-64 corridor, PECO partnered with NPS to restore the acquired land to a native warm season grass community. PECO provided both contractors and equipment for this effort (Exelon 2011b).

### 2.1.6. Cooling and Auxiliary Water Systems

LGS uses a cooling tower-based heat dissipation system that normally withdraws from and discharges cooling water to the Schuylkill River. In summary, the majority of the makeup water withdrawn is to provide cooling water for the LGS steam turbine condensers. As water evaporates in the cooling towers to dissipate heat to the atmosphere, cooling water is lost and must be replaced. Additionally, to control the chemistry of the circulating water in the cooling system, a portion of the cooling water is continuously discharged (i.e., blowdown). A much smaller portion of the makeup water is used to remove heat from auxiliary equipment during normal operation. A clay-lined spray pond located north of the cooling towers provides emergency cooling but has an insignificant interface with the environment. Four groundwater wells are also located on the LGS site to support LGS operations. Unless otherwise cited for clarity, the NRC drew information about LGS's cooling and auxiliary water systems from Exelon's ER (Exelon 2011b) and responses to NRC's request for additional information (Exelon 2012b). NRC staff also toured these systems and facilities during the environmental site audit (NRC 2012).

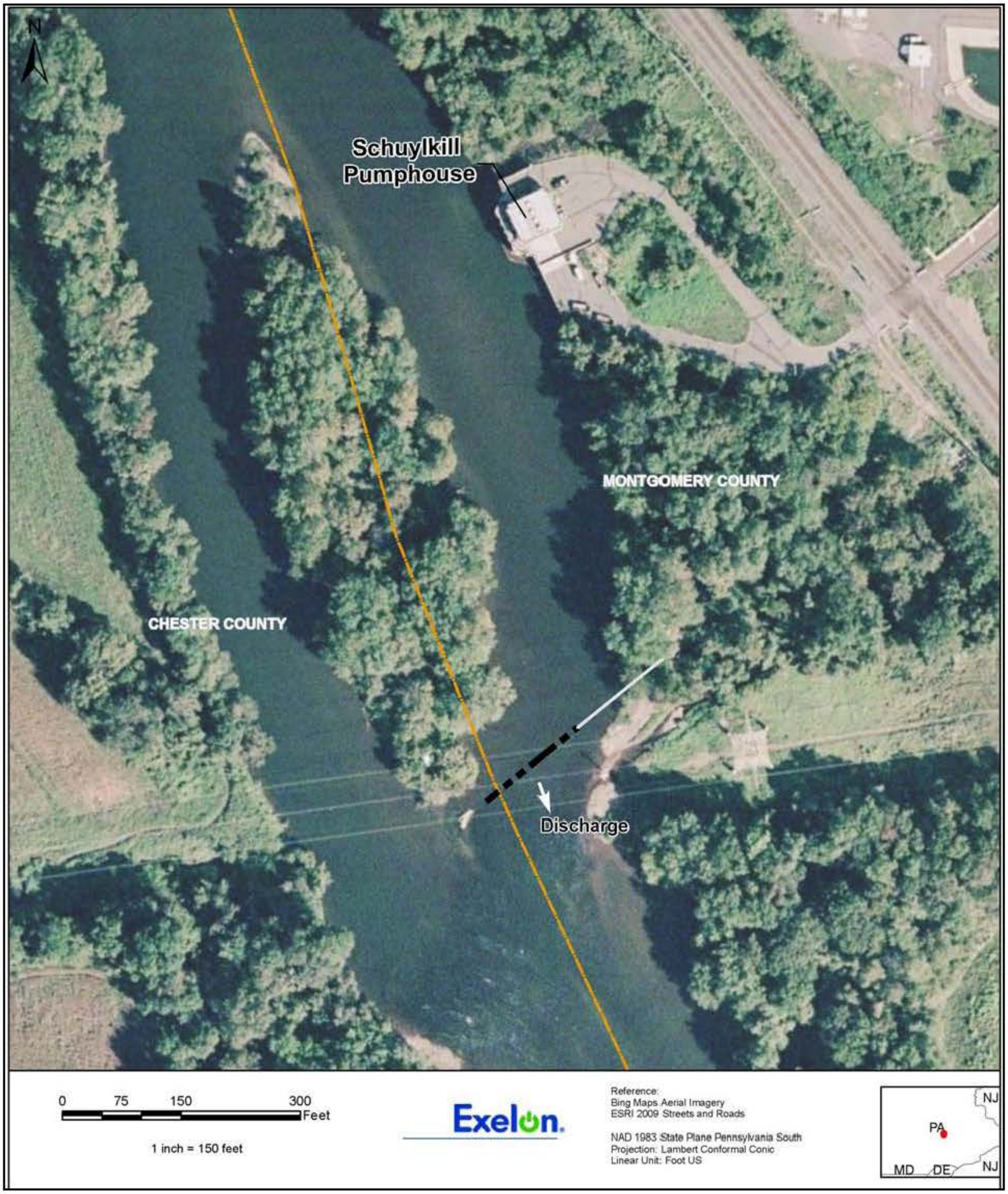
Individual LGS systems that interact with the environment are summarized below and focus on facilities owned and operated by Exelon.

<u>Makeup Water Supply System</u>. The LGS makeup water supply system is comprised of the individual water sources, facilities, systems, and components used for supplying makeup water to LGS plant systems. These include the cooling water system, including the circulating water systems for each LGS unit, and other plant systems. In total, LGS operates its makeup water supply system and uses its makeup sources in accordance with Delaware River Basin Commission (DRBC) approvals (Docket No. D-69-210, as revised) (DRBC 2004). A discussion of these makeup sources and associated facilities and their attributes follows.

#### *2.1.6.1. Schuylkill River Source*

The Schuylkill River is the primary source of makeup water for LGS (see Figure 2–8). Water is withdrawn from the river via the Schuylkill Pumphouse located on the eastern bank of the river on the LGS site. River water enters the pumphouse through eight trash rack (bar screen) panels with sufficient bar spacing to allow aquatic life to pass. A floating trash dock with skirt located in front of the trash rack functions to divert river debris and some aquatic life before reaching the trash racks. Intake water then passes through four travelling screens prior to the intake bays. The screens have 0.25-in. (0.64-cm) mesh openings designed to limit water approaching the screens to a velocity of 0.75 fps (0.23 m/s). A backwash system operates automatically to clean the traveling screens of debris to maintain adequate pump wet-well levels. Screen backwash water is returned to the river via a Pennsylvania NPDES permitted outfall (no. 011). Leaves and debris removed from the traveling screens are collected in a dumpster and transported off site for disposal (Exelon 2012b). The facility has three pumps for cooling water makeup and two pumps for blowdown (nonconsumptive) water makeup use. The three cooling water pumps each have a rated capacity of 11,300 gpm (25.2 cfs or 0.71 $m^3/s$), and the two blowdown makeup pumps are each rated at 4,000 gpm (8.9 cfs or 0.25 $m^3/s$). These pumps are usable in any combination to meet the total plant makeup demand (for consumptive and nonconsumptive use) of up to 56.2 million gallons per day (mgd) (212,700 $m^3$). From the pumphouse, a 36-in. (91-cm) pipeline conveys water to the cooling tower basins. Two smaller lines supply water to (1) a raw water clarifier in the process water treatment system and (2) the spray pond.

1 **Figure 2–8. Location of Schuylkill Pumphouse and LGS Discharge Structure**




Source: Exelon 2011a

Seasonal low flows in the Schuylkill River and specific conditions and limitations imposed by the DRBC require that alternative makeup water sources be used by LGS either directly or to augment flow in the Schuylkill River. In point, source augmentation averaging 35 mgd (132,500 $m^3$) or 24,300 gpm (54.1 cfs or 1.5 $m^3/s$) is required about 6 months per year (Exelon 2012d). Pursuant to DRBC rules and regulations, dockets are used to place limits and conditions on individual projects, such as LGS, that use water within the Delaware River Basin. DRBC Docket No. D-69-210 CP, as revised, prescribes the low-flow conditions that trigger the requirement for LGS to use alternative water sources for consumptive use. Depending on conditions, a combination of the DRBC-approved alternative water sources (as depicted in Figure 2–9) are used to supply consumptive use makeup water to LGS, although LGS may withdraw water from the Schuylkill River for nonconsumptive use without restriction. Perkiomen Creek is the first supplemental water source to be considered when withdrawals from the Schuylkill River are restricted because of low flow.

*2.1.6.2. Perkiomen Creek Source*

LGS must also withdraw water from Perkiomen Creek when the flow in the Schuylkill begins to drop below 560 cfs (15.9 $m^3/s$) for two-unit operation (as measured at the U.S. Geological Survey [USGS] maintained Pottstown, Pennsylvania, gage station), if instream flow conditions in Perkiomen Creek allow. Water is withdrawn via Exelon's Perkiomen Pumphouse (auxiliary intake pumphouse), which is located just inland from the west bank of Perkiomen Creek. Water is withdrawn from the creek through a set of 15 submerged, stationary "wedge-wire" screen intakes on the middle of the streambed. Each screen is sized at 24-in. (61-cm) by 72-in. (183-cm), with a slot size of 0.08 in. (0.2 cm). The screens provide an average through-slot velocity of 0.4 fps (0.12 m/s). An air burst backwash system automatically functions to remove accumulated debris (Exelon 2012b). Three intake pumps, including a spare, rated at 14,600 gpm (33 cfs pr 0.92 $m^3/s$) are sized to supply the consumptive cooling demands for both LGS units. A small auxiliary pump operates as needed to maintain the facility's water storage tank when the intake system is not active. Water is conveyed by an underground pipeline approximately 8 miles (13 km) to a storage tank located at the LGS site.

*2.1.6.3. Delaware River Augmentation Source*

The natural flow in Perkiomen Creek is not always adequate for LGS's consumptive makeup water needs. This situation arises when the natural flow of Perkiomen Creek falls below 210 cfs (5.9 $m^3/s$) for two-unit operation, as measured at the USGS-maintained Graterford, Pennsylvania, gage station. Therefore, Exelon has established a system to transfer water for flow augmentation purposes from the Delaware River to East Branch Perkiomen Creek and, ultimately, Perkiomen Creek. This diversion of water originates at the Point Pleasant Pumping Station on the Delaware River, located about 30 miles (48 km) northeast of the LGS (see Figure 2–9). The pumping station is owned by a municipal water purveyor and not Exelon. The Point Pleasant Pumping Station withdraws from a deep water, mid-channel intake in the Delaware River. The intake structure consists of two rows of fixed cylindrical wedge-wire screens, with each row comprised of 12 screens. Each screen measures 40-in. (102-cm) in diameter and 80-in. (203-cm) of total screened length. Screens have a slot size of 0.08 in. (0.2 cm). At the maximum pumping rate of 95 mgd (360,000 $m^3$), the average intake velocity is 0.35 fps (0.11 m/s). Maintenance of the intake screens includes high-pressure spray washing and scrubbing by divers four times a year, with return of organic debris to the Delaware River (Exelon 2012b).

**Figure 2–9. LGS Makeup Water Supply System and Alternative Water Sources within the Delaware River Basin**


Source: Modified from Exelon 2011a

Once withdrawn at Point Pleasant, water is conveyed through a series of pumping stations, to the Bradshaw Reservoir, and then via transmission mains to East Branch Perkiomen Creek. At the outset, water is transferred as necessary to the Bradshaw Reservoir to maintain adequate reservoir operational volume and reserve storage. Located on a 43-ac (17-ha) site and approximately 27 miles (44 km) northwest of LGS, both the reservoir and associated Bradshaw Pumphouse are owned and operated by Exelon. According to Exelon personnel, the reservoir is maintained at an operating level of 17 to 21 ft (5.2 to 6.4 m), and the reservoir can be pumped down as far as 8 ft (2.4 m) before suction is lost. From the Bradshaw Reservoir, water is pumped about 6 miles (10 km) by pipeline routed along a natural gas pipeline right-of-way to East Branch Perkiomen Creek. Located about midway along the pipeline routing, Exelon also owns and operates the Bedminster Water Processing (Treatment) Facility that is used to seasonally disinfect the water before it is discharged into the East Branch Perkiomen Creek in accordance with NPDES Permit PA0052221.

In the event drought conditions on the Delaware River threaten the ability to transfer water to East Branch Perkiomen Creek, Exelon also has an agreement in place as one of the seven utility owners of the Merrill Creek Reservoir in northwestern New Jersey to release water to the Delaware for flow augmentation purposes. This could be exercised in the event of a DRBC-declared drought emergency. A separate DRBC docket governs operation of the reservoir.

*2.1.6.4. Wadesville Mine Pool and Still Creek Reservoir Augmentation Sources*

LGS also uses two additional upstream water sources, the Wadesville Mine Pool and Merrill Creek Reservoir, to directly augment Schuylkill River flow (see Figure 2–9). As a demonstration project, DRBC approved the use of these sources in 2002 to compensate for the withdrawal of cooling water from the Schuylkill River and to evaluate the feasibility of continuing withdrawals from the river even under low flow conditions. Flow augmentation with these sources began in 2003 and has included DRBC oversight. The Wadesville Mine Pool is located approximately 70 miles (112 km) northwest of LGS in Pennsylvania's anthracite coal region. The mine pool is comprised of an extensive complex of flooded underground mine workings some 700 ft (210 m) deep, storing an estimated 3.6 billion gal (13.6 billion $m^3$) of water. The mine pool is unique, as compared to other coal workings that contribute to acid mine drainage, in that the water percolating through the workings has a neutral pH (NAI and URS 2011). Additionally, releases from the Still Creek Reservoir, located northeast of the Wadesville Mine Pool, are included in the demonstration project. DRBC previously approved this reservoir for emergency releases under a contract between Exelon and its owner and operator to augment low flows in the Schuylkill River when the Delaware River diversion system is unavailable (see Section 2.1.7.1).

<u>Circulating Water System</u>. The LGS circulating water system is a closed-cycle cooling system that removes heat from the condenser and transfers it to the atmosphere through evaporation using hyperbolic natural-draft cooling towers. The plant's twin cooling towers rise more than 500 ft (152 m) above the ground. The circulating water system uses water from the LGS makeup water system to replenish the water lost from evaporation, drift, and blowdown. For each LGS unit, the circulating water system consists of one cooling tower, three main condensers, four 25-percent-capacity circulating water pumps, and associated piping, valves, controls, and instrumentation.

<u>Blowdown Discharge System</u>. Operation of LGS's closed-cycle cooling system results in evaporative water losses of approximately 75 percent from the plant's twin cooling towers. To control the chemistry of the water in the cooling system due to the buildup of total dissolved solids, a portion of the water must be continuously discharged. Each cooling tower basin has a blowdown line that combines into a single, 36-in. (32-cm) line that discharges through a submerged, multi-port diffuser pipe into the Schuylkill River at a point about 700 ft (210 m) downstream from the Schuylkill Pumphouse (see Figure 2–8). The diffuser is encased in a concrete channel stabilization structure on the east side of the river. The discharge structure consists of a 28-in. (71-cm) pipe with a total of 283 nozzles installed on 6-in. (15-cm) centers; nozzles have a 1.25-in. (3.2-cm) diameter opening. As shown in Figure 2–8, the diffuser does not use the entire channel width.

Plant Service Water System. The plant service water system functions continuously to supply water for service-water cooling (e.g., removal of heat rejected from auxiliary equipment), emergency service water, residual heat removal service water, and the clarified water system. Generally, these are small and normally nonconsumptive uses of water.

Each LGS unit has a nonsafety-related single-loop cooling system for normal operations that uses three 50-percent capacity pumps operating, with one pump on standby status. These loops take water from each unit's cooling tower basin. These pumps circulate cooling water from the cooling tower basins through various heat exchangers and then back to the cooling towers. This service water system may at times also support decay heat removal during a refueling outage.

An emergency service water system exists to supply cooling water to emergency equipment in the event of the loss of normal cooling. The system consists of two independent cooling loops and associated pumps. The pumps circulate water through the LGS spray pond located north of the LGS cooling powers for cooling through spray nozzles or winter bypass lines. Another safety-related system, the residual heat removal system, is also routed through the spray pond. The two loops of this system supply cooling water to each of the two heat exchangers that serve each LGS unit.

Clarified river water for component lubrication and as makeup to the demineralized water system is supplied by the clarified water system. This system uses water from the cooling water intake system.

Groundwater Supply System. Potable water and fire emergency water for LGS are provided by two separate wells. Two additional wells supply nonpotable water intermittently to the Limerick Training Center and the Limerick Energy Information Center, respectively.

### 2.1.7. Facility Water Use and Quality

As discussed above, LGS Units 1 and 2 use a closed-cycle cooling system that primarily relies upon the Schuylkill River for its makeup water supply and, secondarily, Perkiomen Creek (see Section 2.1.6). Water losses from the plant's cooling towers because of evaporation and drift average about 75 percent. As this water must be continually replaced, such a high consumptive use can conflict with the needs of other downstream users and with aquatic life, especially on smaller rivers (Exelon 2011b).

However, Exelon has developed an extensive surface water diversion system to supplement LGS's consumptive cooling water needs and to manage (augment) low river flows, as also described in Section 2.1.6. The Schuylkill River is also the makeup water source for replacing water discharged as blowdown from the cooling towers, which is necessary to control the quality of the recirculating cooling water. This use is considered to be nonconsumptive in nature. Nevertheless, all surface water withdrawals by LGS are regulated by the DRBC. Cooling tower blowdown, in addition to other plant wastewaters, is ultimately discharged back to the Schuylkill River via a submerged discharge structure. This is LGS's main outfall (no. 001), which is regulated under its Pennsylvania NPDES permit (No. PA0051926), in addition to DRBC docket provisions (Exelon 2011b).

Exelon also operates two primary groundwater supply wells in the main plant area to meet the potable needs of plant personnel and to supply fire emergency water, respectively. Two additional wells, one at the Limerick Training Center and another at Limerick Energy Information Center, supply water for sanitary needs in restrooms (Exelon 2011b).

Exelon is annually required to report water use data for LGS to the PADEP in accordance with the Pennsylvania Water Resources Planning Act pursuant to 25 Pa. Code 110 (Exelon 2011b).

NRC staff reviewed the last 5 years of Exelon's Act 220 Water Withdrawal and Use Reports submitted to the PADEP.

A description of surface water resources at LGS and vicinity is provided in Section 2.2.4, and a description of the groundwater resources is presented in Section 2.2.5. The following sections further describe the water use from these resources.

*2.1.7.1. Surface Water Use*

Makeup water demands for LGS Units 1 and 2 nominally total 56.2 mgd or 39,000 gpm (87 cfs or 2.5 $m^3$/s). For full operations, this includes 42 MGD or 29,200 gpm (65 cfs or 1.8 $m^3$/s) for consumptive cooling water use and 14.2 mgd or 9,860 gpm (22 cfs or 0.6 $m^3$/s) for nonconsumptive use (Exelon 2011b). As previously discussed, LGS water usage is governed by the DRBC docket approval and demonstration project that restricts surface water withdrawals from the Schuylkill River for consumptive use to protect water quality and quantity. These restrictions are triggered, requiring Exelon to switch to alternative water sources, when either the flow of the river falls below 560 cfs (15.9 $m^3$/s) for two-unit operation, or 530 cfs (15 $m^3$/s) for one-unit operation. This is adjusted based on upstream releases from DRBC-approved projects (DRBC 2004, Exelon 2011a).

In addition, PADEP requires that water users submit water use information annually, in support of its State Water Plan. Accordingly, Exelon reports LGS water usage to PADEP. The State Water Plan serves as a functional planning tool to establish vision, goals, and recommendations for meeting the challenges of sustainable water use over a 15-year planning horizon.

Since initiating the water supply diversion project in 2003, Exelon has sought to demonstrate that makeup water demands could be obtained from the Schuylkill River over a much wider range of conditions without deleterious effects. This included a major modification to the demonstration project that was approved in 2005 which, for the first time, allowed for withdrawals from the Schuylkill River for consumptive use when ambient water temperature was at or above 59 ºF (15 ºC). Previously, DRBC prohibited withdrawals for consumptive use makeup at or above that temperate and required LGS to rely upon the Perkiomen Pumphouse (Exelon 2011b). In summary, the objectives of the demonstration project include: (1) gaining an understanding of increased reliance on the Schuylkill River, (2) evaluating the effects of permanently lifting the 59 ºF (15 ºC) temperature restriction, (3) evaluating the effects of using the Wadesville Mine Pool and Still Creek Reservoir as low flow augmentation sources, (4) evaluating the effects of reducing water diversions from the Delaware River, and (5) evaluating the effects on public water supplies (Exelon 2012d). Based on the results of the demonstration project, Exelon submitted an application to the DRBC in September 2007 to make the provisions of the demonstration project permanent to support LGS operations and to consolidate all of DRBC's docket approvals for surface water withdrawal, discharge, and groundwater usage into a single comprehensive docket (Exelon 2011a, DRBC 2011a).

In May 2011, the DRBC passed a resolution approving Exelon's request to increase LGS's peak daily surface water withdrawals from 56.2 mgd or 39,000 gpm (87 cfs or 2.5 $m^3$/s) to 58.2 mgd or 40,420 gpm (90 cfs or 2.6 $m^3$/s). This request was made to increase consumptive use withdrawals by 2 mgd or 1,390 gpm (3.1 cfs or 0.09 $m^3$/s) to provide operational flexibility to counter conditions of high air temperature combined with low relative humidity that had caused LGS to approach its maximum daily withdrawal limit in 2010 (DRBC 2011b). In December 2011, the DRBC extended the terms of docket Revision 12 for LGS, including the demonstration project for another year to enable it to complete work on Exelon's docket revision and to hold a public hearing. As such, the terms of the current DRBC docket approval (DRBC 2004), as amended, and demonstration project remain in effect through December 31, 2012 or until the DRBC approves a revised docket (DRBC 2011a).

Exelon officials met with DRBC officials on the status of the consolidated docket in February 2012 (Exelon 2012a). In June 2012, DRBC issued a draft consolidated docket for review and comment and held a hearing on August 28, 2012.

*2.1.7.2. Groundwater Use*

Groundwater is withdrawn at LGS through two onsite wells to support LGS operations, with two additional wells supporting secondary uses (see Section 2.1.7).

Well 1 (the “Alley” Well) supplies potable water to LGS personnel. Well 3 (the “Batch Plant” Well) provides backup water supply to a fire water storage tank. Both wells were constructed as open boreholes in the Brunswick Formation with completion depths of 310 ft (94 m) and 585 ft (178 m) and pump capacities of 50 gpm (189 L/min) and 65 gpm (246 L/min), respectively. Both wells had their pumps replaced in 2004. Well 1 is located just east of the Unit 2 buildings and southeast of the Unit 2 cooling tower, while well 3 is located about 500 ft (150 m) east of the Unit 2 cooling tower (CRA 2006, Exelon 2011a). As a potable supply well for the plant, Well 1 is operated by Exelon under a public water supply permit from the PADEP. Before distribution, the water is treated by disinfection, for corrosion control for lead and copper, and by filtration to reduce arsenic levels (Exelon 2011b).

Two additional active groundwater wells (i.e., the Training Center and Energy Information Center wells) are located on the LGS plant site but outside the main plant complex. These wells are seldom operated and only to provide sanitary water for restrooms at the referenced facilities (Exelon 2011b). The Training Center well is 560 ft (170 m) in depth and the Information Center well is 123 ft (37.5 m) in depth, based on Pennsylvania well records (Exelon 2011a, PADCNR 2012).

LGS’s wells are located in the Southeastern Pennsylvania Ground Water Protected Area designated by the DRBC. Specifically, LGS is located in the Schuylkill-Sprogels Run Subbasin designated by the DRBC and for which basin-wide groundwater withdrawal limits have been set due to stress on the bedrock aquifer system (DRBC 1999, Exelon 2011a). Groundwater users in subbasins designated by the DRBC as stressed and withdrawing 10,000 gallons per day (gpd) (38,000 L/day) or more during any 30-day period are required to obtain a protected area permit from the DRBC or have docket approval for such withdrawals (DRBC 1999, 18 CFR 430). The draft docket issued by the DRBC (see Section 2.1.7.1) proposes groundwater production limits for LGS.

Based on data from 2001 through 2010, LGS’s total groundwater production from its primary production wells has ranged from 14.3 to 21.1 gpm (54.1 to 79.9 L/min) or 20,600 to 30,300 gpd, and averaged 17.9 gpm (67.8 L/min) or 25,800 gpd (Exelon 2011a, 2012b). While not subject to reporting under PADEP regulations, the two LGS secondary wells produce less than 4 gpm (13.9 L/min) combined (Exelon 2011b).

## 2.2. Surrounding Environment

The LGS plant site comprises a total of 645 ac (261.0 ha), including 491 ac (198.7 ha) in Montgomery County and 154 ac (62.3 ha) in Chester County. The LGS site is located along the Schuylkill River, which flows in a southeasterly direction to its confluence with the Delaware River. The Schuylkill River passes through the LGS plant site and separates its western portion, which is located in Chester County, from its eastern portion, which is located in Montgomery County.

The LGS is located about 1.7 miles (2.7 km) southeast of the Borough of Pottstown, the nearest population center. Other nearby population centers are the City of Reading located 19 miles

(30.6 km) northwest of the site, the Borough of Phoenixville located about 9.3 mi(15 km) southeast of the site, the Municipality of Norristown about 11 miles (17.7 km) southeast of the site, and the city limits of Philadelphia, which are about 21 miles (33.8 km) southeast of the site.

### 2.2.1. Land Use

The site is surrounded by gently rolling countryside and farmland, with several valleys containing tributary drainages of the Schuylkill River. The vicinity of the site has experienced suburban growth as local farmland has been converted to several new residential subdivisions since the LGS units came online in 1986 and 1990. Figure 2–1 illustrates the principal land uses in the vicinity of the LGS, out to 6 miles (10 km).

Exelon owns both the primary LGS site and several offsite support facilities, including the Perkiomen Pumphouse, the Perkiomen Pumphouse-to-LGS pipeline, Bradshaw Reservoir and Pumphouse, and the Bedminster Water Processing (Treatment) Facility. Additional offsite facilities and components of the LGS makeup water system having contractual agreements with Exelon, but which are neither owned nor controlled by Exelon, including the following:

- Wadesville Mine Pool, Pumphouse, and discharge channel,
- Still Creek Reservoir,
- Point Pleasant Pumping Station and combined water transmission main to the Bradshaw Reservoir, and
- Pottstown Gage Station, the Graterford Gage Station, and the Bucks Road Gage Station.

Exelon jointly owns and operates the Merrill Creek Reservoir near Phillisburg, New Jersey, with six other utilities. The reservoir stores water for release when required to mitigate consumptive use at designated electric generating facilities, including LGS, in the event of low-flow conditions in the Delaware River.

The major transportation routes located within 6 miles (10 km) of the site include U.S. Highway 422 (US-422), an east-west highway passing about 1.5 miles (2.4 km) north of the site; Pennsylvania Route 100 (PA-100), a north-south highway passing about 4 miles (6.4 km) west of the site in Chester County; and PA-724, a southeast-northwest highway passing about 1 mile (1.6 km) southwest of the site. The single plant entrance/exit can only be accessed by Evergreen Road, either directly from the Sanatoga exit of US-422 or indirectly from the Limerick Linfield exit of US-422 by several local roads. Figure 2–2 illustrates prominent features of the LGS region, out to 50 miles (80 km).

All activities on the LGS site are under the control of Exelon. The immediate area surrounding LGS is enclosed by a security barrier shown in Figure 2–3. Access to LGS is through a security gate by a three-lane road, Evergreen Road, north of the plant. A Conrail rail line (formerly Reading Company) traverses the LGS site along the eastern side of the Schuylkill River. The rail line includes two tracks and a rail spur serving LGS. Another Conrail rail line (formerly Penn Central Railroad) runs along the western side of the Schuylkill River, traversing the Chester County portion of the LGS site.

Notable manmade features within a 6-mile (10-km) radius of LGS (see Figure 2–1) include the Pottstown-Limerick regional airport roughly 1.5 miles (2.5 km) northeast, the Philadelphia Premium Outlets shopping mall roughly 1 mile (1.6 km) northeast, and the Occidental Chemical Corporation/Firestone Tire EPA superfund site roughly 1.5 miles (2.4 km) west of the LGS site.

Nearby communities include Pottstown, approximately 1.7 miles (2.7 km) northwest; Royersford, 3.8 miles (6.1 km) southeast; Phoenixville, 7.6 miles (12.2 km) southeast; and Philadelphia, 29 miles (46 km) southeast of the LGS site.

### 2.2.2. Air Quality and Meteorology

The LGS site is located within the Schuylkill River valley of the Piedmont Plateau in southeastern Pennsylvania. LGS maintains two meteorological towers that are in close proximity to the site. The primary tower (Tower 1) is located approximately at site grade and is 76.2 m (250 ft) above mean sea level (MSL) (Exelon 2011b). The secondary tower (Tower 2) is located closer to the Schuylkill River and is at an elevation of 36.9 m (121 ft) above mean sea level. The meteorological towers are instrumented at three levels and take measurements of wind direction, wind speed, and temperature. Additional measurements, including wind direction fluctuations, relative humidity, pressure, and precipitation, are made at Tower 1.

The region surrounding the LGS site is characterized by a humid, continental climate that is moderated by the presence of the Appalachian Mountains to the west and the Atlantic Ocean to the east (NCDC 2012a). Periods of extreme heat or cold are generally short-lived. The summer months of June through September are warm and humid, and at times the area is engulfed in maritime air from the western Atlantic (NCDC 2012b). The winter months of December through February are characterized by frequent periods of warming and cooling from mid-latitude, low-pressure systems and associated fronts passing through the area; minimum temperatures during this time are usually below freezing, but temperatures below zero are rarely observed (NCDC 2012c).

The staff obtained climatological information with 30-year averages (1981−2010) for the Allentown and Philadelphia, Pennsylvania, first-order National Weather Service (NWS) stations. Both stations are approximately 30 miles from the LGS site and can be used to characterize the region's climate because of their nearby location, comparable elevation, and long period of record. Regionally, the prevailing wind direction is from the southwest during most of the year, except during the winter months, when it is generally from the west-northwest (NCDC 2012b, 2012c). During stable atmospheric conditions, low-level winds at the LGS site may be channeled in the same general direction as the Schuylkill River Valley, which is oriented in the north-northwest to south-southeast direction (Exelon 2012c). Mean annual wind speeds average around 8 to 9 mph (3.5 to 4.0 m/s); winds are faster than average in the spring and slower than average in late summer (NCDC 2012b, 2012c). Peak wind gusts were 69 mph (30.8 m/s) in Allentown (NCDC 2012c) and 75 mph (33.5 m/s) in Philadelphia (NCDC 2012b).

In Allentown, monthly mean temperatures range from a low of 27.9 °F (-2.3 °C) in January to a high of 74.1 °F (23.4 °C) in July (NCDC 2012b). In Philadelphia, monthly mean temperatures are slightly warmer and range from 32.3 °F (0.2 °C) in January to 77.6 °F (25.3 °C) in July (NCDC 2012b). Recent monthly mean temperature observations taken at the LGS site are consistent with these ranges (Exelon 2012b).

Normal annual liquid precipitation is 42.05 in. (1,068 mm) in Philadelphia (NCDC 2012b) and 45.17 in. (1,147 mm) in Allentown (NCDC 2012c). The precipitation during the wettest year from the most recent 30-year period of record was 71.72 in. (1,822 mm) in 2011 (NCDC 2012c); during the driest year from the same period it was 30.41 in. (772 mm) in 1992 (NCDC 2012b). The summer months of June, July, and August are the wettest, averaging 4.0 in. (102 mm) of precipitation each month at both locations (NCDC 2012b, 2012c). February is the driest month, averaging 2.75 in. (70 mm) of precipitation (NCDC 2012b, 2012c). Precipitation trends measured at LGS (Exelon 2012c) are consistent with trends observed at Allentown and Philadelphia. Average annual snowfall for the area is 19.3 in. (49.0 cm) in Philadelphia

(NCDC 2012b) and 32.3 in. (80.0 cm) in Allentown (NCDC 2012c). The higher snowfall amounts at Allentown are likely to be more representative of the LGS site because the Philadelphia NWS station is warmer because of its more southeastern location as well as additional heating from the urban environment.

Thunderstorms are normally observed on 27 days throughout the year (NCDC 2012b, 2012c). Severe weather in the form of hail, tornadoes, or hurricanes is not commonly observed in the region. In the past 5 years, there have been 29 large hail (more than 0.75 in. [1.9 cm] in diameter) events reported in both Montgomery and Chester Counties, but many of the hail reports are associated with the same storm (NCDC 2012d). Tornadoes do not occur frequently in the region. In the past 5 years, no tornadoes were reported in Montgomery County and one tornado (classified on the Enhanced Fujita scale as an EF0, with a 65–85 mph (29.1–38.0 m/s) 3-second wind gust) occurred in Chester County (NCDC 2012d). Using tornado data for the period from January 1, 1950, through August 31, 2003, the annual best-estimate tornado strike probability for a 1-degree box that includes the LGS site is $1.59 \times 10^{-4}$ (Ramsdell and Rishel 2007). Tropical cyclones are rarely of hurricane strength by the time they are in the vicinity of the LGS site. The National Oceanic and Atmospheric Administration (NOAA) maintains a database of tropical cyclone tracks and intensities that covers the period from 1842 through 2010. During this time, only two Category 1 hurricanes, with maximum sustained winds of 74−95 mph (33.0–42.5 m/s), have passed within 80 km (50 miles) of the LGS site (NOAA 2012).

*2.2.2.1. Air Quality*

Under the Clean Air Act (CAA) of 1963, EPA has set primary and secondary National Ambient Air Quality Standards (NAAQSs, 40 CFR 50) for six common criteria pollutants to public health and the environment. The NAAQS criteria pollutants include carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and particulate matter (PM). PM is further categorized by size—$PM_{10}$ (diameter of 10 micrometers or less) and $PM_{2.5}$ (diameter of 2.5 micrometers or less).

EPA designates areas of “attainment” and “nonattainment” with respect to the NAAQSs. Areas for which insufficient data are available to determine designation status are denoted as “unclassifiable.” Areas that were once in nonattainment, but are now in attainment, are called “maintenance” areas; these areas are under a 10-year monitoring plan to maintain the attainment designation status.

Air quality designations are generally made at the county level. For the purpose of planning and maintaining ambient air quality with respect to the NAAQSs, EPA has developed Air Quality Control Regions (AQCRs). AQCRs are intrastate or interstate areas that share a common airshed (40 CFR 81). The LGS site is located in Montgomery and Chester Counties, Pennsylvania; these counties are part of the Metropolitan Philadelphia Interstate AQCR (40 CFR 81.15). Additional counties in this AQCR include Bucks, Delaware, and Philadelphia Counties. With regard to the NAAQSs, Montgomery and Chester Counties are designated as unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$ and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339).

States have primary responsibility for ensuring attainment and maintenance of the NAAQSs. Under Section 110 of the CAA (42 USC 7410) and related provisions, states are to submit, for EPA approval, State Implementation Plans (SIPs) that provide for the timely attainment and maintenance of the NAAQSs. On March 26, 2012, EPA approved and promulgated the PADEP’s SIP for ozone in the Philadelphia area, including Montgomery and Chester Counties (77 FR 17341). Similarly, on March 29, 2012, EPA approved and promulgated PADEP’s revisions to the SIP for $PM_{2.5}$ (77 FR 18987).

As required under 25 Pa. Code Chapter 127, Exelon maintains a Title V operating permit (TVOP-46-00038) for sources of air pollution at the LGS site (Exelon 2011b). Permitted sources include two cooling towers, a spray pond, several standby diesel generators and boilers, a solvent-based degreasing unit, and air emissions from various sources of waste oil (Exelon 2011b). As a condition of the Title V operating permit, Exelon is required to submit an annual compliance certification to the PADEP, which includes fuel usage and estimated air pollutant emissions (Exelon 2012b). Table 2–1 lists the total diesel fuel usage and associated air emissions for the most recent 5 years (Exelon 2012b). There are no plans for refurbishment of structures or components at LGS for license renewal. Therefore, there are no expected new air emissions associated with license renewal (Exelon 2011b).

**Table 2–1. Annual Fuel Use and Estimated Air Emission Estimates for Significant Sources at LGS**

| Year | Fuel Usage (gal)[a] | $NO_x$ (T)[b] | CO (T)[b] | $SO_x$ (T)[b] | $PM_{2.5}$ (T)[b] | $PM_{10}$ (T)[b] | VOC (T)[b] | Pb (T)[b] |
|---|---|---|---|---|---|---|---|---|
| 2007 | 1,128,502 | 29.3 | 22.7 | 6.1 | 0.44 | 42.3 | 0.80 | 0.0000 |
| 2008 | 927,297 | 31.2 | 19.8 | 4.8 | 0.47 | 42.2 | 0.90 | 0.0010 |
| 2009 | 858,760 | 28.4 | 18.5 | 3.8 | 0.41 | 42.7 | 1.97 | 0.0005 |
| 2010 | 1,003,210 | 35.3 | 21.8 | 4.0 | 0.72 | 161.1[c] | 2.13 | 0.0006 |
| 2011 | 1,145,960 | 32.8 | 24.2 | 7.8 | 0.80 | 166.3[c] | 2.10 | 0.0010 |

[(a)] To convert gallons to liters, multiply by 3.8.
[(b)] To convert T to MT, multiply by 0.91.
[(c)] Beginning in 2010, the emission calculation for $PM_{10}$ was changed for reporting purposes; no actual change in operations occurred and therefore no change in actual $PM_{10}$ emissions (LGS RAI Reply E1-1).
$NO_x$ = nitrogen oxides; CO = carbon monoxide; $SO_x$ = sulphur oxides; $PM_{2.5}$ = particulate matter with a diameter of 2.5 micrometers or less; $PM_{10}$ = particulate matter with an aerodynamic diameter between 2.5 and 10 micrometers; VOC = volatile organic compounds; Pb = lead.

Source: Exelon 2012b

40 CFR 81 Subpart D lists mandatory Class I Federal Areas where visibility is an important value. There are no mandatory Class I Federal areas within 50 miles (80 km) of the LGS site. The closest mandatory Class I Federal area is the Brigantine Wilderness in New Jersey, which is approximately 78 miles (127 km) southeast of the LGS site (40 CFR 81.420). Because of the significant distance from the site and prevailing wind direction, no adverse impacts on Class I areas are anticipated from LGS operation.

### 2.2.3. Geologic Environment

This section describes the current geologic environment of the LGS site and vicinity including landforms, geology, soils, and seismic setting.

Physiography. LGS is located within the Gettysburg-Newark Lowland Section of the Piedmont physiographic province. This region is generally comprised of rolling lowlands, shallow valleys, and isolated hills and mainly underlain by red shale, siltstone, and sandstone, with some conglomerate and diabase (DCNR 2000).

The main plant complex, including the LGS nuclear island, is situated on a broad, semi-circular ridge on the eastern bank of the Schuylkill River. Site topography slopes steeply to the west and south toward the Schuylkill River and Possum Hollow Creek, respectively. Elevations range from less than 110 ft (34 m) above MSL at the Schuylkill River to approximately 280 ft

(85 m) MSL at the highest elevation near the cooling towers. Blasting and other construction activities have modified the natural land surface across the plant site (Exelon 2011b).

Geology. Thick bedrock consisting of reddish-brown siltstone and interbedded sandstone and shale of the Brunswick Formation underlies the majority of the LGS site and vicinity. Rocks of the Sanatoga Member of the Lockatong Formation interfinger with the Brunswick in the northern part of the LGS site area and occur in the area of the spray pond, but do not occur beneath the cooling towers or the main plant structures. The Sanatoga is a bluish-gray, calcareous argillite with beds of black shale. This rock is relatively harder than the siltstone and other rocks of the Brunswick. In total, the uppermost bedrock sequence beneath the site is more than 5,000 ft (1,520 m) thick (Exelon 2008b).

The sediments that now comprise the Brunswick and other formations making up the near surface bedrock were deposited by streams feeding into one of a series of down-warped or down-faulted basins that formed during the late Triassic (i.e., between about 200 and 228 million years ago). LGS overlies the northern (Newark) portion of one such basin, the Newark-Gettysburg Basin. The sediments that now constitute the rocks of the Brunswick Formation originally were deposited by an ancient river system in the form of a large alluvial fan while the Lockatong was deposited in a shallow lake environment (Exelon 2008b).

Subsequent to the deposition and consolidation of the basin sediments, the region was uplifted, tilted, and deformed. In addition, the sedimentary materials have been broken by numerous small faults and fractures and locally include interbeds of and intrusions by volcanic rocks. Numerous intrusions of the basin's sedimentary rocks by volcanic diabase have been mapped throughout southeast Pennsylvania. One such prominent feature is a diabase dike (named the Downingtown Dike) that extends from about 11 miles (18 km) southwest of Downingtown, Pennsylvania, through Sanatoga Station, just north of the site, and continues about 3 miles (5 km) to the northeast. The sedimentary rock immediately bordering this feature has been thermally altered to a tough gray hornfels. Age dating of the numerous dikes in the region indicates that they were emplaced between about 140 and 198 million years ago Exelon 2008b).

Across the LGS site and region, bedrock is overlain by up to 40 ft (12 m) of residual soil, developed in place by the weathering and decomposition of the bedrock. This material (regolith) grades into weathered rock (saprolite), then into fresh, unweathered rock; no clearly defined boundary exists between soil and rock. Holocene (recent) alluvium consisting of silt, sand, and gravel occurs along the Schuylkill River and tributaries such as Possum Hollow Run (Exelon 2008b).

Numerous small faults and fractures occur in the Triassic strata underlying LGS. These features formed as a result of regional uplift that occurred following the consolidation of sediments in the Newark basin (Exelon 2008b). Most notable on a regional basis, the northwest border of the Newark basin in northern New Jersey and southeastern New York State is marked by a system of normal faults known as the Ramapo fault system. This fault system has been extensively studied by various investigators, including the USGS, in part because historical epicenters of small earthquakes have been loosely associated with this fault system (Crone and Wheeler 2000). Information compiled by Exelon (2008b) indicated that there is no clear association between the Ramapo fault and earthquake epicenters in the region, and no evidence for fault reactivation or fault offset at the surface. USGS's review of data for evidence of Quaternary fault activity (i.e., within the last 1.6 million years) encompassing the Eastern United States supports these conclusions, finding that geologic evidence is insufficient to demonstrate either the existence of a tectonic fault or Quaternary slip or deformation associated with the feature (Crone and Wheeler 2000, Wheeler 2006). Further, the Ramapo is not included in the USGS's latest Quaternary Fault and Fold Database (USGS 2012a).

Three small faults, the Sanatoga, the Brooke Evans, and the Linfield, occur within 2 miles (3.2 km) of the LGS site. The nearest approach of any fault, the Sanatoga fault, to the reactor area is 1,300 ft (400 m) to the west. The fault plane is intruded by Triassic diabase, which is part of the Downingtown Dike. The Brooke Evans fault passes within 2,800 ft (850 m) to the south of the plant area, and the trace of the Linfield fault lies about 2 miles (3.2 km) southeast of the LGS site. All three of these faults are associated with the Jurassic-Triassic events that occurred some 140 to 200 million years ago. Field studies of diabase intrusions of these faults indicate that they have been inactive for at least 140 million years (Exelon 2008b). Thus, none of these faults are active or considered "capable" of producing earthquakes per 10 CFR 100, Appendix A.

During foundation excavation for the plant, several features, including shear-fractures with some small offsets (displacement), were encountered. While not unusual for the region and not posing a hazard to plant structures, these areas were treated as necessary to ensure subsurface stability. Treatment included excavating any soft or otherwise weathered material down to competent bedrock and/or by replacing excavated material with concrete, as further described in the updated final safety analysis report (UFSAR) (Exelon 2008b).

There are no outstanding mineral rights within the LGS exclusion area (Exelon 2008b). There is one quarry (Pottstown Trap Rock Sanatoga Quarry) located about 0.8 miles (1.2 km) from the center of the main plant complex and adjacent to LGS's northern property boundary. Operations at the quarry consist of blasting, crushing, grading, and stockpiling rock (Exelon 2008b). The Sanatoga Quarry produces red aggregate stone for use in construction and landscaping applications. The site also has an asphalt production operation (H&K Group 2012).

Soils. Soils at the site, where present, consist predominantly of residual clayey silts (Exelon 2008b). Soil unit mapping by the Natural Resources Conservation Service (NRCS) identifies the majority of the LGS site complex as Urban land-Udorthents, shale and sandstone complex, 8 to 25 percent slopes. Consistent with the developed nature of the LGS site, this soil mapping unit is used to identify buildings and other impervious surfaces on hills and other uplands on graded land surfaces underlain by shale and sandstone. Natural soils bordering the main plant complex to the north and northeast include Penn silt loam, Readington silt loam, and Reaville silt loam, 0 to 8 percent slopes. These are generally moderately to well-drained soils on hills and hillslopes that developed from residuum weathered from sandstone and shale parent material. Depth to bedrock ranges from 20 to 40 in. (50 to 100 cm), which imparts a slight limitation for building site development. These soils are all prime farmland soils or farmland of statewide importance, where otherwise not committed to developed uses (7 CFR 657.5). This includes a continuous area totaling about 25 ac (10 ha) of Penn silt loam, 3 to 8 percent slopes just to the northeast of the spray pond. To the south and southeast along the north side of Possum Hollow Run, the soils are mapped as Klinesville channery silt loam, 35 to 60 percent slopes. These soils are relatively shallow and somewhat excessive drained. Soils along both banks of the Schuylkill River in the vicinity of LGS are mapped as Gibraltar silt loam. These soils are relatively deep, well-drained soils occupying valley flats, hills, and levees. Their parent material is coal overwash (i.e., materials derived from upstream coal mining) over alluvium derived from shale and siltstone. These soils are very limited for building site development because of the threat of ponding and flooding (NRCS 2012).

Foundations for all seismic Category I (safety-related) structures at LGS are founded on hard, competent bedrock or were excavated to unweathered bedrock. In addition, no other localized geologic hazards, old landslides, rock slips, or landslide scars have been identified near plant structures (Exelon 2008b).

<u>Seismic Setting</u>. Eastern Pennsylvania lies within a region that has experienced a moderate level of earthquake activity. However, zones of major earthquakes are located more than 200 miles (340 km) from the site and have not had an appreciable effect at LGS (Exelon 2008b). Probabilistic analysis that considers both the occurrence and intensity of earthquakes within and outside Pennsylvania indicate a relatively low seismic risk overall (DCNR 2003).

Pennsylvania is affected by small earthquakes that occur on local faults (DCNR 2003). Within a radius of 62 miles (100 km) of LGS, a total of 56 earthquakes have been recorded since 1973. The largest was a magnitude 4.6 event in January 1994, centered 24 miles (39 km) west of the site near Reading, Pennsylvania. The closest event was a magnitude 2.7 event in November 2003 with an epicenter 15 miles (24 km) west-northwest of LGS (USGS 2012b). These earthquakes are generally in association with the Lancaster Seismic Zone, an area of increased seismic activity, which encompasses recorded seismic events in Lancaster, York, Lebanon, and Berks Counties. This is the most active seismic zone in Pennsylvania. Southeastern Pennsylvania is not known to have experienced an earthquake with a magnitude greater than 4.7 (DCNR 2003).

The largest earthquake recorded to date within the Commonwealth's borders was a magnitude 5.2 event on September 25, 1998, in northwestern Pennsylvania, some 280 miles (450 km) northwest of LGS. It caused only minor structural damage near the epicenter (e.g., bricks shaken from chimneys) and was classified by the USGS as producing Modified Mercalli Intensity (MMI) VI shaking. It was felt throughout northern Ohio and most of Pennsylvania and into bordering states (Dewey and Hopper 2009; USGS 2012c, 2012d). By comparison, a magnitude 6 earthquake occurring in southeastern New York or northern New Jersey could affect the easternmost counties of Pennsylvania. Historically, such events (i.e., in 1737 and 1884) have produced MMI IV shaking in eastern Pennsylvania (DCNR 2003). Such a level of shaking would likely result in little to no damage to structures.

As documented in the LGS UFSAR, evaluation of tectonic structures and the historical seismic record for the region indicated that a plant design for MMI VII shaking was adequately conservative for the site. MMI VII shaking was determined to correspond with a peak ground acceleration (PGA) of 0.13 g (i.e., force of acceleration relative to that of Earth's gravity, "g"). For additional conservatism, 0.15 g was adopted for the LGS safe-shutdown earthquake (SSE) (Exelon 2008b).

For the purposes of comparing the plant SSE with a more contemporary measure of predicted earthquake ground motion for the site, the NRC staff also reviewed current PGA data from the USGS National Seismic Hazard Mapping Project. The PGA value cited is based on a 2 percent probability of exceedance in 50 years. This corresponds to an annual frequency (chance) of occurrence of about 1 in 2,500 or $4 \times 10^{-4}$ per year. For LGS, the calculated PGA is approximately 0.11 g (USGS 2008).

### 2.2.4. Surface Water Resources

#### *2.2.4.1. Site Description and Surface Water Hydrology*

The LGS main plant site is situated on a terraced hill that adjoins and overlooks the eastern bank of the Schuylkill River, and is located approximately 4 river miles (6.6 km) downriver from Pottstown, Pennsylvania. The plant site also lies 49 miles (79 km) upstream from the

Schuylkill's confluence with the Delaware River (Exelon 2011b). The Schuylkill River is within the boundaries of the Delaware River Basin.

In addition to being bordered by the Schuylkill River, the LGS property is also cut by two northeast to southwest trending tributaries to the Schuylkill River, Possum Hollow Run, and Brooke Evans Creek. Possum Hollow Run runs along the southeastern boundary of the main plant complex and receives stormwater runoff from plant facilities (see Section 2.2.4.2). The only other notable surface water features on the LGS site are the spray pond and a small holding pond. Part of the emergency cooling system (see Section 2.1.6), the spray pond is a clay-lined, man-made impoundment covering 9.9 ac (4 ha). The holding pond is a concrete-lined structure located south of the power block and beyond the main plant protected area. It covers less than 0.5 ac (0.2 ha) and receives industrial wastewater from various plant systems; it is an internal NPDES monitoring point (outfall 201) to the plant's main outfall 001 (Exelon 2010d, 2011a). These features are not further assessed from the perspective of surface water hydrology.

As described in Sections 2.1.6 and 2.1.7, all the water needs for the plant are provided by a combination of multiple subbasins' flows in addition to flow from the mainstem Delaware River. While the Schuylkill River is the primary source of water for the plant, makeup water for consumptive (evaporative cooling) use must be supplemented with water taken from Perkiomen Creek during low flow periods on the Schuylkill River. Perkiomen Creek and its tributary (East Branch Perkiomen Creek) provide a channel to convey water pumped from the Delaware River to LGS. The nonconsumptive water withdrawals and other plant effluents are discharged to the Schuylkill River downstream of the LGS Schuylkill River intakes.

<u>Schuylkill River</u>. The Schuylkill River flows for approximately 130 miles (209 km) to its confluence with the Delaware River at Delaware River Mile (RM) 92.5. Its watershed encompasses approximately 1,916 $m^2$ (4,962 $km^2$) and is one of the two largest tributaries to the Delaware River. Exelon's Schuylkill Pumphouse is located at Schuylkill RM 48 (Exelon 2011b). The mean annual discharge measured at the USGS gage at Pottstown, Pennsylvania, for water years 1928 through 2010 is 1,935 cfs (54.8 $m^3$/s). The 90 percent exceedance flow is 482 cfs (13.6 $m^3$/s) (USGS 2010a, 2012e). For water year 2011, the mean discharge was 3,145 cfs (89.1 $m^3$/s). The 90 percent exceedance flow is an indicator value that a drought warning is appropriate. It signifies that the current 30-day average flow has been exceeded 90 percent of the time, as compared to the average flow for the period of record (DEP 2012). For the Schuylkill River, August is the low-flow month and March is the high-flow month over the period of record.

<u>East Branch Perkiomen Creek</u>. The East Branch Perkiomen Creek flows for a distance of 24 miles (39 km) and enters Perkiomen Creek at a point about 11 stream miles (18 km) from the confluence of Perkiomen Creek with the Schuylkill River. Its flow is highly variable and, before the establishment of the diversion of water from Exelon's Bradshaw Reservoir, the creek was reportedly intermittent in nature during the summer and fall (Exelon 2011b). Based on water year data from 1990 through 2011, the mean annual discharge and 90 percent exceedance flow measured at the USGS gage at Dublin, Pennsylvania, are 35.8 cfs (1.0 $m^3$/s) and 13 cfs (0.37 $m^3$/s), respectively (USGS 2011a).

<u>Perkiomen Creek</u>. Perkiomen Creek drains an area of some 363 $m^2$ (940 $km^2$) and joins with the Schuylkill River at a point approximately 16 stream miles (26 km) downstream from LGS. For the period of 1915 through 1956 and prior to flow regulation due to Green Lane Reservoir beginning in late 1956, the reported mean annual discharge and 90 percent exceedance flow at the USGS gage at Graterford, Pennsylvania, are 389 cfs (11 $m^3$/s) and 42 cfs (1.2 $m^3$/s), respectively. As previously described (see Section 2.1.6), water has been diverted to the creek

since August 1989 from the Delaware River at Point Pleasant to Bradshaw Reservoir and then pumped from the reservoir to East Branch Perkiomen Creek. For the period 1957 through 2011, the measured mean annual discharge and 90 percent exceedance flow values are 435 cfs (12.3 $m^3$/s) and 65 cfs (1.8 $m^3$/s), respectively (USGS 2011b).

Delaware River. The Delaware River flows 330 miles (531 km) from its origin in southern New York to the Delaware Bay, and it is the longest un-dammed river in the United States east of the Mississippi (DRBC 2012). The tidal portion of the Delaware River extends upriver from the estuary at Delaware Bay to Trenton, New Jersey. Upriver salinity intrusion varies according to increases or decreases in upriver inflows. The boundary of salinity intrusion, also known as the salt line, fluctuates with flow changes. The salt line is the point where the average sodium chloride concentration in the river exceeds 250 mg/L. The Point Pleasant Pumping Station used to transfer Delaware River water is located at Delaware RM 157, which is above the salt line (Exelon 2011b). Based on data for 1913 through 2010, the mean annual discharge and 90 percent exceedance flow measured at the USGS gage at Trenton, New Jersey, are 11,900 cfs (337 $m^3$/s) and 3,080 cfs (87.2 $m^3$/s), respectively. This gage site is at Delaware RM 134.5, about 20 river miles (32.2 km) downstream from the Point Pleasant Pumping Station (USGS 2010b).

*2.2.4.2. Surface Water Quality and Effluents*

Among the powers and duties assigned to the DRBC are classifying all waters in the basin as to use, setting basin-wide water quality standards, establishing pollutant treatment and control regulations, and reviewing projects or other undertakings with the potential to affect basin water resources for conformance with the DRBC Comprehensive Plan (DRBC 2001). DRBC has also promulgated water quality standards for the basin under 18 CFR 410. The DRBC acts in cooperation with the States and other parties that are signatories to the DRBC Compact (DRBC 1961) and who retain their authority to set more stringent standards necessary to protect the water resources of the basin. Article 3.8 of the DRBC Compact (DRBC 1961) requires that the DRBC approve a project whenever it finds and determines that the project would not substantially impair or conflict with the Comprehensive Plan. DRBC's Comprehensive Plan already accounts for existing LGS operations (DRBC 2001).

The Commonwealth of Pennsylvania has established surface water quality standards for individual rivers, streams, and unnamed tributaries, including wetlands, along with associated numeric water quality criteria to protect the desired and designated uses of the water bodies. Relative to the LGS site, PADEP has specifically designated the main stem of the Schuylkill River traversing Montgomery County to its mouth with the Delaware River for use in the maintenance and propagation of warm water fishes (WWF) and the passage, maintenance, and propagation of migratory fishes (MF). The main stem of Perkiomen Creek is also designated as WWF and MF. East Branch Perkiomen Creek is designed for use in the maintenance of stocked trout from February 15 to July 31 of each year, in addition to WWF and MF during the rest of the year. It should be noted that all surface waters in Pennsylvania are protected for water supply (public, industrial, and wildlife use) and for recreational uses (25 Pa. Code 93). Ambient water quality data Exelon compiled (Exelon 2011b) to support its 2010 NPDES permit renewal application and as part of the DRBC monitored demonstration study (Exelon 2012d) were reviewed by NRC staff during the course of the LGS license renewal environmental review. Comparison of the available data with the water quality criteria established by the DEP under 25 Pa. Code 93.7 and 93.9 for the designated uses of the Schuylkill River and tributaries indicate that existing water quality is supportive of designated uses. Section 2.2.6 discusses key trends in ambient water quality and its influence on aquatic biota.

Section 303(d) of the Federal Clean Water Act (CWA) requires the Commonwealth of Pennsylvania and other states to identify all waters for which effluent limitations and pollution control activities are not sufficient to attain water quality standards in such waters. The 303(d) list includes those water quality limited segments that require the development of total maximum daily loads (TMDLs) to assure future compliance with water quality standards. While the Schuylkill River is listed as supporting its designated aquatic life uses, Pennsylvania's draft 2012 Clean Water Act Section 303(d) list of impaired waters continues to list the main stem of the Schuylkill River in the plant vicinity as impaired because of polychlorinated biphenyl (PCB) contamination from unidentified upstream sources (DEP 2011, Exelon 2011b).

Industrial wastewater, cooling water, and stormwater discharges from LGS are governed by a Pennsylvania DEP-issued NPDES permit (No. PA0051926) and regulated under PADEP's regulations at 25 Pa. Code 92a. Exelon's current permit sets effluent quality limits and monitoring requirements for the plant's discharges covering some 24 outfall locations. These include 17 outfalls discharging stormwater either to the Schuylkill River or Possum Hollow Run, with one outfall discharging stormwater runoff north to the headwaters of Sanatoga Creek. Six outfalls discharge industrial wastewater (mainly noncontact cooling water) or comingled noncontact cooling water with stormwater. Most notably, cooling tower blowdown, closed-cycle cooling water, spray pond water, stormwater via the plant's holding pond, and other plant wastewaters (e.g., liquid radwaste treatment system and laundry drain wastes) are discharged through the plant's primary outfall (no. 001) to the Schuylkill River (Exelon 2010d, 2011b). In particular, the treated liquid radwaste is batch discharged to the cooling tower blowdown line where it is diluted by the normal blowdown flow. This ensures that radionuclides discharged through outfall 001 comply with 10 CFR 20 limits (Exelon 2011b).

The cooling tower blowdown line is also equipped with an overflow vent, which is monitored as a separate NPDES outfall (no. 023) (Exelon 2010d, 2011b). The vent, which NRC staff observed during the November 2011 environmental site audit (NRC 2012), is located south of the power block and just downslope from the plant's holding pond.

LGS's current NPDES permit for plant operations was issued by PADEP with an effective date of April 1, 2006; the permit expired on March 31, 2011 (Exelon 2011b, 2012b). However, Exelon submitted a permit renewal application to PADEP on September 28, 2010, which the PADEP accepted as administratively complete on December 15, 2010 (PADEP 2010; Exelon 2010d, 2012a). As a result, LGS's NPDES permit for LGS operations remains in effect (i.e., administratively continued) because Exelon submitted an application for renewal at least 180 days before the expiration of the current permit in accordance with 25 Pa. Code 92a.7.

Exelon has a separate PADEP-issued NPDES permit (No. PA0052221) for the discharge of diversion water from the Bradshaw Reservoir to East Branch Perkiomen Creek. The permit was issued with an effective date of July 1, 2009, and expires June 30, 2014.

Continued NPDES permit coverage is an indication that Exelon's discharges from LGS and other facilities meet applicable water quality standards, while satisfying state Water Quality Certification requirements under Section 401 of the Federal Clean Water Act. This is because, in Pennsylvania, the 401 Water Quality Certification process is integrated with other PADEP-issued permits and approvals, including those under the NPDES permit program.

The NRC staff's review of the last 3 years of NPDES Discharge Monitoring Reports (DMRs) submitted by Exelon to the PADEP revealed no unusual conditions or exceedances of effluent limitations. Further, the staff determined that Exelon has not received any Notices of Violation, nonconformance notifications, or related infractions associated with the site's NPDES permits or related to other water quality matters within the past 5 years (Exelon 2012a).

### 2.2.5. Groundwater Resources

#### *2.2.5.1. Site Description and Hydrogeology*

Groundwater beneath LGS and vicinity occurs in the thick bedrock of the Brunswick and Lockatong Formations, as described in Section 2.2.3.

The USGS has grouped the water-bearing portions (i.e., aquifers) of these formations into the Aquifers in the Early Mesozoic Basins system (Trapp and Horn 1997). The Brunswick bedrock aquifer is the most widespread source of groundwater in the plant region and across the Triassic lowlands of the Newark Basin (Exelon 2008a). In general, aquifer zones occur in association with secondary fractures, joints, and bedding planes in the rock where groundwater is stored and may move along (Exelon 2008a, 2011b; Trapp and Horn 1997). In strata where approximately vertical sets of joints are tightly spaced and have some degree of interconnection, aquifer permeability is increased and groundwater flow and yield to wells are greatly enhanced. However, these localized zones of enhanced aquifer permeability vary vertically and laterally through the rock, especially as the basin strata dips to the north and northwest at 10 to 20 degrees on a regional basis and strikes approximately east to west (Exelon 2008a). Consequently, individual bedrock aquifer zones also dip downward and may run in the downdip direction for only a few hundred feet but can be continuous in extent for thousands of feet along (parallel to) the bedrock strike (Trapp and Horn 1997). As such, groundwater yield to individual wells can vary greatly over relatively short distances (Exelon 2008a, Trapp and Horn 1997). Because of decreasing fracture density with depth, groundwater movement primarily occurs in the upper 600 ft (180 m) of the Brunswick system (Exelon 2008b). In fact, within the Newark Basin in Pennsylvania, yields are highest from wells with completion depths ranging from 200 to 500 ft (60 to 150 m). Groundwater yields from large-diameter wells within the basin typically range from about 12 gpm (45 L/min) in shale and argillite up to 80 gpm (300 L/min) in massive sandstones (Trapp and Horn 1997).

Recharge to the bedrock aquifer occurs from precipitation that falls over the higher elevations of the region's groundwater basins, and which is able to infiltrate through the overlying soils and regolith (Exelon 2008a, 2011b). While overlying surficial materials (i.e., soils, regolith, and stream alluvium), where present in the region, are not typically thick enough to be a sustained source of groundwater to wells by themselves, thick deposits do help to increase the availability of water to wells withdrawing from the underlying bedrock (Trapp and Horn 1997). Nevertheless, the majority of the precipitation and runoff occurring in recharge areas moves laterally downgradient through the regolith and discharges to streams or low-lying areas rather than recharging groundwater (Trapp and Horn 1997). The regolith across the LGS site is relatively thin at no more than 12 ft (3.7 m) in thickness, and well measurements indicate that the materials are not water-bearing (Exelon 2011b).

Beneath LGS, groundwater occurs under water table (unconfined) conditions but can occur under confined (artesian) conditions at depth. From static water levels recorded in the plant's primary production wells, the depth to the water table surface beneath the plant ranges from 20 to 30 ft (6 to 9 m) below ground surface. The water table approximates the surface topography, with groundwater generally flowing to the south and southwest beneath the site and discharging to Possum Hollow Run and the Schuylkill River. The groundwater flow rate through the Brunswick bedrock is estimated to be on the order of 0.07 ft (0.02 m) per day or about 26 ft (7.9 m) per year, based on the results of the site's 2006 hydrogeologic investigation, as further described in Section 2.2.5.2. Locally on the plant site, a groundwater high point and groundwater flow divide (striking northeast to southwest) is evident just northeast of the cooling towers adjacent to the spray pond (Exelon 2008a, 2011a). Water table mapping does not indicate any groundwater mounding beneath the spray pond, an observation that would be expected if significant seepage were occurring from the pond.

LGS's four groundwater production wells are completed in the Brunswick aquifer system. These wells range in depth from 198 ft (60 m) to 585 ft (178 m), as further described in Section 2.1.7. They are located within a groundwater protected area (Schuylkill-Sprogels Run Subbasin) designated by the DRBC, and site groundwater withdrawals are otherwise subject to Pennsylvania reporting requirements as also described in Section 2.1.7. As for other groundwater users in the vicinity of LGS, a search of Pennsylvania water well records revealed 54 wells within a 1-mile (1.6-km) radius from the center of the LGS site. This number includes eight wells attributed to the LGS property, although only four remain in service. Other than the LGS wells, only 3 of the 54 wells reportedly are used for other than domestic (i.e., residential) purposes. Most of the recorded residential wells range in depth from 120 to 200 ft (37 to 61 m). For the other nondomestic wells, they include one public water supply well at a mobile home park located northeast of the plant; the well depth is not recorded. One other nondomestic (commercial/industrial) supply well is located at the Pottstown Trap Rock-Sanatoga Quarry located just to the north of the LGS property boundary. This well is recorded as 100 ft (30 m) deep. The remaining well supplies a local bed and breakfast business located southeast of LGS; the well is recorded as 96 ft (29 m) in depth (Exelon 2011b, DCNR 2012).

*2.2.5.2. Groundwater Quality*

Regional groundwater is characteristically of the calcium bicarbonate type and is generally suitable for a wide range of purposes (Exelon 2008a, Trapp and Horn 1997). However, the natural quality of groundwater from the region's bedrock aquifers is typically hard with TDS concentrations averaging 230 mg/L and hardness (measured as calcium carbonate) of 160 mg/L (Trapp and Horn 1997). Groundwater from the Brunswick aquifer system can naturally have a TDS in excess of 500 mg/L, which exceeds the EPA secondary drinking water standard (DWS) primarily established for aesthetic (taste) purposes (40 CFR 143). Data collected from the plant's production wells to establish background water quality indicated moderately hard water ranging from 134 to 618 mg/L with TDS concentrations from 199 to 1,052 mg/L (Exelon 2008a). As noted in Section 2.1.7, groundwater used at LGS is treated, as necessary, including that withdrawn to meet the potable needs of LGS site personnel.

Exelon initiated a program at LGS in 2006 to characterize the hydrogeologic environment of the plant site and to specifically assess the potential impacts on groundwater quality of any inadvertent releases of tritium or other LGS-related radionuclides. The assessment conducted at LGS was part of a fleet-wide effort by Exelon to assess conditions at all of its nuclear plants and which was undertaken consistent with its participation in the Nuclear Energy Institute's Groundwater Protection Initiative (NEI 2007). These efforts provided the framework for the plant's ongoing Radiological Groundwater Protection Program (RGPP) (CRA 2006, Exelon 2011a). The RGPP incorporates knowledge gained from the LGS pre-operational Radiological Environmental Monitoring Program (REMP) assessment conducted between 1982 and 1984 (CRA 2006).

The 2006 hydrogeologic investigation and its associated report (CRA 2006) considered historical releases from LGS facilities to include the structures, systems, and components (SSCs) and areas that may have the potential to contribute to releases. Consequently, a groundwater monitoring well network was designed, sited, and installed as part of the study to include wells located at appropriate upgradient and downgradient locations (i.e., relative to groundwater flow) so as to assess the potential for radionuclides to migrate off site. The monitoring network established as part of the investigation initially included use of seven (i.e., nos. P3, P11, P12, P14, P16, P17, and SP22) of the 22 wells that were installed on site before and during LGS construction plus eight new wells (wells MW-LR-1 through MW-LR-8). The wells have total depths in the Brunswick Formation ranging from 34 to 115 ft (10 to 35 m) below ground surface. Aside from groundwater, surface water samples also were collected and analyzed for tritium and other radionuclides (CRA 2006, Exelon 2011b).

From the initial 2006 sampling, no strontium-90 or gamma-emitting radionuclides were detected in groundwater or surface water above analytical detection limits. Tritium was detected in 5 of 16 wells sampled (i.e., in well nos. MW-LR-4, MW-LR-5, MW-LR-8, MW-LR-9, and P12). Observed tritium concentrations ranged from 222±118 pCi/L to 4,360±494 pCi/L, all below the EPA primary DWS of 20,000 pCi/L (40 CFR 141). From three of the five wells with detectable tritium (MW-LR-4, MW-LR-5, MW-LR-8), levels ranged from 222±121 pCi/L to 305±121 pCi/L, which are within the range of background levels (established as 200 pCi/L) documented for the site and vicinity. The highest tritium level measured, at 4,360±494 pCi/L, was from monitoring well P12 located almost immediately south and within 100 ft (30.5 m) of the LGS power block perimeter. A subsequent sample yielded a comparable result. At the same time, a sample from the power block foundation sump had tritium at 2,020±154 pCi/L. Nevertheless, it was affirmed during the site investigation that well P12 was completed in a discrete zone normally located above the water table and thus not representative of overall site groundwater flow conditions (CRA 2006). This also had been noted before the start of plant operations, as documented in the UFSAR (Exelon 2008a). As a result, well MW-LR-9 was installed nearby to a depth of 100 ft (30.5 m) below ground surface to take the place of well P12. The new well was sampled in August 2006 and yielded a tritium concentration of 1,500±210 pCi/L (CRA 2006).

Tritium was also detected in one surface water sample collected from the plant’s holding pond. The holding pond is located approximately 500 ft (152 m) due south and downgradient from wells P12 and MW-LR-9. Tritium was measured at 523±137 pCi/L. This concrete-lined structure receives nonradioactive wastewater, roof, and plant yard runoff from power block buildings, and collected drainage from the power block sump (CRA 2006). It is also an internal monitoring point (outfall 201) under the site’s NPDES permit, as discussed in Section 2.2.4.1 (Exelon 2010d, 2011b).

The 2006 hydrogeologic investigation identified two possible sources of tritium to account for the levels in the referenced monitoring wells: (1) releases that occurred in December 2004 and February 2005 from the Unit 1 Condensate Storage Tank dike because of heating steam valves leaking condensation and (2) the release of tritiated steam condensation to the ground from an auxiliary heating steam pipe in October 2002. The releases could have migrated directly downgradient and through bedrock fractures toward the wells or were collected by the power block drain system and into the sump, which then migrated through the bedrock fractures to groundwater. From observations the staff made during the November 2011 environmental site audit (NRC 2012) and the data reviewed, the conclusions presented in the 2006 hydrogeologic report are reasonable.

Under the ongoing RGPP at LGS, groundwater and surface water samples are collected and analyzed for tritium and other radionuclides at least semi-annually. The results are reported as a component of the annual Radiological Environmental Operation (REOP) reports (Exelon 2008a, 2009, 2010c, 2011b, 2012c) submitted to the NRC. Exelon continues to adhere to a detection limit of 200 pCi/L for tritium, which is lower than the detection threshold (2,000 pCi/L) recommended by industry guidance (NEI 2007) and the site ODCM. This enables early detection and response to any releases (Exelon 2011b). As documented in the annual REOPs referenced above, a number of releases of tritiated water from plant SSCs have been documented and for which investigative and corrective action was taken, as necessary. Between 2007 and 2011, the highest tritium level observed was 1,750 pCi/L in well MW-LR-9 in 2009 and was attributed to a release of condensate from the outside of the Unit 1 and 2 condenser bays in February 2009. Tritium in MW-LR-9 had decreased to a maximum of 1,154 pCi/L by April 2011 (Exelon 2012c). Overall, the RGPP results reveal that there is no migration of tritium in groundwater at LGS at concentrations exceeding 2,000 pCi/L, and observed tritium levels have been well within the EPA primary DWS at all onsite monitoring wells.

### 2.2.6. Aquatic Resources

Potentially affected waterbodies primarily occur within the Piedmont physiographic province portion of the Delaware River Basin, including the Schuylkill River, Perkiomen Creek, East Branch Perkiomen Creek, and the Delaware River near the Point Pleasant Pump Station (Figure 2–9). LGS relies on consumptive and nonconsumptive water primarily from the Schuylkill River, as described in Section 2.1.6. When temperature and flow conditions in the Schuylkill River do not meet DRBC criteria for water use, LGS secondarily relies on water from Perkiomen Creek. Withdrawing water from Perkiomen Creek often requires augmentation of flow by transferring water from the Delaware River. A series of pumping stations delivers Delaware River water from the Point Pleasant Pump Station by pipeline to the Bradshaw Reservoir, which is then delivered by pipeline to the East Branch Perkiomen Creek. Water ultimately flows from the East Branch Perkiomen Creek to the Perkiomen Creek. The rate of flow into the East Branch Perkiomen Creek equals the LGS consumptive water demand plus an additional 3 percent to account for evaporative losses (Exelon 2011b). Because of the complex water diversion system, descriptions of the biological communities for each water body appear as separate resources.

#### *2.2.6.1. Description of the Aquatic Resources Associated With Limerick Generating Station*

<u>*Schuylkill River*</u>

The Schuylkill River flows 209.2 km (130 miles) from headwaters at Tuscarora Springs, Pennsylvania, to the confluence of the Delaware River in Philadelphia, Pennsylvania. LGS is located on the Schuylkill River, 6.4 river km (4 river miles) downriver of Pottstown, Pennsylvania, and 56.3 river km (35 river miles) upriver of Philadelphia, Pennsylvania.

The Schuylkill River historically contained abundant aquatic resources, including large populations of mussels and anadromous fish. Around the turn of the 18th century, coal mining became a predominant industry near the headwaters of the Schuylkill River. Mining waste effluents degraded downstream water quality and reduced optimal habitat for aquatic life (Rhoads and Block 2008). For example, the flow of acidic waters from mines, known as acid mine drainage, lowered pH values and increased dissolution of heavy metals in the river. Aquatic biota often cannot survive in waters with low pH values and increased concentrations of heavy metals (Sadak 2008). Water quality throughout the Schuylkill River basin continues to be influenced by mining activities from the last several decades (Interlandi and Crockett 2003).

The Schuylkill River once supported large numbers of anadromous fishes such as the American shad (*Alosa sapidissima*), alewife (*A. pseudoharengus)*, and river herring (or blueback herring, *A. aestivalis*), which spawn in freshwater and inhabit marine waters as adults. Anadromous fish would migrate from the Atlantic Ocean to the Delaware and Schuylkill Rivers to spawn. However, construction of the Fairmont Dam, built in 1820, and eight subsequent dams built in the 1800s, cut off access to upriver spawning locations for anadromous fish. Starting in the 1970s, fish passage systems, such as vertical fish slots and the removal of dams along the Schuylkill River, have helped to reestablish migration upriver. For example, Pennsylvania Fish and Boating Commission (PFBC) conducted fish ladder passage counts in 2004 and 2005 and observed a total of 91 and 41 American shad migrating upriver, respectively (PFBC 2012b). In addition, the PFBC has been stocking American shad fry in the Schuylkill River for the past

13 years in an effort to restore the legacy fishery (PFBC 2012a, NMFS 2012c). PFBC collected migrating shad between 2003 and 2007 in the Schuylkill River and observed that 95 percent were of hatchery origin. PFBC plans to continue to stock American shad fry annually until monitoring results indicate a self-sustaining fishery with spring runs averaging 300,000 to 850,000 returning adults (PFBC 2012b).

*Biological Communities in the Schuylkill River*

The aquatic ecology of eastern U.S. streams and rivers is made up of producers and consumers that transfer energy through food web interactions. The base of the food web is primary producers, which convert light energy into organic matter. Common primary producers in the Schuylkill River include diatoms (a common phytoplankton), filamentous green alga such as *Cladophora*, and *Myriophyllum*, a fresh water flowering plant (NRC 1984). Detritus, nonliving organic matter such as leaves, is also an important base of the foodweb. Primary producers are consumed by zooplankton (small animals that float, drift, or weakly swim in the water column of any body of water), icthyoplankton (fish eggs and larvae), and herbivorous fish and invertebrates (e.g., aquatic insects, worms, and snails). Predatory invertebrates and fish, such as sunfish (*Lepomis* spp.) and brown bullhead (*Ictalurus nebulosus*), in turn consume zooplankton (including ichthyoplankton) and herbivorous fish and invertebrates.

Prior to LGS operations, LGS-related aquatic surveys conducted in the Schuylkill River near the LGS site provided baseline information for aquatic plant, benthic invertebrate, and fish assemblages. Surveys included sampling for phytoplankton (microscopic floating photosynthetic organisms), macrophytes (aquatic plants), macroinvertebrates, ichthyoplankton (fish eggs and larvae), and fish, from 1970 through 1984 (PECO 1984; RMC 1984, 1985, 1989). Subsequent sampling after LGS began operations included sampling for macroinvertebrates, ichthyoplankton, and fish from 1985 through 2009 (RMC 1986, 1987, 1988, 1989; Exelon 2001, 2002, 2003, 2004, 2005; NAI 2010a).

**Periphyton, Phytoplankton, and Macrophytes.** To support the operating license for LGS, PECO (1984) surveyed the seasonal abundances of periphyton (sessile algae and crustaceans that grow attached to hard surfaces) and phytoplankton (microscopic plants) from 1973 through 1974 and macrophytes (plants that can be observed with the naked eye) from 1974 through 1977. PECO (1984) observed peak productivity during summer and fall when light and temperature requirements are optimal for plant growth in shallow, lotic systems. Commonly collected periphyton and phytoplankton included diatoms (*Navicula*, *Diatoma*, and *Gomphonema*) and blue green algae. PECO (1984) observed 10 species of macrophytes. No additional LGS-related studies were conducted to examine plankton and periphyton communities since 1977.

**Macroinvertebrates.** For macroinvertebrate surveys, RMC-Environmental Services (RMC) placed buried cylinder samplers in sediments upstream and downstream of LGS and collected the colonized samplers after several months of deployment (RMC 1984, 1985, 1986). Oligochaetes, true flies (Diptera) and the snail, *Goniobasis viginica* dominated downriver macroinvertebrate communities. In 1984, RMC characterized the macroinvertebrate community as typical of other U.S. temperate rivers (RMC 1984).

From 1985 through 1988, RMC surveyed macroinvertebrates using the same sampling methods as described above for pre-operational surveys. Oligochaetes, snails, beetles (Coleoptera) and flies (Dipteria and Trichoptera) dominated the macroinvertebrate surveys both upstream and downstream of the Schuylkill River intake and discharge structures. RMC (1988) did not observe a substantial variation in the macroinvertebrate community when comparing pre-operational samples to post-operational samples at the same sampling sites (RMC 1988). Similarly, RMC (1988) did not observe a significant change in the benthic macroinvertebrates community when comparing the 3 years of data after LGS operations began. During this time period, LGS solely relied upon the Schuylkill River water for makeup water and did not use Perkiomen Creek (RMC 1988).

In 2009, NAI (2010a) surveyed the macroinvertebrate community in the Schuylkill River using kicknets. Although NAI used different sampling methods than RMC in the 1980s, approximately 95 percent of the taxa collected in the 1980s were also collected in 2009. Both studies found midges (Diptera and Trichoptera) and snails to be among most the abundant taxa.

**Fish.** RMC (1984) used drift and push nets to survey fish eggs and larvae; seines to survey fish fry, juveniles, and small fish; and electrofishing to survey larger fish in the Schuylkill River. Sunfish, goldfish (*Carassius auratus*), and unidentified minnows dominated egg and larval fish samples, which were highest in May, June, and July (PECO 1984). Spot-fin shiner (*Notropis spilopterus*), swallowtail shiner (*Notropis procne*), and redbreast sunfish (*Lepomis auritus*) dominated seine samples. During electrofishing surveys, RMC (1984) captured redbreast sunfish, white sucker (*Catastomus commersonii*), goldfish, brown bullhead, and pumpkinseed (*Lepomis gibbosus*) most often.

RMC (1987) conducted the most recent surveys of icthyoplankton, in the Schuylkill River near LGS in 1986. The species composition and relative abundances of the most common species were similar to that found in pre-operational surveys. The most common taxa included minnows and sunfish (RMC 1987).

Several juvenile and adult fish studies have occurred since LGS began operations. From 1985 through 1988, RMC surveyed juvenile and adult fish using the same sampling methods as described above for pre-operational surveys (RMC 1986, 1987, 1989). RMC collected shiner species, redbreast sunfish, and goldfish most often during seining and electrofishing surveys from 1985 through 1988 (RMC 1986, 1987, 1988, 1989). RMC (1988) noted no obvious shifts in fish population abundances or species diversity in the area of the LGS discharge.

NAI (2010a) compared the fish community from 1987 to 2009. However, the timing and frequency of sampling efforts varied slightly among studies: NAI (2010a) conducted electrofishing and seining surveys in September and October whereas RMC sampled monthly from spring through fall. The most commonly collected species in 2009 were spotfin shiner (73.8 percent of the total catch), swallowtail shiner (8.1 percent), banded killifish (*Fundulus heteroclitus*) (3.7 percent), and tessellated darter (*Etheostoma olmstedi)* (3.4 percent) (NAI 2010a). In 1987, spotfin shiner was also the most abundant species, although the relative abundance (53.9 percent of the total catch) was lower compared to 2009 surveys. NAI collected all age groups of fish (fry, juveniles, and adults) for most fish families observed, with the exception of sunfishes, which were primarily fry and juveniles. NAI electroshocking surveys collected primarily adult and juvenile redbreast sunfish (27.7 percent of the total catch). Other commonly collected species included white sucker (17.4 percent), rock bass (*Ambloplites rupestris)* (17.2 percent), common carp (*Cyprinus carpio)* (16.9 percent), and smallmouth bass *(Micropterus dolomieu)* (8.3 percent). In 1987 the most abundant species was rock bass (19.0 percent), followed by goldfish (17.6 percent), redbreast sunfish (15.7 percent), yellow bullhead (*Ameiurus natalis)* (8.8 percent), and pumpkinseed (8.6 percent). Despite the increased sampling frequency during earlier fish surveys, NAI (2010a) concluded that the overall species diversity was similar to the earlier fish surveys by RMC in 1987. However, the relative abundance of certain species changed between 1987 and 2009. For example, common carp replaced goldfish as one of the more abundant species in 2009 (NAI 2010a). In addition, goldfish (an introduced species) was not collected in 2009 and a single brown bullhead was collected in 2009. Both of these species were one of the five most commonly collected species during 1987 surveys.

The Schuylkill River supports recreational fishing, although there is little public access to the river near the LGS site. Creel surveys indicate that the most common recreational species include sunfishes and smallmouth bass (NRC 1984; RMC 1984; 1985; 1986).

*Schuylkill River Flow Augmentation*

In 2003, Exelon started a flow augmentation demonstration project, which pumped water from the Wadesville mine pool into the Schuylkill River. NAI and URS (2004 and 2011) conducted monitoring studies to determine the potential effects of the flow augmentation demonstration project on aquatic biota. Monitoring studies during the first year of the project indicated that the flow augmentation had no effect on water quality parameters such as total dissolved solids and pH (NAI and URS 2004). Aquatic biota monitoring included an assessment of macroinvertebrate and fish community composition and abundances before and after initiation of the demonstration project at upstream and downstream locations of the Norwegian Creek confluence with the Schuylkill River (NAI and URS 2004). NAI and URS sampled macroinvertebrates using kick nets and fish using electroshocking. Prior to the initiation of the demonstration project, predominant fish species included blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), white sucker and green sunfish (*Lepomis cyanellus*), while macroinvertebrate sampling revealed limited species diversity with decapods, oligochaetes, and Trichoptera comprising the majority of samples. Fish abundances and community composition remained similar following commencement of the demonstration project. However, macroinvertebrate diversity and abundance increased below the confluence of Norwegian Creek and the Schuylkill River (NAI and URS 2004). Exelon and the DRBC have extended the initial demonstration project on a year-to-year basis. The most recent assessment compared water quality and aquatic biotic from 2003 to 2011. NAI and URS (2011) reported no significant changes to water quality or aquatic biota species diversity or abundances within the Schuylkill River due to use of the Wadesville Mine Pool water using sampling methods described for the initial study conducted in 2003. As described in Section 2.1.6, Exelon plans to continue to rely more on use of Schuylkill River water for consumptive water use rather than Perkiomen Creek in the future (Exelon 2012b).

<u>Perkiomen Creek</u>

As described in Section 2.1.6, LGS withdraws water from Perkiomen Creek, rather than the Schuylkill River, if the flow and temperature conditions in the Schuylkill River do not meet DRBC criteria for water use. Maintenance of minimal flow in Perkiomen Creek to meet the DRBC criteria often requires diversion of Delaware River water via East Branch Perkiomen Creek as discussed in Section 2.1.6.

The Perkiomen Creek enters the middle reach of the Schuylkill River at RM 32.3 which is 25.7 stream km (16 stream miles) downstream of LGS (Exelon 2011b). Perkiomen Creek supports a warm water fishery with migratory fishes (Rhoads and Block 2008). The watershed includes predominantly agricultural and increasingly more residential land uses. Few large industrial facilities operate within the watershed, although some municipal wastewater treatment plants discharge to Perkiomen Creek (PECO 1984, PADEP 2003). The Perkiomen Railroad historically ran along a portion of Perkiomen Creek. The rail bed today is now part of the Perkiomen Trail used for recreation (Rhoads and Block 2007). The PFBC, in partnership with American Rivers, is currently proposing to restore habitat in the creek for diadromous fish, including American eels, alewife, and blueback herring (NMFS 2012c).

*Biological Communities in Perkiomen Creek*

Pre-operational biotic sampling of Perkiomen Creek began in 1970 and included surveys of macroinvertebrates and fish in the 1970s and early 1980s, ichthyoplankton from 1973 through

1975, and phytoplankton in 1974 (PECO 1984; RMC 1984, 1985, 1989). Post-operational biotic sampling included surveys of macroinvertebrates from 1996 through 2007 (Stroud 2011) and fish from 1985 to 1987 (RMC 1986, 1987, 1988).

**Periphyton and Phytoplankton.** Surveys from 1973 through 1974 indicated that diatoms dominated periphyton and phytoplankton communities (PECO 1984). The most common diatom was *Navicula*, which is a benthic diatom that occurs throughout the year in Perkiomen Creek. No additional LGS-related studies were conducted to examine plankton and periphyton communities since 1974.

**Macroinvertebrates.** Pre-operational benthic macroinvertebrate surveys indicated that a diverse and productive macrobenthos occurs within Perkiomen Creek (NRC 1984). Caddisflies, black flies, and Chironomidae (midges) dominated the collected species. PECO (1984) collected the greatest overall biomass during the fall.

Stroud Water Research Center (Stroud) conducted a diversity assessment of macroinvertebrates between 1996 and 2007 using hand-picked collection off rocks and Hess samplers (Stroud 2011). The goal of the study was to use macroinvertebrate diversity as an indicator of water and habitat quality. Stroud evaluated the diversity at different areas of Perkiomen Creek by calculating the macroinvertebrate aggregated index for streams (MAIS) score. The MAIS score incorporates 10 indices, such as the number of sensitive taxa and diversity of certain taxa, to come up with a score of 0 through 20. Sites with an MAIS score of 0 to 6 are considered “Poor,” 6.1 to 13 “Fair,” and 13.1 to 20 “Good.” Stroud (2011) ranked the lower Perkiomen Creek as fair and assigned the site an MAIS value of 9.5 (Stroud 2011). The most abundant taxa included Chironomidae (midges), Elmidae (riffle beetles), and Oligochaetes (aquatic earthworms; Stroud 2011). Midges also dominated samples collected during pre-operational studies (PECO 1984).

**Fish.** Pre-operational studies employed seines and electrofishing to survey juvenile and adult fish (PECO 1984). In addition, drift and shoreline traps were used to survey fish larvae (PECO 1984). Fish sampling efforts between 1970 and 1987 indicated that Perkiomen Creek supports fish assemblages typical of same-sized southeastern Pennsylvania lotic systems (PECO 1984; RMC 1984, 1985, 1986, 1987, 1988). Carp and minnows dominated larval fish collections, while dominant adult and juvenile species included minnows and sunfishes (PECO 1984).

After operations began at LGS, RMC sampled Perkiomen Creek as part of the annual nonradiological monitoring program for LGS from 1985 through 1986. Species diversity for adult fish remained similar to pre-operational studies with redbreast sunfish being the predominant species (RMC 1986, 1987, and 1988).

LGS-related studies did not include icthyoplankton surveys after operations began or juvenile or adult surveys following initiation of the Point Pleasant Water Diversion Project in 1988. However, the current fish community in Perkiomen Creek is likely similar to the current fish community in the East Branch Perkiomen Creek, which NAI (2010b, 2010c) sampled for fish from 2001 through 2009, as described below. The two creeks likely have similar fish communities because the creeks are in the same watershed, the East Branch Perkiomen Creeks flows into Perkiomen Creek, similar land uses (and related anthropogenic stresses) surround both creeks, and because both creeks provide similar habitats for fish. Furthermore, LGS-related studies collected a total of 54 fish species in East Branch Perkiomen Creek and Perkiomen Creek between 1970 and 2009 (Exelon 2011b). Of the 54 fish species collected, 47 species (87 percent) were collected in both waterbodies (Exelon 2011b). Based on the historical similarities in fish communities, the hydraulic connection of the two creeks, and similar habitats, NRC staff expects that the current fish communities would be similar in Perkiomen Creek and East Branch Perkiomen Creek.

Recreational fishing in Perkiomen Creek existed historically for sunfishes, pike fishes, and carp (NRC 1984). Currently, the PFBC stocks Perkiomen Creek with brown trout (*Salmo trutta*) and rainbow trout (*Onchorhynchus mykiss*) in Montgomery County (PFBC 2011a).

<u>*East Branch Perkiomen Creek*</u>

As part of the transfer of water from the Delaware River to the Perkiomen Creek, a series of pumping stations delivers Delaware River water from the Point Pleasant Pump Station to the Bradshaw Reservoir by pipeline and then to East Branch Perkiomen Creek by pipeline (see Section 2.1.6). The water then flows from the East Branch of the Perkiomen Creek to Perkiomen Creek.

The East Branch Perkiomen Creek joins the Perkiomen Creek approximately 18 stream km (11.2 stream miles) upstream of the Perkiomen Creek and Schuylkill River confluence. The East Branch Perkiomen Creek is a warm water stream with riffles, runs, and shallow pools (Exelon 2011b).

*Biological Communities in East Branch Perkiomen Creek*

Aquatic sampling in the East Branch Perkiomen Creek before LGS operations included surveys of phytoplankton from 1973 through 1974, macroinvertebrates and fish in the 1970s through 1984, and ichthyoplankton from 1973 through 1975 (PECO 1984; RMC 1984, 1985, 1989). Aquatic sampling after LGS operations began includes surveys of macroinvertebrates and fish from 1985 through 1986 and 2001 through 2009 (RMC 1986, 1987; Exelon 2011b; NAI 2010b, 2010c).

**Periphyton and Phytoplankton.** Surveys from 1973 through 1974 indicated that diatoms dominated periphyton and phytoplankton communities (PECO 1984). The most common diatoms were *Navicula*, *Melosira*, *Synedra*, *Nitzschia*, and *Cocconeis*. No additional LGS-related studies were conducted to examine plankton and periphyton communities since 1974.

**Macroinvertebrates.** Aquatic sampling for macroinvertebrates occurred from 1970 through 1987, 1979 through 1986, and 2001 through 2009 (PECO 1984, RMC 1986, 1987; Exelon 2011b; NAI 2010b, 2010c). Sampling methods followed those previously described under the studies described for Perkiomen Creek. Pre-operational sampling indicated that a diverse macroinvertebrate community made up of a variety of aquatic insects, annelids, and mollusks occurred within the East Branch of Perkiomen Creek (PECO 1984). Subsequent sampling between 1983 and 1986 showed similar diversity with the earlier studies. In addition, the biotic communities in the East Branch Perkiomen Creek resembled those found in the Perkiomen Creek with regard to macroinvertebrates assemblages (Exelon 2011b). After LGS operations began, RMC (1986 and 1987) reported the most abundant taxa as oligochaetes, stoneflies, caddisflies, snails, and clams from 1985 through 1986.

After the initiation of the Point Pleasant water diversion project, which transported water from the Delaware River to East Branch Perkiomen Creek, NAI (2010b, 2010c) sampled macroinvertebrates between 2001 and 2009 using methods similar to those reported by RMC. This study was part of an analysis to examine post-operational effects of the Point Pleasant water diversion effort (Exelon 2011b). NAI (2010b, 2010c) observed similar levels of macroinvertebrate species diversity as compared to pre-diversion sampling. Midges and oligochaetes dominated samples both before and after the diversion project. However, after the diversion project, less variability existed along the stream gradient and pollution-sensitive species increased in abundance over time (NAI 2010b, 2010c).

**Fish.** Fish studies from 1970 through 1976 examined fish larvae using drift nets and juvenile and adult fish using seines and electroshocking (PECO 1984). White sucker, yellow bullhead, sunfish, and minnows dominated larval fish samples (PECO 1984). Common species collected in juvenile and adult fish surveys included minnows, sunfish, shiners, banded killifish, suckers, catfish, and pike (PECO 1984). Species abundances varied by sampling site, suggesting possible species zonation along the regions sampled.

From 1985 through 1987, dominant species in the seining and electrofishing studies included shiners, minnows, suckers, and sunfish (RMC 1986, 1987, 1988). NAI (2010b, 2010c) sampled for fish in East Branch of Perkiomen Creek from 2001 through 2009. Dominant species included sunfishes and minnows, which is similar to the dominant species captured in previous studies (NAI 2010b, 2010c). NAI (2010b, 2010c) did not observe approximately one quarter of the species identified in the 1970s and 1980s surveys. NAI (2010b, 2010c) may not have observed these species because they are no longer present or because the aquatic biota was sampled more frequently in the 1970s and 1980s, which would make it more likely that the surveys captured more species (Exelon 2011b). As with the macroinvertebrate sampling, NAI (2010b, 2010c) noted that pollution-sensitive fish species increased in abundance and that less variability existed between sampling locations.

Recreational fishing in East Branch Perkiomen Creek existed historically for catfish, sunfishes, and pike fishes (NRC 1984). Currently, the PFBC stocks East Branch Perkiomen Creek with brown trout and rainbow trout in Montgomery County (PFBC 2011a).

<u>Delaware River</u>

The Delaware River flows 531 km (330 miles) from its origin in southern New York to the Delaware Bay. Historically, degradation of the Delaware River began as early as the late 1700s and by 1940, the Delaware River was considered one of the most polluted rivers in the United States. The Delaware River has high vessel traffic ports along with a large concentration of industry and oil-refinery plants (Albert 1988). The toxicity and low dissolved oxygen levels of the estuarine and tidal portions of the Delaware River presented a chemical barrier for fish to complete migration from the tidal to freshwater portions of the Delaware River. Restoration efforts started in the 1960s and continue to this day. The DRBC manages water resources and contaminant levels in the Delaware River (Albert 1988).

The Point Pleasant Pump Station, which withdraws water that is transferred to the East Branch Perkiomen Creek, occurs at RM 157. The Point Pleasant Pump Station is above the salt line, or the boundary where salt intrudes the river from tidal flows (Exelon 2011b). Riffle, run, and pool habitat characterize the Delaware River within 2.5 km (1.5 miles) upstream and downstream of the Point Pleasant Pump Station.

*Biological Communities in the Delaware River*

Aquatic sampling in the Delaware River before LGS operations included surveys for macrophytes, macroinvertebrates, and fish from 1972 through 1973 and ichthyoplankton from 1979 through 1984 (NRC 1984; PECO 1984; RMC 1984, 1985). Once operations began, RMC (1986) sampled ichthyoplankton in 1985.

**Periphyton and Macrophytes.** Similar to the other waterbodies discussed above, diatoms dominated periphyton samples collected in the early 1970s (Exelon 2011b). Pre-operational monitoring for macrophytes indicated that water milfoils (*Myriophyllum* sp.) were common in back eddies near the Point Pleasant Pump Station (Exelon 2011b). No additional LGS-related studies have been conducted near the Point Pleasant Pump Station to examine periphyton and macrophyte communities since 1973.

**Macroinvertebrates.** Aquatic sampling for macroinvertebrates occurred from 1972 through 1973 using dip nets, hand removal, and stationary fine mesh nets. Sampling areas included approximately 2 km (1.2 miles) upstream to 2.4 km (1.5 miles) downstream of Point Pleasant Pump Station. Samples included aquatic insects, snails, clams, mollusks, and worms (Exelon 2011b). Dominant taxa within dip net samples included chironomid midges and amphipods (Exelon 2011b). No additional LGS-related macroinvertebrate studies have been conducted near the Point Pleasant Pump Station since 1973.

DRBC conducted a diversity assessment of macroinvertebrates between 2001 and 2008 throughout the non-tidal portion of the Delaware River (DRBC 2009). DRBC collected invertebrates annually using kick nets at 25 sites along the river, including two sites within 3 RM of the Point Pleasant Pump Station. DRBC calculated a multi-metric Index of Biotic Integrity (IBI) score, which was composed of 6 ecological metrics, including species richness (total number of species), EPT Richness (total number of species within three insect orders: Ephemeroptera, Plecoptera, Trichoptera), Shannon-Wiener Diversity (an index of species diversity based on the relative abundance and total number of species), the Biotic Index (an index based on the relative abundance species sensitive to environmental stress), Intolerant Percent Richness (the percent of species intolerant to environmental stress relative to the overall number of species), and Scraper Richness (degree of overlap and number of select invertebrate species). The IBI score for the two sites near the Point Pleasant Pump Station was generally similar to or slightly less than the IBI score of upriver sites within the Delaware Watergap National Recreation Area and the Upper Delaware Scenic & Recreational River (DRBC 2009). These results suggest that the area surrounding the Point Pleasant Pump Station is similar to, or slightly more disturbed, than upriver sites within Federally-designated areas.

**Fish.** RMC and PECO surveyed ichthyoplankton in the Delaware River from 1972 through 1973 and 1979 through 1985 using drift and push nets (PECO 1984; RMC 1984, 1985, 1986). RMC sampled ichthyoplankton near the Point Pleasant Pump Station and downriver to RM 138 near Yardley, Pennsylvania (RMC 1984, 1985, 1986). Dominant species within ichthyoplankton samples included herring (Clupeidae), *s*unfish, American shad, and common carp eggs and larvae.

Adult fish studies were conducted from 1972 through 1973 and 1979 through 1980 in the vicinity of the Point Pleasant Pump Station using seines, fyke nets, and trap nets (Exelon 2011b). The most common taxa included sunfishes, shiners, and catfishes (Exelon 2011b). The adult fish studies also observed anadromous species such as the alewife, American shad, and blueback herring (Exelon 2011b). These species used this region of the Delaware River as a nursery area (Exelon 2011b). No additional LGS-related studies have been conducted near the Point Pleasant Pump Station to examine adult fish communities since 1980.

PFBC sampled American shad in the non-tidal portion of the Delaware River at RM 178.9, which is approximately 20 RM upstream of the Point Pleasant Pump Station (PFBC 2011c). RFBC conducted the electrofishing surveys during the spring from 1997 through 2001 and 2010 through 2011. The average annual catch per unit effort (CPUE) ranged from approximately 11 to 50 shad per hour (PFBC 2011c). All females collected in 2011 were gravid, indicating that the females had produced eggs but had not yet spawned or released the eggs into the river.

Recreational and commercial fishing occur in the Delaware River (NYSDEC 2009). Common recreational species caught in the non-tidal portion of the Delaware River include American shad, American eel, channel catfish, rainbow trout, smallmouth bass, striped bass (*Morone* *saxatilis*), and walleye (Versar 2003, PFBC 2012d). In 2003, river herring and hickory shad comprised a small portion of the catches (Versar, 2003). As of October 2012, river herring and hickory shad fisheries are closed in the Delaware River (PFBC 2012d).

*Onsite Water Bodies*

Two streams, Possum Hollow Run and Brooke Evans Creek, run parallel to each other and flow through the LGS site. LGS discharges industrial wastewater and stormwater to Possum Hollow Run under NPDES compliance (Exelon 2012b). Brooke Evans Creek is a freestone stream and a tributary to the Schuylkill River (PADEP 2006a). The State of Pennsylvania designates both streams with water use protection for maintenance and propagation of flora and fauna indigenous to warm water habitat (Pa. Code 93.3).

Exelon has not conducted any sampling or monitoring of aquatic biota in Possum Hollow Run (Exelon 2012b). PADEP (2006a) conducted an evaluation of indigenous aquatic biota as an indicator of long-term water quality conditions in Brook Evans Creek. PADEP staff collected benthic macroinvertebrate data and assessed habitat using a modified index of biotic integrity protocols under PADEP's antidegradation implementation guidance (PADEP 2006a). PADEP observed relatively high abundances of macroinvertebrates tolerant of water quality degradation, indicating that human activity in the basin has influenced the habitat quality and composition of aquatic biota within Brooke Evans Creek.

*2.2.6.2. NOAA Trust Resources*

NOAA trust resources include, but are not limited to, commercial and recreational fishery resources, anadromous species (fish that spawn in fresh water and then migrate to salt water), catadromous species (species that spawn in salt water and then migrate to fresh water), and threatened and endangered species. NOAA trust resources in the Schuylkill River and Perkiomen Creek include alewife, blueback herring, American shad, striped bass, hickory shad, bluefish, yellow perch, white perch, bay anchovy, and American eel and their habitat (NMFS 2012a). Alewife, blueback herring, American shad, striped bass, hickory shad, and white perch are anadromous species that spawn in fresh water, such as the Delaware River and its estuary, and then return to the Atlantic Ocean after spawning (PFBC 2012c). American eel is a catadromous species that spawns in the Atlantic Ocean and returns to the Delaware River after spawning (PFBC 2012c). Table 2–2 describes the NOAA trust species that have been observed in LGS-related surveys of the Delaware River, Perkiomen Creek, East Branch of the Perkiomen Creek, and the Schuylkill River. As noted above, dams throughout the Schuylkill River historically have limited the movement of migrating fish. More recent efforts to remove dams, the addition of fish ladders, and stocking rivers with fry have helped to increase the population of anadromous fish (NMFS 2012a).

**Table 2–2. NOAA Trust Resources Observed in LGS-related Aquatic Studies**

| | Schuylkill River[a] | East Branch Perkiomen Creek[b] | Perkiomen Creek[c] | Delaware River[d] |
|---|---|---|---|---|
| Alewife | X | | | X |
| American eel | X | X | X | X |
| American shad | X | | | X |
| Bay anchovy | | | | |
| Blueback herring | | | | |
| Bluefish | | | | |
| Hickory shad | | | | |
| Striped bass | | | | |
| White perch | X | | | X |
| Yellow perch | X | X | X | X |

(a) LGS-related surveys occurred from 1970–1976, 1979–2004, and 2009.
(b) LGS-related surveys occurred from 1970–1976, 1979–1987, and 2001–2009.
(c) LGS-related surveys occurred from 1970–1977 and 1979–1987.
(d) LGS-related surveys occurred from 1972–1973 and 1982–1985 near the Point Pleasant Pumping Station on the Delaware River.
Note: A blank cell indicates that the species was not observed during LGS-related surveys.

Source: Exelon 2011

*2.2.6.3. Invasive or Introduced Aquatic Species*

Hydrilla (*Hydrilla verticillata*) forms dense mats at the surface of waterbodies and reduces light to aquatic plants residing below. Hydrilla can also impair commercial water use by clogging pipes and reducing flow rates (Sea Grant Pennsylvania 2012). Hydrilla grows in freshwater habitats and tolerates a wide range of environmental conditions. Hydrilla occurs in the Schuylkill River near Philadelphia, Pennsylvania (Exelon 2011b).

The Asiatic clam (*Corbicula fluminea*) can be problematic for nuclear facilities in terms of biofouling in the intake and circulating water systems (NRC 1996). NAI indicated that this invasive organism is present in the Schuylkill River upstream and downstream of LGS (NAI 2010a, 2010d), in Perkiomen Creek near the Perkiomen Pumphouse (NAI 2010d), East Branch Perkiomen Creek (NAI 2010b, 2010c), and the Delaware River near the Point Pleasant Pump Station (RMC 1989).

Zebra mussels (*Dreissena polymorpha*) actively filter feed large amounts of freshwater and remove available plankton food sources making less food available for other aquatic organisms (Sea Grant Pennsylvania 2007). Exelon conducted surveys to determine if any zebra mussels were present near the LGS intakes in the Schuylkill River and in Perkiomen Creek (Exelon 2011b). Exelon did not find evidence of zebra mussels in the Schuylkill River or Perkiomen Creek (NAI 2010d, Exelon 2011b).

### 2.2.7. Terrestrial Resources

LGS Ecoregion

The LGS site lies in the Triassic Lowlands portion of the Northern Piedmont ecoregion (EPA 2010). The Triassic Lowlands contain wide undulating ridges and broad nearly level valleys with limited local relief. Appalachian oak forest dominated by white oak (*Quercus alba*) and red oak (*Q. rubra*) is the most prevalent forest community. Hickory (*Carya* spp.) is more abundant in this region of the Piedmont because of the less acidic soils, while red maple (*Acer rubrum*) and black tupelo (*Nyssa sylvatica*) are present but less abundant than in other portions of the Northern Piedmont ecoregion (EPA 2010). Streams, wetlands, and a few ponds occur in the Triassic lowlands. Farms and houses have replaced much of the native vegetation, and suburban development intensifies nearer to Philadelphia (EPA 2010), which lies about 21 miles (34 km) southeast of the LGS site. In the immediate vicinity of the LGS site, land uses include light residential development, agriculture, old fields, and woodlands.

The LGS site is included in the Upper Schuylkill Conservation Landscape. The Montgomery County Planning Commission designated this as one of 13 conservation landscapes in the county that have high natural biodiversity. The Upper Schuylkill Conservation Landscape totals 2,392 ac (968 ha) and extends from just above Royersford Borough to the Berks County line. The conservation landscape includes 1,064 ac (431 ha) of forest, about 275 ac (111 ha) of which qualify as interior forest. Although this area, especially along the Schuylkill River, has been the site of intensive industrial development, riparian habitat remains along the Schuylkill River and some of its tributaries, such as Possum Hollow Run and Brook Evans Run, which enter the Schuylkill River from the LGS site (Rhoads and Block 2008).

The riparian area of the Schuylkill River is included in the river's designation as a Pennsylvania Scenic River (PDCNR 2010). The Pennsylvania Department of Conservation and Natural Resources (PDCNR) manages designated scenic rivers that are free-flowing and capable of supporting water-based recreation and aquatic life.

Pennsylvania State Game Land #234 lies about 2 miles (3.2 km) southeast of the LGS site on the east side of the Schuylkill River in close proximity to the Limerick to Cromby 230-kV transmission line corridor (22-60 line) (PGC 2011). Pennsylvania State Game Lands are managed by the Pennsylvania Game Commission for hunting, trapping, and fishing.

LGS Site

Before construction of the LGS plant, the LGS site consisted primarily of immature, nearly climax oak-hickory forest, and some fruit orchards (AEC 1973). LGS construction disturbed about 270 ac (110 ha; 42 percent of the current LGS site) (AEC 1973). PECO (which constructed and first operated LGS) seeded temporarily disturbed areas with perennial grasses after construction (AEC 1973, NRC 1984). When LGS first began operating in 1984, mixed deciduous forest occurred along the Schuylkill River, Possum Hollow Run, and in an area approximately 50 m (164 ft) west of the LGS Unit 1 cooling tower (NRC 1984). Today, riparian and upland forest, small forested and emergent wetlands, pioneer herbaceous, old fields, agricultural fields, and developed areas occupy the site (Exelon 2011a, WHC 2006). A description of each of these habitats appears below. Several linear corridors run through the LGS site, including utility distribution rights-of-way that are maintained as grass or scrub-shrub habitat (WHC 2006).

Forest habitat on the LGS site includes both lowland riparian and upland communities. Riparian forest occurs along the banks of the Schuylkill River and smaller tributaries such as Brooke Evans Creek and Possum Hollow Run. Tree species in these areas include silver maple (*Acer saccharinum*), American sycamore (*Plantanus occidentalis*), American elm (*Ulmus americana*), and slippery elm (*U. rubra*). Riparian forest provides food, cover, and reproductive habitat to wildlife. For example, during spring, forest depressions may collect water and form ephemeral pools that amphibians use for breeding and waterfowl and neotropical migrant birds use as stopover habitat. Riparian forest provides dispersal and seasonal migration corridors. Upland forest supports common tree species, such as white ash (*Fraxinus Americana*), tulip poplar (*Liriodendron tulipifera*), red maple, chestnut oak (*Quercus prinus*), American elm, black walnut (*Juglans nigra*), slippery elm (*Ulmus rubra*), flowering dogwood (*Cornus florida*), bitternut hickory (*Carya cordiformis*), American beech (*Fagus grandifolia*), and red oak. Upland forest also provides food, cover, and reproductive habitat for wildlife (Exelon 2010a).

Small palustrine forested and emergent wetlands on the LGS site are important habitat for wildlife, especially amphibians. Red maple and silver maple typically dominate the palustrine forested wetlands on the LGS site. Common vegetation in palustrine emergent wetlands includes sedges (*Carex* spp.), microstegium (*Eulalia viminea*), bedstraws (*Galium* spp.), arrow-leaf tearthumb (*Polygonum sagittatum*), halberd-leaf tearthumb (*Polygonum arifolium*), flatsedges (*Cyperus* spp.), hollow joe-pye-weed (*Eupatoriadelphus fistulosus*), and swamp milkweed (*Ascelpias incarnata*) (Exelon 2010a).

Pioneer herbaceous habitat on the LGS site consists of plant communities that colonize areas following disturbances such as construction, grading, and periodic mowing. This plant community typically consists of wineberry (*Rubus phoenicolasius*), mugwort (*Artemisia vulgaris*), multiflora rose (*Rosa multiflora*), lesser celandine (*Ranunculus ficaria*), orchardgrass (*Dactylis glomerata*), foxtails (*Alopecurus* spp.), white goosefoot (*Chenopodium album*), spotted lady's thumb (*Polygonum persicaria*), Pennsylvania smartweed (*Polygonum pensylvanicum*), cespitose knotweed (*Polygonum cespitosum*), curly dock (*Rumex crispus*), wild carrot (*Daucus carota*), white amaranth (*Amaranthus albus*), butter-and-eggs (*Linaria vulgaris*), red clover (*Trifolium pretense*), yellow sweetclover (*Melilotus officinalis*), white sweetclover (*Melilotus alba*), and Deptford pink (*Dianthus armeria*). This habitat is of low value to native wildlife, but it is beneficial to some species such as white-tailed deer, eastern cottontail (*Sylvilagus floridanus*), and meadow vole (*Microtus pennsylvanicus*) (Exelon 2010a).

Old field habitat on the LGS site consists of abandoned agricultural areas that are either in the meadow (grasses and forbs) or scrub/shrub state of succession. Old field meadow habitat supports grasses such as fescue (*Festuca* spp.), Kentucky bluegrass (*Poa pratensis*), timothy (*Phleum pretense*), and orchardgrass, and forbs such as Canada goldenrod (*Solidago canadensis*), daisy fleabane (*Erigeron strigosus*), evening primrose (*Oenothera biennis*), dwarf cinquefoil (*Potentilla candensis*), wild carrot, teasel (*Dipsacus fullonum*), red clover, smartweeds (*Polygonum* spp.), and shrubs such as brambles (*Rubus* spp.). Common wildlife species include white-tailed deer, red fox (*Vulpes vulpes*), eastern cottontail, raccoon (*Procyon lotor*), and Virginia opossum (*Didelphis virginiana*) (Exelon 2010a).

Agricultural fields on the LGS site contain crops such as corn, wheat, barley, soybeans, and hay. Agricultural areas also support hedgerows of upland tree species such as black cherry (*Prunus serotina*), black walnut (*Juglans nigra*), Osage orange (*Maclura pomifera*), white ash (*Fraxinus americana*), red cedar (*Juniperus virginiana*), tulip poplar (*Liriodendron tulipfera*), sassafras (*Sassafras albidum*), and common hackberry (*Celtis occidentalis*). These areas provide cover and food for wildlife species such as white-tailed deer that are adapted to edge habitats (Exelon 2010a).

Buildings, asphalted parking lots, roads, landscaping, and mowed lawns occupy the developed portions of the LGS site. Mowed lawns consist largely of non-native cool season grasses that are of minimal value to native wildlife species. Landscaped areas contain mostly non-native ornamental species, some of which may serve as nesting habitat, cover, and food sources for some native bird species (Exelon 2010a).

Common mammal species on the LGS site include the white-tailed deer, raccoon, striped skunk (*Mephitis mephitis*), red fox, Virginia opossum, eastern cottontail, gray squirrel (*Sciurus carolinensis*), groundhog (*Marmota monax*), and white-footed mouse (*Peromyscus leucopus*) (Exelon 2010a, NRC 1984, Kriner and MacDonald 2009).

Common bird species on the LGS site include game birds such as Canada goose (*Branta canadensis*) and mourning dove (*Zenaida macroura*); raptors such as red-tailed hawk (*Buteo jamaicensis*) and turkey vulture (*Cathartes aura*); resident songbird species such as northern cardinal (*Cardinalis cardinalis*); and neotropical migrant songbirds such as Baltimore oriole (*Icterus galbula*), indigo bunting (*Passerina cyanea*), and red-eyed vireo (*Vireo olivaceous*). Other avian species include eastern bluebird (*Sialia sialis*), American robin (*Turdus migratorius*), eastern towhee (*Pipilo erythrophthalmus*), tufted titmouse (*Baeolophus bicolor*), downy woodpecker (*Picoides pubescens*), blue jay (*Cyanocitta cristata*), American crow (*Corvus brachyrhynchus*), killdeer (*Charadrius vociferous*), barn swallow (*Hirundo rustica*), tree swallow (*Tachycineta bicolor*), purple martin (*Progne subis*), and the introduced European starling (*Sturnus vulgaris*) (Blye 1973, Exelon 2010a, Kriner and MacDonald 2009). The U.S. Geological Survey has also regularly recorded all of these species during its annual Breeding Bird Survey along the Schwensksvill route (Sauer et al. 2011). This route, which runs near Pottstown (USGS 2001), lies about 3 miles to the northwest of the LGS site.

Reptiles that inhabit the riparian habitat bordering the Schuylkill River and its tributaries on the LGS site include the northern black racer (*Coluber constricter*), northern ring-necked snake (*Diadophis punctatus punctatus*), eastern garter snake (*Thamnophis sirtalis*), water snake (*Nerodia sipedon*), spotted turtle (*Clemmys guttata*), mud turtle (*Trachemys scripta*), eastern box turtle (*Terrapene carolina carolina*), and eastern painted turtle (*Chrysemys picta picta*). Amphibians that inhabit the LGS site include the red-backed salamander (*Plethodon cinereus*), long-tailed salamander (*Eurycea longicauda*), northern two-lined salamander (*Eurycea bislineata bislineata*), American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*), bullfrog (*Rana catesbeiana*), leopard frog (*Rana pipiens*), and green frog (*Rana clamitans*) (Exelon 2010a, Kriner and MacDonald 2009). The amphibians range from fully aquatic (e.g., bullfrog) to semi-aquatic (e.g., toad species) and are closely tied to water habitats, including streams, wetlands, and temporary pools where they reproduce. The frog and toad species, except the bullfrog, also make extensive use of adjacent terrestrial habitats, such as forest, grassland, and cropland as juveniles and adults. The turtle species leave the water to nest (egg deposition) in nearby soft substrates.

Exelon joined the Wildlife Habitat Council in 2005, and since that time has formed an Environmental Stewardship Committee that has developed a Wildlife Management Plan (Exelon 2010b). The Wildlife Management Plan is a comprehensive strategy that outlines the goals of the wildlife habitat program for the LGS site and describes projects and milestones to achieve these goals. As part of the program, Exelon places and monitors artificial avian nesting structures and bat roost boxes (WHC 2006). In 2007, Exelon installed structures around the perimeter of the LGS site for eastern blue birds, purple martins, owls, raptors, other perching birds, and bats. In addition, in 2010, Exelon installed a 300-ft-(90-m)-long barrier between Possum Hollow Run and an adjacent road and parking area on the east side of the LGS site to decrease the mortality of amphibians during post-natal dispersal (Exelon 2010b). Exelon staff continues to develop the wildlife habitat enhancement program and evaluate future projects that would enhance the quality of the natural environment on the site. In 2010, Exelon received WHC's Corporate Wildlife Habitat Certification in recognition of its implementation of the wildlife habitat enhancement program (Exelon 2011b).

Transmission Line Corridors

Section 2.1.5 describes the transmission lines that were built to connect the LGS to the regional electricity grid and that are within the scope of this SEIS. Section 2.1.5 also describes vegetation maintenance along the transmission line corridors. The NRC is not aware of any biological field surveys or studies of these transmission line corridors. Habitat within the corridors is highly variable and includes suburban, residential, agricultural, forested, wetland/floodplain, and open water. The lines also traverse several parks and natural heritage areas, including the Evansburg State Park and Schuylkill River National and State Heritage Area (Exelon 2011b).

The NRC staff did not identify any ecological surveys or studies that provide information on habitats and species along the transmission line corridors. However, some studies on the transmission lines in southeastern Pennsylvania provide information on common vegetation and species along the LGS transmission line corridors. Common tree species in transmission line corridors in the northern Piedmont ecoregion of Pennsylvania include white ash, red maple, and sassafras (Bramble et al. 1992, Yahner et al. 2001, Yahner and Yahner 2007). Common shrub species include multiflora rose, Japanese honeysuckle (*Lonicera japonica*), blackberry (*Rubus allegheniensis*), dewberry (*R. hispidus*), gray dogwood (*Cornus paniculata*), black haw (*Viburnum prunifolium*), and poison ivy (*Toxicodendron* radicans) (Bramble et al. 1992, 1997; Yahner and Yahner 2007). Common forb species include goldenrod (*Solidago* spp.), strawberry (*Fragaria virginiana*), common cinquefoil (*Potentilla simplex*), goosegrass (*Galium aparine*), sow-thistle (*Sonchus oleraceus*), and mile-a-minute (*Polygonum perfoliatum*) (Bramble et al. 1992, 1997; Yahner and Yahner 2007). Common grass species include fall panic grass (*Panicum* spp.), deertongue grass (*Panicum clandestinum*), foxtail grass (*Setaria glauca*), and broomsedge (*Andropogon virginicus*) (Bramble et al. 1992, 1997; Yahner and Yahner 2007).

Common breeding bird species in transmission line corridors in the northern Piedmont ecoregion of Pennsylvania include the field sparrow (*Spizella pusilla*), black-throated blue warbler (*Dendroica caerulescens*), gray catbird (*Dumetella carolinensis*), rufous-sided towhee (*Pipilo erythrophthalmus*), common yellowthroat (*Geothlypis trichas*), American goldfinch (*Carduelis tristis*), and indigo bunting (Bramble et al. 1992). Amphibian species include the Jefferson salamander (*Ambystoma jeffersonianum*), redbacked salamander (*Plethodon cinereus*), spotted salamander (*Ambystoma maculatum*), and the American toad (Yahner et al. 2001). Reptile species include the eastern garter snake, northern ringneck snake (*Diadophis punctatus edwards*), black rat snake (*Pantherophis obsoletus*), and eastern box turtle (Yahner et al. 2001). Small mammals include the white-footed mouse, northern short-tailed shrew (*Blarina brevicauda*), and meadow vole (Yahner and Yahner 2007). Common butterfly species include the cabbage white (*Pieris rapae*), little wood-satyr (*Megisto cymela*), and great spangled fritillary (*Speyaria cybele*) (Bramble et al. 1997).

### 2.2.8. Protected Species and Habitats

The U.S. Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS) jointly administer the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.). The FWS manages the protection of and recovery effort for listed terrestrial and freshwater species, while the NMFS manages the protection of and recovery effort for listed marine and anadromous species.

Within Pennsylvania, the PGC, the PFBC, and the PDCNR oversee the protection of Commonwealth-listed species under the Pennsylvania Endangered Species Program. The PGC, PFBC, and PDCNR manage the recovery efforts for wild birds and mammals

(34 Pa. Code 133); fish, amphibians, reptiles, and aquatic organisms (30 Pa. Code 75); and native plants (17 Pa. Code 45), respectively.

The Magnuson–Stevens Fishery Conservation and Management Act (MSA), as amended, is administered by the NMFS. The MSA requires Federal agencies to consider the impact of Federal actions on essential fish habitat (EFH) and to consult with the NMFS if any activities may adversely affect EFH. The NMFS has not designated any EFH under the MSA within the affected waterbodies. However, in a letter dated June 27, 2012, NMFS stated that the Schuylkill River and Perkiomen Creek provide habitat for a variety of prey species consumed by Federally managed species whose EFH has been designated in the mixing zone of the Delaware River (NMFS 2012c). The NRC staff's EFH assessment will be issued separately as part of the staff's consultation with NMFS under the MSA.

The FWS and NMFS have not designated any critical habitat under the ESA within the action area, nor has either agency proposed the listing or designation of any new species or critical habitat within the action area (Exelon 2011b; FWS 2011, 2012d; NMFS 2012a, 2012c).

*2.2.8.1. Action Area*

For the purposes of its protected species and habitat discussion and analysis, the NRC considers the action area, as defined by the ESA regulations at 50 CFR 402.02, to include the lands and waterbodies described below. The following sections only consider terrestrial and aquatic species that occur or have the potential to occur within this action area.

**LGS site and surrounding area within a 6-mile (10-km) radius.** The majority of the LGS site lies in Limerick Township, Montgomery County, although a portion of the property extends into the adjacent Lower Pottsgrove Township in Montgomery County, and East Coventry Township in Chester County, directly across the Schuylkill River.

**Transmission line corridors and 1-mile (1.6-km) buffer on either side of the lines.** Of the five in-scope transmission lines (described in Section 2.1.5), three of the lines terminate within Montgomery County. One of lines—the 220-61 line—runs parallel to the Schuylkill River on the Chester County side for about 8 miles (12.9 km). Another line—the 220-60 line—crosses the Schuylkill River into East Pikeland Township, Chester County, just before terminating.

**Waterbodies and facilities associated with the LGS makeup water supply system.** The makeup water supply system includes a number of waterbodies and facilities off site of the LGS site. These include the Perkiomen Pumphouse (Montgomery County); the Bradshaw Reservoir and Bradshaw Pumphouse (Bucks County), which are located on 42 ac (17 ha) of Exelon-owned property; and the Bedminster Water Processing Facility (Bucks County), which is located on a 3 ac (1.2 ha) Exelon-owned property. Section 2.1.6 describes the LGS makeup water supply system in detail.

*2.2.8.2. Aquatic Species and Habitats*

The aquatic species described in this section and summarized in Table 2–3 are Federally listed or Pennsylvania-listed threatened, endangered, or species of special concern that may occur in the action area, as defined above. The three Federally listed species appear in bold.

FWS, NMFS, and/or PFBC list the species in Table 2–3 as occurring within Montgomery, Chester, or Bucks Counties, Pennsylvania, which are the three counties associated with LGS. LGS infrastructure and associated waters bodies within Montgomery County include the main plant site (e.g., power block), the Schuylkill River, Perkiomen Creek and Pumphouse, and the East Branch Perkiomen Creek. LGS infrastructure and associated waterbodies in Chester County include portions of the main plant site on the other side of the Schuylkill River and transmission lines. LGS infrastructure and associated waterbodies in Bucks County include the

Delaware River and Point Pleasant Pumping Station, the Bradshaw Reservoir and Bradshaw Pumphouse, and the Bedminster Water Processing (Treatment) Facility.

**Table 2–3. Federally and Pennsylvania-Listed Aquatic Species**

| Scientific Name | Common Name | Federal Status[(a)] | State Status[(b)] | County(ies) of Occurrence[(c)] |
|---|---|---|---|---|
| **Fish** | | | | |
| ***Acipenser brevirostrum*** | **shortnose sturgeon** | **FE** | **PE** | **B** |
| ***Acipenser oxyrinchus oxyrinchus*** | **Atlantic sturgeon** | **FE** | **PE** | **B** |
| *Alosa aestivalis* | blueback herring | CS | — | B, C, M |
| *Alosa pseudoharengus* | Alewife | CS | — | B, C, M |
| *Enneacanthus obesus* | banded sunfish | — | PE | B |
| *Lepomis megalotis* | longear sunfish | — | PE | B |
| *Notropis chalybaeus* | ironcolor shiner | — | PE | B, M |
| **Invertebrates** | | | | |
| ***Alasmidonta heterodon*** | **dwarf wedgemussel** | **FE** | **PE** | **B, C, M** [(d)] |
| *Stygobromus pizzinii* | Pizzini's cave amphipod | — | SSC | C, M |
| **Aquatic Plants** | | | | |
| *Myriophyllum farwellii* | Farwell's water-milfoil | — | PE | B |
| *Myriophyllum heterophyllum* | broad-leaved water milfoil | — | PE | B |
| *Nymphoides cordata* | floating-heart | — | PT | B |
| *Potamogeton pulcher* | spotted pondweed | — | PE | B |

[(a)] Federal status determined by the FWS and NMFS under the authority of the Endangered Species Act; CS = candidate species (NMFS 2012c, 2012a; FWS 2012d); FE = endangered, FT = threatened, — = not listed.
[(b)] Commonwealth of Pennsylvania status determined by the PFBC under the Pennsylvania Endangered Species Program; PE = endangered, PT = threatened, SSC = species of special concern; — = not listed (PNHP 2012a).
[(c)] The LGS site lies in Montgomery County; the in-scope transmission lines traverse Montgomery and Chester Counties; and the offsite facilities associated with the LGS makeup water system lie in Montgomery and Bucks Counties. B = Bucks County, C = Chester County, M = Montgomery County.
[(d)] FWS (2012d) lists the dwarf wedgemussel as known to or believed to occur in Monroe, Pike, and Wayne Counties, Pennsylvania, which do not contain LGS-related infrastructure or waterbodies. PNHP (2012a) lists the dwarf wedgemussel as potentially occurring in Bucks, Chester, and Montgomery Counties. PECO (1984) observed rare, unidentified species of the genus *Alasmidonta* in the Schuylkill River in the 1970s and it is unknown whether the specimen was the dwarf wedgemussel (Exelon 2011b).

In addition to the species listed in the above table, LGS collected bridle shiner (*Notropis bifrenatus*), a Pennsylvania-listed endangered species, through 1977. LGS did not observe bridle shiner since 1977 (Exelon 2011b). Furthermore, PNHP (2012a) does not list this species as occurring within Bucks, Chester, or Montgomery Counties and PBFC (2011b) did not identify the species as a concern regarding the proposed license renewal. Therefore, this species is not considered further within this SEIS.

**Fish**

Shortnose Sturgeon (*Acipenser brevirostrum*)

The shortnose sturgeon was initially listed as a Federally endangered species in 1967 and is designated as a Pennsylvania endangered species (NMFS 2012b, PNHP 2012a). Adult shortnose sturgeon use freshwater for spawning and estuarine and marine habitats for feeding. Juveniles migrate downriver to estuarine waters and may go back and forth between freshwater and estuarine habitats for several years before maturing to adults. Adults sometimes migrate to marine habitats for feeding, but primarily inhabit estuarine habitats (Rohde et al. 1994, NMFS 2012b). Spawning occurs in freshwaters characterized by low-to-moderate velocities and over substrates that include clay, sand, gravel, and woody debris. Eggs are adhesive and survival depends on water having little turbidity (Rohde et al. 1994). Sturgeon feed on benthic invertebrates such as snails, insect larvae, crustaceans, and worms (Gilbert 1989).

In Pennsylvania, populations of shortnose sturgeon inhabit the Delaware River (Hastings et al. 1987, O'Herron et al. 1993). Hastings et al. (1987) surveyed shortnose sturgeon movement in the Delaware River and estimated an overwintering population of about 6,000 to 14,000 fish in the upper tidal portion of the Delaware River near Trenton, NJ at river kilometer (RKm) 211.8 (river mile [RM] 131.6) (Hastings et al. 1987). Sturgeon moved upstream into the non-tidal reach of the river in late March presumably to spawn before traveling downstream to lower tidal waters near Philadelphia (O'Herron et al. 1993). Hastings et al. (1987) observed upstream movement to non-tidal water as far as Lambertville, NJ at RKm 238 (RM 147.9). This location is approximately 15 river km (9.1 river miles) from the Point Pleasant Pumping Station, which is located at RM 157 (RKm 253).

Shortnose sturgeon occur in Bucks County (PNHP 2012a, NMFS 2012a). On the Delaware River, LGS-related studies from 1979 to 1985 did not capture shortnose sturgeon eggs or larvae near the Point Pleasant Pumping Station and downriver to RM 138 (RKm 222.1) (Exelon 2011a; RMC 1984, 1985, 1986). NMFS (2012a) concluded that no species listed under the ESA occur within the action area.

Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)

The Atlantic sturgeon is currently listed as a Federally endangered species for the New York Bight distinct population segment, which includes the Delaware River (77 FR 5880). The Atlantic Sturgeon is also designated as a Pennsylvania State endangered species (PNHP 2012a). Atlantic sturgeon share many life-history characteristics with the shortnose sturgeon in that adults migrate to freshwater to spawn and feed on benthic invertebrates such as worms, crustaceans, and aquatic insects (Gilbert 1989). Unlike shortnose sturgeon, adult Atlantic sturgeon prefer more marine habitats and make extensive migrations away from natal estuaries beginning as subadults (Gilbert 1989).

Atlantic sturgeon occur in Bucks County (PNHP 2012a, NMFS 2012a). Historically, the Delaware River supported the largest population of Atlantic sturgeon along the Atlantic coast (Secor and Waldman 1999). Tagging studies in 2005 and 2006 indicated that Atlantic sturgeon followed similar migration patterns as shortnose sturgeon with spawning potentially occurring between mid to late June in the upper tidal Delaware reaches between Philadelphia, Pennsylvania, and Trenton, New Jersey (Simpson and Fox undated).

LGS-related studies from 1979 to 1985 did not observe Atlantic sturgeon eggs or larvae near the Point Pleasant Pumping Station and downriver to RM 138 (RKm 222.1) (Exelon 2011b; RMC 1984, 1985, 1986). NMFS concluded that no species listed under the ESA occur within the action area (NMFS 2012c).

Alewife and Blueback Herring (*Alosa pseudoharengus* and *A. aestivalis*)

Blueback herring and alewife are candidate species that occur in the project area (NMFS 2012, 76 FR 67652). As candidate species, blueback herring and alewife are not afforded any procedural or substantive protections under ESA. NFMS currently is considering whether to list blueback herring and alewife under ESA (69 FR19976). Blueback herring and alewife also are NMFS species of concern. A species is designated as a species of concern if NMFS has some concerns about the species' status and threats, but there is insufficient information to indicate a need to list the species under the ESA (NMFS 2012). This status level does not carry any procedural or substantive protections under the ESA (NMFS 2012b).

Alewife and blueback herring are both part of the herring family, Clupeidae (PFBC 2012). The two species look similar to one another. However, blueback herring generally are more slender and darker in color than alewife (PFBC 2012c). Blueback herring grow to a maximum of 15 in. (38 cm) and 1 lb (0.45 kg). Herring are an important component of freshwater, estuarine, and marine food webs because they are prey for many predatory fish and help transport nutrients to freshwater systems. Alewife and blueback herring prey include zooplankton, shrimp, small fish, and fish eggs (PFBC 2012c).

Blueback herring and alewife spawn in freshwater during the spring and migrate to estuaries or marine waters during the summer and cooler months. Alewife begin their spring migration to freshwater earlier than blueback herring and alewife spawn earlier (Collette and Klein-MacPhee 2002). In Pennsylvania, blueback herring spawn in the lower Delaware River and the Delaware estuary (PFBC 2012c). Alewife spawn in similar areas, but they also may inhabit and spawn in freshwater lakes and impoundments. In streams and rivers, spawning habitat includes fresh water several miles upstream of the tidal line in the Delaware River and in areas with a rocky, firm bottom (PFBC 2012c). Eggs are demersal and adhesive (PFBC 2012). Adults return to salt water after spawning, although adult alewife also can inhabit freshwater. Historically, dams have severely limited movement of blueback herring and alewife to and from spawning grounds (NMFS 2012c).

In Pennsylvania, blueback herring only occur in the lower Delaware River and the Delaware estuary (PFBC 2012). LGS-related surveys did not observe blueback herring in the Schuylkill River, East Branch of the Perkiomen Creek, Perkiomen Creek, or the Delaware River near the Point Pleasant Pump Station (Table 2–2; Exelon 2011b). LGS-related studies captured alewife in the Schuylkill and Delaware Rivers, but did not observe this species in the East Branch of the Perkiomen Creek or the Perkiomen Creek (Table 2–2; Exelon 2011b). Studies from 1979–80 indicated that American shad, alewife, and blueback herring used the Delaware River in the vicinity of Point Pleasant as a nursery area.

Banded Sunfish (*Enneacanthus obesus*)

The Commonwealth of Pennsylvania lists the banded sunfish as endangered (PNHP 2012a). Banded sunfish prefer a restricted home range in coastal habitats such as small ponds, backwaters of creeks and rivers, and slow-moving waters that have high acidity and abundant vegetation. Banded sunfish prey on insects and microcrustaceans (PNHP 2012b). Spawning over gravel or sand nests occurs in April through July, and the buoyant eggs drift with the slow current (Rohde et al. 1994).

Banded sunfish occur in Bucks County (PNHP 2012a). Waters in Bucks County associated with the LGS cooling system include the Delaware River at the Point Pleasant Pumping Station. However, this area is not a preferred habitat for the banded sunfish as it is far upriver from the coast and banded sunfish occur in the lower Delaware River (PNHP 2012b). LGS-related studies from 1979 to 1985 did not observe banded sunfish eggs or larvae in surveys in the

Delaware River at the Point Pleasant Pumping Station and downriver to RM 138 (RKm 222.1) (Exelon 2011b; RMC 1984, 1985, 1986).

Longear Sunfish (*Lepomis megalotis*)

The Commonwealth of Pennsylvania lists the longear sunfish as endangered (PNHP 2012a). Longear sunfish prefer slow-moving, shallow, headwater streams where they prey on invertebrates, fish eggs, and smaller fish. Spawning occurs in spring and summer. Males defend eggs and fry (PNHP 2012c).

Before 1980, the longear sunfish occurred in Bucks County (PNHP 2012a). However, Pennsylvania records since 1980 do not list longear sunfish as occurring in Bucks County (PNHP 2012c). LGS-related studies from 1979 to 1985 did not observe longear sunfish eggs or larvae during surveys in the Delaware River at the Point Pleasant Pumping Station and downriver to RM 138 (RKm 222.1) (Exelon 2011b; RMC 1984, 1985, 1986).

Ironcolor Shiner (*Notropis chalybaeus*)

The Commonwealth of Pennsylvania lists the ironcolor shiner as endangered (PNHP 2012a). Little is known about the habitat preference and life cycle of ironcolor shiner in Pennsylvania. Rohde et al. (1994) assumes that ironcolor shiner prefer habitats of headwaters in creeks or small rivers with sandy or rocky bottoms. They likely spawn during spring months and prey on insect larvae and algae, as is common among many shiner species along the eastern U.S. coast.

PNHP (2012a) lists ironcolor shiners as possibly extirpated in both Bucks and Montgomery Counties. LGS-related studies from 1979 to 1985 did not observe ironcolor shiner eggs or larvae during surveys on the Delaware River at the Point Pleasant Pumping Station and downriver to RM 138 (RKm 222.1) (Exelon 2011b; RMC 1984, 1985, 1986). In the East Branch Perkiomen Creek, Perkiomen Creek, and the Schuylkill River, LGS-related studies did not observe ironcolor shiner eggs, larvae, juveniles, or adults during fish surveys between 1970 and 2009 (Exelon 2001, 2002, 2003, 2004, 2005, 2011; NAI 2010a, 2010b, 2010c; PECO 1984; RMC 1984, 1985, 1986, 1987, 1988, 1989).

**Invertebrates**

Dwarf Wedgemussel (*Alasmidonta heterodon*)

The dwarf wedgemussel is currently listed as a Federally endangered species wherever it occurs, and is designated as a Pennsylvania-endangered species (FWS 2012a, PNHP 2012a). The dwarf wedgemussel prefers habitat characterized by mud, sand, or gravel bottom in slow-to-moderate, clear flowing streams and rivers (FWS 1992). Reproduction requires mussel larvae (glochidia) to attach to host fish gills before completion of metamorphosis into juveniles. The dwarf wedgemussel uses a number of different fish host species for glochidial reproduction, including darter and sculpin fish species (FWS 2007b).

FWS lists the dwarf wedgemussel as known to or believed to occur in Monroe, Pike, and Wayne Counties, Pennsylvania, which do not contain any LGS-associated infrastructure or waterbodies (FWS 2012c). PNHP lists the dwarf wedgemussel as potentially occurring in Bucks, Chester, and Montgomery Counties (PNHP 2012a). PECO observed rare, unidentified species of the genus *Alasmidonta* in the Schuylkill River in the 1970s and it is unknown whether the specimens were the dwarf wedgemussel (PECO 1984, Exelon 2011b). Other than the rare *Alasmidonta* specimens observed in the 1970s in the Schuylkill River, LGS-related studies did not observe dwarf wedgemussels during benthic surveys in East Branch Perkiomen Creek, Perkiomen Creek, and the Schuylkill River between 1970 and 2009 (Exelon 2011b; NAI 2010c; PECO 1984; RMC 1984, 1985, 1986, 1987, 1989).

<u>Pizzini's Cave Amphipod (*Stygobromus pizzinii*)</u>

The Commonwealth of Pennsylvania lists the Pizzini's cave amphipod, previously named *Stygonectes pizzinii,* as a Pennsylvania species of concern. The Pizzini's cave amphipod is an invertebrate that occurs within a variety of groundwater habitats, such as seeps, small springs, small spring and seep-fed streams, mines, wells, and caves (Holsinger 1978). As of 1978, the Schuylkill River was the northern most portion of the known geographic range for this species (Holsinger 1978). Although the Pizzini's cave amphipod is not listed as a candidate, threatened, or endangered species, PFBC (2011b) noted that the species may be listed "in the not so distant future." This species is threatened by habitat destruction and poor water quality (PFBC 2011b).

Pizzini's cave amphipod is possibly extirpated in Montgomery and Chester Counties (PNHP 2012a). PECO (1984) observed *Stygonectes pizzinii* and *Stygonectes* sp. during surveys of the Schuylkill River, Perkiomen Creek, and East Branch Perkiomen Creek conducted between 1970 and 1976. RMC reported *Stygobromus* sp. (not specifically identified as *Stygobromus pizzinii*) during a survey in the East Branch Perkiomen Creek in 1983 (RMC 1984) and during surveys in the Schuylkill River in 1985 and 1986 (RMC 1986, 1987). However, from 1986 until 1988, LGS-related studies did not observe *Stygobromus* species in the East Branch Perkiomen Creek nor the Schuylkill River (Exelon 2011a; RMC 1987, 1988, 1989). Based the Pennsylvania Natural Diversity Inventory (PNDI) database and PFBC files, PFBC (2011b) stated in its letter to the NRC that globally rare amphipod and/or isopod species are known to occur within the vicinity of the LGS site.

**Aquatic Plants**

<u>Farwell's Water-Milfoil (*Myriophyllum farwellii*)</u>

The Commonwealth of Pennsylvania lists the Farwell's water-milfoil as an endangered aquatic plant (PNHP 2012a). Farwell's water-milfoil is a submerged plant that will grow up to 1 ft (0.3 m) in length. This species of milfoil grows in lakes and ponds (PNHP 2012d). Farwell's water-milfoil is often confused with other invasive milfoil species (PNHP 2012d).

PNHP reports no current observations of Farwell's water-milfoil in the three counties associated with LGS. However, this plant was present in the coastal region of Bucks County before 1980 (PNHP 2012d). PECO (1984) did not observe Farwell's water-milfoil during aquatic surveys in the Delaware River near the Point Pleasant Pumping Station, East Branch Perkiomen Creek, Perkiomen Creek, or the Schuylkill River between 1970 and 1976.

<u>Broad-Leaved Water-Milfoil (*Myriophyllum heterophyllum*)</u>

The Commonwealth of Pennsylvania lists the broad-leaved water-milfoil as an endangered aquatic plant (PNHP 2012a). Broad-leaved water-milfoil colonizes slow-moving freshwater habitats and has both submerged and emergent foliage. Reproduction occurs when part of the plant breaks off, grows roots, and settles in a new location (NHDES 2010).

The broad-leaved water-milfoil is possibly extirpated in Bucks County (PNHP 2012a). PECO (1984) did not observe broad-leaved water-milfoil during aquatic surveys in the Delaware River at Point Pleasant Pumping Station, East Branch Perkiomen Creek, Perkiomen Creek, or the Schuylkill River between 1970 and 1976.

<u>Floating-Heart (*Nymphoides cordata*)</u>

The Commonwealth of Pennsylvania lists the floating-heart as a threatened aquatic plant (PNHP 2012a). Floating-heart grows in lakes and ponds and resembles a small water-lily (PNHP 2012e). In the spring, floating-heart propagates, or creates new plants, as rhizomes, tubers, or seeds sprout new growth.

Floating-heart is listed as possibly extirpated in Bucks County (PNHP 2012e). PECO (1984) did not observe floating-heart during aquatic surveys in the Delaware River at Point Pleasant Pumping Station, East Branch Perkiomen Creek, Perkiomen Creek, or the Schuylkill River between 1970 and 1976.

Spotted Pondweed (*Potamogeton pulcher*)

The Commonwealth of Pennsylvania lists the spotted pondweed as an endangered aquatic plant (PNHP 2012a). Leaves are floating or submerged and flowering occurs between June and September. Spotted pondweed grows in wetlands characterized by acidic, standing water (PNHP 2012f).

Spotted pondweed occurs within coastal regions of Bucks County (PNHP 2012f). PECO (1984) did not observe spotted pondweed during aquatic surveys in the Delaware River at Point Pleasant Pumping Station, or in East Branch Perkiomen Creek, Perkiomen Creek, or the Schuylkill River between 1970 and 1976.

*2.2.8.3. Terrestrial Species and Habitats*

Before LGS construction, PECO compiled lists of plants and animals likely to occur on the site and along the transmission line corridors based on species' ranges and habitat requirements. In the late 1970s, PECO conducted surveys to confirm the presence of these species on the site. The final environmental statement (FES) for construction of LGS (AEC 1973) includes tables of those species PECO observed on the site as well as those species not specifically observed during surveys but that are likely to occur on the site or along the transmission line corridors. The NRC published an FES for operation of LGS in 1984 (NRC 1984), although this FES did not document any new surveys or studies not already mentioned in the previous FES. Exelon staff and Normandeau Associates, Inc. (Normandeau) performed reconnaissance surveys to confirm the accuracy of the pre-construction site surveys in 2009 and 2010, and Exelon's ER (Exelon 2011b) and the LGS Wildlife Management Plan (Exelon 2010b) include information on the results of these reconnaissance surveys. The WHC's "Site Assessment and Wildlife Management Opportunities for Exelon Corporation's Limerick Generating Station" (WHC 2006) also provides information on LGS site habitats and species. The NRC staff did not identify any ecological surveys or studies that include the transmission line corridors or the offsite facilities within the action area or that might provide additional information about the occurrence of protected species and habitats.

Neither the pre-construction surveys nor the recent reconnaissance surveys identified any Federally listed species on the LGS site. However, several Federally listed species (see Table 2–4) have the potential to occur in the action area. In pre-operational surveys and ongoing informal surveys, Normandeau has identified 10 Pennsylvania-listed bird species on the LGS site. The PDCNR (2011) identified eight Pennsylvania-listed plants that occur along or near the transmission line corridors. Exelon's LGS Wildlife Management Plan (Exelon 2010a) identifies two additional Pennsylvania-listed plants that occur on the LGS site. The PFBC (2011b) identified one reptile—the eastern redbelly turtle (*Pseudemys rubriventris*)—as occurring in the vicinity of the LGS site. Federally and Pennsylvania-listed species are discussed in more detail below.

Table 2–4 identifies the Federally and Pennsylvania-listed species that occur or have the potential to occur in the action area. The three Federally listed species appear in bold. The staff compiled this table from the FWS's online species search by county (FWS 2012a); the Pennsylvania Natural Heritage Program (PNHP)'s online species database (PNHP 2012a); and correspondence with the FWS (2011), the PGC (2011), the PFBC (2011b), and the PDCNR (2011). The NRC staff did not identify any proposed species, proposed critical habitat, or designated critical habitat in the action area. In its correspondence with the NRC, the FWS (2011) also did not identify these categories of species or habitats. The Pennsylvania Endangered Species Program does not designate insects or spiders as Pennsylvania endangered or threatened; therefore, no insects or spiders appear in Table 2–4.

**Table 2–4. Federally and Pennsylvania-listed Terrestrial Species**

| Scientific Name | Common Name | Federal Status[a] | State Status[b] | County(ies) of Occurrence[c] |
|---|---|---|---|---|
| **Amphibians** | | | | |
| *Acris crepitans* | northern cricket frog | — | PE | B, C, M |
| *Lithobates sphenocephalus utricularius* | southern leopard frog | — | PE | B, C |
| *Pseudacris kalmi* | New Jersey chorus frog | — | PE | B, M |
| *Scaphiopus holbrookii* | eastern spadefoot | — | PE | B |
| **Birds** | | | | |
| *Ardea alba* | great egret | — | PE | M[e] |
| *Asio flammeus* | short-eared owl | — | PE | B |
| *Asio otus* | long-eared owl | — | PT | C |
| *Bartramia longicauda* | upland sandpiper | — | PT | B, C, M |
| *Botaurus lentiginosus* | American bittern | — | PE | C |
| *Cistothorus platensis* | sedge wren | — | PE | B, C |
| *Dendroica striata* | blackpoll warbler | — | PE | M[e] |
| *Empidonax flaviventris* | yellow-bellied flycatcher | — | PE | M[e] |
| *Falco peregrinus* | peregrine falcon | — | PE | B |
| *Haliaeetus leucocephalus* | bald eagle | — | PT | B, C, M |
| *Ixobrychus exilis* | least bittern | — | PE | C |
| *Nyctanassa violacea* | yellow-crowned night-heron | — | PE | M |
| *Nycticorax nycticorax* | black-crowned night-heron | — | PE | C |
| *Pandion haliaetus* | osprey | — | PT | B, C |
| *Rallus elegans* | king rail | — | PE | C |
| *Spiza Americana* | dickcissel | — | PE | C |
| **Mammals** | | | | |
| *Cryptotis parva* | least shrew | — | PE | C |
| *Myotis leibii* | eastern small-footed myotis | — | PT | B |
| ***Myotis sodalist*** | **Indiana bat** | **FE** | **PE** | **B, C, M[d]** |
| **Plants** | | | | |
| *Andropogon gyrans* | Elliott's beardgrass | — | PR | B, C, M |
| *Arabis missouriensis* | Missouri rock-cress | — | PE | M |
| *Arabis patens* | spreading rock-cress | — | PT | B, C, M |

| Scientific Name | Common Name | Federal Status(a) | State Status(b) | County(ies) of Occurrence(c) |
|---|---|---|---|---|
| *Cuscuta campestris* | dodder | — | PT | B, C, M |
| *Cyperus schweinitzii* | Schweinitz's flatsedge | — | PR | C, M |
| *Ilex opaca* | American holly | — | PT | B, C |
| *Iris prismatica* | slender blue Iris | — | PE | B, C, M |
| ***Isotria medeoloides*** | **small-whorled pogonia** | **FT** | **PE** | **C** |
| *Ranunculus fascicularis* | tufted buttercup | — | PE | C, M |
| *Rotala ramosior* | tooth-cup | — | PR | B, C, M |
| *Viburnum nudum* | wild raisin | — | PE | B, C, M |
| **Reptiles** | | | | |
| ***Glyptemys muhlenbergii*** | **bog turtle** | **FT** | **PE** | **B, C, M** |
| *Opheodrys aestivus* | rough green snake | — | PE | C |
| *Plestiodon laticeps* | broadhead skink | — | PC | C |
| *Pseudemys rubriventris* | eastern redbelly turtle | — | PT | B, C, M |

(a) Federal status determined by the FWS under the authority of the Endangered Species Act; FE = endangered, FT = threatened, — = not listed.
(b) Commonwealth of Pennsylvania status determined by the PDCNR, PGC, and PFBC under the Pennsylvania Endangered Species Program; PE = endangered, PT = threatened, PR = rare (plants), PC = candidate (amphibians and reptiles).
(c) The LGS site lies in Montgomery County; the in-scope transmission lines traverse Montgomery and Chester Counties; and the offsite facilities associated with the LGS makeup water system lie in Montgomery and Bucks Counties. B = Bucks County, C = Chester County, M = Montgomery County.
(d) The FWS (2012a) identifies the species as occurring in Montgomery, Chester, or Bucks Counties; however the PNHP (2012a) does not identify the Indiana bat as occurring in any of these three counties.
(e) The PNHP (2012a) does not identify the great egret, blackpoll warbler, or yellow-bellied flycatcher as occurring in Montgomery County. However, according to Exelon's Wildlife Management Plan (Exelon 2010a), Normandeau staff has observed these species on the LGS site.

Sources: FWS 2011, 2012a; PDCNR 2011; PGC 2011; PFBC 2011b; PNHP 2012a

In addition to the species listed in the Table 2–4, the NRC identified an additional 14 Pennsylvania-listed amphibians, birds, and reptile species and about 100 additional plant species that occur within Montgomery, Chester, or Bucks Counties (PNHP 2012a). The table does not include these species, and this section does not consider these species further because the PGC, PFBC, and PDCNR, which oversee the recovery efforts of Pennsylvania-listed species, did not identify these species as occurring in the action area in correspondence with Exelon or the NRC (PDCNR 2011, PFBC 2011b, PGC 2011).

**Species and Habitats Protected under the Endangered Species Act**

Bog Turtle (*Glyptemys muhlenbergii*)

The FWS listed the northern population of the bog turtle, which occurs from New York and Massachusetts south to Maryland, as threatened under the ESA in 1997 (62 FR 59605). The FWS has not designated critical habitat for this species (FWS 2012a). This species is also listed as endangered by the PFBC.

The bog turtle is one of the smallest turtles in North America. Its upper shell is 3 to 4 in. (8 to 10 cm) long and light brown to black in color. Each side of its black head has a distinctive patch of color that is bright orange to yellow. The bog turtle is diurnal and semiaquatic; it forages on land and in water for its varied diet of insects and other invertebrates, frogs, plants, and carrion. In Pennsylvania, the bog turtle usually is active from late March through late September and hibernates the remainder of the year under water in soft mud and crevices. Bog turtles construct nests in sphagnum moss or on tussock sedges, which allows them to deposit eggs above the wetland inundation level. Females lay one to six eggs in June and July. Eggs incubate unattended for 6 to 8 weeks, which often leaves them vulnerable to mice, raccoons, skunks, foxes, birds, and other predators. Young hatch during late August through early September (FWS 2001, 2010).

Northern bog turtles primarily inhabit early to mid-successional wetlands fed by groundwater or associated with the headwaters of streams and dominated by emergent vegetation (spring seeps and open marshy meadows) (FWS 2001). These habitats typically have shallow, cool, slow-flowing water, early to mid-successional vegetation, open canopies, and wet meadows of sedges (*Carex* spp.) (FWS 2001, PADEP 2006b). The species is also associated with spike rushes (*Eleocharis* spp.) and bulrushes (*Juncus* spp. and *Scirpus* spp.) (FWS 2001, PADEP 2006b). The species' continued existence is threatened by loss and fragmentation of wetlands; hydrologic alterations that affect groundwater and surface water quantity and quality; livestock grazing and associated nutrient loading; habitat alterations associated with invasive plant species; and illegal collection and trade (FWS 2010).

In Pennsylvania, the bog turtle occurs in the southeastern part of the state. As of 2000, the FWS (2001) identified 14 Pennsylvania counties (including Montgomery, Chester, and Bucks Counties) with extant populations on bog turtles (FWS 2001). Two additional counties historically contained bog turtles, and the FWS (2001) considers a third county's population extirpated. In total, the FWS (2001) identified 75 extant populations, many of which occur within the Delaware River and Susquehanna River watersheds.

None of the available surveys or reports of the LGS site (described in the first paragraph of this section; AEC 1973; Exelon 2010a, 2011a; NRC 1984; WHC 2006) identified the bog turtle as occurring on the LGS site. However, no bog turtle habitat (Phase 1) surveys have been completed in the action area. Small sections of the LGS site along the Schuylkill River contain palustrine emergent and forested wetlands. Wetlands also occur along each of the transmission line corridors. Thus, the species may occur within suitable wetland habitat in these areas.

<u>Indiana Bat (*Myotis sodalis*)</u>

The FWS listed the Indiana bat as endangered wherever found in 1967 under the Endangered Species Preservation Act of 1966, the predecessor regulation to the ESA (32 FR 4001). The FWS has not designated critical habitat for the species in Pennsylvania (41 FR 41914). This species is also listed as endangered by the PGC.

The Indiana bat is an insectivorous, migratory bat that occurs within the central portion of the eastern United States and hibernates colonially in caves and mines. Menzel et al. (2005) concluded that habitat use is highly correlated with insect abundance, which means that Indiana bats often forage in riparian areas where insect densities are highest. Menzel et al. (2005) also found that Indiana bats were more closely associated with linear landscape features (forest corridors and roads) than open areas (agricultural land, grasslands, or meadows). Reproductive females migrate and form maternity colonies in wooded riparian areas, bottomlands, floodplains, wetlands, and upland areas. Males and nonreproductive females may stay close to their hibernation site or migrate to summer habitat, but they do not roost in colonies. Indiana bats create roosts in the exfoliating bark of large (often dead) trees. Both males and females return to hibernation sites in late summer or early fall to mate and enter hibernation. Destruction and degradation of caves from mining, tourism, and physical barriers (such as construction of doors or gates) threaten hibernation habitat (FWS 2007a). Loss and degradation of forest habitat, which affects migration pathways, maternity roosts, and breeding areas, also has contributed to the decline of the species (FWS 2007a).

The PGC (2010) reports that about 1,000 Indiana bats hibernate in 18 sites within 11 Pennsylvania counties. The PGC (2010) also has identified nine summer maternity sites in seven counties. According to the draft Indiana bat draft recovery plan (FWS 2007a), no hibernation or maternity sites occur in Montgomery, Chester, or Bucks Counties. The closest hibernation site is north of the LGS site in Luzerne County, and the closest maternity colony to the LGS site is in Berks County, which borders the northwest edges of Montgomery and Chester Counties (FWS 2007a, PGC 2010).

None of the available surveys or reports of the LGS site (described in the first paragraph of this section; AEC 1973; Exelon 2010a, 2011a; NRC 1984; WHC 2006) identified the Indiana bat as occurring on the LGS site. No FWS-qualified Indiana bat surveyor has conducted formal surveys on the site, and the NRC staff did not identify any other ecological studies that would provide information on the Indiana bat in the action area. Based on the species' historic distribution (FWS 2007a) and the lack of records for the action area, the NRC staff cannot preclude the potential presence of the Indiana bat in the action area. Therefore, the NRC staff assumes that the species may occur in areas of suitable habitat within the action area.

<u>Small-Whorled Pogonia (*Isotria medeoloides*)</u>

The FWS listed the small-whorled pogonia as threatened wherever found in 1982 (47 FR 39827). The FWS has not designated critical habitat for this species (FWS 2012b). This species is also listed as endangered by the PDCNR.

The small-whorled pogonia is a small, herbaceous, perennial orchid. Its primary range extends through the Atlantic seaboard states, but it also occurs in adjacent states, including Pennsylvania. The species generally grows in young and maturing stands of mixed-deciduous or mixed-deciduous/coniferous forests that are in second- or third-growth stages of succession. The species inhabits areas with sparse to moderate ground cover, a relatively open understory, or areas in proximity to logging roads, streams, or other features that create long-persisting breaks in the forest canopy. In the northern part of its range, it has been associated with the following canopy species that are also prevalent in the action area: red maple (*Acer rubrum*), northern red oak (*Quercus rubra*), and American beech (*Fagus grandifolia*) (see Section 2.2.7). Throughout its range, the small-whorled pogonia is associated with understories containing red maple and oak species (*Quercus* spp.) (FWS 1992). Habitat destruction, disease, and predation by deer and rabbits threaten the species' continued existence (FWS 1992, 2008).

None of the available surveys or reports of the LGS site (described in the first paragraph of this section; AEC 1973; Exelon 2010a, 2011a; NRC 1984; WHC 2006) identified the small-whorled pogonia as occurring on the LGS site. However, PECO conducted the last botanical surveys of the site before construction of LGS, and the FES for operation of LGS (NRC 1984) indicates that PECO did not complete any surveys along the transmission line corridors before its construction. During its license renewal application review, the staff did not identify any ecological surveys or studies of the transmission line corridors or the offsite facilities within the action area since LGS began operating that might provide additional information about the occurrence of the small-whorled pogonia within the action area.

As of 2007, FWS (2008) reported three extant populations in Pennsylvania and an additional six populations that were historic, extirpated, or of unknown status. Historic population occurred in both Montgomery and Berks Counties (FWS-PA 2012). Both the PNHP online species database (PNHP 2012a) and the FWS Pennsylvania Field Office Web site (FWS-PA 2012) indicate that the species occurs in Chester County. The NRC did not identify any more specific information on the location of the three extant populations; therefore, the NRC assumes that the species has the potential to occur in the action area in areas of suitable habitat along or near the transmission line corridor that runs through Chester County.

**Species Protected under the Bald and Golden Eagle Protection Act**

The Bald and Golden Eagle Protection Act of 1940, as amended, prohibits anyone from taking bald eagles (*Haliaeetus leucocephalus*) or golden eagles (*Aquila chrysaetos*), including their nests or eggs without an FWS-issued permit. The term "take" in the Act is defined as, among other things, to pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, destroy, molest, or disturb (50 CFR 22.3). "Disturb" means, among other things, to take action that (1) causes injury to an eagle; (2) decreases its productivity or nest abandonment, by substantially interfering with breeding, feeding, or sheltering behavior (50 CFR 22.3).

Pennsylvania maintains a Bald Eagle Management Plan (Gross and Brauning 2010), which lays out management goals and objectives to increase the number of successful nesting pairs and to delist the bald eagle from Pennsylvania-threatened to a secure, protected status. As of 2009, the PGC identified 174 active nests that produced 244 young in 48 Pennsylvania counties. In the same year, the PGC recorded three active nests in Bucks County, three in Chester County, and one in Montgomery County. Data from the 2008 FWS midwinter bald eagle survey indicate that the bald eagle is also present in Bucks and Chester Counties in the winter months (Gross and Brauning 2010).

**Species Protected under the Migratory Bird Treaty Act**

The FWS administers the Migratory Bird Treaty Act of 1918, as amended (MBTA), which prohibits anyone from taking native migratory birds or their eggs, feathers, or nests. The MBTA definition of a "take" differs from that of the ESA. Under the MBTA, take means to pursue, hunt, shoot, wound, kill, trap, capture, or collect, or any attempt to carry out these activities (50 CFR 10.12). Unlike a take under the ESA, a take under the MBTA does not include habitat alteration or destruction. The MBTA protects a total of 1,007 migratory bird species (75 FR 9282). Of these 1,007, the FWS allows for the legal hunting of 58 species as game birds (FWS undated). Within Pennsylvania, the PGC manages migratory bird hunting seasons and associated licenses for woodcock, pheasant, ruffed grouse, and a number of waterfowl species. All Federally and Pennsylvania-listed bird species that appear in Tables 2–4 and 2–5 are protected under the MBTA. Additionally, the MBTA protects all U.S.-native bird species that belong to the families, groups, or species listed at 50 CFR 10.13.

**Species Protected by the Commonwealth of Pennsylvania**

This section only discusses those Pennsylvania-listed species from Table 2–4 for which the NRC has specific occurrence information within the action area. The remaining species in the table have the potential to occur in the action area, but were not identified during early surveys of the site (AEC 1973, NRC 1984), or in subsequent reports (Exelon 2010a, 2011a), or were not identified as species of specific concern in correspondence with the PDCNR (2011), PGC (2011), or PFBC (2011b) regarding the proposed LGS license renewal.

<u>Birds</u>

Normandeau conducted bird surveys on the LGS site from 1972 to 1985. Since 1985, Normandeau has maintained a running checklist of bird species on the site (Exelon 2010a). Normandeau has identified 10 state-listed bird species. These species and their habitat requirements appear in Table 2–5. Because more recent occurrence information is based on

Normandeau's running checklist, the year in which each bird species was last observed is not available (Exelon 2010a).

**Table 2–5. Pennsylvania-listed Bird Species in the Action Area**

| Species | Habitat |
|---|---|
| **American bittern** (*Botaurus lentiginosus*) | dense freshwater marshes; wet meadows |
| **bald eagle** (*Haliaeetus leucocephalus*) | riparian areas near rivers or open water bodies |
| **black-crowned night heron** (*Nycticorax nycticorax*) | coastlines; swamps; river and stream riparian areas; canals; wet agricultural fields |
| **blackpoll warbler** (*Dendroica striata*) | second-growth scrub; woodlands; dense conifer forests |
| **great egret** (*Ardea alba*) | marshes; river margins; lakeshores; coastal swamps; lagoons |
| **least bittern** (*Ixobrychus exilis*) | dense marshland containing cattails and reeds |
| **osprey** (*Pandion haliaetus*) | lakes, ponds, rivers, and other open water bordered by trees |
| **peregrine falcon** (*Falco peregrines*) | cliffs, buildings, and other high structures overlooking rivers |
| **yellow-bellied flycatcher** (*Empidonax flaviventris*) | shady coniferous forests and forested wetlands at higher elevations; mossy, poorly drained swamps and bogs |
| **yellow-crowned night heron** (*Nyctanassa violacea*) | small, shallow streams often associated with sycamores |

Plants

The PDCNR (2011) identified eight Pennsylvania-listed plants that occur along or near the transmission line corridors. None of the available surveys or reports (AEC 1973; Exelon 2010a, 2011a; NRC 1984; WHC 2006) indicate that these species occur on the LGS site; however, two additional Pennsylvania-listed plants occur on the LGS site. Exelon's Wildlife Management Plan (Exelon 2010a) identifies American holly (*Ilex opaca*) and wild raisin (*Viburnum nudum* var. *cassinoides*), which are Pennsylvania-listed as threatened and endangered, respectively, as having been identified on the site in 1978 during surveys associated with the construction of LGS. The continued occurrence of these species on the site today cannot be confirmed because no vegetation surveys have been completed on the site since the 1970s.

American Holly (*Ilex opaca*). American holly is an evergreen shrub or small tree that grows to 15 m (50 ft) in height. The species grows on wooded slopes and streambanks from coastal New England south and west into Florida and Texas (PNHP 2007a). Exelon's ER (Exelon 2011b) and the LGS Wildlife Management Plan (Exelon 2010a) identify American holly as having occurred on the LGS site in 1978 during surveys associated with the construction of the LGS. The continued occurrence of this species on the site today cannot be confirmed because no vegetation surveys have been completed on the site since the 1970s. A 2007 PNHP Pennsylvania distribution map does not indicate that the species occurs within Montgomery, Chester, or Bucks Counties (PNHP 2007a).

Dodder (*Cuscuta campestris*). Dodder is an annual stem parasitic plant that lacks normal roots and leaves, but bears flowers and fruits that inhabit thickets and waste ground. In its correspondence with Exelon, the PDCNR (2011) indicated that this species occurs in an old impounding basin near the Schuylkill River along the 220-63 and 220-64 transmission line corridors.

Elliott's Beardgrass (*Andropogon gyrans*). Elliott's beardgrass is an erect, bunched, perennial grass that may grow to 3 ft (1 m) in height. It grows in dry to damp grasslands, clearings, open slopes, and successional old fields from New Jersey to Illinois and south into Florida and Texas (PNHP 2011a). Though it has not been identified on the LGS site, a 2011 PNHP Pennsylvania distribution map indicates that the species occurs in southwestern Montgomery County and throughout Chester County (PNHP 2011a). Additionally, in its correspondence with Exelon, the PDCNR (2011) indicated that the species occurs in an old field near the 220-63 and 220-64 transmission line corridor.

Missouri Rock-Cress (*Arabis missouriensis*). Missouri rock-cress is an herbaceous biennial from a taproot, with stems 2 to 5 cm (0.8 to 2 in.) high. The species occurs on dry slopes across the central and eastern United States (NatureServe 2010a, PDCNR 2011). In its correspondence with Exelon, the PDCNR (2011) indicated that Missouri rock-cress occurs on a dry forested slope with scattered outcrops of Brunswick red shale located just east of the 220-60 and 220-61 transmission line corridors.

Schweinitz's Flatsedge (*Cyperus schweinitzii*). Schweinitz's flatsedge is a grass-like perennial with stems 10- to 40-cm (4- to 16-in.) high. The species occurs on dry or moist sand flats and dunes across much of the continental United States (NatureServe 2010b, PDCNR 2011). In its correspondence with Exelon, the PDCNR (2011) indicated that Schweinitz's flatsedge occurs in association with tooth-cup (described below) in a wet wooded area along the west side of the Schuylkill River near the 220-60 and 220-61 transmission line corridors.

Slender Blue Iris (*Iris prismatica*). Slender blue iris is a tall perennial forb with grass-like leaves and dark purple flowers. The species occurs in moist meadows and sandy or gravelly shores throughout the eastern seaboard of the United States from Maine to Georgia (NatureServe 2010c, PDCNR 2011). In its correspondence with Exelon, the PDCNR (2011) indicated that the species occurs on gently sloping land, open with scattered red maples in a mossy floodplain of Perkiomen Creek near the 220-62 and 5031 transmission line corridors.

Spreading Rock-Cress (*Arabis patens*). Spreading rock-cress is a slender, perennial herb. It occurs in moist, rocky woods over much of the central and southeastern portions of the eastern United States (NatureServe 2010d, PDCNR 2011). In its correspondence with Exelon, the PDCNR (2011) indicated that spreading rock-cress occurs in moist, shaded northwest-facing rock faces near the 220-60, 220-61, 220-62, 220-63, and 220-64 transmission line corridors.

Tooth-Cup (*Rotala ramosior*). Tooth-cup is a small annual herb that has smooth stems that may grow up to 12 in. (30 cm) in height. It grows on exposed shorelines, stream margins, streambed outcrops, and other damp, open places across much of the continental United States (PNHP 2011b). A 2011 PNHP Pennsylvania distribution map indicates that the species occurs in the Schuylkill River watershed between Montgomery and Chester Counties (PNHP 2011b). In its correspondence with Exelon, the PDCNR (2011) indicated that the species occurs in a wet wooded stretch along the west side of the Schuylkill River near the 220-60 and 220-61 transmission line corridors and on an exposed mud flat and sandy-cobbly shores of seasonally flooded shallow basins near the 220-63 and 220-64 transmission line corridors.

Tufted Buttercup (*Ranunculus fascicularis*). Tufted buttercup is a small perennial forb with five-petal yellow flowers. It inhabits dry, thick woods and exposed calcareous slopes and edges across the central and eastern United States (NatureServe 2010e). In its correspondence with Exelon, the PDCNR (2011) indicated that the species occurs in a ridgetop glade in a state park near the 220-62 and 5031 transmission line corridors.

Wild Raisin (*Viburnum nudum* var. *cassinoides*). Wild raisin (also called possum-haw) is a deciduous shrub or small tree that grows up to about 12 ft (4 m) in height. The species inhabits swamps, wet thickets, and pond margins from New York west and south into Texas and Florida (PNHP 2007b). The LGS Wildlife Management Plan (Exelon 2010a) identifies wild raisin as having occurred on the LGS site in 1978 during surveys associated with construction of LGS. The continued occurrence of this species on the site today cannot be confirmed because no vegetation surveys have been completed on the site since the 1970s. A 2007 PNHP Pennsylvania distribution map indicates that the species occurs in southwestern Montgomery County, northern Chester County, and central Bucks County (PHNP 2007b).

Reptiles

Eastern Redbelly Turtle (*Pseudemys rubriventris*). The eastern redbelly turtle is one of Pennsylvania's largest turtles. It occurs in large water bodies including lakes, ponds, marshes, slow-moving rivers, and creeks from New York to North Carolina (PNHP 2007c). Redbelly turtles prefer areas with deeper water with sandy or muddy substrate and aquatic vegetation in proximity to basking sites. Females nest in upland habitat within 100 m (330 ft) of water. A 2007 PNHP Pennsylvania distribution map indicates that the species occurs throughout Montgomery, Bucks, and Chester Counties. In its correspondence with the NRC, the PFBC (2011b) noted that the eastern redbelly turtle occurs in the vicinity of the LGS site.

### 2.2.9. Socioeconomics

This section describes current socioeconomic factors that have the potential to be directly or indirectly affected by changes in operations at LGS. LGS and the communities that support it can be described as a dynamic socioeconomic system. The communities provide the people, goods, and services required to operate the nuclear power plant. Power plant operations, in turn, provide wages and benefits for people and dollar expenditures for goods and services. The measure of a communities' ability to support LGS operations depends on the ability of the community to respond to changing environmental, social, economic, and demographic conditions.

The socioeconomic region of influence (ROI) is defined by the area where LGS employees and their families reside, spend their income, and use their benefits, thereby affecting the economic conditions of the region. The ROI consists of a three-county area (Montgomery, Chester, and Berks Counties), where approximately 84 percent of LGS employees reside.

Exelon employs a permanent workforce of 821 full time workers at LGS (Exelon 2011b). As previously discussed, approximately 84 percent live in Montgomery, Berks, and Chester Counties (see Table 2–6). Most of the remaining 16 percent of the workforce are divided among 12 counties across Pennsylvania and other states, with numbers ranging from 1 to 35 employees per county. Given the residential locations of LGS employees, the most significant impacts of plant operations are likely to occur in Montgomery, Berks, and Chester Counties. The focus of the socioeconomic impact analysis in this SEIS is therefore on the impacts of continued LGS operations on these three counties.

**Table 2–6. Limerick Generating Station, Employee Residence by County**

| County | Number of Employees | Percentage of Total |
|---|---|---|
| **Pennsylvania** | | |
| Montgomery | 339 | 41 |
| Berks | 249 | 30 |
| Chester | 105 | 13 |
| Delaware | 35 | 4 |
| Bucks | 18 | 2 |
| Lancaster | 18 | 2 |
| Lehigh | 13 | 2 |
| Other | 31 | 4 |
| Other States | 13 | 2 |
| **Total** | **821** | **100** |
| Source: Exelon 2011a | | |

Refueling outages at LGS normally occur at 24-month intervals. During refueling outages, site employment increases by as many as 1,400 temporary workers for approximately 20 to 30 days (Exelon 2011b). Most of these workers are assumed to be located in the same geographic areas as LGS employees. The following sections describe the housing, public services, offsite land use, visual aesthetics and noise, population demography, and the economy in the socioeconomic ROI surrounding LGS.

*2.2.9.1. Housing*

Table 2–7 lists the total number of occupied and vacant housing units, vacancy rates, and median value in the two-county ROI. According to American Community Survey estimates, there were approximately 683,000 housing units in the socioeconomic region, of which approximately 648,000 were occupied. The median value of owner-occupied housing units in the socioeconomic region was: Berks County, $175,700; Chester County, $350,500; and Montgomery County, $295,300. All three counties had a homeowner vacancy rate of less than 2 percent (USCB 2011).

**Table 2–7. Housing in Berks, Chester, and Montgomery Counties in 2010**

| | Berks | Chester | Montgomery | ROI |
|---|---|---|---|---|
| Total | 164,861 | 192,614 | 325,733 | 683,208 |
| Occupied housing units | 155,329 | 184,160 | 308,233 | 647,722 |
| Vacant units | 9,532 | 8,454 | 17,540 | 35,526 |
| Vacancy rate (percent) | 1.2 | 1.2 | 1.6 | 1.3 |
| Median value (dollars) * | 175,700 | 350,500 | 295,300 | 273,833 |
| Key: *estimated. | | | | |
| Source: USCB, 2011; 2010 American Community Survey 1-Year Estimates | | | | |

*2.2.9.2. Public Services*

This section presents information regarding public services including water supply, education, and transportation.

Water Supply

The discussion of public water supply systems is limited to major municipal water systems in Berks, Chester, and Montgomery Counties. Information about municipal water suppliers in these counties, their average daily production, system capacity, and population served are presented in Table 2–8.

Berks County is served by 75 water systems, with the Reading Area Water Authority serving the largest population at 87,000 (EPA 2012a). Water for this surface water system is primarily drawn from Lake Ontelaunee, a reservoir built and owned by the city of Reading. The system storage capacity is approximately 76 million gallons (Exelon 2011b).

Chester County is served by 83 water systems, with the Pennsylvania American Water Company serving the largest population at 44,000 (EPA 2012a). Montgomery County is served by 39 water systems, with Aqua Pennsylvania, Inc., serving the largest population at 785,000 (EPA 2011).

LGS withdraws water primarily from the Schuylkill River; however, the specific water source(s) from which LGS makeup water may be withdrawn at any particular time is subject to conditions and limitations established by the DRBC. The DRBC has jurisdiction over withdrawals and uses of water in the Delaware River Basin, which includes the Schuylkill Valley Subbasin where LGS is located (Exelon 2011b).

**Table 2–8. Public Water Supply Systems in Berks, Chester, and Montgomery Counties (in million gallons per day [mgd])**

| Water Supplier | Primary Water Source | Average Daily Production (mgd) | System Capacity (mgd) | Population Served |
|---|---|---|---|---|
| **Berks County** | | | | |
| Reading Area Water Authority | SW | 14.0 | 40.0 | 87,000 |
| Paw Penn District | GW | 2.5 | 3.7 | 29,552 |
| Western Berks Water Authority | SW | 3.5 | 8.0 | 25,000 |
| Paw Glen Alsace Division | SW | 1.4 | 28.1 | 23,251 |
| Muhlenberg Township Municipal Authority | GW | 4.1 | 8.5 | 21,000 |
| **Chester County** | | | | |
| PA American Water Company Main System | SW | 2.5 | 5.8 | 44,000 |
| PA American Coatesville | SW | 3.8 | 8.0 | 35,600 |
| Aqua PA West Chester | SW | 5.0 | 8.0 | 35,000 |
| Aqua PA Uwchlan | SW | 2.0 | 3.2 | 22,000 |
| Phoenixville Water Department | SW | 2.5 | 10.3 | 16,438 |
| **Montgomery County** | | | | |
| Aqua Pennsylvania Main System | SW | 87.6 | 125.0 | 784,939 |
| North Penn Water Authority | SW | 10.0 | 24.0 | 82,822 |
| Pennsylvania American Water-Norristown | SW | 9.6 | 16.9 | 91,000 |
| North Wales Water Authority | SW | 7.4 | 13.3 | 68,656 |
| Pottstown Borough water Department | SW | 6.0 | 12.0 | 36,000 |

Key: Surface Water = SW, Groundwater = GW

Sources: EPA 2012; Exelon 2011a

Montgomery County has 22 school districts with 155 schools. LGS is located in the Spring-Ford Area School District in Montgomery County, Pennsylvania. The Spring-Ford Area School District has 12 public schools and had a total enrollment of approximately 7,700 students in 2010–2011 (PDE 2011). Berks County has 18 school districts with 108 schools, and Chester County has 12 school districts with 92 schools (NCES 2011). During the 2010–2011 school year, public school enrollment in Montgomery County was 108,768 students, with 70,517 and 83,589 students in Berks and Chester Counties, respectively (PDE 2011).

Transportation

There is a high concentration of Interstates and major roadways in the vicinity of LGS. Highways and other major roadways within a 50-mile (80-km) radius of LGS include U.S. Interstates I-78, I-176, I-178, I-276, and I-476, as well as US-30, US-1, and US-422 (known as “the Pottstown Expressway”). US-422 provides a direct link to Philadelphia, to the east. To the west, US-422 connects Reading to Lebanon, Harrisburg, and the Capitol region.

Montgomery County is traversed by Interstate Highways I-76 (known as the “Schuylkill Expressway”), I-276 (the East-West Pennsylvania Turnpike), and I-476 (known as the

"Northeast Extension of the Pennsylvania Turnpike" north of I-276 and as the "Blue Route" or "Mid-County Expressway" south of I-276). The Northeast Extension can be accessed approximately 15 miles (24.1 km) east of the LGS plant site. I-76, I-276, and I-476 are about 15 miles (24.1 km) south of LGS and can be accessed by US-422.

The LGS plant site can only be accessed by Evergreen Road, either directly from the Sanatoga exit of US-422 or indirectly from the Limerick Linfield exit of US-422 by several local roads. US-422 runs northwest from the Sanatoga exit through Pottstown Borough and the City of Reading, and then continues west through Berks County.

Table 2–9 lists common commuting routes to LGS and average annual daily traffic (AADT) volume values. The AADT values represent traffic volumes for a 24-hour period factored by both day of week and month of year.

**Table 2–9. Major Commuting Routes in the Vicinity of LGS, 2010 Average Annual Daily Traffic Count**

| Roadway and Location | Annual Average Daily Traffic (AADT) |
|---|---|
| **Montgomery County** | |
| US-422 east of Sanatoga Interchange | 49,000 |
| South Pleasantview/Linfield Road, between Evergreen Road and Ridge Pike | 1,300–2,500 |
| Linfield Road between Linfield and US-422 | 6,600 |
| Sanatoga/Limerick Center Road between Evergreen Road and Limerick Road | 1,600–1,900 |
| North and South Lewis Road and Main Street from Royersford to US-422 Limerick-Linfield Interchange | 14,000 |
| Main Street Royersford from Linfield Road (bridge) | 7,000 |
| Evergreen Road | 3,000 |
| **Berks County** | |
| PA-82/PA-345 from PA-724 Birdsboro to US-422 | 8,400 |
| PA 662 North of US-422 from Douglassville | 8,900 |
| PA-724 from Birdsboro | 5,800–7,000 |
| US-422 East of Douglassville/US-422 West of Douglassville | 28,000–36,000 |
| **Chester County** | |
| US-422 West of Armand Hammer Interchange | 53,000 |
| PA-100 from PA-23 North to PA-724 | 17,000–20,000 |
| PA-724 West of PA-100 | 5,800–7,000 |
| PA-724 East of PA-100 | 8,900–14,000 |
| Linfield Road (bridge) to Main Street Royersford | 5,700 |
| PA-100 South of US-422 | 25,000 |

[a] All AADTs represent traffic volume during the average 24-hour day during 2009.

Source: PennDOT 2012

#### 2.2.9.3. *Offsite Land Use*

Offsite land use conditions in Berks, Chester, and Montgomery Counties are described in this section. More than 84 percent of the LGS permanent workforce lives in these three counties.

Within the region of the LGS, approximately 44 percent of the land is developed urban or rural land, 32 percent agricultural land, 23 percent woodlands, and 1 percent fresh water bodies (Exelon 2011b).

Montgomery County occupies approximately 483 square miles (1,251 square km) (USCB 2011). Agricultural land is used principally as cropland (68.2 percent) and pasture (20.0 percent). Crop sales (mostly nursery and floriculture products) comprise 63 percent of the total market value of products sold in the county while livestock products (mostly milk, hogs, and cattle) comprise the remaining 37 percent. The number of farms in Montgomery County decreased just over 1 percent from 2002 to 2007. Farmland acreage in the county decreased over 13 percent during the same period, and the average size of a farm decreased 12 percent to 58 ac (23 ha) (USDA 2009).

Chester County occupies approximately 751 square miles (1,945 square km) (USCB 2011). Agricultural land is used principally as cropland (70.2 percent) and pasture (18.6 percent). Crop sales (mostly nursery, greenhouse, floriculture, and sod) comprise 73 percent of the market value of agricultural products sold from the county while livestock sales (mostly milk and poultry products) comprise the remaining 27 percent. The number of farms in Chester County decreased from 2002 to 2007 by 9.6 percent. In the same period, the number of farmland acres decreased by less than 1 percent, however, the average size of farms increased by over 9 percent to 96 ac (39 ha) (NASS 2009).

Berks County occupies approximately 857 square miles (2,220 square km) (USCB 2011). Agricultural land is used principally as cropland (76.9 percent) and pasture (10.7 percent). Livestock sales (mostly milk and poultry products) comprise 55 percent of the market value of agricultural products sold from the county while crop sales (mostly nursery, greenhouse, floriculture, and sod) comprise the remaining 45 percent. The number of farms in Berks County increased from 2002 to 2007 by 10.2 percent. The number of farmland acres increased nearly 3 percent, however, the average size of farms decreased by over 6 percent to 112 ac (45 ha) (NASS 2009).

Even though population growth is projected to continue, there is ample urban and rural land to accommodate the anticipated growth over the next 20 years. Agriculture will continue to be the major land use outside urban areas.

#### *2.2.9.4. Visual Aesthetics and Noise*

LGS is situated in gently rolling countryside, traversed by numerous valleys containing small creeks or streams that empty into the Schuylkill River. LGS is surrounded by urbanized areas, the Borough of Pottstown being the closest at 1.7 miles. Predominate features of the site include the reactor enclosures, turbine enclosures, two cooling towers (154.2 m high), electrical substations, independent spent fuel storage installation, Schuylkill River Pumphouse, cooling tower blowdown discharge line and associated structures, spray pond (17.2 ac), administrative buildings, and miscellaneous supporting buildings (Exelon 2011b).

Noise from nuclear plant operations can be detected off site. Sources of noise at LGS include the turbines and large pump motors. Given the industrial nature of the station, noise emissions from the station are generally nothing more than an intermittent minor nuisance. However, noise levels may sometimes exceed the 55 dBA level that EPA uses as a threshold level to protect against excess noise during outdoor activities (EPA 1974). However, according to EPA this threshold does “not constitute a standard, specification, or regulation,” but was intended to provide a basis for State and local governments establishing noise standards (EPA 1974).

*2.2.9.5. Demography*

According to the 2010 Census, an estimated 1,365,850 people live within 32.2 km (20 miles) of the LGS plant site, producing a population density of 420 persons per square km (1,087 persons per square mile) (Exelon 2011b). This translates to a Category 4, "least sparse" population density using the GEIS measure of sparseness (greater than or equal to 120 persons per square mile within 20 miles). Approximately 8,311,616 people live within 80.4 km (50 miles) of LGS, which equates to a population density of 409 persons per square km (1,058 persons per square mile) (Exelon 2011b). As the ROI has a population greater than or equal to 190 persons per square mile within 80.4 km (50 miles), this translates to a Category 4 (greater than or equal to 190 persons per square mile within 50 miles). Therefore, LGS is classified as being located in a high population area based on the GEIS sparseness and proximity matrix.

Table 2–10 shows population projections and growth rates from 1970 to 2050 in Berks, Chester, and Montgomery Counties in Pennsylvania. All counties experienced an increased growth rate during the 2000 to 2010 time period. Montgomery County showed the smallest population increase between 2000 and 2010 (6.6 percent). All three county populations are expected to continue to increase at lower rates in the next decades through 2050.

**Table 2–10. Population and Percent Growth in Berks, Chester, and Montgomery Counties from 1970 to 2000 and Projected for 2010-2050**

| | Berks | | Chester | | Montgomery | |
|---|---|---|---|---|---|---|
| **Year** | **Population** | **Percent Change[a]** | **Population** | **Percent Change[a]** | **Population** | **Percent Change[a]** |
| 1970 | 296,382 | – | 278,311 | – | 623,799 | – |
| 1980 | 312,497 | 5.4 | 316,660 | 13.8 | 643,621 | 3.2 |
| 1990 | 336,523 | 7.7 | 376,396 | 18.9 | 678,111 | 5.4 |
| 2000 | 373,638 | 11.0 | 433,501 | 15.2 | 750,097 | 10.6 |
| 2010 | 411,442 | 10.1 | 498,886 | 15.1 | 799,874 | 6.6 |
| 2020 | 450,718 | 9.5 | 604,385 | 21.1 | 854,994 | 6.9 |
| 2030 | 491,914 | 9.1 | 692,054 | 14.5 | 888,265 | 3.9 |
| 2040 | 531,830 | 8.1 | 791,610 | 14.4 | 936,102 | 5.4 |
| 2050 | 572,066 | 7.6 | 888,194 | 12.2 | 980,298 | 4.7 |

[a] Percent growth rate is calculated over the previous decade.

Sources: Population data for 1970 through estimated population data for 2009 (USCB 2011); population projections for 2012 to 2030 by Pennsylvania State Data Center, October 2010 (PASDC, 2010); 2040 to 2050 calculated.

Demographic Profile

The 2010 (estimate) demographic profiles of the three-county ROI population are presented in Table 2–11. In 2010, minorities (race and ethnicity combined) comprised 20.6 percent of the total three-county population. The largest minority populations in the three county area are Hispanic or Latino (7.8 percent) and Black or African American (6.6 percent).

**Table 2–11. Demographic Profile of the Population in the Limerick Generating Station Socioeconomic Region of Influence in 2010**

| | Berks | Chester | Montgomery | Region of Influence |
|---|---|---|---|---|
| **Population** | 411,142 | 498,886 | 799,874 | 1,710,202 |
| **Race (Not Hispanic or Latino) - percent of total population** | | | | |
| White | 76.9 | 82.1 | 79.0 | 79.4 |
| Black or African American | 4.0 | 5.9 | 8.4 | 6.6 |
| American Indian and Alaska Native | 0.1 | 0.1 | 0.1 | 0.1 |
| Asian | 1.3 | 3.9 | 6.4 | 4.4 |
| Native Hawaiian and Other Pacific Islander | 0.0 | 0.0 | 0.0 | 0.0 |
| Some other race | 0.1 | 0.1 | 0.2 | 0.1 |
| Two or more races | 1.2 | 1.4 | 1.6 | 1.4 |
| **Ethnicity** | | | | |
| Hispanic or Latino | 67,355 | 32,503 | 34,233 | 134,091 |
| Percent of total population | 16.4 | 6.5 | 4.3 | 7.8 |
| **Total minority** | 95,036 | 89,325 | 168,090 | 352,451 |
| **Percent minority** | 23.1 | 17.9 | 21.0 | 20.6 |

Source: USCB 2011

<u>Transient Population</u>

Within 50 miles (80 km) of LGS, colleges and recreational opportunities attract daily and seasonal visitors who create demand for temporary housing and services. In 2010, there were approximately 354,728 students attending colleges and universities within 50 miles (80 km) of LGS (NCES 2011).

In 2010, all three counties in the direct ROI had a similar percentage of temporary housing for seasonal, recreational, or occasional use; Berks at 0.4 percent, Chester at 0.6 percent and Montgomery at 0.5 percent (USCB 2011). In comparison, the highest percent of temporary housing for seasonal, recreational, or occasional use in the counties located within 50 miles (80 km) of LGS is Monroe County, Pennsylvania, at 16.9 percent (UCSB 2010). Table 2–12 provides information on seasonal housing for the 26 counties located all or partly within 50 miles (80 km) of LGS.

**Table 2–12. Seasonal Housing in Counties Located within 50 Miles (80 Km) of the Limerick Generating Station[(a)]**

| County | Housing Units: Total | Vacant Housing Units: For Seasonal; Recreational; or Occasional Use | Percent |
|---|---|---|---|
| **Pennsylvania** | | | |
| Berks | 164,827 | 724 | 0.4 |
| Bucks | 245,956 | 1,536 | 0.6 |
| Carbon | 34,299 | 5,033 | 14.7 |
| Chester | 192,462 | 1,064 | 0.6 |
| Delaware | 222,902 | 621 | 0.3 |
| Lancaster | 202,952 | 930 | 0.5 |
| Lebanon | 55,592 | 506 | 0.9 |
| Lehigh | 142,613 | 663 | 0.5 |
| Monroe | 80,359 | 13,590 | 16.9 |
| Montgomery | 325,735 | 1,498 | 0.5 |
| Northampton | 120,363 | 755 | 0.6 |
| Philadelphia | 670,171 | 2,228 | 0.3 |
| Schuylkill | 69,323 | 1,360 | 2.0 |
| York | 9,870 | 1,117 | 11.3 |
| **County Subtotal** | **2,537,424** | **31,625** | **1.2** |
| **Maryland** | | | |
| Cecil | 41,103 | 1,912 | 4.7 |
| Harford | 95,554 | 451 | 0.5 |
| **County Subtotal** | **136,657** | **2,363** | **1.7** |
| **New Jersey** | | | |
| Burlington | 175,615 | 696 | 0.4 |
| Camden | 204,943 | 551 | 0.3 |
| Cumberland | 55,834 | 627 | 1.1 |
| Gloucester | 109,796 | 316 | 0.3 |
| Hunterdon | 49,487 | 512 | 1.0 |
| Mercer | 143,169 | 558 | 0.4 |
| Salem | 27,417 | 150 | 0.5 |
| Somerset | 123,127 | 173 | 0.1 |
| Warren | 44,925 | 457 | 1.0 |
| **County Subtotal** | **934,313** | **4,040** | **0.4** |
| **Delaware** | | | |
| New Castle | 217,511 | 712 | 0.3 |
| **Total** | **3,825,905** | **38,740** | **1.0** |

[(a)] Counties within 50 miles (80 km) of LGS with at least one block group located within the 50-mile (80-km) radius

Source: USCB 2011

Migrant Farm Workers

Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These workers may or may not have a permanent residence. Some migrant workers follow the harvesting of crops, particularly fruit, throughout rural areas of the United States. Others may be permanent residents near LGS who travel from farm to farm harvesting crops.

Migrant workers may be members of minority or low-income populations. Because they travel and can spend a significant amount of time in an area without being actual residents, migrant workers may be unavailable for counting by census takers. If uncounted, these workers would be “underrepresented” in USCB minority and low-income population counts.

Information on migrant farm and temporary labor was collected in the 2007 Census of Agriculture. Table 2–13 provides information on migrant farm workers and temporary farm labor (less than 150 days) within 50 miles (80 km) of the LGS. According to the 2007 Census of Agriculture, approximately 6,205 farm workers were hired to work for less than 150 days and were employed on 6,324 farms within 50 miles (80 km) of LGS. Pennsylvania had the largest number of farms hiring workers for less than 150 days (1,212), with Chester County containing the largest number of farms hiring workers for less than 150 days at 580.

In the 2002 Census of Agriculture, farm operators were asked for the first time whether or not any hired migrant workers, defined as a farm worker whose employment required travel that prevented the migrant worker from returning to their permanent place of residence the same day. A total of 528 farms in the 50-mile (80-km) radius of LGS reported hiring migrant workers in the 2007 Census of Agriculture. Chester County, Pennsylvania, hired the largest number of migrant workers at 101, followed by Cumberland County, New Jersey (65) (USDA 2011).

In the direct ROI, 591 temporary farm workers (those working fewer than 150 days per year) were employed on 458 farms in Berks County; 652 temporary farm workers (those working fewer than 150 days per year) were employed on 580 farms in Chester County; 208 temporary farm workers (those working fewer than 150 days per year) were employed on 105 farms in Montgomery County (USDA 2011).

**Table 2–13. Migrant Farm Workers and Temporary Farm Labor in Counties Located within 50 Miles (80 Km) of Limerick Generating Station**

| County[(a)] | Number of Farms with Hired Farm Labor[(b)] | Number of Farms Hiring Workers for Less Than 150 days[(b)] | Number of Farm Workers Working for Less Than 150 days[(b)] | Number of Farms Reporting Migrant Farm Labor[(b)] |
|---|---|---|---|---|
| **Pennsylvania** | | | | |
| Berks | 458 | 180 | 591 | 32 |
| Bucks | 265 | 100 | 375 | 23 |
| Carbon | 27 | 12 | 59 | 6 |
| Chester | 580 | 233 | 653 | 101 |
| Delaware | 25 | 8 | 15 | 2 |
| Lancaster | 1,716 | 60 | 138 | 7 |
| Lebanon | 324 | 137 | 317 | 6 |
| Lehigh | 118 | 44 | 161 | 5 |
| Monroe | 155 | 23 | 66 | 0 |
| Montgomery | 155 | 71 | 208 | 14 |
| Northampton | 97 | 24 | 89 | 2 |
| Philadelphia | 5 | 2 | (D) | 0 |
| Schuylkill | 165 | 100 | 323 | 12 |
| York | 404 | 218 | 657 | 22 |
| **County Subtotal** | **4,494** | **1,212** | **3,652** | **232** |
| **Maryland** | | | | |
| Cecil | 128 | 52 | 213 | 5 |
| Harford | 155 | 62 | 154 | 12 |
| **County Subtotal** | **283** | **114** | **367** | **17** |
| **New Jersey** | | | | |
| Burlington | 217 | 93 | 326 | 39 |
| Camden | 52 | 25 | 85 | 17 |
| Cumberland | 192 | 60 | 230 | 65 |
| Gloucester | 163 | 57 | 216 | 56 |
| Hunterdon | 283 | 144 | 353 | 18 |
| Mercer | 86 | 39 | 102 | 8 |
| Salem | 172 | 71 | 248 | 33 |
| Somerset | 132 | 52 | 147 | 6 |
| Warren | 169 | 94 | 321 | 27 |
| **County Subtotal** | **1,466** | **635** | **2,028** | **269** |
| **Delaware** | | | | |
| New Castle | 81 | 34 | 158 | 10 |
| **Total** | **6,324** | **1,995** | **6,205** | **528** |

[(a)] Counties within 50 miles (80 km) of LGS with at least one block group located within the 50-mile (80-km) radius.
[(b)] Table 7. Hired farm Labor – Workers and Payroll: 2007.
(D) – Withheld to avoid disclosing data for individual farms.

Source: 2007 Census of Agriculture – County Data (USDA 2009)

*2.2.9.6. Economy*

This section contains a discussion of the economy, including employment and income, unemployment, and taxes.

Employment and Income

Between 2000 and 2010, the civilian labor force in Berks, Chester, and Montgomery Counties increased slightly. Chester County experienced the highest percentage of growth with 10.2 percent (229,469 civilian worker to 252,993), while Berks and Montgomery experienced a similar growth of civilian labor force by 1.4 percent (190,552 civilian workers to 193,364) and 2.2 percent (402,653 civilian workers to 411,517),respectively (USCB 2000, 2010).

In 2010, educational, health, and social services represented the largest sector of employment (24.4 percent) in the ROI followed by manufacturing and (13.2 percent) and professional, scientific, management, administration, and waste management (13 percent). A list of some of the major employers by industry in each county and the ROI area is provided in Table 2–14.

**Table 2–14. Major Employers by Industry in the LGS ROI in 2010**

| Industry | Berks | Chester | Montgomery | Total | Percent |
|---|---|---|---|---|---|
| Total employed civilian workers | 193,364 | 252,993 | 411,517 | 857,874 | |
| Construction | 10,555 | 12,814 | 23,472 | 46,841 | 5.5 |
| Manufacturing | 32,843 | 33,512 | 47,202 | 113,557 | 13.2 |
| Wholesale Trade | 6,246 | 7,384 | 12,669 | 26,299 | 3.1 |
| Retail Trade | 21,699 | 28,157 | 43,224 | 93,080 | 10.9 |
| Transportation, warehousing, and utilities | 9,077 | 8,482 | 14,631 | 32,190 | 3.8 |
| Information | 3,462 | 4,615 | 9,183 | 17,260 | 2.0 |
| Finance, insurance, real estate, rental, and leasing | 10,613 | 24,447 | 41,825 | 76,885 | 9.0 |
| Professional, scientific, management, administrative, and waste management services | 16,398 | 36,113 | 58,720 | 111,231 | 13.0 |
| Educational, health, and social services | 49,407 | 57,072 | 102,572 | 209,051 | 24.4 |
| Arts, entertainment, recreation, accommodation, and food services | 14,904 | 17,876 | 26,997 | 59,777 | 7.0 |
| Other services (except public administration) | 10,856 | 10,254 | 17,919 | 39,029 | 4.5 |
| Public administration | 4,021 | 5,522 | 11,353 | 20,896 | 13.2 |

Source: UCSB 2011

The top eight employers in Montgomery County are listed in Table 2–15. King of Prussia currently houses the largest number of private sector employers (SGP 2007).

**Table 2–15. Largest Private Sector Employers – Montgomery County – 2007**

| Company | Industry | Number of Employees |
|---|---|---|
| Merck & Company | Pharmaceutical and Vaccines: Global R&D HQ | 12,000 |
| Abington Memorial Hospital | Hospitals, General Market and Surgical | 5,896 |
| Allied Barton Security Services | Security, Integrated Asset Protection | 5,160 |
| Northwestern Human Services | Outpatient Mental Health and Substance Abuse Centers | 4,000 |
| Lockheed Martin | Systems Integrations, Systems Engineering, Software Development, and Program Management | 3,700 |
| Aetna | Managed Care, Health Insurance | 3,000 |
| Unisys | Information and Technology Solutions and Services | 3,400 |
| Citizens Bank | Commercial Banking | 3,000 |
| Source: SGP 2007 | | |

Estimated income information for the socioeconomic ROI and Pennsylvania is presented in Table 2–16. According to the U.S. Census Bureau's 2010 American Community Survey 1-Year Estimates, people living in the ROI had median household and per capita incomes above the state average. Chester County had the highest median household and per capita income among the three counties. Berks County has the highest percentages of persons (14.1 percent) living below the official poverty level when compared to the other two counties and the Commonwealth as a whole. Chester and Montgomery Counties had 6.2 and 5.5 percent, respectively, and the Commonwealth of Pennsylvania as a whole had 13.4 percent. The percentage of families living below the poverty level in Chester and Montgomery Counties (3.6 percent) was lower than the percentage of families in Berks County and the Commonwealth of Pennsylvania as a whole (9.3 percent and 10.9 percent, respectively) (USCB 2011).

**Table 2–16. Estimated Income Information for the Limerick Generating Station Region of Influence in 2010**

| | Berks | Chester | Montgomery | Pennsylvania |
|---|---|---|---|---|
| Median household income (dollars)[a] | 51,719 | 84,284 | 75,448 | 49,288 |
| Per capita income (dollars)[a] | 25,384 | 40,138 | 38,792 | 26,374 |
| Individuals living below the poverty level (percent) | 14.1 | 6.2 | 5.5 | 13.4 |
| Families living below the poverty level (percent) | 10.9 | 3.6 | 3.6 | 9.3 |
| (a) In 2010 inflation-adjusted dollars. | | | | |
| Source: USCB 2011 | | | | |

<u>Unemployment</u>

According to the U.S. Census Bureau's 2010 American Community Survey 1-Year Estimates, the unemployment rates in 2010 were: Berks County, 10.2 percent; Chester County, 6.2 percent; and Montgomery County, 7.3 percent. Comparatively, the Commonwealth of Pennsylvania's unemployment rate during the same time period was 9.6 percent (USCB 2011).

Taxes

Exelon pays real estate taxes directly to local taxing authorities for the parcels of company-owned property located within its tax jurisdiction. The taxing authorities include the counties, municipalities, and school districts in which these properties are located. LGS parcels are located only in Montgomery, Chester, and Bucks Counties. There are no LGS parcels located in Berks County.

Exelon is the sole owner of the LGS plant site along with the following components of the LGS makeup water supply system, which include the Perkiomen Pumphouse, the Bradshaw Reservoir; the Bradshaw Pumphouse; and the Bedminster Water Processing Facility. PECO, rather than Exelon, owns or has rights to the LGS transmission system beyond the two onsite substations (Exelon 2011b).

The discussion of taxes in this section is limited to the taxes paid by Exelon, because taxes paid by PECO for the LGS transmission system would continue, whether or not the LGS operating licenses are renewed.

Table 2–17 shows the tax payments made by Exelon for LGS from years 2006–2010. Table 2–18 lists the 2010 budgets for each of the LGS taxing authorities and the percentages of the 2010 budget represented by LGS tax payments. The budgets are funded through payments made to the local government jurisdictions either directly (e.g., property tax payments) or indirectly (e.g., state tax and revenue-sharing programs). In all cases, the LGS property tax payments represent a small percentage (generally 3.1 percent or less) of the budget for each of the taxing authorities (Exelon 2011b).

Currently, Exelon pays the majority of its annual real estate taxes to Limerick Township/Montgomery County and the Spring-Ford Area School District because most of the taxable Exelon-owned LGS assets are located in Limerick Township. Limerick Township provides a portion of these taxes to Montgomery County to fund county services such as county operations, the judicial system, public safety, public works, cultural and recreational programs, human services, and conservation and development programs. Limerick Township property tax revenues fund various operations, including libraries, hospitals, roads, school districts, and fire departments. The Exelon payments to Limerick Township and the Spring-Ford Area School District represent approximately 3.1 percent of the Township's budget and 2.2 percent of the School District's budget, respectively (Exelon 2011b).

Real estate taxes paid by Exelon to the following taxing authorities represent less than 1 percent of each of their respective budgets:

- Lower Pottsgrove Township/Montgomery County and the Pottsgrove School District,
- East Coventry Township/Chester County and the Owen J. Roberts School District,
- Plumstead Township/Bucks County and the Central Bucks School District, and
- Bedminster Township/Bucks County and the Pennridge School District.

**Table 2–17. Limerick Generation Station Tax Distribution, 2006–2010**

| | Calendar Year | | | | |
|---|---|---|---|---|---|
| | **2006** | **2007** | **2008** | **2009** | **2010** |
| **Montgomery County** | | | | | |
| Limerick Township | 368,376 | 402,404 | 479,143 | 495,044 | 466,315 |
| Spring-Ford Area School District | 2,340,454 | 2,184,627 | 2,193,537 | 2,429,533 | 2,271,282 |
| Lower Pottsgrove Township | 1,802 | 1,849 | 1,797 | 1,817 | 1,804 |
| Pottsgrove School District | 10,482 | 10,943 | 11,479 | 11,988 | 12,271 |
| **Total** | **2,721,114** | **2,599,823** | **2,685,956** | **2,938,382** | **2,751,672** |
| **Chester County** | | | | | |
| Chester County | 6,207 | 6,383 | 6,383 | 6,654 | 6,654 |
| East Coventry Township | 2,517 | 2,517 | 5,319 | 5,034 | 5,035 |
| Owen J. Roberts School District | 39,052 | 40,210 | 41,770 | 42,794 | 43,919 |
| **Total** | **47,776** | **49,110** | **53,472** | **54,482** | **55,608** |
| **Bucks County** | | | | | |
| Plumstead Township | 6,481 | 6,481 | 6,481 | 6,481 | 7,372 |
| Central Bucks School District | 21,373 | 22,178 | 23,148 | 24,048 | 24,971 |
| Bedminster Township | 5,097 | 4,920 | 4,920 | 4,920 | 4,920 |
| Pennridge School District | 17,461 | 18,664 | 19,484 | 19,977 | 20,557 |
| **Total** | **50,412** | **52,243** | **54,033** | **55,426** | **57,820** |
| **Total Taxes** | **2,819,302** | **2,701,176** | **2,793,461** | **3,048,290** | **2,865,100** |

Source: Exelon 2011

**Table 2–18. Payment as a Percentage of Taxing Authority 2010 Adopted Budget**

| Taxing Authority | 2010 Adopted Budget ($ millions)[a] | LGS Property Tax Payment as Percentage of Budget[b] |
|---|---|---|
| **Montgomery County** | | |
| Montgomery County – Through Limerick Township | 407.7 | Less than 0.1% |
| Limerick Township | 14.5 | 3.1% |
| Spring-Ford Area School District | 125.5 | 2.2% |
| Montgomery County – Through Lower Pottsgrove Township | 403.9 | Less than 0.1% |
| Lower Pottsgrove Township | 5.4 | Less than 0.1% |
| Pottsgrove School District | 56.8 | Less than 0.1% |
| **Chester County** | | |
| Chester County | 420.7 | Less than 0.1% |
| East Coventry Township | 3.2 | Less than 0.1% |
| Owen J. Roberts School District | 103.0 | Less than 0.1% |
| **Bucks County** | | |
| Bucks County – Through Plumstead Township | 460.1 | Less than 0.1% |
| Plumstead Township | 4.3 | 0.17% |
| Central Bucks School District | 283.2 | Less than 0.1% |
| Bucks County – Through Bedminster Township | 460.1 | Less than 0.1% |
| Bedminster Township | 2.0 | 0.2% |
| Pennridge School District | 111.4 | Less than 0.1% |

(a) Municipal budget is for calendar year; school district budget is for school year 2010–2011.
(b) Percentages are based on 2010 LGS property tax payments shown in Table 2–17.

Source: Exelon 2011a

### 2.2.10. Historic and Archaeological Resources

In accordance with 36 CFR 800.8(c), the NRC has elected to coordinate compliance with Section 106 of the National Historic Preservation Act (NHPA) with steps it has taken to meet its requirements under NEPA. In addition, NUREG–1555 (NRC 2000) provides guidance to staff on how to conduct historic and cultural resource analysis in its environmental reviews.

In the context of NHPA, the NRC has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environment that may be affected by post-license renewal and land-disturbing activities associated with the proposed action (NRC 2011a) The APE may extend beyond the immediate environs in instances where post-license renewal and land-disturbing activities or refurbishment activities specifically related to license renewal may potentially have an effect on historic properties (NRC 2011a). Figure 2–3 shows the area under review.

*2.2.10.1. Cultural Background*

This section discusses the cultural background and the known historic and archaeological resources at the LSG site and in the surrounding area. The cultural background for the State of Pennsylvania has been characterized by the staff in the following license renewal environmental impact statements and therefore, will be briefly described in this section:

- Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 10, Regarding Peach Bottom Nuclear Reactor, Units 2 and 3, January 2003 (NRC 2003)
- Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 35, Regarding Susquehanna Steam Electric Station, Units 1 and 2, March 2009 (NRC 2009a)
- Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 36, Regarding Beaver Valley Power Station, Units 1 and 2, May 2009 (NRC 2009b)
- Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 37, Regarding Three Mile Island Nuclear Station, Unit 1, June 2009 (NRC 2009c)

The Paleo-Indian Period occurred approximately 10,000 to 15,000 years ago. The Paleo-Indians were hunters and gathers and this period is largely characterized by the Clovis point (NRC 2009a).

The Early Archaic Period occurred approximately 3,000 to 10,000 years ago. As the glaciers retreated northward, larger fauna became extinct and people adapted to the resources in the surrounding environment. As the resources improved, the population of the Archaic people increased. Recent archaeological evidence suggests larger populations by the end of the Archaic era (NRC 2009a).

The Woodland Period occurred approximately 3,000 years ago until the point of European contact. The Woodland Period is characterized by being dependent on maize agriculture, people living in villages, and the introduction of the bow and arrow for hunting (NRC 2009a).

The Late Woodland peoples were known as the Delaware, Nanticoke, Shawnee, Iroquois, and Susquehannock (NRC 2009a). Early Native American contact with European colonists and events associated with that contact make it difficult to associate present-day tribal groups with the territory in the vicinity of the LGS site. The contacts led to tribal movements, alliances with either the French or English, armed conflicts, epidemics, shifting inter-tribal confederacies, and eventual removal, or extinction in some cases, as the European expansion took place (NRC 2003).

The historic period can be traced to 1681 when King Charles II granted William Penn a charter for a tract of land running from the Delaware River toward Maryland. William Penn founded the City of Philadelphia, which contained 600 houses by 1685. William Penn also established Chester, Bucks, and Philadelphia Counties in 1682. The earliest colonists were farmers. Milling, distilling, and other processing industries were established along streams. A dramatic increase in the development of political organization and infrastructure can be seen through the period of 1784 to 1870. Because efficient means of transportation were needed to support the movement of settlers westward, turnpikes, canals, and railways were built.

The Schuylkill Navigation Company constructed a canal system between Philadelphia and the coal fields of Schuylkill County. The canal opened in 1824 and ran from south of Reading to Parker Ford, following the west bank of the Schuylkill River through land that is currently LGS property. The canal development spurred the farming industry in the area and, from 1857 to 1937, a farming and commercial center arose around the locks. Locks 54, 55, and a two-story stone lockkeeper's house (now part of Fricks Lock Historic District) were built by the canal company on property owned by John Frick (Exelon 2011b).

The Philadelphia and Reading Railroad, which also passed through land that is now on LGS property, ran along the east bank of the Schuylkill River. It was one of the first railroads built in the Unites States and was completed in 1843. The Reading Company, an owner of the railroad, operated successfully until 1971 when it declared bankruptcy. Another railroad line, the Schuylkill Branch of the Pennsylvania Railroad, was built along the western bank of the river in 1884. It served primarily as a commuter line, but was abandoned by the 1950s (Exelon 2011b).

*2.2.10.2. Historic and Cultural Resources at the Limerick Generating Station Site*

The following information was used to identify the historic and cultural resources at the LGS site:

- original construction FES (NRC 1973),
- original operating FES (NRC 1984),
- Exelon, Applicant's Environmental Report, Operating License Renewal State, LGS Units 1 & 2 (Exelon 2011b),
- site audit (NRC 2012a),
- LGS, request for additional information (Exelon 2012b),
- consultation with Pennsylvania BHP, and
- consultation with tribes.

Exelon's ER describes the cultural resources investigations that occurred on the LGS site for the initial construction and operation of LGS Units 1 and 2 (Exelon 2011b). An archaeological survey of the LGS plant site was conducted to identify prehistoric archaeological resources and, as a result, four areas of occupation were identified. Three were located on the western shores of the Schuylkill River, in the vicinity of Fricks Locks, and are identified as 36CH38, 36CH103, and 36CH364. The other site was recorded on the eastern side of the Schuylkill and is recorded as site 36MG37. The artifacts associated with these sites were those associated with the Archaic, Early Woodland, and Middle Woodland cultural periods (Exelon 2011b)

On October 5, 1983, the BHP stated that the operations of "LGS would have no effect on significant historic or archaeological resources provided that archaeological surveys/mitigation were undertaken for the proposed transmission lines and provided that measures were taken to mitigate visual impacts to historic sites" (Exelon 2011b). The mitigation measures were reviewed and approved by the BHP. Archaeological surveys were conducted for the five transmission system lines: Lines 220-60, 220-61, 220-62, 220-63/64, and 5031, and the results of these surveys are summarized in Exelon's ER (Exelon 2011b).

In 2011 the NRC performed a query of the Pennsylvania Cultural Resources Geographic Information System, a database maintained by the State of Pennsylvania through its BHP office, to identify historic and archaeological resources and their NRHP determinations within the APE and surrounding area. A total of 164 aboveground historic resources and 3 archeological sites are listed on the NRHP in Montgomery County, and 380 aboveground historic resources and 6 archeological sites are listed in Chester County. Directly within the APE, the query noted two aboveground historic resources and six archeological sites. All eight sites are located within the LGS owner-controlled area. The six archaeological resource sites are recorded as 36MG37, 36CH37, 36CH38, 36CH103, 36CH364, and 36CH382, and date to the prehistoric time period. The aboveground historic resources are recorded as the Fricks Locks Historic District and the Schuylkill Navigation Company Canal, and both could contain associated archaeological material (Exelon 2011a, 2012b).

Site 36MG37 (Underpass Site), a multi-component 44-acre site, extends along the eastern terrace of the Schuylkill River. The site reflects evidence from the Middle Archaic through Transitional Archaic periods, along with Late Woodland. Because of insufficient data, no determination has been made for eligibility for inclusion in the National Register of Historic Places (NRHP) (Exelon 2012b).

Site 36CH37 (Warehouse Field) is located upland to the west of the Schuylkill River. Evidence suggests the site is from the Late and Transitional Archaic period. NRHP eligibility has not been determined (Exelon 2012b).

Site 36CH38 (Turkey Point House), an 8-acre prehistoric site, is located on the west side of the Schuylkill River and is commonly referred to as the Turkey Point House site. NRHP eligibility has not been determined (Exelon 2012b)

Site 36CH103 (Fricks Lock Site), a 22-acre site, is located on the west terrace of the Schuylkill River, directly east of the Fricks Lock Historic District. It is commonly referred to as the Fricks Lock site. Evidence collected from the site suggests Archaic and Early Woodland occupations. Data recovery was performed at the site; however, the NRHP status is listed as undetermined (Exelon 2012b).

Site 36CH364 (Payne #1) is located south of site 36CH103 and is approximately 2 acres. No specific components were noted, other than the site was prehistoric and the NRHP eligibility was undetermined (Exelon 2012b).

Site 36CH382 (Locus 25) was recorded through an archaeological survey for transmission line 220-61 and the site is listed as Late Archaic. “Subsurface testing was conducted, but did not provide sufficient data for NRHP eligibility determination” (Exelon 2012b).

The Fricks Locks Historic District is 18 acres. Its buildings were built between 1757 and 1937 as part of a farming hamlet. The site was listed on the NRHP in 2003 under Criteria A (local historical significance) and C (engineering significance) and the eligibility under Criterion D (information potential) has not been determined (Exelon 2012b). The district contains historic buildings, the Schuylkill Navigation Company’s Girard Canal, the filled-in remains of Locks 54 and 55, and the Lock Keeper’s House (Exelon 2012b). Currently, Exelon is working with East Coventry Township and Chester County to rehab and mothball the site. The rehabilitation and mothballing activities are specified to meet the Secretary of Interior’s Standards for Rehabilitation and construction activity is expected to begin in 2012 (Exelon 2012b). In addition to historic archaeological deposits, prehistoric artifacts have been produced within the boundaries of the Fricks Locks Historic District (Exelon 2012b).

The Schuylkill Navigation Company Canal was determined eligible for listing in the NRHP in 2003 under Criteria A (local historical significance) and C (engineering significance) (Exelon 2012b). The 5-mile section of the canal, Locks 52-53 and Locks 54-55, originally was part of the 17-mile-long Girard Lock. “There are several intact remnants of the canal in this NRHP-eligible linear resource. However, the canal prism (channel) and Fricks Locks Historic District are the only canal-related resources recorded within the LGS property” (Exelon 2012b).

*2.2.10.3. Consultation*

In September 2011, the NRC initiated consultation on the proposed action with the Advisory Council on Historic Preservation, Pennsylvania's Bureau of Historic Preservation, and 15 Federally recognized tribes. An overview of consultation activities that occurred during the preparation of the SEIS is given in Section 4.9.6.

## 2.3. Related Federal and State Activities

The staff reviewed the possibility that activities of other Federal agencies might affect the renewal of the operating license for LGS. Any such activity could result in cumulative environmental impacts and the possible need for a Federal agency to become a cooperating agency in the preparation of NRC's SEIS for LGS.

There are no Federal projects that would make it necessary for another Federal agency to become a cooperating agency in the preparation of this SEIS. There are no known American Indian lands within 50 miles (80 km) of LGS. The only Federally owned facility within 50 miles (80 km) of LGS is Valley Forge National Park.

The NRC is required, under Section 102(2)(c) of NEPA, to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. The NRC has consulted with the FWS, the NMFS, and the State of Pennsylvania SHPO. Federal agency consultation correspondence is listed in Appendix D.

## 2.4. References

7 CFR Part 657. *Code of Federal Regulations,* Title 7, *Agriculture*, Part 657, "Prime and unique farmlands."

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for protection against radiation."

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic licensing of production and utilization facilities."

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions."

10 CFR Part 61. *Code of Federal Regulations*, Title 10, *Energy*, Part 61, "Licensing requirements for land disposal of radioactive waste."

10 CFR Part 71. *Code of Federal Regulations*, Title 10, *Energy*, Part 71, "Packaging and transportation of radioactive material."

10 CFR Part 72. *Code of Federal Regulations,* Title 51, *Energy*, Part 72, "Licensing requirements for the independent storage of spent nuclear fuel, high-level radioactive waste, and reactor-related greater than Class C waste."

10 CFR Part 100. *Code of Federal Regulations*, Title 10, *Energy*, Part 100, "Reactor site criteria."

18 CFR Part 410. *Code of Federal Regulations,* Title 18, *Conservation of Power and Water Sources*, Part 410, "Basin regulations; water code and administrative manual part III water quality regulations."

18 CFR Part 430. *Code of Federal Regulations,* Title 18, *Conservation of Power and Water Sources*, Part 430, “Ground water protected area: Pennsylvania.”

36 CFR Part 800. Code of Federal Regulations. Title 36, *Parks, Forests, and Public Property*, Part 800, “Protection of historic properties.”

40 CFR Part 50. *Code of Federal Regulations*, Title 40, *Protection of the Environment*, Part 50, “National primary and secondary ambient air quality standards.”

40 CFR Part 81. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 81, “Designation of areas for air quality planning purposes.”

40 CFR Part 112. *Code of Federal Regulations,* Title 40, *Protection of Environment*, Part 112, “Oil pollution prevention.”

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40 CFR Part 260. *Code of Federal Regulations,* Title 40, *Protection of Environment*, Part 260, “Hazardous waste management system: general.”

40 CFR Parts 260–279. *Code of Federal Regulations,* Title 40, *Protection of Environment*, Parts 260–279, “Hazardous waste.”

40 CFR Part 261. *Code of Federal Regulations,* Title 40, *Protection of Environment*, Part 261, “Identification and listing of hazardous waste.”

40 CFR Part 262. *Code of Federal Regulations,* Title 40, *Protection of Environment*, Part 262, “Standards applicable to generators of hazardous waste.”

40 CFR Part 266. *Code of Federal Regulations,* Title 40, *Protection of Environment*, Part 266, “Standards for the management of specific hazardous wastes and specific types of hazardous waste management facilities.”

50 CFR Part 10. *Code of Federal Regulations*, Title 50, *Wildlife and Fisheries*, Part 10, “General provisions.”

50 CFR Part 22. *Code of Federal Regulations*, Title 50, *Wildlife and Fisheries*, Part 22, “Eagle permits.”

50 CFR Part 402. *Code of Federal Regulations*, Title 50, *Wildlife and Fisheries*, Part 402, “Interagency cooperation—Endangered Species Act of 1973, as amended.”

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# 3.0 ENVIRONMENTAL IMPACTS OF REFURBISHMENT

Facility owners or operators may need to undertake or, for economic or safety reasons, may choose to perform refurbishment activities in anticipation of license renewal or during the license renewal term. The major refurbishment class of activities characterized in the *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants* (NRC 1996) is intended to encompass actions which typically take place only once in the life of a nuclear plant, if at all. Examples of these activities include, but are not limited to, replacement of boiling water reactor recirculation piping and pressurized water reactor steam generators. These actions may have an impact on the environment beyond those that occur during normal operations and may require evaluation, depending on the type of action and the plant-specific design. Table 3-1 lists the environmental issues associated with refurbishment that the U.S. Nuclear Regulatory Commission (NRC) staff (the staff) determined to be Category 1 issues in the GEIS.

**Table 3–1. Category 1 Issues Related to Refurbishment**

| Issue | GEIS Section(s) |
|---|---|
| **Surface water quality, hydrology, and use (for all plants)** | |
| Impacts of refurbishment on surface water quality | 3.4.1 |
| Impacts of refurbishment on surface water use | 3.4.1 |
| **Aquatic ecology (for all plants)** | |
| Refurbishment | 3.5 |
| **Groundwater use and quality** | |
| Impacts of refurbishment on groundwater use and quality | 3.4.2 |
| **Land use** | |
| Onsite land use | 3.2 |
| **Human health** | |
| Radiation exposures to the public during refurbishment | 3.8.1 |
| Occupational radiation exposures during refurbishment | 3.8.2 |
| **Socioeconomics** | |
| Public services: public safety, social services, and tourism and recreation | 3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6 |
| Aesthetic impacts (refurbishment) | 3.7.8 |
| Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 | |

Table 3-2 lists environmental issues related to refurbishment that the staff determined to be plant-specific or inconclusive in the GEIS. These issues are Category 2 issues. The definitions of Category 1 and 2 issues can be found in Section 1.4.

**Table 3–2. Category 2 Issues Related to Refurbishment**

| Issue | GEIS Section(s) | 10 CFR 51.53 (c)(3)(ii) Subparagraph |
|---|---|---|
| **Terrestrial resources** | | |
| Refurbishment impacts | 3.6 | E |
| **Threatened or endangered species (for all plants)** | | |
| Threatened or endangered species | 3.9 | E |
| **Air quality** | | |
| Air quality during refurbishment (nonattainment and maintenance areas) | 3.3 | F |
| **Socioeconomics** | | |
| Housing impacts | 3.7.2 | I |
| Public services: public utilities | 3.7.4.5 | I |
| Public services: education (refurbishment) | 3.7.4.1 | I |
| Offsite land use (refurbishment) | 3.7.5 | I |
| Public services, transportation | 3.7.4.2 | J |
| Historic and archaeological resources | 3.7.7 | K |
| **Environmental justice** | | |
| Environmental justice[a] | Not addressed | Not addressed |

[a] Guidance related to environmental justice was not in place at the time the U.S. Nuclear Regulatory Commission (NRC) prepared the GEIS and the associated revision to 10 CFR Part 51. If an applicant plans to undertake refurbishment activities for license renewal, the applicant's environmental report (ER) and the staff's environmental impact statement must address environmental justice.

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51

Table B–2 of the GEIS identifies systems, structures, and components (SSCs) that are subject to aging and might require refurbishment to support continued operation during the license renewal period of a nuclear facility. In preparation for its license renewal application, Exelon Generation Company, LLC (Exelon) performed an evaluation of these SSCs pursuant to Title 10 of the *Code of Federal Regulation* (10 CFR 54.21), in order to identify the need to undertake any major refurbishment activities that would be necessary to support the continued operation of Limerick Generating Station Units 1 and 2 (LGS) during the proposed 20-year period of extended operation.

In its SSC evaluation, Exelon did not identify the need to undertake any major refurbishment or replacement actions associated with license renewal to support the continued operation of LGS beyond the end of the existing operating license (Exelon 2011). Therefore, the staff will not assess refurbishment activities in this SEIS.

## 3.1. References

10 CFR Part 51. *Code of Federal Regulations,* Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

10 CFR Part 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

[Exelon] Exelon Generation Company, LLC. 2011. *License Renewal Application, Limerick Generating Station, Units 1 and 2, Appendix E, Applicant's Environmental Report, Operating License Renewal Stage*. Agencywide Documents Access and Management System (ADAMS) Accession No. ML11179A104.

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# 4.0 ENVIRONMENTAL IMPACTS OF OPERATION

This chapter addresses potential environmental impacts related to the period of extended operation of Limerick Generating Station, Units 1 and 2 (LGS). These impacts are grouped and presented according to resource. Generic issues (Category 1) rely on the analysis presented in the *Generic Environmental Impact Statement* (GEIS) *for License Renewal of Nuclear Plants* (NRC 1996), unless otherwise noted. Site-specific issues (Category 2) have been analyzed for LGS and assigned a significance level of SMALL, MODERATE, or LARGE, accordingly. Some issues are not applicable to LGS because of site characteristics or plant features. For an explanation of the criteria for Category 1 and Category 2 issues, as well as the definitions of SMALL, MODERATE, and LARGE, refer to Section 1.4.

## 4.1. Land Use

Section 2.2.1 of this supplemental environmental impact statement (SEIS) describes the land use around LGS.

Land use in the vicinity of nuclear power plants could be affected by the license renewal decision. However, as discussed in the GEIS, onsite land use and power line right of way (ROW) conditions are expected to remain unchanged during the license renewal term at all nuclear plants and any impacts would therefore be SMALL. These issues were classified as Category 1 issues in the GEIS and are listed in Table 4–1.

Exelon Generation Company, LLC's (Exelon) Environmental Report (ER) (Exelon 2011a), scoping comments, and other available information about land use in the vicinity of LGS, Units 1 and 2 were reviewed and evaluated for new and significant information. The review included a data gathering site visit to LGS. No new and significant information was identified during this review that would change the conclusions in the GEIS. Therefore, for these Category 1 issues, impacts during the renewal term are not expected to exceed those discussed in the GEIS.

Montgomery County has been working to develop an interconnected system of open space and trails along the Schuylkill River and within other natural resource areas of the county. The LGS site contains land along the Schuylkill River that has been identified as part of the Schuylkill River Greenway in the county plan. Onsite land use conditions at LGS are expected to remain unchanged during the license renewal term. Therefore, activities associated with continued reactor operations during the license renewal term are not expected to affect the use and management of LGS lands identified as part of the Schuylkill River Greenway.

**Table 4–1. Land Use Issues**

| Issue | GEIS Section | Category |
|---|---|---|
| Onsite land use | 4.5.3 | 1 |
| Power line ROW | 4.5.3 | 1 |

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51

## 4.2. Air Quality

Section 2.2.2 of this report describes the meteorology and air quality in the vicinity of the LGS site. One Category 1 air quality issue is applicable to LGS—air quality effects of transmission lines. No Category 2 issues apply for air quality, as there is no planned refurbishment associated with license renewal. The U.S. Nuclear Regulatory Commission (NRC) staff did not identify any new and significant information related to the Category 1 air quality issue during the review of Exelon's ER, the site audit, or during the scoping process. Therefore, there are no impacts related to this issue beyond those discussed in the GEIS. For this issue, the GEIS concluded that the impacts are SMALL.

**Table 4–2. Air Quality Issues**

| Issue | GEIS Section | Category |
|---|---|---|
| Air quality effects of transmission lines | 4.5.2 | 1 |

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51

## 4.3. Geologic Environment

### 4.3.1. Geology and Soils

As described in Section 1.4 of this SEIS, the NRC has approved a revision to its environmental protection regulation, Title 10 of the Code of Federal Regulations (10 CFR) Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions." With respect to the geologic environment of a plant site, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by adding a new Category 1 issue, "Geology and soils." This new issue has an impact level of SMALL. This new Category 1 issue considers geology and soils from the perspective of those resource conditions or attributes that can be affected by continued operations during the renewal term. An understanding of geologic and soil conditions has been well established at all nuclear power plants and associated transmission lines during the current licensing term, and these conditions are expected to remain unchanged during the 20-year license renewal term for each plant. The impact of these conditions on plant operations and the impact of continued power plant operations and refurbishment activities on geology and soils are SMALL for all nuclear power plants and not expected to change appreciably during the license renewal term. Operating experience shows that any impacts to geologic and soil strata would be limited to soil disturbance from construction activities associated with routine infrastructure renovation and maintenance projects during continued plant operations. Implementing best management practices would reduce soil erosion and subsequent impacts on surface water quality. Information in plant-specific SEISs prepared to date and reference documents has not identified these impacts as being significant.

Section 2.2.3 of this SEIS describes the local and regional geologic environment relevant to LGS. The NRC staff did not identify any new and significant information with regard to this Category 1 (generic) issue based on review of the ER (Exelon 2011a), the public scoping process, or as a result of the environmental site audit. As discussed in Chapter 3 of this SEIS and as identified in the ER (Exelon 2011a), Exelon has no plans to conduct refurbishment or replacement actions associated with license renewal to support the continued operation of LGS. Further, Exelon anticipates no new construction or other ground disturbing-activities or changes in operations and that operation and maintenance activities would be confined to previously disturbed areas or existing ROWs. Based on this information, it is expected that any incremental impacts on geology and soils during the license renewal term would be SMALL.

## 4.4. Surface Water Resources

The Category 1 (generic) and Category 2 surface water use and quality issues applicable to LGS, Units 1 and 2 are discussed in the following sections and listed in Table 4–3. Surface water resources-related aspects and conditions relevant to the LGS site are described in Sections 2.1.7.1 and 2.2.4.

**Table 4–3. Surface Water Resources Issues**

| Issues | GEIS Section | Category |
|---|---|---|
| Altered current patterns at intake and discharge structures | 4.2.1.2.1 | 1 |
| Altered salinity gradients | 4.2.1.2.2 | 1 |
| Temperature effects on sediment transport capacity | 4.2.1.2.3 | 1 |
| Scouring caused by discharged cooling water | 4.2.1.2.3 | 1 |
| Eutrophication | 4.2.1.2.3 | 1 |
| Discharge of chlorine or other biocides | 4.2.1.2.4 | 1 |
| Discharge of sanitary wastes and minor chemical spills | 4.2.1.2.4 | 1 |
| Discharge of other metals in wastewater | 4.2.1.2.4 | 1 |
| Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river with low flow) | 4.3.2.1 | 2 |
| Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 | | |

### 4.4.1. Generic Surface Water Issues

The NRC staff did not identify any new and significant information with regard to the Category 1 (generic) surface water issues based on review of the ER (Exelon 2011a), the public scoping process, or as a result of the environmental site audit. As a result, no information or impacts related to these issues were identified that would change the conclusions presented in the GEIS. Therefore, it is expected that there would be no incremental impacts related to these Category 1 issues during the renewal term beyond those discussed in the GEIS. For these surface water issues, the GEIS concludes that the impacts are SMALL.

### 4.4.2. Surface Water Use Conflicts

This section presents the NRC staff's review of plant-specific (Category 2) surface water use conflict issues as listed in Table 4–3.

*4.4.2.1. Plants Using Makeup Water from a Small River with Low Flow*

For nuclear power plants utilizing cooling towers or cooling ponds supplied with makeup water from a small river, the potential impact on the flow of the river and related impacts on instream and riparian ecological communities is considered a Category 2 issue, thus, requiring a plant-specific assessment. A small river is defined in 10 CFR 51.53(c)(3)(ii)(A) as one whose annual flow rate is less than $3.15 \times 10^{12}$ $ft^3$/yr ($9 \times 10^{10}$ $m^3$/yr) or 100,000 cfs (2,820 $m^3$/s). LGS has a closed-cycle, heat-dissipation system that uses natural draft cooling towers with makeup water pumped from the Schuylkill River (see Section 2.1.7). As noted in Section 2.2.4.1, the Schuylkill River near the LGS site has a mean annual flow rate of less than $6.3 \times 10^{10}$ $ft^3$/yr (2,000 cfs). Therefore, an assessment of the impact of the proposed action on the flow of the river is required.

Flow conditions in the Schuylkill River have required Exelon to supplement LGS's water sources. As discussed in Section 2.2.4.1, the mean annual flow and 90 percent exceedance flow for the Schuylkill River, as measured at the U.S. Geological Survey (USGS) Pottstown, Pennsylvania, gage station, total 1,935 cfs (54.8 $m^3$/s) and 482 cfs (13.6 $m^3$/s), respectively. Against these measures of flow, the withdrawal of water at the maximum consumptive use permitted by the Delaware River Basin Commission (DRBC) (65 cfs (1.84 $m^3$/s)) represents a 3.4 percent and a 13 percent reduction, respectively, in the flow of the Schuylkill River downstream of LGS. In order to limit downstream, including aquatic and riparian, impacts in the Schuylkill River during low flow, the DRBC requires LGS to augment its consumptive use of water when the river flow falls to 560 cfs (15.9 $m^3$/s), based on two-unit operation. This is accomplished either through withdrawing makeup water directly from other DRBC-approved water sources or through augmentation of the flow in the Schuylkill River through surface water diversion, as described in Sections 2.1.6 and 2.1.7.1 of this SEIS.

In 2003, as part of a demonstration project approved by the DRBC, Exelon included water from Wadesville Mine Pool and the Still Creek Reservoir in its portfolio of water sources for flow augmentation. Since their use presently remains a demonstration project and has not received final docket approval from the DRBC (Docket No. D-69-210, as revised), the NRC staff did not consider these alternative water sources in its impact level determination. Before 2003, the frequency of water withdrawals by LGS for consumptive use was approximately 50 percent from the Schuylkill River, 4 percent from Perkiomen Creek natural flow, and 46 percent from Perkiomen Creek supplemented by water diverted from the Delaware River. Under the demonstration project with releases from the Wadesville Mine Pool to the Schuylkill River, the frequency of withdrawals from the Schuylkill River to support LGS consumptive uses has increased (Exelon 2012a). This trend toward an increasing reliance on augmented flows in the Schuylkill River would be expected to increase during the license renewal term should the demonstration project continue or be made permanent by DRBC, as requested by Exelon. Regardless of the above considerations, the DBRC Comprehensive Plan (DRBC 2001) includes consideration of LGS operations. The DBRC's mission includes water conservation, control, use, and management, which is to be accomplished through the adoption and promotion of uniform and coordinated policies basin-wide (DRBC 1961). The DBRC requirement that LGS shift to alternative water sources when the flow of the Schuylkill River falls to 560 cfs (15.9 $m^3$/s) ensures that LGS cooling water withdrawals and associated consumptive use will not reduce river flow by more than 12 percent during low-flow periods. During average flows, LGS operations will reduce the flow by about 3 percent. Therefore, because DRBC imposes requirements to ensure that LGS's consumptive water use from the Schuylkill River remains within acceptable limits, the NRC staff concludes that the impact on surface water resources and downstream water availability from consumptive water use by LGS, Units 1 and 2 during the license renewal term would be SMALL.

## 4.5. Groundwater Resources

The Category 1 (generic) and Category 2 groundwater use and quality issues applicable to LGS are discussed in the following sections and listed in Table 4–4. Groundwater resources related aspects and conditions relevant to the LGS site are described in Sections 2.1.7.2 and 2.2.5.

**Table 4–4. Groundwater Resources Issues**

| Issues | GEIS Section | Category |
|---|---|---|
| Groundwater use conflicts (potable and service water; plants that use less than 100 gpm) | 4.8.1.1 | 1 |
| Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river) | 4.8.1.3 | 2 |
| Radionuclides released to groundwater | To be determined[(a)] | 2 |

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51; [(a)]NRC 2012b

### 4.5.1. Generic Groundwater Issues

Section 2.2.5 of this SEIS discusses groundwater use and quality at LGS. The NRC staff did not identify any new and significant information with regard to Category 1 (generic) groundwater issues based on the review of the ER (Exelon 2011a), the public scoping process, or as a result of the environmental site audit. NRC staff also reviewed other sources of information, such as various permits and data reports. As a result, no information or impacts related to these issues were identified that would change the conclusions presented in the GEIS. Therefore, for the single issue found to be directly applicable to LGS, it is expected that there would be no incremental impacts related to this Category 1 issue during the renewal term beyond those discussed in the GEIS. For this groundwater issue, the GEIS concludes that the impacts are SMALL.

### 4.5.2. Groundwater Use and Quality Conflicts

This section presents the NRC staff's review of plant-specific (Category 2) groundwater resources issues as listed in Table 4–4.

#### *4.5.2.1. Plants Using Cooling Towers Withdrawing Makeup Water from a Small River, Alluvial Aquifers*

For nuclear power plants utilizing cooling towers supplied with makeup water from a small river (as defined in Section 4.3.2.1), the potential impact on alluvial aquifers is also considered a Category 2 issue, thus, requiring a plant-specific assessment. This groundwater aspect was classified as a Category 2 issue in the GEIS because consumptive use of water withdrawn from a small river could adversely affect groundwater aquifer recharge. Low river flow conditions are of particular interest.

Based on the topography of the plant site and review of local groundwater elevations, NRC staff determined that groundwater flow across and in the vicinity of the plant site predominately discharges to the Schuylkill River and Possum Hollow Run. Groundwater provides baseflow to these surface waters. For groundwater use conflicts to occur due to reduced streamflow, the affected stream segments must also be a principal source of recharge to an affected aquifer, which is not the case. Recharge to the bedrock aquifer (Brunswick) in the region predominantly occurs in upgradient areas from precipitation and runoff, as described in Section 2.2.5.1 of the SEIS. In addition, the alluvial sediments and regolith overlying the area's bedrock are relatively thin and not used as a source of groundwater. A review of Pennsylvania water well records within a 1-mi (1.6-km) radius of the LGS site revealed that all recorded wells are in the Brunswick Formation rather than in surficial materials. Therefore, the NRC staff concludes that continued withdrawals of surface water for the operation of LGS, Units 1 and 2 during low-flow periods would have a SMALL impact on groundwater recharge during the license renewal term.

*4.5.2.2. Radionuclides Released to Groundwater*

In its ER (Exelon 2011a), Exelon identified the presence of tritium in groundwater as new, but not significant, information based on site groundwater monitoring. In response, the NRC staff specifically reviewed information relating to the current state of knowledge on groundwater quality beneath and downgradient of LGS, as detailed in Section 2.2.5.2 and summarized below.

As described in Section 1.4 of this SEIS, the NRC has approved a revision to its environmental protection regulation, 10 CFR Part 51. With respect to groundwater quality, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by adding a new Category 2 issue, “Radionuclides released to groundwater,” with an impact level range of SMALL to MODERATE, to evaluate the potential impact of discharges of radionuclides from plant systems into groundwater. This new Category 2 issue has been added to evaluate the potential impact to groundwater quality from the discharge of radionuclides from plant systems, piping, and tanks. This issue was added because, within the past several years, there have been events at nuclear power reactor sites that involved unknown, uncontrolled, and unmonitored releases of radioactive liquids into the groundwater.

Exelon commissioned a hydrogeologic investigation in 2006 (CRA 2006), in part, to evaluate the potential impacts on groundwater quality of any inadvertent releases of tritium or other LGS-related radionuclides and to identify and eliminate contributing sources of radionuclides to groundwater. The investigation provided the basis for the site’s current Radiological Groundwater Protection Program (RGPP).

As part of the 2006 investigation, a network of 15 onsite groundwater monitoring wells was installed in the Brunswick Formation (bedrock aquifer) at LGS. From the initial 2006 sampling, no strontium-90 or gamma-emitting radionuclides were detected in groundwater or surface water above analytical detection limits. Tritium was detected in five of the monitoring wells at relatively low wells, but one well (P12), located immediately south and downgradient of the power block, had a concentration of 4,360 ± 494 pCi/L. At the same time, a sample from the power block foundation sump had tritium at 2,020 ± 154 pCi/L. As noted in Section 2.2.5.2, well P12 was replaced with well no. MW-LR-9 in August 2006, to be more representative of water table conditions beneath the site. Sampling of this new well yielded tritium at 1,500 ± 210 pCi/L.

Under the ongoing RGPP at LGS, groundwater and surface water samples are collected and analyzed for tritium and other radionuclides at least semi-annually. The results are reported in annual radiological environmental operating (REOP) reports (Exelon 2008a, 2009a, 2010a, 2011b, 2012b) that are submitted to the NRC. Since 2006, there have been no detections in groundwater of gamma-emitting radionuclides or strontium-90 associated with LGS operations. The peak tritium level observed in groundwater was 1,750 pCi/L in well MW-LR-9 in 2009. Exelon traced this to a condensate release in February 2009, which was corrected (see Section 2.2.5.2). Tritium in MW-LR-9 had decreased to a maximum of 1,154 pCi/L by April 2011. It is noted that tritium concentrations have exceeded 2,000 pCi/L in samples from the power block foundation sump since 2006 (Exelon 2011a). Regardless, monitoring data indicates that there is no migration of tritium in groundwater at LGS at concentrations exceeding 2,000 pCi/L, and observed tritium levels have been well within the U.S. Environmental Protection Agency (EPA) primary drinking water standard (i.e., 20,000 pCi/L) at all onsite monitoring wells. In addition, there are no potable water wells downgradient of the LGS power block and no drinking water pathway. The plant’s potable water supply well (well 1) is located about 1,000 ft (300 m) upgradient and slightly cross-gradient (northeast) of MW-LR-9 and the power block sump pit. Based on the information presented and the NRC staff's review, NRC staff concludes that inadvertent releases of tritium have not substantially impaired site groundwater quality or affected groundwater use downgradient of the LGS site. The NRC staff further concludes that groundwater quality impacts would remain SMALL during the license renewal term.

## 4.6. Aquatic Resources

Section 2.1.6 of this SEIS describes the LGS cooling-water system; Section 2.2.5 describes the aquatic resources. Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B–1, which are applicable to the operation of the LGS cooling-water systems during the renewed license term, are listed in Table 4–5. There are no Category 2 issues that apply to aquatic resources at LGS. The NRC staff did not find any new and significant information during the review of the applicant's ER (Exelon 2011a), the site audit, the scoping process, or the evaluation of other available information; therefore, the NRC staff concludes that there are no impacts related to aquatic resource issues beyond those discussed in the GEIS (NRC 1996) and the revised rule (NRC 2012b). Consistent with the GEIS, the NRC staff concludes that the impacts are SMALL, and additional site-specific mitigation measures are unlikely to be sufficiently beneficial to warrant implementation.

**Table 4–5. Aquatic Resources Issues**

| Issues | GEIS Section | Category |
|---|---|---|
| **For all plants** | | |
| Accumulation of contaminants in sediments or biota | 4.2.1.2.4 | 1 |
| Entrainment of phytoplankton and zooplankton | 4.2.2.1.1 | 1 |
| Cold shock | 4.2.2.1.5 | 1 |
| Thermal plume barrier to migrating fish | 4.2.2.1.6 | 1 |
| Distribution of aquatic organisms | 4.2.2.1.6 | 1 |
| Premature emergence of aquatic insects | 4.2.2.1.7 | 1 |
| Gas supersaturation (gas bubble disease) | 4.2.2.1.8 | 1 |
| Low dissolved oxygen in the discharge | 4.2.2.1.9 | 1 |
| Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses | 4.2.2.1.10 | 1 |
| Stimulation of nuisance organisms | 4.2.2.1.11 | 1 |
| Exposure of aquatic organisms to radionuclides | To be determined[a] | 1 |
| **For plants with cooling tower-based heat dissipation systems** | | |
| Entrainment of fish and shellfish in early life stages | 4.3.3 | 1 |
| Impingement of fish and shellfish | 4.3.3 | 1 |
| Heat shock | 4.3.3 | 1 |

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51; [a]NRC 2012b

### 4.6.1. Exposure of Aquatic Organisms to Radionuclides

As described in Section 1.4 of this SEIS, the NRC has approved a revision to its environmental protection regulation, 10 CFR Part 51. With respect to the aquatic organisms, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by adding a new Category 1 issue, "Exposure of aquatic organisms to radionuclides," among other changes. This new Category 1 issue considers the impacts to aquatic organisms from exposure to radioactive effluents discharged from a nuclear power plant during the license renewal term. An understanding of the radiological conditions in the aquatic environment from the discharge of radioactive effluents within NRC regulations has been well established at nuclear power plants during their current licensing term. Based on this information, the NRC concluded that the doses to aquatic organisms are expected to be well below exposure guidelines developed to protect these organisms and assigned an impact level of SMALL.

The NRC staff has not identified any new and significant information related to the exposure of aquatic organisms to radionuclides during its independent review of LGS's ER, the site audit, and the scoping process. Section 2.1.2 of this SEIS describes the applicant's radioactive waste management program to control radioactive effluent discharges to ensure that they comply with NRC regulations in 10 CFR Part 20, "Standards for protection against radiation." Section 4.9.3 of this SEIS contains the NRC staff's evaluation of the LGS's radioactive effluent and radiological environmental monitoring programs. LGS's radioactive effluent and radiological environmental monitoring programs provide further support for the conclusion that the impacts of aquatic organisms from radionuclices are SMALL. The NRC staff concludes that there would be no impacts to aquatic organisms from radionuclides beyond those impacts contained in Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 of the revised rule and, therefore, the impacts to aquatic organisms from radionuclides are SMALL.

## 4.7. Terrestrial Resources

The Category 1 (generic) and Category 2 (site-specific) terrestrial resources issues applicable to LGS are discussed in the following sections and listed in Table 4–6. Terrestrial resources issues that apply to LGS are described in Sections 2.2.7 and 2.2.8.

**Table 4–6. Terrestrial Resources Issues**

| Issue | GEIS Section | Category |
|---|---|---|
| Cooling tower impacts on crops and ornamental vegetation | 4.3.4 | 1 |
| Cooling tower impacts on native plants | 4.3.5.1 | 1 |
| Bird collisions with cooling towers | 4.3.5.2 | 1 |
| Power line right-of-way management (cutting herbicide application) | 4.5.6.1 | 1 |
| Bird collisions with power lines | 4.5.6.2 | 1 |
| Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) | 4.5.6.3 | 1 |
| Floodplains and wetland on power line right-of-way | 4.5.7 | 1 |
| Exposure of terrestrial organisms to radionuclides | To be determined[a] | 1 |
| Effects on terrestrial resources (non-cooling system impacts) | To be determined[a] | 2 |

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51; [a]NRC 2012b

### 4.7.1. Generic Terrestrial Resources Issues

For the Category 1 terrestrial resources issues listed in Table 4–6, the NRC staff did not identify any new and significant information during the review of the ER (Exelon 2011a), the NRC staff's site audit, the scoping process, or the evaluation of other available information. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS and the revised rule (NRC 2012b). For these issues, the GEIS and the revised rule concluded that the impacts are SMALL, and additional site-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

#### *4.7.1.1. Exposure of Terrestrial Organisms to Radionuclides*

As described in Section 1.4 of this draft SEIS, the NRC has approved a revision to its environmental protection regulation, 10 CFR Part 51. With respect to the terrestrial organisms, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by adding a new Category 1 issue, "Exposure of terrestrial organisms to radionuclides," among other changes. This new issue has an impact level of SMALL. This new Category 1 issue considers the impacts to terrestrial organisms from exposure to radioactive effluents discharged from a nuclear power plant during the license renewal term. An understanding of the radiological conditions in the terrestrial environment from the discharge of radioactive effluents within NRC regulations has been well established at nuclear power plants during their current licensing term. Based on this information, the NRC concluded that the doses to terrestrial organisms are expected to be well below exposure guidelines developed to protect these organisms and assigned an impact level of SMALL.

The NRC staff has not identified any new and significant information related to the exposure of terrestrial organisms to radionuclides during its independent review of LGS's ER, the site audit, and the scoping process. Section 2.1.2 of this SEIS describes the applicant's radioactive waste management program to control radioactive effluent discharges to ensure that they comply with NRC regulations in 10 CFR Part 20. Section 4.9.3 of this SEIS contains the NRC staff's evaluation of LGS's radioactive effluent and radiological environmental monitoring programs, which provide further support for the conclusion that the impacts from radioactive effluents are SMALL.

Therefore, the NRC staff concludes that there would be no impact to terrestrial organisms from radionuclides beyond those impacts contained in Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51of the revised rule and, therefore, the impacts to terrestrial organisms from radionuclides are SMALL.

### 4.7.2. Effects on Terrestrial Resources (Non-Cooling System Impacts)

As described in Section 1.4 of this SEIS, the NRC has approved a revision to its environmental protection regulation, 10 CFR Part 51. With respect to the terrestrial organisms, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by expanding the Category 2 issue, "Refurbishment impacts," among others, to include normal operations, refurbishment, and other supporting activities during the license renewal term. This issue remains a Category2 issue with an impact level range of SMALL to LARGE; however, the revised rule renames this issue "Effects on terrestrial resources (non-cooling system impacts)."

Section 2.2.7 describes the terrestrial resources on and in the vicinity of the LGS site and vicinity, and Section 2.2.8 describes protected species and habitats. During construction of LGS, approximately 42 percent of the plant site (270 ac (110 ha)) was cleared for buildings, parking lots, roads, and other infrastructure. The remaining terrestrial habitats have not changed significantly since construction. As discussed in Chapter 3 of this SEIS and according to the applicant's ER (Exelon 2011a), Exelon has no plans to conduct refurbishment or replacement actions associated with license renewal to support the continued operation of LGS. Further, Exelon (2011a) anticipates no new construction or other ground-disturbing activities, changes in operations, or changes in existing land use conditions because of license renewal. Exelon (2011a) reports that operation and maintenance activities would be confined to previously disturbed areas or existing ROWs. As a result, Entergy (2011a) anticipates no new impacts on the terrestrial environment on the LGS site or along the in-scope transmission line corridors during the license renewal term. Based on the staff's independent review, the staff concurs that operation and maintenance activities that Exelon might undertake during the renewal term, such as maintenance and repair of plant infrastructure (e.g., roadways, piping installations, onsite transmission lines, fencing, and other security infrastructure), likely would be confined to previously disturbed areas of the LGS site. Therefore, the staff expects non-cooling system impacts on terrestrial resources during the license renewal term to be SMALL.

## 4.8. Protected Species and Habitats

Section 2.2.7 of this SEIS describes the action area, as defined by the ESA regulations at 50 CFR 402.02, and describes the protected species and habitats within the action area associated with the LGS license renewal. Table 4–7 lists the one Category 2 issue related to protected species and habitats that is applicable to LGS.

**Table 4–7. Protected Species and Habitats Issues**

| Issue | GEIS Section | Category |
|---|---|---|
| Threatened or endangered species | 4.1 | 2 |
| Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 | | |

### 4.8.1. Correspondence with Federal and State Agencies

In accordance with Section 7 of the Endangered Species Act (ESA), in a letter to the U.S. Fish and Wildlife Service (FWS), dated September 8, 2011, the NRC staff requested information regarding Federally listed species in the action area (NRC 2011d). Also in accordance with Section 7 of the ESA, the NRC staff sent a similar request regarding Federally listed species to the National Marine Fisheries Service (NMFS) (NRC 2012a). The NRC staff sent further requests to the Pennsylvania Fish and Boat Commission (PFBC) (NRC 2011e), Pennsylvania Game Commission (PGC) (NRC 2011g), and Pennsylvania Department of Conservation and Natural Resources (PDCNR) (NRC 2011f) regarding the presence of Pennsylvania-listed species in the action area. The PFBC, PGC, FWS, and NMFS responded to the NRC staff in letters dated October 5, 2011 (PFBC 2011b); November 17, 2011 (PGC 2011); November 22, 2011 (FWS 2011b); and June 2, 2012 (NMFS 2012c), respectively. The PFBC noted that the eastern redbelly turtle (*Pseudemys rubriventris*) and globally rare amphipods and/or isopods may be in the project area (PFBC 2011b); Section 4.7.3 considers the potential effects to this species. The PGC determined that no impacts to Pennsylvania-listed threatened or endangered birds or mammals under PGC responsibility would be likely from the proposed license renewal (PGC 2011). The FWS indicated that the proposed project is within the known range of the bog turtle (*Clemmys muhlenbergii*) (FWS 2011b); Section 4.7.3 considers the potential effects to this species. However, because FWS concluded that the proposed action is not likely to have an adverse effect on the bog turtle, no further consultation with FWS under Section 7 of the ESA is required. NMFS stated that no species listed under the ESA occur within the action area (NMFS 2012c). NMFS also stated that two candidate species—alewife (*Alosa pseudoharengus)* and blueback herring *(Alosa aestivalis)*—occur in the project area. However, as candidate species, NMFS is still considering whether the species should be listed and protected under ESA. Therefore, no further consultation with NMFS under Section 7 of the ESA is required. The NRC staff has not received a response from the PDCNR to date. However, in a March 9, 2011, letter to Exelon, the PDCNR identified several plant species that occur within the action area near LGS transmission line corridors (PDCNR 2011). The PDCNR indicated that because the proposed license renewal does not involve new construction, refurbishment, ground disturbance, or changes to operations or existing land-use conditions, no impact is likely to occur to species under the PDCNR's jurisdiction (PDCNR 2011).

### 4.8.2. Aquatic Species and Habitats

For purposes of its protected species and habitat discussion and analysis, the NRC staff considers the action area, as defined by 50 CFR 402.02, to include the lands and waterbodies associated with LGS, as defined in Section 2.2.7. Two fish species and one aquatic invertebrate protected under the ESA may occur in the Delaware River or in small waterbodies throughout Pennsylvania (FWS 2012, NMFS 2012a). Two fish within the action area are considered candidate species and species of concern by NMFS (NMFS 2012c). Three additional fish species, one additional aquatic invertebrate, and four aquatic plant species listed as a species of special concern, endangered, or threatened by the Commonwealth of Pennsylvania may occur in waterbodies in Bucks, Chester, or Montgomery Counties (PNHP 2012a).

#### *4.8.2.1. Federally Protected Species*

Shortnose Sturgeon (*Acipenser brevirostrum*)

The endangered shortnose sturgeon uses the tidal, estuarine, and lower portion of the Delaware River in Bucks County, Pennsylvania (NMFS 2012b). LGS-related studies from 1979-1985 did not observe shortnose sturgeon eggs or larvae at the Point Pleasant Pumping Station and downriver to river mi (RM) 138 (river km (RKm) 222.1) (Exelon 2011a; RMC 1984, 1985, 1986). The most recent population studies observed the farthest upriver migration up to 9 RM (15 RKm) below the Point Pleasant Pumping Station, which is located at RM 157 (RKm 253) (Hastings et al. 1987, O'Herron et al. 1993). NMFS stated that no species listed under the ESA occur within the action area (NMFS 2012c).

The NRC staff concludes that the proposed LGS license renewal would have **no effect** on the shortnose sturgeon because:

- NMFS (2012c) stated that no species listed under the ESA occur within the action area,
- the LGS intake at the Point Pleasant Pumping Station is approximately 9 RM (15 RKm) upriver of the farthest known upriver occurrence of this species,
- LGS-related studies from 1979–1985 did not observe Atlantic sturgeon eggs or larvae near the Point Pleasant Pumping Station, and
- no new construction, refurbishment, ground-disturbing activities, or changes to existing land use conditions at the Point Pleasant Pumping Station would occur.

<u>Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*)</u>

The endangered Atlantic sturgeon uses the tidal, estuarine, and lower portion of the Delaware River in Bucks County, Pennsylvania (NMFS 2012b). LGS-related studies from 1979 to 1985 did not observe Atlantic sturgeon eggs or larvae at the Point Pleasant Pumping Station and downriver to 138 RM (222.1 RKm) (Exelon 2011a; RMC 1984, 1985, 1986). Tagging studies in 2005 and 2006 indicated that Atlantic sturgeon followed similar migration patterns as shortnose sturgeon with spawning potentially occurring in the upper tidal Delaware reaches between Philadelphia, Pennsylvania, and Trenton, New Jersey (Simpson and Fox undated). NMFS (2012c) stated that no species listed under the ESA occur within the action area.

The NRC staff concludes that the proposed LGS license renewal would have **no effect** on Atlantic sturgeon because:

- NMFS (2012) stated that no species listed under the ESA occur within the action area,
- LGS-related studies from 1979 to1985 did not observe Atlantic sturgeon eggs or larvae near the Point Pleasant Pumping Station, and
- no new construction, refurbishment, ground-disturbing activities, or changes to existing land use conditions at the Point Pleasant Pumping Station would occur.

<u>Dwarf Wedgemussel (*Alasmidonta heterodon*)</u>

FWS (2012b) lists the endangered dwarf wedgemussel as known to or believed to occur in Monroe, Pike, and Wayne Counties, Pennsylvania, which is not part of the action area. PNHP (2012a) lists the dwarf wedgemussel as potentially occurring in Bucks, Chester, and Montgomery Counties. The Philadelphia Electric Company (PECO 1984) observed rare, unidentified species of the genus *Alasmidonta* in the Schuylkill River in the 1970s and it is unknown whether the specimens were the dwarf wedgemussel (Exelon 2011a). Other than the rare *Alasmidonta* specimens observed in the 1970s in the Schuylkill River, LGS-related studies did not observe dwarf wedgemussels during benthic surveys in East Branch Perkiomen Creek, Perkiomen Creek, and the Schuylkill River between 1970 and 2009 (Exelon 2011a; NAI 2010c; PECO 1984; RMC 1984, 1985, 1986, 1987, 1989).

Both Exelon and the NRC staff contacted FWS to request information on potential impacts to Federally protected species. In a March 22, 2011, letter to Exelon, FWS (2011a) did not identify the dwarf wedgemussel as a concern in regard to LGS's proposed license renewal. In a November 22, 2011, letter to the NRC, the FWS (2011b) confirmed that the conclusions in their previous letter to Exelon were still appropriate.

Therefore, the NRC staff concludes that the proposed LGS license renewal would have **no effect,** on dwarf wedgemussel because effects to the species would be insignificant, discountable, or beneficial.

*4.8.2.2. Pennsylvania-Protected Species, Candidate Species, and Species of Concern*

<u>Fish</u>

The Commonwealth of Pennsylvania lists the banded sunfish (*Enneacanthus obesus*) and the longear sunfish (*Lepomis megalotis*) as endangered in Bucks County (PNHP 2012a). The Pennsylvania endangered ironcolor shiner (*Notropis chalybaeus*) occurs in Bucks and Montgomery Counties (PNHP 2012a). Blueback herring and alewife are considered candidate species and NMFS species of concern (NMFS 2012).

LGS-related activity in Bucks County that could affect the blueback herring, alewife, banded sunfish, longear sunfish, or ironcolor shiner and their habitat is the intermittent withdrawal of Delaware River water for the LGS cooling system. Direct impacts could include impingement or entrainment and indirect impacts could include impingement or entrainment of prey. Blueback herring and alewife eggs are demersal and adhesive, which make them less likely to be entrained. Eggs and larvae entrained in the Point Pleasant Pumping Station would be transported from the Delaware River to the East Branch Perkiomen Creek. Eggs and larvae would experience sudden pressure fluctuations, velocity shear forces, and physical abrasion in the pumps at Point Pleasant and Bradshaw Reservoir and throughout the pipeline. If any eggs or larvae survive the transport, successful development would depend on organisms finding suitable habitat. Prey species that survive the transport would no longer be available as prey for fish in the Delaware River.

LGS license renewal would include continued operation at the Point Pleasant Pumping Station. However, as described in Section 2.1.6, Exelon's withdrawal of water from the Delaware River is secondary to its withdrawal of water from the Schuylkill River, and Exelon plans to continue to rely less on the Delaware River and more on the Schuylkill River in the future (Exelon 2012a). LGS license renewal would not involve new construction, refurbishment, ground-disturbing activities, or changes to existing land use conditions at the Point Pleasant Pumping Station. Transmission lines associated with LGS do not cross any portion of the Delaware River (Exelon 2011a).

In addition to Bucks County, blueback herring, alewife, and the ironcolor shiner may occur in Montgomery County. Waters in Montgomery County associated with LGS include East Branch Perkiomen Creek, Perkiomen Creek, and the Schuylkill River.LGS license renewal would include continued operation at the Perkiomen Pumphouse, the Schuylkill Pumphouse, and the Schuylkill River discharge structure. Direct effects could include mortality if fish are impinged or entrained. Blueback herring and alewife eggs are demersal and adhesive, which make them less likely to be entrained. Indirect effects could include a decrease in habitat quality from thermal discharge in the Schuylkill River. However, the flow, temperature, and other conditions of the discharge are regulated by LGS's NPDES permit, which would limit changes in water quality. Indirect effects could also occur from the Delaware River intrabasin transfer of water, which involves diversion of Delaware River water to the East Branch Perkiomen Creek that discharges by gravity flow to Perkiomen Creek in order to augment the flow in Perkiomen Creek. As described in Section 2.2.6, NAI (2010a) sampled aquatic biota between 2001 and 2009 as part of an analysis to examine post-operational effects of the water diversion effort (Exelon 2011a). Species diversity remained relatively consistent and samples continued to be dominated by midges and oligochaetes. In addition, less variability existed along the stream gradient and over time; NAI noted that pollution-sensitive species increased in abundance (NAI 2010a, 2010c).

The LGS license renewal would include continued operation and maintenance of four transmission lines that extend from the Limerick site and travel and cross portions of the Schuylkill River and Perkiomen Creek (Section 2.1.5 describes the in-scope transmission lines in more detail). The transmission lines associated with LGS cross rivers and streams that have the potential to be blueback herring, alewife, or ironcolor shiner habitat. PECO must maintain the transmission lines and associated structures and manage vegetation along the transmission line corridors to prevent interference with the lines. Line and vegetation maintenance may result in a temporary decline in habitat quality from increased sedimentation and turbidity during maintenance activities.

If PECO needs to perform maintenance in or near waterbodies, it takes a number of precautions to avoid impacts to blueback herring, alewife, and ironcolor shiners or their habitat. First, PECO typically performs mechanical vegetation maintenance activities on foot and does not operate heavy machinery near wetlands and water bodies. This type of maintenance avoids the potential for heavy machinery to affect fish habitat by reducing the amount of sedimentation and turbidity in the stream. Foot traffic could result in some minimal disturbance of fish habitat. However, foot traffic would create impacts that are insignificant (i.e., those impacts that would never reach the scale where fish mortality would occur) or discountable (i.e., those impacts that cannot be meaningfully measured, detected, or evaluated). In addition, PECO must obtain several permits and certifications for maintenance activities in wetlands or near waterbodies, which for a given work area may include: (1) a General Permit or Water Obstruction and Encroachment General Permit issued jointly by the USACE and PADEP, (2) a CWA 404 permit issued by the USACE, or (3) an erosion and sedimentation control plan from the appropriate county conservation district.

LGS license renewal would not involve new construction, refurbishment, ground-disturbing activities, or changes to existing land use conditions at LGS-associated facilities or transmission lines.

The NRC staff contacted PFBC to request information on potential impacts to Pennsylvania-protected species. In an October 5, 2011, letter to the NRC, PFBC (PFBC 2011b) did not identify the banded sunfish, longear sunfish, or the ironcolor shiner as a concern in regard to LGS's proposed license renewal.

<u>Pizzini's Amphipod</u>

The Pizzini's cave amphipod (*Stygobromus pizzinii*), previously named *Stygonectes pizzinii,* is a Pennsylvania species of concern and is possibly extirpated in Montgomery and Chester Counties (PNHP 2012a). Based on the Pennsylvania Natural Diversity Inventory (PNDI) database and PFBC files, PFBC (2011) stated in its letter to the NRC that globally rare amphipod and/or isopod species are known to occur within the vicinity of the LGS site.

LGS license renewal would include continued operation at the Perkiomen Pumphouse, the Schuylkill Pumphouse, and the Schuylkill River discharge structure. Direct effects could include mortality if amphipods are entrained. Indirect effects could include a decrease in habitat quality from thermal discharge in the Schuylkill River. However, the flow, temperature, and other conditions of the discharge are regulated by LGS's NPDES permit, which would limit changes in water quality. Indirect effects could also occur from the Delaware River intrabasin transfer of water, which involves diversion of Delaware River water to the East Branch Perkiomen Creek that discharges by gravity flow to Perkiomen Creek in order to augment the flow in Perkiomen Creek. As described in Section 2.2.6, NAI (2010a) sampled aquatic biota between 2001 and 2009 as part of an analysis to examine post-operational effects of the water diversion effort (Exelon 2011a). Species diversity remained relatively consistent and samples continued to be dominated by midges and oligochaetes. In addition, less variability existed along the stream gradient and over time; NAI noted that pollution-sensitive species increased in abundance (NAI 2010a, 2010c).

The LGS license renewal would include continued operation and maintenance of four transmission lines that extend from the Limerick site and travel and cross portions of the Schuylkill River and Perkiomen Creek (Section 2.1.5 describes the in-scope transmission lines in more detail). The transmission lines associated with LGS cross rivers and streams that have the potential to be Pizzini's cave amphipod habitat. PECO must maintain the transmission lines and associated structures and manage vegetation along the transmission line corridors to prevent interference with the lines. Line and vegetation maintenance may result in direct impacts to Pizzini's cave amphipod if instream work is required that could crush the amphipods. Potential indirect effects could include a temporary decline in habitat quality from increased sedimentation and turbidity during maintenance activities. In PFBC's (2011) letter to the NRC, PFBC noted that the Pizzini's cave amphipod is threatened by habitat destruction and poor water quality. If PECO needs to perform maintenance in or near waterbodies, it takes a number of precautions to reduce the likelihood of crushing amphipods and to reduce sedimentation and water quality impacts. These actions, such as performing mechanical vegetation maintenance activities on foot and obtaining necessary permits, are described in more detail earlier in this section.

LGS license renewal would not involve new construction, refurbishment, ground-disturbing activities, or changes to existing land use conditions at LGS-associated facilities or transmission lines.

The NRC staff contacted PFBC to request information on potential impacts to Pennsylvania-protected species. In an October 5, 2011, letter to the NRC, PFBC (2011) identified Pizzini's cave amphipod as potentially occurring in the vicinity of the LGS site. However, given that license renewal would not involve new construction, earth disturbances, or changes to existing land uses, PFBC did not anticipate any significant adverse impacts to this species (PFBC 2011b).

<u>Aquatic Plants</u>

Pennsylvania lists Farwell's water-milfoil (*Myriophyllum farwellii*), broad-leaved water-milfoil (*Myriophyllum heterophyllum*), floating-heart (*Nymbphoides cordata*), and spotted pondweed (*Potamogeton pulcher*) as either threatened or endangered as described in Section 2.2.7. All four plants have historic or current records of occurrence in coastal portions of Bucks County (PNHP 2012a).

LGS-related activity that could affect the Farwell's water-milfoil, broad-leaved water-milfoil, floating-heart, and spotted pondweed and their habitat is the intermittent withdrawal of Delaware River water for the LGS cooling system. Direct impacts could include mortality if the plants were sucked into the intake at the Point Pleasant Pumping Station. As described above, preferred habitat does not occur near the Point Pleasant Pumping Station. LGS license renewal would include continued operation at the Point Pleasant Pumping Station. However, as described in Section 2.1.6, Exelon's withdrawal of water from the Delaware River is secondary to its withdrawal of water from the Schuylkill River, and Exelon plans to continue to rely less on the Delaware River and more on the Schuylkill River in the future (Exelon 2012a). LGS license renewal would not involve new construction, refurbishment, ground-disturbing activities, or changes to existing land use conditions at the Point Pleasant Pumping Station. Transmission lines associated with LGS do not cross any portion of the Delaware River (Exelon 2011a).

The NRC staff contacted PFBC to request information on potential impacts to Pennsylvania-protected species. In an October 5, 2011, letter to the NRC, PFBC (2011b) did not identify the Farwell's water-milfoil, broad-leaved water-milfoil, floating-heart, and spotted pondweed aquatic plants as a concern in regard to LGS's proposed license renewal.

*4.8.2.3. Conclusion for Aquatic Species*

The NRC staff evaluated the three ESA-listed species, two candidate species, and eight additional Pennsylvania-protected species and species of special concern that could be present in the action area defined in Section 2.2.8. In its evaluation, NRC staff examined the known distributions and habitat ranges of those species, the ecological impacts of the operation of LGS on the species, and the LGS-related occurrence and monitoring studies described above. In addition, no critical habitat occurs within the action area. Given that LGS license renewal would not involve new construction, refurbishment, ground-disturbing activities, or changes to existing land use conditions at LGS-associated facilities or transmission lines, the continued operation of

LGS is not likely to noticeably affect these species. Thus, the NRC staff concludes that the impact on protected aquatic species from the proposed license renewal would be SMALL.

### 4.8.3. Terrestrial Species and Habitats

#### Species and Habitats Protected Under the Endangered Species Act

Bog Turtle (*Clemmys muhlenbergii*)

The following analysis of the impacts of LGS license renewal on the bog turtle constitutes the biological assessment for that species required by the ESA. Under the ESA, an agency's requirement to prepare a biological assessment is independent of consultation and can be completed through the NEPA process.

Section 2.2.8 concludes that the bog turtle could occur in suitable wetland habitat on the LGS site, within palustrine emergent and forested wetlands along the Schuylkill River, or within wetland habitat along the transmission line corridors.

Small sections of the LGS site contain suitable habitat for bog turtles. According to Figure 10, "Habitat Map of Limerick Generating Station," in Exelon's Wildlife Management Plan (Exelon 2012a), palustrine emergent and forested wetlands lie along the Schuylkill River adjacent to riparian forest, old field, and agricultural land. Within the LGS site, the LGS license renewal would include maintenance and operation activities within developed or previously disturbed areas and would not involve new construction, refurbishment, ground-disturbing activities, changes to conduct of operations, or changes to existing land use conditions in either natural or developed areas. The proposed license renewal would have no direct or indirect adverse impacts to LGS site wetlands; therefore, it would have no direct or indirect adverse effects on the bog turtle. As noted in Section 2.2.7, poaching and loss of habitat are two of the primary threats to the species. Continued operation of LGS during the license renewal term would preserve the existing wetlands on the LGS site. Site security would prevent public access to the site, and thus, prevent poaching. Therefore, continued operation of the LGS could result in beneficial effects to the species.

The LGS license renewal would include Exelon's continued operation and maintenance of the Perkiomen Pumphouse, Bradshaw Reservoir and Pumphouse, and the Bedminster Water Processing Facility. Exelon would only perform maintenance and operation activities within developed or previously disturbed areas during the license renewal period. Thus, the proposed license renewal would have no direct or indirect adverse impacts to habitat at these offsite facilities and no direct or indirect adverse effects on the bog turtle.

The LGS license renewal also would include continued operation and maintenance of four transmission line corridors that extend from the Limerick site and travel through Montgomery and Chester Counties (Section 2.1.5 describes the in-scope transmission lines in more detail). Although the NRC does not license or regulate PECO, which owns and operates the transmission lines, the NRC considers all transmission lines that were constructed specifically to connect the facility to the transmission system in its NEPA analysis. The transmission lines associated with LGS cross rivers, streams, and wetlands that have the potential to be bog turtle habitat. PECO must maintain the transmission lines and associated structures and manage vegetation along the transmission line corridors to prevent interference with the lines. Line and vegetation maintenance may result in direct impacts to bog turtles, including takes of bog turtles or their eggs and disturbance or destruction of bog turtle habitat. Potential indirect effects could include prevention of natural successional changes in transmission line plant communities over time. This indirect effect could positively affect bog turtles because they prefer early successional wetlands.

Generally, PECO maintains transmission line corridors to promote the growth of shrubs, grasses, and other low-growing vegetation. Because bog turtles prefer shallow, open-canopy wetlands, the need for maintenance in these areas is much lower. If PECO needs to perform maintenance in wetland areas, it takes a number of precautions to avoid impacts to the bog turtle or its habitat.

First, PECO trains all of its contractors to be knowledgeable about Federally protected species they may encounter while working and that they are able to identify potential wetlands and obtain the necessary permits before proceeding with work.

Second, PECO typically performs mechanical vegetation maintenance activities on foot and does not operate heavy machinery near wetlands and water bodies. This type of maintenance avoids the potential for heavy machinery to crush turtles or nests or to create ruts, crush wetland vegetation, or otherwise alter bog turtle habitat. PECO also makes an effort to perform work in wetland areas during the winter months when the ground is hard or frozen. Foot traffic could result in some minimal disturbance of wetland habitat. However, foot traffic would create insignificant impacts (i.e., those impacts that would never reach the scale where a take might occur) or discountable impacts (i.e., those impacts that cannot be meaningfully measured, detected, or evaluated).

Finally, PECO must obtain several permits and certifications for maintenance activities in wetlands or near waterbodies, which for a given work area may include: (1) a General Permit or Water Obstruction and Encroachment General Permit issued jointly by the USACE and PADEP, (2) a CWA 404 permit issued by the USACE, or (3) an erosion and sedimentation control plan from the appropriate county conservation district. Within Montgomery and Chester Counties (through the in-scope transmission lines traverse), PADEP requires applicants for a General Permit or Water Obstruction and Encroachment General Permit to comply with bog turtle screening requirements, which includes a site assessment by qualified PADEP personnel (PADEP 2006c). In cases in which a site assessment identifies potential bog turtle habitat, the USACE and PADEP will not issue a permit until the FWS determines that the project will not have an impact on the species (PADEP 2006c). In cases in which PECO must obtain a CWA 404 permit, this permitting process triggers a PECO company process during which PECO personnel must review the proposed maintenance activities for potential impacts to bog turtles and coordinate with FWS to avoid such impacts.

PECO’s maintenance of transmission line corridors to promote low-growing vegetation may benefit the species by preventing or stalling natural plant succession. Successional changes within wetland communities often gradually eliminate some wetland vegetation and reduce open areas that bog turtles use for nesting and basking (Morrow et al. 2001). In a study of bog turtles at two sites in Maryland, Morrow et al. (2001) found that bog turtles avoided dense and higher-growing vegetation and sought areas with low-lying cover.

Both Exelon and the NRC staff have contacted FWS to request information on potential impacts to Federally protected species. In a March 22, 2011, letter to Exelon, FWS (2011a) indicated that the bog turtle occurs or may occur in or near the project area, but that the proposed action is not likely to have an adverse effect on the bog turtle based on the FWS’s review of the project description and location. In a November 22, 2011, letter to the NRC, the FWS (2011b) confirmed that the conclusion in its previous letter to Exelon was still appropriate.

The NRC staff concludes that the proposed LGS license renewal **may affect, but is not likely to adversely affect** the bog turtle because effects to the species would be insignificant, discountable, or beneficial.

Indiana Bat (*Myotis sodalis*)

Section 2.2.8 concludes that the Indiana bat could occur in suitable forest habitat within the action area. Potential types of Indiana bat habitat that occur in the action area include summer roosting habitat, foraging habitat, and commuting habitat. Summer roosting habitat includes trees with exfoliating bark, cracks, or crevices in trees or snags (dead trees) that are greater than 3-in. (8-cm) diameter-at-breast height (FWS 2012a). Foraging habitat includes forest patches, wooded riparian corridors, and natural vegetation adjacent to such habitats (FWS 2012a). Commuting habitat includes wooded tracts, tree lines, wooded hedgerows, streams, or other linear pathways within or connected to roosting or foraging habitat (FWS 2012a).

The LGS license renewal would not disturb or alter any natural habitats within the LGS site or offsite facilities associated with the LGS makeup water system. Thus, no direct or indirect adverse effects would result from continued operation and maintenance of these facilities. If the Indiana bat occurs on the LGS site, continued operation of LGS would be beneficial to the species because it would preserve forest habitat that might otherwise be developed or converted to some other land use.

Because the majority of LGS transmission line corridors contain low-growing plant communities dominated by grasses, herbs, and small shrubs, PECO's continued maintenance of the lines generally would not alter the existing habitat. Occasionally, PECO may need to remove trees that either grow tall enough to interfere with the lines or trees that die and could fall on the lines. In such cases, PECO could have to remove trees that provide summer roosting habitat for Indiana bats. However, PECO trains all of its contractors to be knowledgeable about Federally protected species they may encounter while working. If a tree that provided potential Indiana bat habitat required removal, PECO would typically coordinate with FWS and the appropriate state agencies. PECO could also perform such maintenance in the fall or winter months when the Indiana bat has migrated to hibernation sites. Thus, this potentially adverse impact would be insignificant because it is unlikely to result in a take.

Both Exelon and the NRC staff have contacted FWS to request information on potential impacts to Federally protected species. The FWS did not mention that the Indiana bat was of particular concern in either its March 22, 2011, letter to Exelon (FWS 2011a) or its November 22, 2011, letter to the NRC (FWS 2011b).

The NRC staff concludes that the proposed LGS license renewal **may affect, but is not likely to adversely affect** the Indiana bat because effects to the species would be insignificant.

Small-Whorled Pogonia (*Isotria medeoloides*)

Section 2.2.8 indicates that three extant populations of the small-whorled pogonia occur in Pennsylvania, and at least one of these populations occurs in Chester County. Thus, Section 2.2.8 conservatively concludes that the small-whorled pogonia could occur in areas of suitable habitat along or near the transmission line corridor that runs through Chester County.

Because the small-whorled pogonia does not occur in Montgomery or Bucks Counties, continued operation and maintenance of the LGS site and offsite facilities associated with the LGS makeup water system would have no direct or indirect effects on the small-whorled pogonia. LGS license renewal would include continued operation and maintenance of four transmission line corridors that extend from the Limerick site and travel through Montgomery and Chester Counties. The corridor within Chester County is about 13 mi (21 km) long (Section 2.1.5 describes the in-scope transmission lines in more detail). The small-whorled pogonia generally grows in young and maturing stands of mixed-deciduous or mixed-deciduous/coniferous forests in areas close to logging roads, streams, or other features that create long-persisting breaks in the forest canopy. Therefore, the species could occur near the transmission line corridor, but it is unlikely to occur in the corridor itself. Because the species is unlikely to occur within the corridor, it would not experience any direct adverse effects such as trampling caused by worker foot traffic, crushing caused by vehicles and equipment, or herbicide application when workers spray adjacent vegetation. Depending on the proximity of the small-whorled pogonia to the transmission line corridor, the species could experience indirect adverse effects such as taking up water containing chemicals from herbicide runoff. However, PECO maintains vegetation on a 5-year cycle and selectively sprays herbicides by hand, so the indirect effects from herbicide application would be so small as to not be able to be meaningfully measured or detected and would not reach the scale where a take would occur. Thus, such effects would be discountable and insignificant.

Both Exelon and the NRC staff have contacted FWS to request information on potential impacts to Federally protected species. The FWS did not mention the small-whorled pogonia was of particular concern in either its March 22, 2011, letter to Exelon (FWS 2011a) or its November 22, 2011, letter to the NRC (FWS 2011b).

The NRC staff concludes that the proposed LGS license renewal **may affect, but is not likely to adversely affect** the small-whorled pogonia because effects to the species would be insignificant or discountable.

Designated Critical Habitat

The NRC staff did not identify any Federally designated critical habitat within the action area during its review (see Section 2.2.7). Additionally, in its correspondence with Exelon and the NRC, the FWS (2011a, 2011b) did not identify any designated critical habitat. Thus, the NRC staff concludes that the proposed license renewal would have **no effect** on designated critical habitat.

Proposed Species and Proposed Critical Habitat

The NRC staff did not identify any Federally proposed species or proposed critical habitat within the action area during its review (see Section 2.2.7). Additionally, in its correspondence with Exelon and the NRC, the FWS (2011a, 2011b) did not identify any proposed species or proposed critical habitat. Thus, the NRC staff concludes that the proposed license renewal would have **no effect** on Federally proposed species or proposed critical habitat.

**Species Protected Under the Bald and Golden Eagle Protection Act**

Though bald eagles occur throughout the action area, no known nests are in close proximity to any of the LGS site buildings, parking lots, or other structures; the LGS makeup water system offsite facilities; or along the transmission line corridors that could be disturbed by operations or maintenance activities associated with the proposed license renewal. Because the proposed license renewal does not involve construction or land disturbances, the proposed license renewal would not affect any bald eagle habitat. The NRC staff concludes that the impacts of the proposed LGS license renewal on the bald eagle would be SMALL.

**Species Protected Under the Migratory Bird Treaty Act**

As discussed in Section 2.2.7, a variety of migratory birds inhabit the LGS site and surrounding region. Because the proposed license renewal does not involve construction or land disturbances, the NRC staff concludes that the impacts of the proposed LGS license renewal on migratory birds would be SMALL.

**Species Protected by the Commonwealth of Pennsylvania**

Section 2.2.8.3 discusses species protected under the Pennsylvania Endangered Species Program. Ten Pennsylvania-listed birds and two Pennsylvania-listed plants occur or have occurred on the LGS site since the plant began operating. An additional eight plant species occur near the transmission line corridors. One Pennsylvania-listed reptile, the eastern redbelly turtle (*Pseudemys rubriventris*), occurs in the vicinity of the LGS site. Because the proposed license renewal does not involve construction or land disturbances, the NRC staff concludes that the impacts of the proposed LGS license renewal on Pennsylvania-protected species on the LGS site or at offsite facilities associated with the LGS makeup water system would be SMALL.

Continued transmission line maintenance would not adversely affect any of the Pennsylvania-listed birds or the eastern redbelly turtle. As discussed in Section 2.1.5, PECO has implemented an avian management program to ensure that it does not unnecessarily disturb or harm birds or nests and to ensure compliance with applicable Federal and state bird regulations. The mitigative measures described above for the bog turtle would also be protective of the eastern redbelly turtle. Because the eastern redbelly turtle inhabits aquatic and wetland habitats, the likelihood of habitat disturbance or direct effects to this species is lower because PECO follows more stringent procedures when performing work in these areas. Additionally, in its February 11, 2011, letter to Exelon, the PFBC (2011a) noted that it does not anticipate the proposed license renewal will have any significant adverse impacts on Pennsylvania-listed species of concern under the PFBC's jurisdiction.

Some of the Pennsylvania-listed plants discussed in Section 2.2.8.3 occur in woodlands or other habitats near, but not directly within, the transmission line corridors. Continued transmission line maintenance would not affect these plant species because PECO only manages vegetation within the corridor. The other plant species occur in habitats compatible with transmission lines, such as old fields or other early successional communities, and PECO likely would not perform intensive maintenance or use herbicides in these areas because these habitats already contain low-growing vegetation. The NRC staff concludes that the impacts of the proposed license renewal on Pennsylvania-listed plants along the transmission line corridors would be SMALL.

**Conclusion**

The NRC staff concludes that the impacts of the proposed LGS license renewal on protected terrestrial species and habitats would be SMALL as defined by the NRC for the purposes of NEPA.

## 4.9. Human Health

Table 4–8 lists the Category 1 and 2 issues related to human health that are applicable to LGS.

**Table 4–8. Human Health Issues**

| Issue | GEIS Section | Category |
|---|---|---|
| Radiation exposure to the public during refurbishment | 3.8.1[a] | 1 |
| Occupational radiation exposures during refurbishment | 3.8.2[a] | 1 |
| Microbiological organisms (occupational health) | 4.3.6 | 1 |
| Microbiological organisms (public health) | 4.3.6[(b)] | 2 |
| Noise | 4.3.7 | 1 |
| Radiation exposures to public (license renewal term) | 4.6.2 | 1 |
| Occupational radiation exposures (license renewal term) | 4.6.3 | 1 |
| Electromagnetic fields—acute effects (electric shock) | 4.5.4.1 | 2 |
| Electromagnetic fields—chronic effects | 4.5.4.2 | Uncategorized |
| Human health impact from chemicals | To be determined[(c)] | 1 |
| Physical occupational hazards | To be determined[(c)] | 1 |

[(a)] Issues apply to refurbishment, an activity that LGS does not plan to undertake

[(b)] Issue applies to plants with features such as cooling lakes or cooling towers that discharge to a small river. The issue applies to LGS.

[(c)] NRC 2012b

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51

### 4.9.1. Generic Human Health Issues

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B–1, applicable to LGS in regard to human health impacts are listed in Table 4–9. Exelon stated in its ER (Exelon 2011a) that it was aware of one new radiological issue associated with the renewal of the LGS operating license, tritium in groundwater. Exelon’s groundwater monitoring program for radioactive material is discussed in Sections 2.2.5, 4.5.2, and 4.11 of this document. Based on its review of LGS’s groundwater monitoring data, the NRC staff concluded that the issue, while new, is not significant. The NRC staff has not identified any new and significant information during its independent review of Exelon’s ER, the site visit, the scoping process, or its evaluation of other available information.

#### *4.9.1.1. New Category 1 Human Health issues*

As described in Section 1.4 of this draft SEIS, the NRC has approved a revision to its environmental protection regulation, 10 CFR Part 51. With respect to the human health, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by adding two new Category 1 issues, “Human health impact from chemicals” and “Physical occupational hazards.” The first issue considers the impacts from chemicals to plant workers and members of the public. The second issue only considers the nonradiological occupational hazards of working at a nuclear power plant. An understanding of these non-radiological hazards to nuclear power plant workers and members of the public have been well established at nuclear power plants during those plants' current licensing terms. The impacts from chemical hazards are expected to be minimized through the licensee's use of good industrial hygiene practices as required by permits and Federal and state regulations. Also, the impacts from physical hazards to plant workers will be of small significance if workers adhere to safety standards and use protective equipment as required by Federal and state regulations. The impacts to human health for each of these new issues from continued plant operations are SMALL.

The NRC staff has not identified any new and significant information related to these non-radiological issues during its independent review of LGS's ER, the site audit, and the scoping process. Therefore, the NRC staff concludes that there would be no impact to human health from chemicals or physical hazards beyond those impacts described in Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 of the revised rule and, therefore, the impacts are SMALL.

### 4.9.2. Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B–1, applicable to LGS in regard to radiological impacts to human health are listed in Table 4–8. The NRC staff has not identified any new and significant information related to radiological issues during its independent review of Exelon's ER, the site audit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there would be no impact from radiation exposures to the public or to workers during the license renewal term beyond those discussed in the GEIS.

The findings in the GEIS are as follows:

- Radiation exposures to the public (license renewal term). Based on information in the GEIS, the Commission found the following:

- Radiation doses to the public will continue at current levels associated with normal operations.

- Occupational exposures (license renewal term). Based on information in the GEIS, the Commission found the following:

- Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.

According to the GEIS, the impacts to human health are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

There are no Category 2 issues related to radiological impacts of routine operations.

The information presented below is a discussion of selected radiological programs conducted at LGS.

Limerick Generating Station Radiological Environmental Monitoring Program

LGS conducts a Radiological Environmental Monitoring Program (REMP) to assess the radiological impact, if any, to its employees, the public, and the environment from the operations at LGS, Units 1 and 2. The REMP measures the aquatic, terrestrial, and atmospheric environment for radioactivity, as well as the ambient radiation. In addition, the REMP measures background radiation (i.e., cosmic sources, global fallout, and naturally occurring radioactive material, including radon). The REMP supplements the radioactive effluent monitoring program by verifying that any measurable concentrations of radioactive materials and levels of radiation in the environment are not higher than those calculated using the radioactive effluent release measurements and transport models.

An annual radiological environmental operating report (REOP) is issued, which contains a discussion of the results of the monitoring program. The report contains data on the monitoring performed for the previous year. The REMP collects samples of environmental media in order to measure the radioactivity levels that may be present. The media samples are representative of the radiation exposure pathways that may affect the public.

The LGS REMP is made up of three categories based on the exposure pathways to the public. They are as follows: atmospheric, aquatic, and ambient gamma radiation. The atmospheric samples taken around LGS are airborne particulate, airborne iodine, milk, and broad leaf vegetation. Airborne iodine and particulate samples are taken using vacuum pumps and glass fiber filters. The aquatic pathway samples are taken from surface water and drinking water sources. Also included in this pathway are sediment samples and fish samples. The ambient gamma radiation pathway measures direct exposure from environmental radiation doses using thermoluminescent dosimeters.

In addition to the REMP, LGS has a groundwater protection program designed to monitor the onsite plant environment for the detection of leaks from plant systems and pipes containing radioactive liquid (see Sections 2.2.5.2 and 4.5.2).

The NRC staff reviewed the LGS annual REOPs for 2007 through 2011 to look for any significant impacts to the environment or any unusual trends in the data (Exelon 2008a, 2009a, 2010a, 2011b, 2012b). A 5-year period provides a data set that covers a broad range of activities that occur at a nuclear power plant, such as refueling outages, routine operation, and years in which there may be significant maintenance activities. Based on the NRC staff's review, no adverse trends (i.e., steadily increasing buildup of radioactivity levels) were observed and the data showed that there was no measurable impact to the environment from LGS operations.

Groundwater Protection Program

A radioactive groundwater protection program was established at LGS in 2006 to assess potential impacts to groundwater from plant's operation.

In 2007, the Nuclear Energy Institute (NEI) established a standard for monitoring and reporting radioactive isotopes in groundwater: NEI 07-07, "Industry Ground Water Protection Initiative–Final Guidance Document" (NEI 2007). LGS implemented the recommendations of this industry standard. Data from the groundwater monitoring program are contained in the annual radiological environmental operating report submitted to the NRC in May of each year. These reports are available for review by the public through the Agencywide Documents Access and Management System (ADAMS) electronic reading room available through the NRC website.

Additional information on the groundwater protection program is discussed in Sections 2.2.5 and 4.5.2 of this SEIS.

Pennsylvania Department of Environmental Protection Bureau of Radiation Detection Environmental Monitoring Program

The Bureau of Radiation Protection (BRP) performs its own independent environmental monitoring around the LGS site and other nuclear facilities located in Pennsylvania. All analyses of environmental media (i.e., soil, air, water, and vegetation) are performed by its Bureau of Laboratories (BOL). The state's BRP performs the monitoring of direct radiation from a facility using thermoluminescent dosimeters (TLDs).

The NRC staff reviewed the state's environmental summary reports for 2003 through 2004 (the most recent reports available at the time of the NRC's review) (PADEP undated). In each of the reports, the state concluded that the sample data indicated no release of radioactive material to the environment that exceeded the regulatory or license limits of the PADEP or the NRC.

Limerick Generating Station Radioactive Effluent Release Program

All nuclear plants were licensed with the expectation that they would release radioactive material to both the air and water during normal operation. However, NRC regulations require that radioactive gaseous and liquid releases from nuclear power plants must meet radiation dose-based limits specified in 10 CFR Part 20, and the as low as is reasonably achievable (ALARA) criteria in Appendix I to 10 CFR Part 50. Regulatory limits are placed on the radiation dose that members of the public can receive from radioactive effluents released by a nuclear power plant. In addition, nuclear power plants are required by 10 CFR 50.36(a) to submit an annual report to the NRC that lists the types and quantities of radioactive effluents released into the environment. The radioactive effluent release reports are available for review by the public through the ADAMS electronic reading room available through the NRC website.

The NRC staff reviewed the annual radioactive effluent release reports for 2007 through 2011 (Exelon 2008b, 2009b, 2010b, 2011c, 2012c). The review focused on the calculated doses to a member of the public from radioactive effluents released from LGS. The doses were compared to the radiation protection standards in 10 CFR 20.1301 and the ALARA dose design objectives in Appendix I to 10 CFR Part 50.

Dose estimates for members of the public are calculated based on radioactive gaseous and liquid effluent release data and atmospheric and aquatic transport models. The 2011 annual radioactive effluent release report (Exelon 2012d) contains a detailed presentation of the radioactive discharges and the resultant calculated doses. The following summarizes the calculated dose to a member of the public located outside the LGS site boundary from radioactive gaseous and liquid effluents released during 2011:

- The combined total-body dose to an offsite member of the public from LGS, Units 1 and 2 radioactive liquid effluents was $8.38 \times 10^{-2}$ mrem ($8.38 \times 10^{-4}$ mSv), which is well below the combined 6 mrem (0.06 mSv) dose criterion for two reactor units in Appendix I to 10 CFR Part 50.
- The organ (liver) dose to an offsite member of the public from LGS, Units 1 and 2 radioactive liquid effluents was $8.38 \times 10^{-2}$ mrem ($8.38 \times 10^{-4}$ mSv), which is well below the combined 20 mrem (0.20 mSv) dose criterion for two reactor units in Appendix I to 10 CFR Part 50.
- The air dose at the site boundary from gamma radiation in gaseous effluents from LGS, Units 1 and 2 was $1.46 \times 10^{-2}$ mrad ($1.46 \times 10^{-4}$ mGy), which is well below the combined 20 mrad (0.2 mGy) dose criterion for two reactor units in Appendix I to 10 CFR Part 50.
- The air dose at the site boundary from beta radiation in gaseous effluents from LGS, Units 1 and 2 was $8.73 \times 10^{-3}$ mrad ($8.73 \times 10^{-5}$ mGy), which is well below the combined 40 mrad (0.4 mGy) dose criterion for two reactor units in Appendix I to 10 CFR Part 50.
- The dose to an organ (bone) from radioactive iodine, radioactive particulates, and carbon-14 from LGS, Units 1 and 2 was $4.13 \times 10^{-1}$ mrem ($4.13 \times 10^{-3}$ mSv), which is well below the combined 30 mrem (0.3 mSv) dose criterion for two reactor units in Appendix I to 10 CFR Part 50.

- No radiation above background was detected at the site boundary from direct radiation, as measured by TLDs. There is no dose criterion for direct radiation in Appendix I to 10 CFR Part 50. The data is included in the summation of doses from all radioactive effluent release pathways to determine compliance with EPA's 40 CFR Part 190 dose standard of 25 mrem (0.25 mSv) for the total dose to members of the public from the reactor units at the LGS site.
- The NRC staff summed the applicant's data on the individual total body doses from radioactive gaseous and liquid effluents from both units and added it to the dose from direct radiation to obtain the maximum all pathways dose to an offsite member of the public from the operation of LGS, Units 1 and 2. The dose to a member of the public from all radioactive releases in 2011 was $1.30 \times 10^{-1}$ mrem ($1.30 \times 10^{-3}$ mSv), which is well below the 25 mrem (0.25 mSv) dose standard in EPA's 40 CFR Part 190.

The NRC staff's review of the LGS radioactive effluent control program showed that radiation doses to members of the public were controlled within Federal radiation protection standards contained in Appendix I to 10 CFR Part 50, 10 CFR Part 20, and 40 CFR Part 190.

- The applicant has no plans to conduct refurbishment activities during the license renewal term; however, routine plant refueling and maintenance activities currently performed will continue during the license renewal term. Based on the past performance of the radioactive waste system to maintain the dose from radioactive effluents to be ALARA, similar performance is expected during the license renewal term. Continued compliance with regulatory requirements is expected during the license renewal term; therefore, the impacts from radioactive effluents to the public would be SMALL.

### 4.9.3. Microbiological Organisms

The effects of thermophilic microbiological organisms on human health (see Table 4–8), are categorized as a Category 2 issue and require a plant-specific evaluation during the license renewal process for plants using closed-cycle cooling, located on a small river. The Schuylkill River is considered a small river because its average annual flow is approximately $6.3 \times 10^{10}$ cubic feet per year ($ft^3/yr$) ($1.7 \times 10^8$ cubic meters per year ($m^3/yr$)), which is less than the threshold value of $3.15 \times 10^{12}$ $ft^3/yr$ ($9 \times 10^{10}$ $m^3/yr$) in 10 CFR 51.53(c)(3)(ii)(G) (Exelon 2011a). Therefore, the effects of the LGS cooling water discharge on microbiological organisms must be addressed for LGS license renewal.

The Category 2 designation is based on the magnitude of the potential public health impacts associated with thermal enhancement of enteric pathogens such as *Salmonella* spp. and *Shigella* spp., the *Pseudomonas aeruginosa* bacterium, the pathogenic strain of the free-living amoebae *Naegleria* spp., and *Legionella* spp. bacteria (NRC 1996). Thermophilic microorganisms generally occur at temperatures of 77 °F to 176 °F (25 °C to 80 °C) with an optimal growth temperature range of 122 °F to 150 °F (50 °C to 66 °C), and minimum and maximum temperature tolerances of 68 °F (20 °C) and 158 °F (70 °C), respectively. However, thermal preferences and tolerances vary across bacterial groups. Pathogenic thermophilic microbiological organisms of concern during nuclear reactor operation typically have optimal growing temperatures of approximately 99 °F (37 °C) (Joklik and Smith 1972).

*Pseudomonas aeruginosa* is an opportunistic pathogen that causes serious and sometimes fatal infections in immunocompromised individuals. The organism produces toxins harmful to humans and animals. It has an optimal growth temperature of 99 °F (37 °C) (Todar 2012). *Legionella* spp. consists of at least 46 species and 70 serogroups. It is responsible for Legionnaires' disease, with the onset of pneumonia in the first 2 weeks of exposure. Risk groups for *Legionella* spp. include elderly, cigarette smokers, persons with chronic lung or immunocompromising disease, and persons receiving immunosuppressive drugs.

The LGS NPDES permit (No. PA0051926) requires the temperature in the thermal discharge to be monitored at least once weekly for compliance with an instantaneous maximum limit of 110 °F (43.3 °C) for the protection of human health. Although thermophilic microbiological organisms of concern during nuclear reactor operation could grow at that stated instantaneous maximum temperature limit, there are several years of Discharge Monitoring Report (DMR) data showing that maximum summer discharge temperatures range from 90 °F to 95 °F (32.2 °C to 35.0 °C) (Exelon 2011a). These temperatures are below the stated optimal growing temperature of approximately 99°F (37°C); therefore, ambient river conditions are not likely to support the proliferation of the pathogenic organisms of concern.

Exelon requested PADEP to provide comments or concerns about LGS's contribution to potential health effects resulting from thermophilic organisms. Exelon requested PADEP to alternatively confirm Exelon's conclusion that operation of LGS during the period of extended operation would not enhance growth of thermophilic pathogens. In response, PADEP identified that it does not have any data associated with thermophilic organisms in the Schuylkill River nor has it conducted any investigations on the impact or potential impact of the LGS discharge on thermophilic organisms in the river. As a result, PADEP is unable to make any conclusions regarding the effect on public health from thermophilic organisms in the Schuylkill River (Exelon 2011a).

DRBC designated that uses to be maintained in the Schuylkill River in the vicinity of LGS include secondary contact recreation, in which body contact is either incidental or accidental, and in which the probability of ingesting appreciable quantities of water, particularly through nasal passages, is minimal.

LGS currently discharges sanitary sewage to the local publicly owned treatment works for treatment, which further reduces the potential for the facility's discharge to introduce pathogenic microorganisms that could present a threat to recreational users of the Schuylkill River.

The NRC staff reviewed all documents applicable to this Category 2 issue, including Exelon's ER and the LGS NPDES permit. The NRC staff concludes that for the reasons above, thermophilic microbiological organisms are unlikely to present a public health hazard as a result of LGS discharges to the Schuylkill River. The NRC staff concludes that impacts on public health from thermophilic microbiological organisms from continued operation of LGS in the license renewal period would be SMALL.

### 4.9.4. Electromagnetic Fields—Acute Effects

Based on the GEIS, the Commission found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been found to be a problem at most operating plants and generally is not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of this SEIS.

In the GEIS (NRC 1996), the Commission found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC) criteria, it was not possible to determine the significance of the electric shock potential (IEEE 2002).

Additionally, the Commission found that evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For other plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with 10 CFR 51.53(c)(3)(ii)(H), Exelon must provide an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents.

Limerick Units 1 and 2 electrical outputs are delivered to the PJM Interconnection by the LGS transmission system. Each Limerick unit is provided with an independent substation, which are 230 kilovolts (kV) for Unit 1 and 500 kV for Unit 2. Four 230-kV transmission lines, the Limerick-Cromby 220-60 line, the Limerick-Cromby 220-61 line, the Cromby-North Wales 220-62 line, and the Cromby-Plymouth Meeting 220-63/64 line, were constructed to connect the Limerick Unit 1 substation to the electric grid. One 500-kV transmission line, the Limerick-Whitpain 5031 line, was constructed to connect the Limerick Unit 2 substation to the electric grid. These are the lines that are within scope of license renewal. Exelon developed an electric field strength policy for the design and operation of its transmission system. The policy is intended to minimize shock hazards consistent with the NESC criteria. Exelon used the Electric Power Research Institute (EPRI) HERB 2.0 software to determine NESC compliance. Their analysis determined that there are no locations within the right-of-way under these transmission lines that have the capacity to induce more than 5 milliamperes (mA) to a vehicle parked beneath the lines. Therefore, the lines meet the NESC 5 mA criterion. The maximum induced current calculated for the power lines was 4.6 mA on the Cromby-Plymouth Meeting 220-63/64 line (Exelon 2011a).

The LGS transmission line corridor crosses over highways, streets, other public places, or property owned by others for which PECO, a subsidiary of Exelon Corporation, has permits, grants, easements, or licenses. PECO, and owners and operators of the transmission lines, conduct surveillance and maintenance activities to verify that design ground clearances will not change. These procedures include routine inspection for clearance problems by aircraft periodically. Ground inspections are conducted yearly for clearance problems, which are brought to the attention of the appropriate organizations for maintenance. Exelon expects that it, as well as PECO, will continue to use these or similar processes during the period of extended operation. No land use changes are anticipated in the vicinity of the corridor. Exelon's and PECO's periodic surveillance of the transmission system assures that ground clearances would remain in compliance with NESC criteria (Exelon 2011a).

The NRC staff reviewed the available information, including Exelon's evaluation and results. Based on this information, the NRC staff concludes that the potential impacts from electric shock during the renewal period would be SMALL.

### 4.9.5. Electromagnetic Fields—Chronic Effects

In the GEIS, the effects of chronic exposure to 60 Hertz electromagnetic fields from power lines were not designated as Category 1 or 2 and will not be until a scientific consensus is reached on the health implications of these fields.

The potential effects of chronic exposure from these fields continue to be studied and are not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy (DOE).

The report by NIEHS (NIEHS 1999) contains the following conclusion:

> The NIEHS concludes that ELF EMF (extremely low frequency electromagnetic field) exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF EMF, passive regulatory action is warranted such as continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the NRC staff to change its position with respect to the chronic effects of electromagnetic fields. The NRC staff considers the GEIS finding of "UNCERTAIN" still appropriate and will continue to follow developments on this issue.

## 4.10. Socioeconomics

Section 2.2.9 of this SEIS describes socioeconomics in the vicinity of the LGS site. Table 4–9 lists the Category 1 and Category 2 issues related to socioeconomics.

**Table 4–9. Socioeconomics Issues**

| Issues | GEIS Section | Category |
|---|---|---|
| Housing impacts | 4.7.1 | 2 |
| Public services: public safety, social services, and tourism and recreation | 4.7.3, 4.7.3.3, 4.7.3.4, 4.7.3.6 | 1 |
| Public services: public utilities | 4.7.3.5 | 2 |
| Public services: education (license renewal) | 4.7.3.1 | 1 |
| Offsite land use (license renewal term) | 4.7.4 | 2 |
| Public services: transportation | 4.7.3.2 | 2 |
| Historic and archaeological resources | 4.7.7 | 2 |
| Aesthetic impacts (license renewal term) | 4.7.6 | 1 |
| Aesthetic impacts of transmission lines (license renewal term) | 4.5.8 | 1 |
| Environmental justice minority and low-income populations | To be determined[a] | 2 |

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51; [a]NRC 2012b

### 4.10.1. Generic Socioeconomic Issues

The NRC staff did not identify any new and significant information during the review of the applicant's ER (Exelon 2011a), the NRC staff's site audit, the scoping process, or the evaluation of other available information. Therefore, there are no impacts related to Category 1 socioeconomic issues beyond those discussed in the GEIS. For these issues, the GEIS concluded that the impacts are SMALL, and additional site-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

### 4.10.2. Housing

Appendix C of the GEIS presents a population characterization method based on two factors, sparseness and proximity (GEIS Section C.1.4). Sparseness measures population density within 20 mi (32 km) of the site, and proximity measures population density and city size within 50 mi (80 km). Each factor has categories of density and size (GEIS Table C.1). A matrix is used to rank the population category as low, medium, or high (GEIS Figure C.1).

According to the 2010 Census, an estimated 1,365,850 people live within 32.2 km (20 mi) of the LGS plant site, producing a population density of 420 persons per square kilometer (1,087 persons per square mile) (Exelon 2011a). This translates to a Category 4, "least sparse" population density using the GEIS measure of sparseness (greater than or equal to 120 persons per square mile within 20 miles). Approximately 8,311,616 people live within 80.4 kilometers (50 miles) of LGS, which equates to a population density of 409 persons per square kilometer (1,058 persons per square mile) (Exelon 2011a). As the region of influence (ROI) has a population greater than or equal to 190 persons per square mile within 80.4 kilometers (50 miles), this translates to a Category 4 (greater than or equal to 190 persons per square mile within 50 miles). Therefore, LGS is classified as being located in a high population area based on the GEIS sparseness and proximity matrix.

Table B–1 of 10 CFR Part 51, Subpart A, Appendix B, states that impacts on housing availability are expected to be of small significance in a medium or high density population area where growth-control measures are not in effect. Since LGS is located in a high population area and Montgomery, Berks, and Chester Counties are not subject to growth-control measures that would limit housing development; any changes in employment at LGS, Units 1 and 2 would have little noticeable effect on housing availability in these counties. Since Exelon has no plans to add non-outage employees during the license renewal period, employment levels at LGS, Units 1 and 2 would remain relatively constant with no new demand for permanent housing during the license renewal term. Based on this information, there would be no additional impact on housing during the license renewal term beyond what has already been experienced.

### 4.10.3. Public Services—Public Utilities

Impacts on public utility services (e.g., water, sewer) are considered SMALL if the public utility has the ability to respond to changes in demand and would have no need to add or modify facilities. Impacts are considered MODERATE if service capabilities are overtaxed during periods of peak demand. Impacts are considered LARGE if additional system capacity is needed to meet ongoing demand.

Analysis of impacts on the public water systems considered both plant demand and plant-related population growth. Section 2.1.7 describes the permitted withdrawal rate and actual use of water for reactor cooling at LGS, Units 1 and 2.

Since Exelon has no plans to add non-outage employees during the license renewal period, employment levels at LGS, Units 1 and 2 would remain relatively unchanged with no additional demand for public water services. Public water systems in the region are adequate to meet the demands of residential and industrial customers in the area. Therefore, there would be no impact to public water services during the license renewal term beyond what is currently being experienced.

### 4.10.4. Offsite Land Use

Offsite land use during the license renewal term is a Category 2 issue (10 CFR Part 51, Subpart A, Appendix B, Table B–1). Table B–1 notes that "significant changes in land use may be associated with population and tax revenue changes resulting from license renewal." Section 4.7.4 of the GEIS defines the magnitude of land-use changes as a result of plant operation during the license renewal term as SMALL when there will be little new development and minimal changes to an area's land-use pattern, as MODERATE when there will be considerable new development and some changes to the land-use pattern, and LARGE when there will be large-scale new development and major changes in the land-use pattern.

Tax revenue can affect land use because it enables local jurisdictions to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land-use impacts during the license renewal term should consider: (1) the size of the plant's tax payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land-use changes during the plant's license renewal term would be SMALL, especially where the community has pre-established patterns of development and has provided public services to support and guide development. Section 4.7.2.1 of the GEIS states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdiction's revenue, the significance level would be SMALL. If tax payments are 10 to 20 percent of the community's total revenue, new tax-driven land-use changes would be MODERATE. If tax payments are greater than 20 percent of the community's total revenue, new tax-driven land-use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development.

#### *4.10.4.1. Population-Related Impacts*

Since Exelon has no plans to add non-outage employees during the license renewal period, there would be no plant operations-driven population increase in the vicinity of LGS, Units 1 and 2. Therefore, there would be no population-related offsite land use impacts during the license renewal term beyond those already being experienced.

#### *4.10.4.2. Tax Revenue-Related Impacts*

As discussed in Chapter 2, Exelon pays property taxes for LGS to the following entities in Montgomery and Chester Counties: Limerick Township, Spring-Ford Area School District, Lower Pottsgrove Township, Pottsgrove School District, Chester County, East Coventry Township, and Owen J. Roberts School District. Exelon also makes tax payments to taxing authorities in Bucks County, but the amounts are relatively minor. Since Exelon started making property tax payments to local jurisdictions, population has increased steadily and land has continued to be converted to residential and commercial uses in the affected counties—adding to the tax base of affected jurisdictions. Therefore, tax revenue from LGS as a proportion of total tax revenue has had little or no effect on land use conditions within these counties.

Since employment levels would remain relatively unchanged with no increase in the assessed value of LGS, annual property tax payments also would be expected to remain relatively unchanged throughout the license renewal period. Based on this information, there would be no tax-revenue-related offsite land use impacts during the license renewal term beyond those already being experienced.

### 4.10.5. Public Services—Transportation

Table B–1 of Appendix B to Subpart A of 10 CFR Part 51 states the following:

Transportation impacts (level of service) of highway traffic generated during the term of the renewed license are generally expected to be of SMALL significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of MODERATE or LARGE significance at some sites.

The regulation in 10 CFR 51.53(c)(3)(ii)(J) requires all applicants to assess the impacts of highway traffic generated by the proposed project on the level of service of local highways during the term of the renewed license. Since Exelon has no plans to add non-outage employees during the license renewal period; traffic volume and levels of service on roadways in the vicinity of LGS, Units 1 and 2 would not change. Therefore, there would be no transportation impacts during the license renewal term beyond those already being experienced.

### 4.10.6. Historic and Archaeological Resources

This section provides the NRC staff's assessment of the effects on historic and archaeological resources from the proposed license renewal action for LGS, Units 1 and 2. The National Historic Preservation Act (NHPA) requires Federal agencies to consider the effects of their undertakings on historic properties. Historic properties are defined as resources that are eligible for listing on the National Register of Historic Places (NRHP). The criteria for NRHP eligibility are listed in 36 CFR 60.4 and include, among other things, (1) association with significant events that have made a significant contribution to the broad patterns of history, (2) association with the lives of persons significant in the past, (3) embodiment of distinctive characteristics of type, period, or method of construction, and (4) sites or places that have yielded or may be likely to yield important information in history or prehistory. The historic preservation review process (Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA)) is outlined in regulations issued by the Advisory Council on Historic Preservation (ACHP) in 36 CFR Part 800. In accordance with 36 CFR 800.8(c), the NRC has elected to use the National Environmental Policy Act of 1969, as amended (NEPA), process to comply with its obligations under Section 106 of the NHPA.

In accordance with 36 CFR 800.8(c), on September 16, 2011, and September 15, 2011, respectively, the NRC staff initiated consultations on the proposed action by writing to the Advisory Council on Historic Preservation and the Pennsylvania Bureau of Historic Preservation (BHP), which houses the Pennsylvania State Historic Preservation Office (NRC 2011a, 2011b). Previously, Exelon, outside of the NHPA process, consulted with the BHP on January 19, 2011, regarding the renewal of operating licenses for LGS, Units 1 and 2. Exelon stated in its letter to the BHP that there would be no effect on historic properties from license renewal and associated operation and maintenance activities (Exelon 2011a). The BHP responded to LGS on February 16, 2011, concluding that "due to the nature of the activity, it is our opinion that there will be no effect on these properties" (Exelon 2011a).

On September 13, 2011, the NRC staff initiated consultation with 15 Federally recognized tribes: the Absentee-Shawnee Tribe of Oklahoma, the Heron Clan, the Delaware Nation (located in Anadarko, Oklahoma), the Delaware Tribe (located in Emporia, Kansas), the Eastern Shawnee Tribe of Oklahoma, the Oneida Indian Nation, the Oneida Nation of Wisconsin, the Onondaga Nation, the Seneca Nations of Indians, the Seneca-Cayuga Tribe of Oklahoma, the St. Regis Mohawk Tribe, the Shawnee Tribe, the Stockbridge-Munsee Band of the Mohican Tribe, the Tonawanda Seneca Nation, and the Tuscarora Nation (see Appendix D for a list of these letters). In its letters, the NRC staff provided information about the proposed action, the definition of APE, and indicated that the NHPA review would be integrated with the NEPA process, according to 36 CFR 800.8(c). The NRC staff invited participation in the identification and possible decisions concerning historic properties and also invited participation in the scoping process.

Before the site audit in May 2011, the NRC staff contacted the BHP concerning license renewal for LGS and concluded there was no need to meet during the environmental audit to discuss cultural resources (NRC 2011c).

The NRC staff received scoping comments from two tribes, the Delaware Tribe and the Stockbridge Munsee Tribe, in September 2011, and one comment from the Onondaga Nation in October 2011. The tribes did not raise any concerns in their scoping comments and indicated there are no religious or culturally significant sites in the project area (see Appendix D). The NRC responded to the tribes concerning their scoping comments.

Section 2.2.10 describes the historic and cultural resources at the LGS site. Exelon currently has no planned changes or ground-disturbing activities associated with license renewal at LGS site (Exelon 2011a). Exelon is presently working with East Coventry Township and Chester County to rehabilitate and mothball the Fricks Lock Historic District located on its property. The rehabilitation and mothballing activities are specified to meet the Secretary of Interior's Standards for Rehabilitation and have been approved by the Pennsylvania Historical and Museum Commission Bureau for Historic Preservation (BHP 2011). Construction activity is expected to begin in 2012 (Exelon 2011a). Exelon has also developed a cultural resources management plan to manage known and potentially existing, or discovered archaeologically or historically significant cultural resources within the Owner-Controlled Area (OCA) of the LGS. The Plan addresses possible impacts from land-disturbing activities or other actions within the OCA that could introduce new noise, air, or visual element impacts to known cultural resources outside the OCA. The plan describes the process for initiating informal consultation with BHP and provides guidance on how to manage an unexpected discovery (Exelon 2012a).

For the purposes of NHPA Section 106 consultation, based on the (1) historic and cultural resources located within the APE, (2) tribal input, (3) Exelon's Cultural Resources Management Plan and the status of the Fricks Lock rehabilitation and mothball project, (4) the fact that there will be no changes or ground-disturbing activities that will occur as part of the relicensing of LGS, Units 1 and 2, (5) BHP finding of "no effect," and (6) the NRC staff's cultural resource analysis and consultation, the NRC staff concludes that license renewal will have no effect on historic properties (36 CFR 800.4(d)(1)).

For the purposes of the NRC staff's NEPA analysis, based on the items that lead to the above finding of no effect, the NRC staff concludes that potential impacts on historic and cultural resources related to operating LGS, Units 1 and 2 during the renewal term would be SMALL.

### 4.10.7. Environmental Justice

As described in Section 1.4 of this SEIS, the NRC has approved a revision to its environmental protection regulation, 10 CFR Part 51. With respect to environmental justice concerns, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by adding a new Category 2 issue, "Minority and low-income populations," to evaluate the impacts of continued operations and any refurbishment activities during the license renewal term on minority populations and low-income populations living in the vicinity of the plant. Environmental justice was listed in Table B–1 as a concern before this revised rule, but it was not evaluated in the 1996 GEIS and, therefore, is addressed in each SEIS.

Under Executive Order (EO) 12898 (59 FR 7629, February 16, 1994), Federal agencies are responsible for identifying and addressing, as appropriate, potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. In 2004, the NRC issued a *Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* (69 FR 52040, August 24, 2004), which states that "[t]he Commission is committed to the general goals set forth in EO 12898, and strives to meet those goals as part of its NEPA review process."

The Council of Environmental Quality (CEQ) provides the following information in *Environmental Justice: Guidance under the National Environmental Policy Act* (CEQ 1997):

> **Disproportionately High and Adverse Human Health Effects.** Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as employed by NEPA) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group.
>
> **Disproportionately High and Adverse Environmental Effects.** A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as employed by NEPA). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered.

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority populations and low-income populations that could result from the operation of LGS during the renewal term. In assessing the impacts, the following definitions of minority individuals and populations and low-income population were used (CEQ 1997):

- **Minority individuals.** Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races—meaning individuals who identified themselves on a Census form as being a member of two or more races (e.g., Hispanic and Asian).
- **Minority populations.** Minority populations are identified when the minority population of an affected area exceeds 50 percent or the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
- **Low-income population.** Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series P60, on Income and Poverty.

*4.10.7.1. Minority Population*

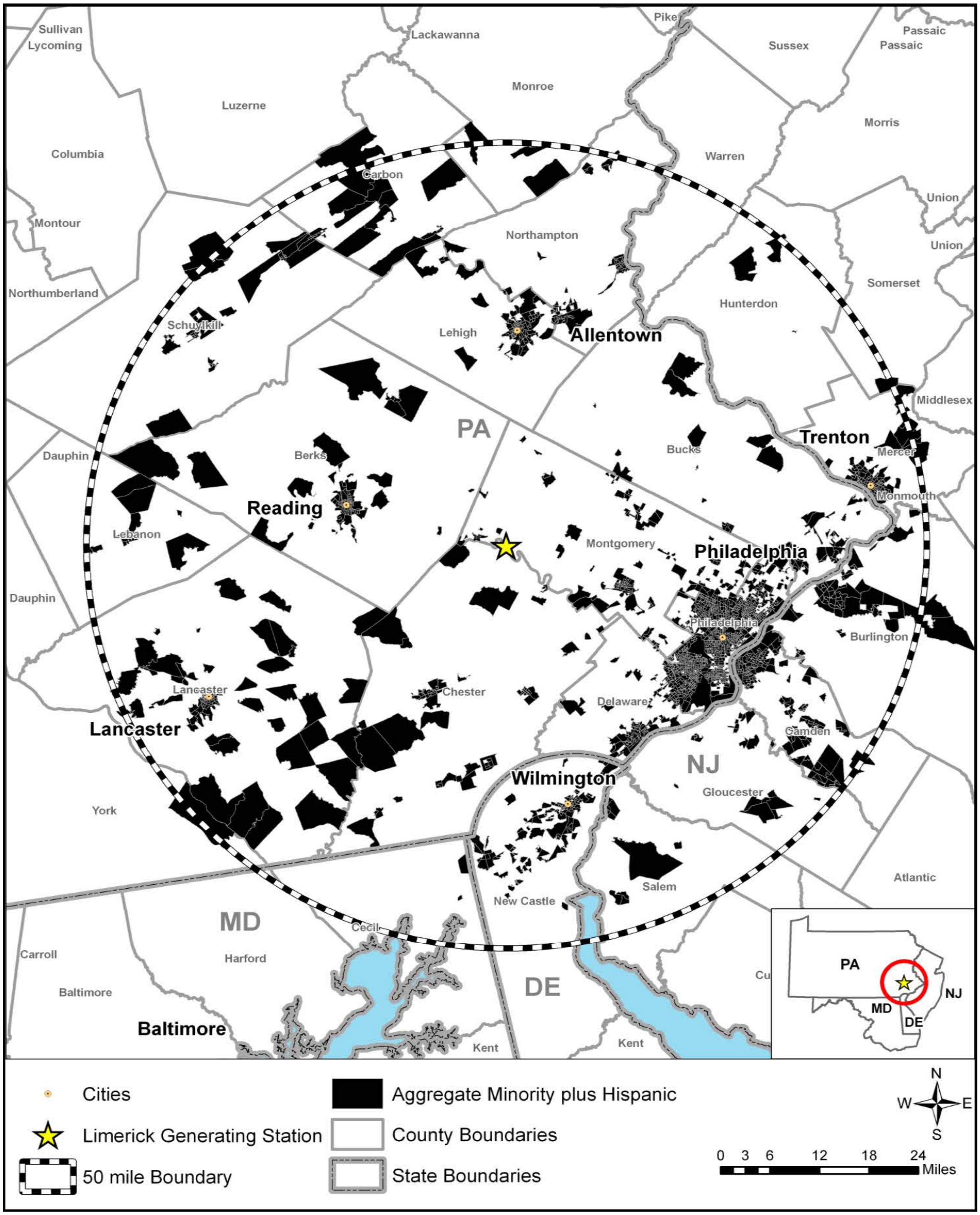
According to 2010 Census data, 34.5 percent of the population residing within a 50-mi (80-km) radius of LGS identified themselves as minority individuals. The largest minority group was Black or African American (17 percent), followed by Hispanic or Latino (of any race) (9.1 percent) (CAPS 2012).

According to 2010 Census data, minority populations in the socioeconomic ROI (Berks, Chester, and Montgomery Counties) comprised 20.6 percent of the total three-county population (see Table 2–9) (USCB 2011). Figure 4–1 shows minority population block groups, using 2010 Census data for race and ethnicity, within a 50-mile (80-kilometer) radius of LGS.

Census block groups were considered minority population block groups if the percentage of the minority population within any block group exceeded 34.5 percent (the percent of the minority population within the 50-mi radius of LGS). A minority population block group exists if the percentage of the minority population within the block group is meaningfully greater than the minority population percentage in the 50-mi (80-km) radius. Approximately 2,030 of the 5,800 census block groups located within the 50-mi (80-km) radius of LGS were determined to have meaningfully greater minority populations.

Minority population block groups are concentrated in the Philadelphia Metropolitan Area, with smaller concentrations in Reading and Allentown, Pennsylvania. The minority population block group nearest to LGS is located in Sanatoga, Limerick Township, Pennsylvania. According to the 2010 Census, approximately 20.7 percent of the total Sanatoga population (which includes more than one census block group) identified themselves as minority.

1 **Figure 4–1. 2010 Census Minority Block Groups within a 50-mi Radius of the LGS**




Source: USCB 2011

*4.10.7.2. Low-Income Population*

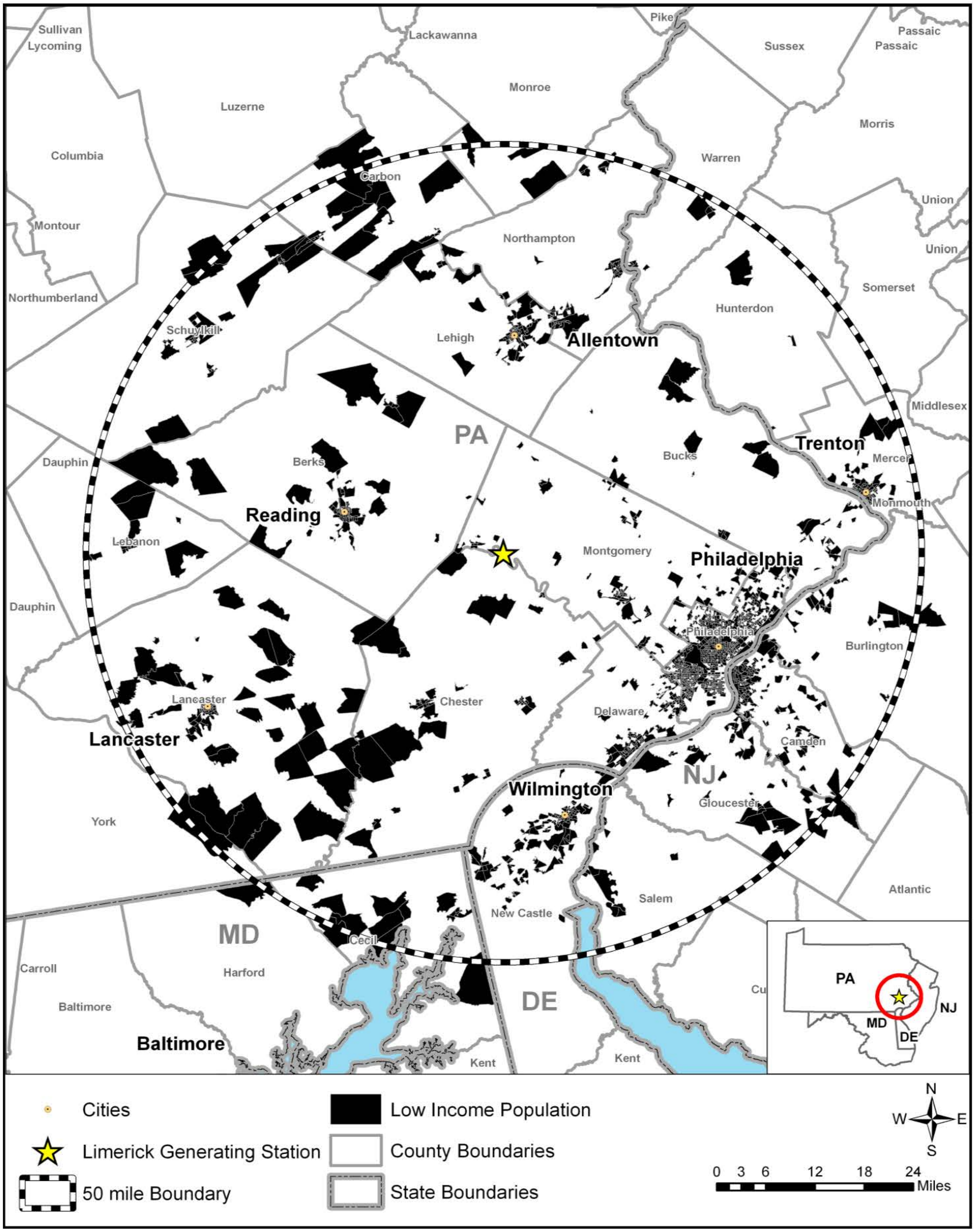
According to 2010 American Community Survey Census data, an average of 7.7 percent of families and 10.4 percent of individuals residing in counties within a 50-mile radius of LGS (Burlington, Camden, Gloucester, Hunterdon, Mercer, Salem, Somerset, and Warren, New Jersey; Berks, Bucks, Carbon, Chester, Delaware, Lancaster, Lebanon, Lehigh, Monroe, Montgomery, Northampton, Philadelphia, and Schuylkill, Pennsylvania; Cecil, Maryland; and New Castle, Delaware) were identified as living below the Federal poverty threshold in 2010. The 2010 Federal poverty threshold was $22,314 for a family of four (USCB 2011).

According to the 2010 Census, 9.3 percent of families and 13.4 percent of individuals in Pennsylvania were living below the Federal poverty threshold in 2010, and the median household income for Pennsylvania was $49,288 (USCB 2011). All three counties in the immediate ROI of LGS had higher median household incomes and Montgomery and Chester Counties had lower percentages of families and individuals living below the poverty level when compared to the state average. Berks County had a median household income average of $51,719 and 14.1 percent of individuals and 10.9 percent of families living below the poverty level. Chester County had a median household income average of $82,284 and 6.2 percent of individuals and 3.6 percent of families living below the poverty level. Montgomery County had a median household income of $75,448 and 5.5 percent of individuals and 3.6 percent of families living below the poverty level (USCB 2011).

Figure 4–2 shows low-income census block groups within a 50-mile (80-kilometer) radius of LGS. Census block groups were considered low-income population block groups if the percentage of individuals living below the Federal poverty threshold within any block group exceeded the percent of the individuals living below the Federal poverty threshold within the 50-mile radius of LGS. Approximately 2,070 of the 5,800 census block groups located within the 50-mile (80-kilometer) radius of LGS were determined to have meaningfully greater low-income populations.

Similar to the locations of minority population block groups, the majority of low-income population block groups are located in the Philadelphia metropolitan area, with smaller concentrations in Reading and Allentown, Pennsylvania. The nearest low-income population to LGS is located in Sanatoga, Limerick Township, Pennsylvania.

**Figure 4–2. 2010 Census Low-Income Block Groups within a 50-mi Radius of LGS**




Source: UCSB 2011

*4.10.7.3. Analysis of Impacts*

The NRC addresses environmental justice matters for license renewal through (1) identifying the location of minority and low-income populations that may be affected by the continued operation of the nuclear power plant during the license renewal term, and (2) determining whether there would be any potential human health or environmental effects to these populations and special pathway receptors, and (3) determining if any of the effects may be disproportionately high and adverse.

Figures 4–1 and 4–2 identify the location of minority and low-income block group populations residing within a 50-mi (80-km) radius of LGS. This area of impact is consistent with the impact analysis for public and occupational health and safety, which also focuses on populations within a 50-mi (80-km) radius of the plant. Chapter 4 presents the assessment of environmental and human health impacts for each resource area. The analyses of impacts for all environmental resource areas indicated that the impact from license renewal would be SMALL.

Potential impacts to minority and low-income populations (including migrant workers or Native Americans) would mostly consist of socioeconomic and radiological effects; however, radiation doses from continued operations during the license renewal term are expected to continue at current levels and would remain within regulatory limits. Socioeconomic effects were likewise found to be SMALL. Chapter 5 of this SEIS discusses the environmental impacts from postulated accidents that might occur during the license renewal term, which include both design-basis and severe accidents. The Commission has generically determined that impacts associated with design-basis accidents are small because nuclear plants are designed and operated to successfully withstand such accidents, and the probability weighted impact risks associated with severe accidents are also small.

Therefore, based on this information and the analysis of human health and environmental impacts presented in Chapters 4 and 5 of this SEIS, there would be no disproportionately high and adverse impacts to minority and low-income populations from the continued operation of LGS during the license renewal term.

As part of addressing environmental justice concerns associated with license renewal, the NRC also assessed the potential radiological risk to special population groups (such as migrant workers or Native Americans) from exposure to radioactive material received through their unique consumption and interaction with the environment patterns, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of airborne radioactive material released from the plant during routine operation. This analysis is presented below.

*4.10.7.4. Subsistence Consumption of Fish and Wildlife*

The special pathway receptors analysis is an important part of the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area, such as migrant workers or Native Americans.

Section 4-4 of Executive Order 12898 (1994) directs Federal agencies, whenever practical and appropriate, to collect, maintain, and analyze information on the consumption patterns of populations that rely principally on fish and/or wildlife for subsistence and to communicate the risks of these consumption patterns to the public. In this SEIS, the NRC staff considered whether there were any means for minority or low-income populations to be disproportionately affected, and it considered this by examining impacts to American Indians, Hispanics, migrant workers, and other traditional lifestyle special pathway receptors. Special pathways took into account the levels of radiological and nonradiological contaminants in native vegetation, crops, soils and sediments, groundwater, surface water, fish, and game animals on or near LGS were considered.

The following is a summary discussion of the NRC staff's evaluation from Section 4.9.2 of the radiological environmental monitoring programs (REMPs) that assess the potential impacts for subsistence consumption of fish and wildlife near the LGS site.

Exelon has an ongoing comprehensive REMP to assess the impact of LGS operations on the environment. To assess the impact of nuclear power plant operations, samples are collected annually from the environment and analyzed for radioactivity. A plant effect would be indicated if the radioactive material detected in a sample was significantly larger than background levels. Two types of samples are collected. The first type, control samples, are collected from areas that are beyond the measurable influence of the nuclear power plant or any other nuclear facility. These samples are used as reference data to determine normal background levels of radiation in the environment. These samples are then compared with the second type of samples, indicator samples, collected near the nuclear power plant. Indicator samples are collected from areas where any contribution from the nuclear power plant will be at its highest concentration. These samples are then used to evaluate the contribution of nuclear power plant operations to radiation or radioactivity levels in the environment. An effect would be indicated if the radioactivity levels detected in an indicator sample was significantly larger than the control sample or background levels.

Samples of environmental media are collected from the aquatic and terrestrial pathways in the vicinity of LGS. Nine hundred and twenty-six radiological environmental samples were collected and analyzed in 2010. The aquatic pathways include groundwater, surface water, drinking water, fish, and shoreline sediment. The terrestrial pathways include airborne particulates, milk, food products (i.e., leafy vegetables, such as cabbage, collards, Swiss Chard, collected from gardens in the vicinity of LGS), and wild animal feed (i.e., broad leaf vegetation). During 2010, analyses performed on samples of environmental media at LGS showed no significant or measurable radiological impact above background levels from site operations (Exelon 2011b).

### 4.10.8. Conclusion

Based on the radiological environmental monitoring data from LGS, the NRC staff finds that no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of water, local food, fish, and wildlife.

## 4.11. Evaluation of New and Potentially Significant Information

New and significant information is: (1) information that identifies a significant environmental issue not covered in the GEIS and codified in Table B–1 of 10 CFR Part 51, Subpart A, Appendix B, or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding that is substantially different from the finding presented in the GEIS and codified in 10 CFR Part 51.

The new and significant assessment that Exelon conducted during the preparation of the license renewal application included: (1) interviews with Exelon subject-matter experts on the validity of the conclusions in the GEIS as they relate to LGS, (2) review of the results of LGS environmental monitoring and reporting, as required by regulations and oversight of plant facilities and operations by state and Federal regulatory agencies, (3) a review of correspondence with state and Federal agencies to determine if agencies had concerns relevant to their resource areas that had not been addressed in the GEIS, (4) a review for issues relevant to the LGS application of certain license renewal applications that operators of other nuclear plants have previously submitted to the NRC, (5) an extensive review of documents related to environmental issues at LGS, and (6) a review of information related to severe accident mitigation.

The NRC also has a process for identifying new and significant information, which is described in NUREG–1555, Supplement 1, "Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1; Operating License Renewal" (NRC 1999b). The search for new information includes: (1) review of an applicant's ER and the process for discovering and evaluating the significance for new information, (2) review of records for public comments, (3) review of environmental quality standards and regulations, (4) coordination with Federal, state, and local environmental protection and resource agencies, and (5) review of the technical literature. New information discovered by the NRC staff is evaluated for significance using criteria set forth in the GEIS. For Category 1 issues in which new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment for the relevant new and significant information; the scope of the assessment does not include other facets of an issue that are not affected by the new information.

Exelon reported in its ER (Exelon 2011a) that it was aware of one new radiological issue associated with the renewal of the LGS operating license—tritium in groundwater. In 2006, Exelon implemented a fleet-wide program to proactively review the environmental status of its nuclear power generating stations, specifically to identify the potential for releases of radionuclides. The program is consistent with the guidance provided in NEI 07-07, "Industry Ground Water Protection Initiative–Final Guidance Document." As part of this program, Exelon commissioned a hydrogeologic investigation of LGS to evaluate any groundwater impact from radionuclides that may have been released from the plant. Exelon also developed its RGPP during this time.

A groundwater monitoring well network for LGS's groundwater protection program was designed and installed to gather any radionuclide release data. Monitoring was initiated in 2006 and performed at least semi-annually on each monitoring well. The results of the program, including trending data, program modifications, reporting protocols, and other information are included in the annual LGS radiological environmental operating reports. Neither Sr-90 nor any LGS-related gamma-emitting radionuclides have been identified in any groundwater sample.

The reporting level for tritium in groundwater specified in the Exelon Offsite Dose Calculation Manual (ODCM) is equal to the EPA drinking water standard of 20,000 picocuries per liter (pCi/L). The ODCM specifies a detection capability of 200 pCi/L for analyzing tritium concentrations in groundwater samples.

The groundwater monitoring data are reported in the annual LGS REMP reports. Sampling of the monitoring well network at LGS has not identified any tritium concentration greater than 20,000 pCi/L. Tritium was detected during a 2006 site investigation at a concentration of 2,020 ± 154 pCi/L in a sample collected from the power block foundation sump, which accumulates water from the drain system around the power block. This water is not in direct contact with groundwater and, therefore, also is not reflective of groundwater quality beneath LGS. Tritium concentrations greater than 2,000 pCi/L, but below the reporting level of 20,000 pCi/L, have been detected in power block foundation sump samples on other occasions since 2006.

Exelon's evaluation of the groundwater monitoring data concluded that there are no significant impacts associated with tritium in groundwater down gradient of LGS. This conclusion is based on the following information. Sampling of the monitoring well network at LGS has not identified tritium concentrations greater than the reporting level of 20,000 pCi/L. There is no groundwater connectivity with the monitoring points that have shown tritium concentrations greater than

2,000 pCi/L. None of the wells that have detectable tritium are used by workers or members of the public for drinking water. The applicant's groundwater protection monitoring program and REMP will continue to monitor the groundwater and report the results in the annual radioactive effluent operating reports. Also, NRC inspectors will periodically review the REMP data for compliance with NRC radiation protection standards. Based on the above, the NRC staff concludes that the issue of tritium contamination of the groundwater on the LGS site is not significant.

## 4.12. Cumulative Impacts

As described in Section 1.4 of this SEIS, the NRC has approved a revision to its environmental protection regulation, 10 CFR Part 51. With respect to cumulative impacts, the revised rule amends Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51 by adding a new Category 2 issue, "Cumulative impacts," to evaluate the potential cumulative impacts of license renewal.

The NRC staff considered potential cumulative impacts in the environmental analysis of continued operation of the LGS nuclear plant during the 20-year license renewal period. Cumulative impacts may result when the environmental effects associated with the proposed action are overlaid or added to temporary or permanent effects associated with other past, present, and reasonably foreseeable actions. Cumulative impacts can result from individually minor, but collectively significant, actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

For the purposes of this cumulative analysis, past actions are those before the receipt of the license renewal application. Present actions are those related to the resources at the time of current operation of the power plant, and future actions are those that are reasonably foreseeable through the end of plant operation, including the period of extended operation. Therefore, the analysis considers potential impacts through the end of the current license terms as well as the 20-year renewal license term. The geographic area over which past, present, and reasonably foreseeable actions would occur depends on the type of action considered and is described below for each resource area.

To evaluate cumulative impacts, the incremental impacts of the proposed action, as described in Sections 4.1 to 4.10, are combined with other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions. The NRC staff used the information provided in the ER; responses to requests for additional information; information from other Federal, state, and local agencies; scoping comments; and information gathered during the visits to the LGS site to identify other past, present, and reasonably foreseeable actions. To be considered in the cumulative analysis, the NRC staff determined if the project would occur within the noted geographic areas of interest and within the period of extended operation, was reasonably foreseeable, and if there would be potential overlapping effect with the proposed project. For past actions, consideration within the cumulative impacts assessment is resource and project-specific. In general, the effects of past actions are included in the description of the affected environment in Chapter 2, which serves as the baseline for the cumulative impacts analysis. However, past actions that continue to have an overlapping effect on a resource potentially affected by the proposed action are considered in the cumulative analysis.

Other actions and projects identified during this review and considered in the NRC staff's independent analysis of the potential cumulative effects are described in Appendix F. Examples of other actions that were considered in this analysis include the following:

- Cromby Generating Station,
- Titus coal plant,
- independent spent fuel storage installation,
- transmission lines
- future urbanization, and
- Schuylkill River greenway.

### 4.12.1. Air Quality

This section addresses the direct and indirect effects of license renewal on air quality resources when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. As described in Section 4.2, the incremental impacts on air quality from the proposed license renewal would be SMALL, as there is no planned refurbishment associated with the LGS license renewal. The geographic area considered in the cumulative air quality analysis is the county of the proposed action because air quality designations for criteria air pollutants are generally made at the county level. Counties are further grouped together based on a common air shed—known as an air quality control region (AQCR)—to provide for the attainment and maintenance of the National Ambient Air Quality Standards (NAAQS). The LGS site is located in Montgomery and Chester Counties, Pennsylvania, and is part of the Metropolitan Philadelphia Intrastate AQCR (40 CFR 81.15). Additional counties in this AQCR include Bucks, Delaware, and Philadelphia Counties.

Section 2.2.2 presents a summary of the air quality designation status for Montgomery and Chester Counties. As noted in Section 2.2.2, EPA regulates six criteria pollutants under the NAAQS, including carbon monoxide, lead, nitrogen dioxide, ozone, sulfur dioxide, and particulate matter. Montgomery and Chester Counties are designated unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$; and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339). All other counties in this AQCR are similarly designated with respect to the NAAQS criteria pollutants.

Criteria pollutant air emissions from the LGS site are presented in Section 2.2.2.1; these emissions are principally from standby diesel generators, boilers, two cooling towers, and a spray pond. Air pollutants from these sources are permitted under a Title V operating permit (TVOP-46-00038) (Exelon 2011a). In Section 4.2, it was noted that there would be no new air emissions associated with the LGS license renewal because there is no planned site refurbishment. Therefore, cumulative changes to air quality in Montgomery and Chester Counties would be the result of changes to present-day emissions from other existing facilities as well as future projects and actions within the county.

Appendix F provides a list of present and reasonably foreseeable projects that could contribute to cumulative impacts to air quality. Continued air emissions from existing projects and actions listed in Appendix F as well as proposed new source activities would contribute to air emissions in Montgomery and Chester Counties and will affect air quality within the region. Development and construction activities associated with regional growth of housing, business, and industry, as well as associated vehicular traffic, also will result in additional air emissions. Project timings and locations, which are difficult to predict, affect cumulative impacts to air quality. However, permitting and licensing requirements, efficiencies in equipment, cleaner fuels, and various mitigation measures can be used to minimize cumulative air quality impacts.

The effects of global climate change are already being felt in the northeastern United States, including an increase in annual average temperatures since 1970. This warming has resulted in many other climate-related changes, such as more frequent days over 90 °F (32 °C), increased heavy precipitation, less snow and more rain in winter, reduced snowpack, earlier spring snowmelt, and rising sea temperatures and sea level. The Northeast is projected to face continued warming and more extensive climate-related changes. Extreme heat and declining air quality (notably ozone) could affect human health. States, however, must continue to comply with the Clean Air Act, so it is likely that additional limitations on ozone precursors could help counteract this effect.

The overall warming trend also affects patterns of agricultural production and fisheries in the region, and the projected reduction in snow cover would adversely affect winter recreation and its related industries. Above all, more frequent flooding due to the sea-level rise and heavy downpours would have severe impacts on densely populated coastal areas, resulting in storm surges, coastal flooding, erosion, losses of life, property damage, and loss of wetlands (Karl et al. 2009). While these impacts are the result of changing atmospheric conditions, most of them are not, in and of themselves, air quality impacts.

Given that there is no planned plant refurbishment associated with the LGS license renewal, and therefore no expected changes in air emissions, cumulative air quality impacts in Montgomery and Chester Counties would be the result of changes to present-day emissions and emissions from reasonably foreseeable projects and actions. As NRC staff noted above, project timings and locations, which are difficult to predict, affect cumulative impacts to air quality. However, various strategies and techniques are available to limit air quality impacts. Therefore, the NRC staff concludes that the cumulative air quality impacts from the proposed license renewal and other past, present, and reasonably foreseeable projects would be SMALL.

### 4.12.2. Water Resources

This section addresses the direct and indirect effects of license renewal on water resources when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. As described in Sections 4.4 and 4.5, the incremental impacts on water resources from continued operations of LGS, Units 1 and 2 during the license renewal term would be SMALL. NRC staff also conducted an assessment of other projects and actions for consideration in determining their cumulative impacts on water resources (see Appendix F). The geographic area considered for the surface water resources component of the cumulative impacts analysis spans the Delaware River Basin. For groundwater, the area considered encompasses the local groundwater basin relative to LGS in which groundwater is recharged and flows to discharge points, or is withdrawn through wells. As such, this review focused on those projects and activities that would (1) withdraw water from or discharge wastewater to the Delaware River or its tributaries (i.e., the Schuylkill River) and/or (2) would use groundwater or could otherwise affect the bedrock aquifer beneath the LGS site.

#### *4.12.2.1. Cumulative Impacts on Surface Water Resources*

Water resource managers must balance multiple conflicting water management objectives. Within the Delaware River Basin, this includes demands for power generation, municipal water, industrial water, agricultural water, mining, recreation, flood protection, and instream flow requirements to sustain aquatic life (see Section 4.12.2). The Delaware River Basin Commission (DBRC) was formed to balance these objectives. These tradeoff decisions reflect an understanding of the inevitable uncertainty in regulated flows that result from inter-annual and intra-annual variability. Based on the USGS gage on the Schuylkill River at Pottstown, Pennsylvania, for water years 1928 to 2010, the highest annual mean flow and lowest annual mean flow recorded are 3,211cfs (90.7 $m^3$/s) and 843 cfs (23.8 $m^3$/s), respectively. The highest daily mean flow and the lowest daily mean flow recorded are 71,200 cfs (2,011 $m^3$/s) and 175 cfs (4.9 $m^3$/s), respectively (USGS 2010). This magnitude of variability reflects climate variability and no other projects within the basin.

To support full operations of LGS, Units 1 and 2, Exelon must withdraw up to 42 mgd or 29,200 gpm (65 cfs or 1.8 $m^3$/s) of water from either the Schuylkill River or other sources for consumptive cooling water use, as further described in Section 2.1.7.1 of this SEIS. Surface water withdrawals by LGS, like other similar surface water users in the basin, are subject to limits and conditions imposed by DRBC dockets. Relative to the cited magnitude of variability of flows in the Schuylkill River, the hydrologic impacts of surface water withdrawals associated with LGS operations are very small.

In general, water quality across the Delaware River Basin has dramatically improved over the past several decades. The water quality of the Delaware River and its main tributaries, such as the Schuylkill River, was profoundly impaired by municipal and industrial waste discharges and mining activities. Regulatory changes, including implementation of the Clean Water Act, have eliminated many of the largest point and nonpoint sources of water quality degradation. Still, within this context, the trend in urban and suburban development in the immediate LGS region (see Sections 4.12.3 and 4.12.4) and associated corridor-type development (e.g., roads) to keep pace with overall population growth in the Delaware River Basin has introduced a different impact dynamic. From the perspective of water quality, these types of development generally substitute more diffuse sources of pollution (i.e., nonpoint) and their impacts for point sources traditionally associated with industry.

Nevertheless, the segment of the Schuylkill River near LGS meets all established water quality standards at present, as further described in Section 2.2.4.1. The DRBC is responsible for classifying all waters in the basin as to use, setting basin-wide water quality standards, establishing pollutant treatment and control regulations, and reviewing projects or other undertakings with the potential to affect basin water resources for conformance with the DRBC Comprehensive Plan (DRBC 2001). DRBC acts in coordination with the states and other parties that are signatories to the DRBC Compact (DRBC 1961) to include the imposition of necessary effluent limitations on industrial wastewater discharges to surface water.

In addition, the NRC staff considered the U.S. Global Change Research Program's (USGCRP's) most recent compilation of the state of knowledge relative to global climate change effects (Karl 2009). Temperatures in the Northeastern United States are projected to rise an additional 2.5 to 4 °F (1.4 to 2.2 °C) in winter and 1.5 to 3.5 °F (0.8 to 1.9 °C) in the summer by about 2050. This would be in addition to the 2 °F (1.1 °C) increase in annual average temperature that has occurred since 1970. Sea level is expected to continue to rise. While there is great uncertainty, sea levels are expected to rise between 3 and 4 ft (0.9 to 1.2 m) by the end of this century. Meanwhile, precipitation and runoff are projected to increase in the winter and spring across the Northeast. Increased runoff generally equates to increased streamflow (Karl et al. 2009).

Without an offsetting increase in discharge in the Delaware River, any sea level rise associated with climate change will cause increased upstream saltwater migration and potentially affect fresh water withdrawals upstream of the salt line (see Section 2.2.4.1). This could lead to fresh water availability and water use conflicts. Moreover, permitting agencies, principally the PADEP and the DRBC, could have to consider imposing more stringent effluent limits on power plant discharges, should water temperatures rise. These predictions, if borne out, have important implications for the Delaware River Basin as a whole, but the overall interaction of predicted hydrologic changes and their effect on water users in the Delaware River Basin is highly speculative at the present time.

Surface water withdrawals for LGS operations are a small fraction of the mean annual flow of the Schuylkill River, and the discharge of cooling tower blowdown has not significantly affected ambient surface water quality. The NRC staff did not identify any exceptional limitations to water resources. The NRC staff concludes that the cumulative impacts from past, present, and reasonably foreseeable future actions on surface water resources during the license renewal term would be SMALL. This conclusion is based on the regulatory framework established by the DBRC and PADEP in managing surface water use and quality and the generally improving trend in conditions in the Schuylkill River and within the Delaware River Basin.

*4.12.2.2. Cumulative Impacts on Groundwater Resources*

The Brunswick bedrock aquifer is the most widespread source of groundwater in the plant region and across the Triassic lowlands of the Newark Basin. LGS's four groundwater production wells are completed in the Brunswick aquifer system along with over 50 domestic and several other commercial/industrial supply wells within a 1-mi (1.6-km) radius of LGS (see Section 2.2.5.1).

The DRBC promulgated its Ground Water Protected Area Regulations (DRBC 1999; 18 CFR 430) to manage groundwater resources in the Triassic lowland and adjacent areas in southeastern Pennsylvania. LGS and its regulated production wells are located in the Schuylkill-Sprogels Run Subbasin, as delineated by the DRBC (DRBC 1999; Exelon 2011a).

The DRBC has established a total maximum withdrawal limit of 1,455 million gal/yr (mgy) (5.49 million $m^3$/yr) for the subbasin. It has also set a withdrawal level of 1,091 mgy (4.12 million $m^3$/yr) as that level where groundwater resources of the subbasin would be "potentially stressed" (DRBC 1999; 18 CFR 430). Nonetheless, total net annual groundwater withdrawals in the subbasin are currently well below the DRBC limits at 174.89 mgy (0.66 million $m^3$/yr) (DRBC 2011). As described in Section 2.1.7.2, total LGS site groundwater withdrawals have averaged about 31,500 gpd or 11.5 mgy (0.04 million $m^3$/yr). This withdrawal is about 0.8 and 1.1 percent, respectively, of the DRBC established thresholds for groundwater withdrawals in the Schuylkill-Sprogels Run Subbasin.

LGS operations have resulted in inadvertent releases of liquids containing tritium to the bedrock aquifer, as described in Sections 4.5.2 and 2.2.5.2 of this SEIS. However, there has been no migration of tritium in groundwater exceeding 2,000 pCi/L, and tritium levels have been well below the EPA primary drinking water standard (i.e., 20,000 pCi/L) at all onsite monitoring wells. In addition, there are no potable water users downgradient of the LGS power block that have been affected by the inadvertent releases. As site groundwater locally discharges to the Schuylkill River and Possum Hollow Run where rapid mixing and dilution occurs, there is no drinking water pathway to other groundwater users. Meanwhile, Exelon maintains an ongoing RGPP at LGS to detect and correct the source of inadvertent releases of radionuclide-containing liquids.

In summary, the DRBC has established limits on total groundwater withdrawals in the local groundwater subbasin, and current total withdrawals for all projects identified in this review are a small percentage of the established thresholds for the subbasin. LGS groundwater withdrawals are not expected to increase during the license renewal term. Further, inadvertent releases of liquids containing tritium have not impacted groundwater quality beyond the site boundary, and there is no pathway to other drinking water users. Tritium levels as measured in groundwater on site are well below the EPA drinking water standard and a program is in place to safeguard groundwater quality. Based on the above considerations, the NRC staff concludes that the cumulative impacts from past, present, and reasonably foreseeable future actions on groundwater use and quality during the license renewal term would be SMALL.

### 4.12.3. Aquatic Resources

This section addresses the direct and indirect effects of license renewal on aquatic resources when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. As described in Section 4.6, the incremental impacts on aquatic biota from the proposed license renewal would be SMALL. The geographic area considered in the cumulative aquatic resources analysis includes the LGS cooling water sources in the vicinity of intake and discharge structures on the Schuylkill River, the Perkiomen Creek, the Delaware River, and along the East Branch Perkiomen Creek and Perkiomen Creek where water from the Delaware River is discharged to augment flows to the Perkiomen Creek.

The benchmark for assessing cumulative impacts on aquatic resources takes into account the preoperational environment as recommended by the EPA (1999), for its review of NEPA documents, as follows:

> Designating existing environmental conditions as a benchmark may focus the environmental impact assessment too narrowly, overlooking cumulative impacts of past and present actions or limiting assessment to the proposed action and future actions. For example, if the current environmental condition were to serve as the condition for assessing the impacts of relicensing a dam, the analysis would only identify the marginal environmental changes between the continued operation of the dam and the existing degraded state of the environment. In this hypothetical case, the affected environment has been seriously degraded for more than 50 years with accompanying declines in flows, reductions in fish stocks, habitat loss, and disruption of hydrologic functions. If the assessment took into account the full extent of continued impacts, the significance of the continued operation would more accurately express the state of the environment and thereby better predict the consequences of relicensing the dam.

Sections 2.2.4 and 2.2.6 present an overview of the condition of the Schuylkill River, Perkiomen Creek, East Branch Perkiomen Creek, and the Delaware River at the Point Pleasant Pumping Station, and the history and factors that led to current conditions. The direct and indirect impacts from water use and industrial discharge, such as mining waste water, are some of the most influential human activities on the Delaware River Basin (DRBC 2010a). Within the Schuylkill River, Perkiomen Creek, and East Branch Perkiomen Creek, increased urbanization over the past 100 years has also led to increased runoff and elevated levels of pollutants within (Rhoads and Block 2008). On the Schuylkill River, the construction of dams beginning in the early 1800s blocked anadromous fish migrations and resulted in the decline of American shad, river herring, and blueback herring, which require movement between freshwater and marine waters to complete their life cycles (Perillo and Butler 2009).

Many natural and anthropogenic activities can influence the current and future aquatic biota in the area surrounding the LGS site and the Delaware River Basin. Potential biological stressors include operational impacts from LGS (as described in Section 4.6), increasing urbanization, energy development, and climate change.

#### *4.12.3.1. Urbanization and Water Quality*

Interlandi and Crockett (2003) reported an increase in residential and commercial development for the area surrounding LGS along the Schuylkill River, Perkiomen Creek, and East Branch Perkiomen Creek, and a decrease in population near Philadelphia. Increased urbanization has led to increases in dissolved nitrate and chloride levels in the Schuylkill River. Urbanization will likely continue to contribute significant organic and metal pollutants to the river through runoff (Interlandi and Crockett 2003). The DRBC and EPA manage and set total maximum daily load (TMDL) limits for contaminants, such as polychlorinated biphenyl (PCBs), to help control future pollution of waters within the Delaware River Basin (DRBC 2008, EPA 2007).

Several other facilities within 10 miles (16 km) of LGS have NPDES permits to discharge into the Schuylkill River, which contributes to the cumulative impacts to aquatic habitats (EPA 2012a). For example, six municipal wastewater treatment facilities discharge treated wastewater to the Schuylkill River for a total discharge of less than 9 mgd (Appendix F). In addition, at least seven major industrial facilities, such as industrial laundry facilities, chemical production facilities, and aluminum die casting facilities, discharge into the Schuylkill River. Two municipal and one industrial treatment facilities discharge to Perkiomen Creek with a maximum total discharge of 2.0 mgd (Appendix F). Three major industrial facility NPDES permits for water discharge to Perkiomen Creek exist within a 10-mi (16-km) radius of LGS. Little effect to aquatic habitats from industrial and wastewater discharges is expected assuming that facilities comply with NPDES permit limitations.

*4.12.3.2. Energy Development*

A number of energy plants withdraw water from the Schuylkill and Delaware Rivers. Within 30 miles (48 km) of LGS, one oil plant and one natural-gas plant also withdraw and discharge to the Schuylkill River. In 2011, Exelon decommissioned two coal-fired units on the Schuylkill River at Cromby Generating Station (Appendix F). Two coal and two natural-gas plants operate near the confluence of the Delaware and Schuylkill Rivers, and use tidal Delaware River water as the main water source. In 2005, DRBC annual consumptive surface water use records show Eddystone Generating Station Coal Plant at 897 million gallons per year (MGY) (3.4 million $m^3$), Florida Power & Light Energy Marcus Hook gas plant at 1,018 MGY (3.85 million $m^3$), and Fairless Energy at 495 MGY (1.87 million $m^3$) (DRBC 2012a). These energy plants use water resources shared by LGS, but do not affect habitats or aquatic biota directly associated with the LGS cooling system.

Marcellus shale formation underlies approximately 36 percent of the Delaware River Basin and energy companies are actively seeking to mine the natural gas deposits within the Marcellus Shale (DRBC 2012b). Several impacts to aquatic habitat could occur during the mining process, including physical habitat disturbance at the drill site; the potential to add, discharge, or cause the release of pollutants into waterbodies near the drill site; reduced water flow where water is withdrawn to support mining operations; and degradation of aquatic habitat if recovered “frac water” is not properly treated before discharge into waterbodies (DRBC 2012b). Direct impacts to aquatic biota could occur if aquatic organisms are immobile or unable to avoid the drill site. On May 5, 2010, DRBC voted to postpone its consideration of well pad dockets until DRBC has developed and implemented regulations for natural gas development within Marcellus Shale. As of May 2012, DRBC was in the process of developing these regulations, which would likely provide protection of aquatic resources during drilling activities (DRBC 2012b).

*4.12.3.3. Climate Change*

Within the northeast region, climate models predict increasing average annual temperatures that foster rising sea surface temperatures and sea levels, increased heavy precipitation, reduced snowpack, and earlier spring peak river flows (Karl et al. 2009). The impacts of climate change on aquatic communities within the Delaware River Basin may be substantial and subsequently affect aquatic resources in the region. For example, seasonal spawning may shift earlier to coincide with earlier spring flows from higher temperatures melting snowpack earlier in the season. Increased water temperatures and higher sea levels may result in anadromous fish migrations further up the Delaware or Schuylkill Rivers. Further degradation of water quality from increased runoff following heavy precipitation events may compromise sensitive life stages of aquatic species in associated watersheds and have noticeable effects on aquatic populations.

Interlandi and Crockett (2003) examined the relative influences of climate change and stormwater discharge on the Schuylkill River Basin from 1895 to 1999 using temperature, precipitation, and river discharge data. While seasonal variations exist, the overall influence of long-term climate change showed marginal influence as increasing urbanization and increased stormwater discharge had a larger direct effect on water quality (Interlandi and Crockett 2003). Therefore, stormwater discharges may play a larger role than climate change in cumulative changes to aquatic biota in the future.

*4.12.3.4. Conclusion*

The stresses from past river flow alterations, increasing urbanization, and demand for water resources across the geographic area of interest depend on many factors that the NRC staff cannot quantify, but they are likely to noticeably alter aquatic resources when all stresses on the aquatic communities are assessed cumulatively. Therefore, the NRC staff concludes that the cumulative impacts from the proposed license renewal and other past, present, and reasonably foreseeable projects would be SMALL to MODERATE.

### 4.12.4. Terrestrial Resources

This section addresses past, present, and future actions that could result in cumulative impacts on the terrestrial species and habitats described in Section 2.2.7. For purposes of this analysis, the geographic area considered in the evaluation includes the LGS site, the in-scope transmission line corridors, and the offsite facilities associated with the LGS makeup water system. See Section 2.2.8.1 for a description of these areas.

Historic Conditions

Section 2.2.7 discusses the ecoregion in which the LGS site is located—the Triassic Lowlands portion of the Northern Piedmont ecoregion—which is dominated by Appalachian oak forest. In the region surrounding the LGS site, much of what would be forest has been cleared and cultivated for crops, hayfields, and pastureland. Forest remains on marginal land, such as steep slopes and land with poorer quality soils. From 1973 to 2000, about 6.2 percent of land in the Northern Piedmont ecoregion changed in land use type. New development surrounding urban areas accounted for about 70 percent of this change. This rate of land development is one of the highest in the Eastern ecoregions over the time period (Auch 2003).

On the immediate site, PECO cleared about 270 ac (110 ha; 42 percent of the current LGS site) for construction of the facility's buildings, parking lots, roads, and other infrastructure (AEC 1973). The terrestrial habitats on the undeveloped portions of the site have not changed significantly since LGS's construction (Exelon 2011a).

Energy-Producing Facilities

A number of operating energy-producing facilities within the vicinity of the LGS site could affect the terrestrial environment now and in the future.

Two bituminous coal plants operate near LGS: the Cromby Generating Station (6 mi [10 km] southeast) and the Titus Coal Plant (18 mi [29 km] northwest). Coal-fired plants are a major source of air pollution in the United States because they release sulfur dioxide, nitrogen oxides, mercury, carbon dioxide, and particulates. Nitrous oxides and sulfur dioxides combine with water to form acid rain, which can lead to erosion and changes in soil pH levels. Mercury deposits onto soil and surface water, which may then be taken up by terrestrial and aquatic plant or animal species and poses the risk of bioaccumulation.

Several natural gas plants operate in the region as well, including Linfield Energy Center, which lies 3 mi (5 km) northwest of LGS. Natural gas plants emit nitrous oxides and sulfur dioxides, though at much lower levels than coal plants. Methane, a primary component of natural gas and also a greenhouse gas, can be released when natural gas is not burned completely or as a result of leaks or losses during transportation. The release of methane contributes to climate change, the terrestrial resource impacts of which are discussed below.

Additionally, a number of distillate oil facilities in the area contribute to air emissions, which can result in bioaccumulation of chemicals and contribute to climate change, as discussed above.

Urbanization and Habitat Fragmentation

As the region surrounding the LGS site becomes more developed, habitat fragmentation will increase. Species that require larger ranges, especially predators, will likely suffer reductions in their populations. In contrast, herbivores will experience less predation pressure and their populations are likely to increase. Edge species will benefit from the fragmentation, while species that require interior forest or swamp habitat will likely suffer. The transmission line corridors established for LGS's transmission lines represent habitat fragmentation, though all of the LGS transmission lines were constructed along existing utility or railroad corridors; therefore, these lines likely did not contribute measurable cumulative impacts.

Agricultural Runoff

As of 2000, agriculture accounted for about 20 percent of Montgomery County's land acreage (MCPCB 2005). As development continues, the county's agricultural lands are being converted to residential and commercial uses; however, a significant portion of the county continues to be used for agriculture. The 2000 National Water Quality Inventory reported that agricultural nonpoint source pollution accounted for the second largest source of impairments to wetlands (EPA 2012b). Fertilizers and pesticides can affect wetlands in a variety of ways. Because wetlands are often at lower elevation than surrounding land, they receive much of the runoff first, and that runoff persists because it is unable to drain to lower ground. This can result in pollutant loadings and bioaccumulation and changes to species composition and abundance and increases. Species that rely on wetlands, such as birds and amphibians, are more sensitive to environmental stressors, which exacerbate these effects.

Parks and Conservation Areas

Eleven National and state parks occur within 30 mi (50 km) of the LGS site (see Appendix F). These areas will continue to provide valuable habitat to native wildlife and migratory birds. As habitat fragmentation resulting from various types of development occurs, these areas will become ecologically more important because they will provide large areas of natural habitat.

The Montgomery County Planning Commission (MCPC) has designated about 24 percent of the county as conservation landscapes. Conservation landscapes provide a focus for the county's restoration and native habitat management efforts. The MCPC has designated 13 of these landscapes, which total about 75,000 ac (30,000 ha). These conservation landscapes include relatively large forested tracts, stream corridors, wetlands, known sites of rare plant and animal species, and areas of high natural biodiversity. The large tracts of forest support native bird and wildlife diversity throughout the county, and the wetland habitats are critical to maintaining native amphibian and reptile populations (Rhoads and Block 2008). In addition, terrestrial habitats within the Schuylkill River corridor are protected by the Schuylkill River National and State Heritage Area.

Climate Change

Over the next several decades, the U.S. Global Change Research Program (Karl et al. 2009) estimates that summer temperatures within the Northeast will rise 1.5 to 3.5 °F (0.8 to 1.9 °C) and winter temperatures will rise 2.5 to 4 °F (1.4 to 2.2 °C). By late this century, the Northeast is likely to experience shorter winters with more precipitation; short-term droughts in the summer months; longer, hotter summers; and sea-level rise, among other effects. Changes in the climate will shift many wildlife population ranges and alter migratory patterns. Such changes could favor non-native invasive species and promote the population increases of insect pests and plant pathogens. Climate change will likely alter disturbance regimes as the severity or frequency of precipitation, flooding, and fire change. Climate change may also exacerbate the effects of existing stresses in the natural environment, such as those caused by habitat fragmentation, invasive species, nitrogen deposition and runoff from agriculture, and air emissions.

Conclusion

The NRC staff examined the cumulative effects of the construction of LGS, neighboring energy-producing facilities, continued urbanization and habitat fragmentation, agricultural runoff, nearby parks and conservation areas, and climate change. The NRC staff concludes that the minimal terrestrial impacts from the continued LGS operations would not contribute to the overall decline in the condition of terrestrial resources. The NRC staff believes that the cumulative impacts of other and future actions during the term of license renewal on terrestrial habitat and associated species, when added to past, present, and reasonably foreseeable future actions, would be MODERATE.

### 4.12.5. Human Health

The radiological dose limits for protection of the public and workers have been developed by the NRC and EPA to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 10 CFR Part 20 and 40 CFR Part 190. For the purpose of this analysis, the area within a 50-mi (80-km) radius of LGS was included. The REMP conducted by Exelon in the vicinity of the LGS site measures radiation and radioactive materials from all sources (i.e., hospitals and other licensed users of radioactive material); therefore, the monitoring program measures cumulative radiological impacts. Within the 50-mi (80-km) radius of the LGS site there are currently no other nuclear power reactors or uranium fuel cycle facilities.

Radioactive effluent and environmental monitoring data for the 5-year period from 2006 to 2010 were reviewed as part of the cumulative impacts assessment. In Section 4.9.2 of this SEIS, the NRC staff concluded that impacts of radiation exposure to the public and workers (occupational) from operation of LGS during the renewal term are SMALL. The NRC and the State of Pennsylvania would regulate any future actions in the vicinity of the LGS site that could contribute to cumulative radiological impacts.

Exelon constructed an Independent Spent Fuel Storage Installation (ISFSI) on the LGS site in 2008 for the storage of its spent fuel. The installation and monitoring of this facility is governed by NRC requirements in 10 CFR Part 72, “Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste.” Radiation from this facility, as well as from the operation of LGS, is required to be within the radiation dose limits in 10 CFR Part 20, 40 CFR Part 190, and 10 CFR Part 72. The NRC carries out periodic inspections of the ISFSI to verify its compliance with its licensing and regulatory requirements.

The cumulative radiological impacts from LGS, Units 1 and 2 and the ISFSI are required to meet the radiation dose limits in 10 CFR Part 20 and 40 CFR Part 190. Therefore, the NRC staff concludes that cumulative radiological impacts would be SMALL.

### 4.12.6. Socioeconomics

Socioeconomics

This section addresses socioeconomic factors that have the potential to be directly or indirectly affected by changes in operations at LGS, Units 1 and 2 in addition to the aggregate effects of other past, present, and reasonably foreseeable future actions. The primary geographic areas of interest considered in this cumulative analysis include Montgomery, Berks, and Chester Counties where approximately 84 percent of LGS, Units 1 and 2 employees reside (see Section 2.2.9). This is where the economy, tax base, and infrastructure would most likely be affected since LGS workers and their families reside, spend their income, and use their benefits within these counties. As previously discussed in Section 4.1, onsite land use conditions at LGS are expected to remain unchanged during the license renewal term. Therefore, activities associated with continued reactor operations during the license renewal term are not expected to affect the use and management of LGS lands identified as part of the Schuylkill River Greenway.

As discussed in Section 4.10 of this SEIS, continued operation of LGS would have no impact on socioeconomic conditions in the region during the license renewal term beyond what is already being experienced. Since Exelon has no plans to hire additional workers during the license renewal term, overall expenditures and employment levels at LGS, Units 1 and 2 would remain relatively unchanged with no new, additional, or increased demand for permanent housing and public services. In addition, since employment levels and tax payments would not change, there would be no population or tax revenue-related land use impacts. Based on this and other information presented in Chapter 4 of this SEIS, there would be no contributory effect from continued operations of LGS, Units 1 and 2 on socioeconomic conditions in the region beyond what is currently being experienced. Therefore, the only cumulative contributory effects would come from the other planned activities in the region independent of LGS, Units 1 and 2 operations.

Environmental Justice

The environmental justice cumulative impact analysis assesses the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from past, present, and reasonably foreseeable future actions including LGS, Units 1 and 2 operations during the renewal term. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceeds the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Some of these potential effects have been identified in resource areas presented in Chapter 4 of this SEIS. Minority and low-income populations are subsets of the general public residing in the area and all would be exposed to the same hazards generated from LGS operations. As previously discussed in this chapter, the impact from license renewal for all resource areas (e.g., land, air, water, ecology, and human health) would be SMALL.

As discussed in Section 4.10.7 of this SEIS, there would be no disproportionately high and adverse impacts to minority and low-income populations from the continued operation of LGS, Units 1 and 2 during the license renewal term. Since Exelon has no plans to hire additional workers during the license renewal term, employment levels at LGS, Units 1 and 2 would remain relatively constant with no new, additional, or increased demand for housing or increased traffic. Based on this information and the analysis of human health and environmental impacts presented in Chapters 4 and 5, it is not likely there would be any disproportionately high and adverse contributory effect on minority and low-income populations from the continued operation of LGS during the license renewal term.

### 4.12.7. Cultural Resources

This section addresses the direct and indirect effects of license renewal on historic and cultural resources when added to the aggregate effects of other past, present, and reasonably foreseeable future actions. The geographic area considered in this analysis is the Area of Potential Effect (APE) associated with the proposed undertaking, as described in Section 2.2.10.

Substantial archeological records indicate that there was historic occupation of the LGS area. Surveys were performed in the 1970s and 1980s. Section 2.2.10 presents an overview of the existing historic and archaeological resources located on the LGS site. Past land development has resulted in impacts on and the loss of cultural resources near and at the LGS site. As described in Section 4.10.6, no cultural resources would be affected by relicensing activities associated with the LGS site because there will be no changes or ground-disturbing activities that will occur as part of the relicensing of LGS, Units 1 and 2 (Exelon 2011a). Cultural resources are being managed through Exelon's Cultural Resources Management Plan and the Fricks Lock rehabilitation and mothball project (Exelon 2012a).

The present and reasonably foreseeable projects reviewed in conjunction with license renewal are noted in Appendix F of this document. Direct impacts would occur if archaeological sites in the APE are physically removed or disturbed. The following projects are located within the geographic area considered for cumulative impacts:

- decommissioning of LGS Units 1 and 2,
- transmission lines, and
- future urbanization.

Decommissioning of LGS Units 1 and 2, transmission lines, and future urbanization have the potential to result in impacts on cultural resources through inadvertent discovery during ground-disturbing activities. However, as discussed above in Section 4.10.6, the contribution from the proposed license renewal action would not incrementally affect historic or cultural resources. Therefore, the NRC staff concludes that the cumulative impacts of the proposed license renewal plus other past, present, and reasonable foreseeable future activities on historic and cultural resources would be SMALL.

### 4.12.8. Summary of Cumulative Impacts

The NRC staff considered the potential impacts resulting from the operation of LGS during the period of extended operation and other past, present, and reasonably foreseeable future actions near LGS. The preliminary determination is that the potential cumulative impacts would range from SMALL to MODERATE, depending on the resource. Table 4–10 summarizes the cumulative impacts on resources areas.

1 **Table 4–10. Summary of Cumulative Impacts on Resource Areas**

| Resource Area | Cumulative Impact |
|---|---|
| Air Quality | Because there are no planned site refurbishments with the LGS license renewal, and no expected changes in air emissions, cumulative impacts in Montgomery and Chester Counties would be the result of changes to present-day emissions and emissions from reasonably foreseeable projects and actions. Various strategies and techniques are available to limit air quality impacts. Therefore, the cumulative impacts from the continued operation of LGS would be SMALL. |
| Water Resources | Surface water withdrawals by LGS and other surface water users in the basin are subject to limits and conditions imposed by DRBC. The DRBC and PADEP established a regulatory framework to manage surface water use and quality. The water quality of Delaware River and its main tributaries, such as the Schuylkill, has improved over the past several decades. The annual net groundwater withdrawals in the Schuylkill-Sprogels Run Subbasin are currently below the DRBC limits. Therefore, the cumulative impacts from the continued operations of LGS would be SMALL. |
| Aquatic Ecology | The stresses from past river flow, alterations, increasing urbanization, and demand of water resources across the geographic area of interest are likely to alter aquatic resources when stresses on the aquatic communities are assessed cumulatively. Therefore, the cumulative impacts from the continued operation of LGS would be SMALL to MODERATE. |
| Terrestrial Ecology | A number of operating energy-producing facilities within the vicinity of LGS have the potential to affect terrestrial resources. Habitat fragmentation will increase as the region surrounding the LGS site becomes more developed. Therefore, the cumulative impacts from the continued operation of LGS would be MODERATE. |
| Human Health | The NRC staff reviewed the radioactive effluent and environmental monitoring data from 2006 to 2010, and concluded the impacts of radiation exposure to the public from operation of LGS during the renewal term are SMALL. The cumulative radiological impacts from LGS and the Independent Spent Fuel Storage Installation would be required to meet radiation dose limits in 10 CFR Part 20 and 40 CFR Part 190. Therefore, the cumulative impacts from the continued operation of LGS would be SMALL. |
| Socioeconomics | As discussed in Section 4.9, continued operation of LGS during the license renewal term would have no impact on socioeconomic conditions in the region beyond those already experienced. Exelon has no plans to hire additional workers during the license renewal term; employment levels at LGS would remain relatively constant with no new demands for housing or increased traffic. Combined with other past, present, and reasonably foreseeable future activities, there will be no additional contributory effect on socioeconomic conditions from the continued operation of LGS during the license renewal period beyond what is currently being experienced. |
| Cultural Resources | Transmission lines, future urbanization, and decommissioning of LGS have the potential to affect cultural resources through inadvertent discovery during ground-disturbing activities. However, no cultural resources would be affected by relicensing activities associated with the LGS site because there will be no changes or ground-disturbing activities that will occur as part of the relicensing of LGS, Units 1 and 2. Therefore, combined with other past, present, and reasonable foreseeable future activities, the potential cumulative impacts on historic and cultural resources would be SMALL. |

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# 5.0 ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS

This chapter describes the environmental impacts from postulated accidents that Limerick Generating Station, Units 1 and 2 (LGS) might experience during the period of extended operation. The term “accident” refers to any unintentional event outside the normal plant operational envelope that results in a release or the potential for release of radioactive materials into the environment. The two classes of postulated accidents listed in Table 5–1 are evaluated in detail in the generic environmental impact statement (GEIS). These two classes of accidents are:

- design-basis accidents (DBAs), and
- severe accidents.

**Table 5–1. Issues Related to Postulated Accidents**

| Issues | GEIS Section | Category |
|---|---|---|
| DBAs | 5.3.2; 5.5.1 | 1 |
| Severe accidents | 5.3.3; 5.3.3.2; 5.3.3.3; 5.3.3.4; 5.3.3.5; 5.4; 5.5.2 | 2 |

## 5.1. Design-Basis Accidents

In order to receive U.S. Nuclear Regulatory Commission (NRC) approval to operate a nuclear power plant, an applicant for an initial operating license must submit a safety analysis report (SAR) as part of its application. The SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The SAR also discusses various hypothetical accident situations and the safety features that prevent and mitigate accidents. The NRC staff (the staff) reviews the application to determine if the plant design meets the NRC’s regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

DBAs are those accidents that both the licensee and the staff evaluate to ensure that the plant can withstand normal and abnormal transients and a broad spectrum of postulated accidents, without undue hazard to the health and safety of the public. Many of these postulated accidents are not expected to occur during the life of the plant but are evaluated to establish the design basis for the preventive and mitigative safety systems of the nuclear power plant. Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 and 10 CFR Part 100 describe the acceptance criteria for DBAs.

The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the nuclear power plant to withstand these accidents is demonstrated to be acceptable before issuance of the operating license. The results of these evaluations are found in license documentation such as the applicant’s final safety analysis report (FSAR), the staff's safety evaluation report (SER), the final environmental statement (FES), and Section 5.1 of this supplemental environmental impact statement (SEIS). A licensee is required to maintain the acceptable design and performance criteria throughout the life of the nuclear power plant, including any period of extended operation. The consequences for these events are evaluated for the hypothetical maximum exposed individual. Because of the requirements that continuous acceptability of the consequences and aging management programs be in effect for license renewal, the environmental impacts, as calculated for DBAs, should not differ significantly from initial licensing assessments over the life of the nuclear power plant, including the license renewal period. Accordingly, the design of the nuclear power plant, relative to DBAs during the extended period, is considered to remain acceptable; therefore, the environmental impacts of those accidents were not examined further in the GEIS.

The NRC has determined in the GEIS that the environmental impacts of DBAs are of SMALL significance for all nuclear power plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, DBAs are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs makes them a part of the current licensing basis (CLB) of the plant; the CLB of the plant is to be maintained by the licensee under its current license and, therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal. This issue is applicable to LGS.

Exelon Generation Company, LLC (Exelon) stated in its environmental report (ER) (Exelon 2011c) that it is not aware of any new and significant information related to DBAs associated with the renewal of the LGS. The staff has not noted any new and significant information during its independent review of Exelon's ER, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to DBAs beyond those discussed in the GEIS (NRC 1996).

## 5.2. Severe Accidents

Severe nuclear accidents are those that are more severe than DBAs because they could result in substantial damage to the reactor core, whether or not there are serious offsite consequences. In the GEIS, the staff assessed the effects of severe accidents during the period of extended operation, using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the period of extended operation.

The impacts from severe accidents initiated by external phenomena such as tornadoes, floods, earthquakes, fires, and sabotage were specifically considered in the GEIS. The GEIS evaluated existing impact assessments—performed by the staff and by the industry at 44 nuclear power plants (including LGS) in the United States—and concluded that the risk from beyond design-basis earthquakes at existing nuclear power plants is SMALL. The GEIS also performed a discretionary analysis of sabotage, in connection with license renewal, and concluded that the core damage and radiological release from such acts would be no worse than the damage and release expected from internally initiated events. In the GEIS, the NRC concludes that the risk from sabotage at existing nuclear power plants is SMALL and, additionally, that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe accidents (NRC 1996).

Based on information in the GEIS, the NRC determined in its regulations that:

The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.

The staff found no new and significant information related to postulated accidents during the review of Exelon's ER (Exelon 2011c), the scoping process, or evaluation of other available information. Therefore, there are no impacts related to these issues, beyond those already discussed in the GEIS.

## 5.3. Severe Accident Mitigation Alternatives

The purpose of the evaluation of severe accident mitigation alternatives (SAMAs) is to identify design alternatives, procedural modifications, or training activities that are cost-beneficial and further reduce the risks of severe accidents (NRC 1999a). The analysis of SAMAs includes the identification and evaluation of alternatives that reduce the radiological risk from a severe accident by preventing substantial core damage (i.e., preventing a severe accident) or by limiting releases from containment in the event that substantial core damage occurs (i.e., mitigating the impacts of a severe accident) (NRC 1999b). In accordance with 10 CFR 51.53(c)(3)(ii)(L) and Table B-1 of Part 51, license renewal ERs must provide a consideration of alternatives to mitigate severe accidents if the staff has not previously evaluated SAMAs for the applicant's plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment.

The staff has previously performed a site-specific analysis of severe accident mitigation in a NEPA document for LGS in the Final Environmental Statement Related to Operation of LGS, Units 1 and 2 in NUREG-0974, Supplement 1 (NRC 1989) ("1989 SAMDA Analysis"). Therefore, no analysis of SAMAs for LGS is required in Exelon's ER or the staff's SEIS. The NRC Staff uses the term SAMA to refer to severe accident mitigation alternatives at the license renewal phase. In contrast, the term severe accident mitigation design alternatives (SAMDA) refers to severe accident mitigation alternatives at the initial licensing phase. The site-specific SAMDAs reviewed for applicability to LGS were evaluated in the 1989 SAMDA Analysis and also documented in GEIS Table 5.35. The staff examined each SAMDA (individually and, in some cases, in combination) to determine the potential SAMDA individual risk reduction potential. This risk reduction was then compared with the cost of implementing the SAMDA to provide cost-benefit evidence of its value. The staff concluded that:

> The risks of early fatality from potential accidents at the site are small in comparison with risks of early fatality from other human activities in a comparably sized population, and the accident risk will not add significantly to population exposure and cancer risks. Accident risks from Limerick are expected to be a small fraction of the risks the general public incurs from other sources. Further, the best estimates show that the risks of potential reactor accidents at Limerick are within the range of such risks from other nuclear power plants.

However, in the LGS specific 1989 SAMDA Analysis, the staff acknowledged:

> In the longer term, these same severe accident issues are currently being pursued by the NRC in a systematic way for all utilities through the Severe Accident Program described in SECY-88-147, "Integration Plan for Closure of Severe Accident Issues" (NRC 1988c). The plan includes provisions for an Individual Plant Examination (IPE) for each operating reactor, a Containment Performance Improvement (CPI) program, and an Accident Management (AM) program. These programs will produce a more complete picture of the risks of operating plants and the benefits of potential design improvements, including SAMDAs. The staff believes that the severe accident program is the proper vehicle for further review of severe accidents at nuclear power plants, including Limerick.

Therefore, the Commission considers ways to mitigate severe accidents at a given site more than once. The Commission has considered alternatives for mitigating severe accidents at many sites, including LGS, multiple times through a variety of NRC programs. When it promulgated Table B-1 of 10 CFR Part 51, the Commission explained,

> The Commission has considered containment improvements for all plants pursuant to its Containment Performance Improvement (CPI) program…and the

> Commission has additional ongoing regulatory programs whereby licensees search for individual plant vulnerabilities to severe accidents and consider cost-beneficial improvements [(the individual plant examination "IPE" and individual plant examination of external events "IPEEE" programs)] (61 Fed. Reg. 28,467).

In light of these studies, the Commission believed it was "unlikely that any site-specific consideration of SAMAs for license renewal will identify major plant design changes or modifications that will prove to be cost-beneficial for reducing severe accident frequency or consequences" (61 FR 28467). Given the significant costs of a major plant design change, such an improvement must result in a substantial reduction in risk to be cost-beneficial. As discussed below, these studies already thoroughly considered severe accidents and ways to mitigate their impacts and did not identify cost-beneficial major plant design changes or modifications for mitigating the impacts of severe accidents. Regulations in 10 CFR 51.53(c)(3)(ii)(L) and Table B-1 reflect the Commission's judgment that in light of these ongoing studies, reconsideration of SAMAs at license renewal would be unlikely to uncover major cost-beneficial plant modifications and is unnecessary.

Containment Performance Improvement Program

One of the programs the Commission relied on in determining that SAMAs need not be performed at license renewal if the staff had already performed a SAMA review in an earlier NEPA document is the CPI program. With this program, the NRC examined each of five U.S. reactor containment types (BWR Mark I, II, and III; PWR Ice Condenser; and PWR Dry) with the purpose of examining the potential failure modes, potential fixes, and the cost benefit of such fixes. Tables 5.32 through 5.34 in the GEIS summarize the results of this program. As can be seen from these tables, many potential changes were evaluated but only a few containment improvements were identified for site-specific review. The items evaluated in the CPI program were also included in the list of plant-specific SAMDAs examined in the LGS FES supplement (NRC 1996).

Individual Plant Examination

Another program the Commission relied on in determining that SAMAs need not be performed at license renewal if the staff had already performed a SAMA review in an earlier NEPA document is the Individual Plant Examination (IPE). The IPE's specific objective was to develop an appreciation of severe accident behavior, and to identify ways in which the overall probabilities of core damage and fission product releases could be reduced if deemed necessary. In general, the IPEs have resulted in plant procedural and programmatic improvements (i.e., accident management) and, in only a few cases, minor plant modifications, to further reduce the risk and consequences of severe accidents (NRC 1996).

In accordance with NRC's policy statement on severe accidents, the licensee performed an IPE to look for vulnerabilities to both internal and external initiating events (NRC 1988a). This examination considered potential improvements on a plant-specific basis. The CDF was found to be considerably less in the LGS IPE ($4.3\times10^{-6}$) than in the original CDF value provided in NUREG-1068 ($1.0\times10^{-5}$) for LGS and the 1989 PRA Update ($1.0\times10^{-5}$) used in the 1989 SAMDA Analysis review. The staff further notes that the 2009 PRA Update ($3.2\times10^{-6}$) is approximately an order of magnitude less than the 1989 PRA Update (Exelon ER). Plant improvements identified and implemented for LGS as a result of the IPE included: (1) relaxing restrictions on the drywell spray initiation curve in the Emergency Operating Procedures; (2) creating a procedure to cross-tie the 4 kV safeguards electrical buses; (3) creating a procedure to power Unit 2 emergency service water pumps from Unit 1; and (4) creating a cross-connection between the fire water and residual heat removal systems (PECO 1992).

Individual Plant Examination of External Events

Another program the Commission relied on in determining that SAMAs need not be performed at license renewal if the staff had already performed a SAMA review in an earlier NEPA document is the Individual Plant Examination of External Events (IPEEE) program. The IPEEE program was initiated in the early 1990s. All operating plants in the United States (including LGS) performed an assessment to identify vulnerabilities to severe accidents initiated by external events and reported the results to the NRC, along with any identified improvements and/or corrective actions. *Perspectives Gained from the Individual Plant Examination of External Events (IPEEE) Program*, NUREG–1742 documents the perspectives derived from the technical reviews of the IPEEE results (NRC 2002). As a result of conducting the LGS IPEEE, PECO Energy identified seismic event and fire event findings. Actions were taken to address minor housekeeping and maintenance issues related to the seismic analysis such as unrestrained tools, lockers, hoist controllers and lifting devices for low voltage switchgear. In addition, Fire brigade drill activities and fire brigade awareness were increased for 3 areas in the common control structure. Furthermore, actions credited in the fire analysis such as improved transient combustible controls, creation of transient combustible free zones and formal designation of certain fire rated doors as "fire" doors were implemented at LGS (PECO 1995).

Accident Management Program

The staff specifically relied on the Accident Management Program as the proper avenue for addressing the improvements considered in the 1989 SAMDA Analysis. Accident management involves the development of procedures that promote the most effective use of available plant equipment and staff in the event of an accident. The staff indicated its intent (NRC 1988a) that licensees develop an accident management framework that will include implementation of accident management procedures, training, and technical guidance. Insights gained as a result of the IPE were factored into the accident management program at LGS. As discussed earlier, the majority of improvements identified from the completed IPEs to date have been in the area of accident management or other procedural and programmatic improvements (NRC 1996 and NRC 1997).

NRC Efforts to Address Severe Accident-Related Issues since the Publication of the 1996 GEIS

The NRC has continued to address accident-related issues since the GEIS was published and 10 CFR Part 51 changes related to license renewal were promulgated. The NRC's efforts have reduced risks from accidents beyond that considered in the 1996 GEIS. As discussed below, in some cases, such as the agency response to Fukushima, these activities are ongoing. Each of the activities applied or continues to apply to all reactors, including LGS. The specific requirement for any given reactor was based either on a site-specific evaluation or a design-specific requirement.

10 CFR 50.54(hh) Conditions of License Regarding Loss of Large Areas of the Plant Due to Fire or Explosions

Following September 11, 2001, the Commission issued Order EA-02-026 and ultimately a new regulation (10 CFR 50.54(hh)), which required commercial power reactor licensees to, among other things, adopt mitigation strategies using readily available resources to maintain or restore core cooling, containment, and spent fuel pool cooling capabilities to cope with the loss of large areas of the facility due to large fires and explosions from any cause, including beyond-design-basis aircraft impacts (See 74 FR 13926). The final rule also added several new requirements developed as a result of insights gained from implementation of the security orders, reviews of site security plans, and implementation of the enhanced baseline inspection program, and updated the NRC's security regulatory framework for the licensing of new nuclear power plants. Compliance with the final rule was required by March 31, 2010, for licensees, including Exelon, currently licensed to operate under 10 CFR Part 50. Exelon has updated its plant and procedures accordingly, and the NRC has inspected the guidelines and strategies that Exelon has implemented to meet the requirements of 10 CFR 50.54(hh)(2). The specifics of the enhancements are security related and not publicly available but in general include: (1) significant reinforcement of the defense capabilities for nuclear facilities, (2) better control of sensitive information, (3) enhancements in emergency preparedness to further strengthen the NRC's nuclear facility security program, and (4) implementation of mitigating strategies to deal with postulated events potentially causing loss of large areas of the plant due to explosions or fires, including those that an aircraft impact might create. These measures are outlined in greater detail in NUREG/BR-0314 (NRC 2004), NUREG-1850 (NRC 2006a), and Sandia National Laboratory's "Mitigation of Spent Fuel Loss-of-Coolant Inventory Accidents and Extension of Reference Plant Analyses to Other Spent Fuel Pools" (NRC 2006b).

*Severe Accident Mitigation Guidelines*

Exelon has also developed and implemented severe accident mitigation guidelines (SAMGs) at LGS, which further reduce risk at the facility. SAMGs were developed by the industry during the 1980s and 1990s in response to the Three Mile Island (TMI) Nuclear Station accident and follow-up activities. SAMGs are meant to "enhance the ability of the operators to manage accident sequences that progress beyond the point where emergency operating procedures (EOPs) and other plant procedures are applicable and useful" (NRC 2011a).

*Fukushima-Related Activities*

The Commission also considered additional measures to enhance plant severe accident performance throughout the nuclear fleet, including LGS, following the March 11, 2011, Fukushima Dai-ichi accident. The Commission established a Task Force to "conduct a methodical and systematic review of the NRC's process and regulations to determine whether the agency should make additional improvements to its regulatory system and to make recommendations to the Commission for its policy direction."

As a result of this review, the Task Force issued SECY-11-0093 (NRC 2011c), "Near-Term Report and Recommendations for Agency Actions Following the Events in Japan;" SECY-11-0124 (NRC 2011d), "Recommended Actions to be Taken Without Delay from the Near-Term Task Force Report;" and SECY-11-0137 (NRC 2011f), "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned," to establish the staff's prioritization of the recommendations. The Commission's direction is provided in SRM-SECY-11-0124 (NRC 2011e) and SRM-SECY-11-0137 (NRC 2011g). In March 2012, three Orders were issued to U.S. nuclear power plants. The first Order requires all U.S. plants to better protect portable safety equipment put into place after the 9/11 terrorist attacks and to obtain sufficient equipment to support all reactors at a given site simultaneously (NRC 2012a). The second Order applies only to U.S. boiling water reactors that have "Mark I" or "Mark II" (such as LGS) containment structures. Mark I reactors must improve installed venting systems that help prevent or mitigate core damage in the event of a serious accident; Mark II reactors must install these venting systems (NRC 2012b). The third Order requires all plants to install enhanced equipment for monitoring water levels in each plant's spent fuel pool (NRC 2012c). The NRC also issued an information request in March 2012, including earthquake and flooding hazard "walkdowns," during which skilled engineers verify that the plants conform to their current license requirements (NRC 2012d).

Under 10 CFR 51.53(c)(3)(ii)(L) and 10 CFR Part 51 Table B-1, the NRC does not need to reconsider SAMAs for LGS at the license renewal phase. As provided above, those regulations rely on more than just the prior 1989 SAMDA Analysis; they also rest on the IPE, IPEEE, and

CPI programs, to consider SAMAs in cases like LGS in which the NRC has already analyzed SAMAs. These studies did not identify major cost-beneficial mitigation measures that could substantially reduce offsite risk. Rather, they mostly uncovered minor improvements and programmatic fixes. The volume of studies cited by the Commission, and their ongoing nature, provide the type of “hard look” the Commission understood it must apply to the issue of severe accident mitigation alternatives in its NEPA review for every license renewal proceeding (61 FR 28481). This approach is all the more reasonable in light of the Commission’s finding that the probability-weighted environmental impacts of severe accidents are small.

Evaluation of New Information

Additionally, both the applicant and the NRC must consider whether new and significant information affects environmental determinations in the NRC’s regulations, including the determination in 10 CFR 51.53(c)(3)(ii)(L) and Table B-1 that the agency need not reconsider SAMAs at license renewal if it has already done so in a NEPA document for the plant. New information is significant if it provides a seriously different picture of the impacts of the Federal action under consideration. Thus, for mitigation alternatives such as SAMAs, new information is significant if it indicates that a mitigation alternative would substantially reduce an impact of the Federal action on the environment. Consequently, with respect to SAMAs, new information may be significant if it indicated a given cost-beneficial SAMA would substantially reduce the impacts of a severe accident, the probability or consequences (risk) of a severe accident occurring. As discussed below, none of the information identified by the applicant or the staff indicates that any SAMAs would be cost beneficial and likely to result in such a reduction of risk. Rather, new information indicates that further SAMA analyses are unlikely to identify a SAMA that substantially reduces the risk of a severe accident, such as major, cost-beneficial plant improvements, and that the overall probability of a severe accident has decreased at LGS. The following evaluation for new and significant information is to determine whether any new and significant information exists that provides a “seriously different picture of the environmental impacts than what was previously envisioned” regarding the determination in 10 CFR 51.53(c)(3)(ii)(L), Table B-1, and the clarifications in the statement of considerations. As explained above, the Commission determined that no new SAMA analysis is required for plants such as LGS at the license renewal stage.

The applicant relied on this and did not submit a SAMA analysis for license renewal. Specifically, the applicant cited 10 CFR 51.53(c)(3)(ii)(L) and stated that no SAMA was submitted as none was required as a matter of law (Entergy 2011c). Thus, the applicant’s treatment of SAMA in its ER is in accordance with the Commission’s regulations, and the applicant evaluated the new and significant information evaluation with respect to the Commission’s regulation (Exelon 2011c). The applicant analyzed whether potentially new and significant information would change the results of its 1989 SAMDA Analysis review. The Commission had indicated that if the Staff identifies information that could invalidate the 1989 SAMDS Analysis, it should determine if that information is significant. The staff reviewed the applicant’s submitted information and also assessed if any new and significant information has been found that would change the generic conclusion codified by the NRC that Exelon need not reassess SAMAs at LGS for license renewal (10 CFR 51.53(c)(3)(ii)(L)) and the staff need not reconsider SAMAS at this stage (10 CFR 51, Table B-1). The following summarizes Exelon’s evaluation and the staff’s review of this information. In addition, the staff’s independent assessment did not identify any other new and significant information with respect to those regulations. Hence, no new and significant information has been found with respect to the generic conclusion codified by the NRC that LGS need not reassess SAMAs for license renewal (10 CFR 51.53(c)(3)(ii)(L)) because neither the Staff nor applicant uncovered any new and significant information that suggested another cost beneficial SAMA that could substantially reduce the risk of a severe accident at Limerick.

The Applicant's Evaluation of New and Significant Information

The applicant explained the process it used to identify any potentially new and significant information related to its existing 1989 SAMA review in Section 5.3.1 of the ER (Exelon 2011c). As provided in Section 5.1 of Appendix E of the ER (Exelon 2011c), the new and significant assessment that Exelon conducted during preparation of this license renewal application included: (1) interviews with Exelon Generation subject-matter experts on the validity of the conclusions in the GEIS as they relate to LGS, (2) an extensive review of documents related to environmental issues at LGS, (3) a review of correspondence with State and Federal agencies to determine if the agencies had concerns relevant to their resource areas that had not been addressed in the GEIS, (4) a review of the results of LGS environmental monitoring and reporting, as required by regulations and oversight of plant facilities and operations by State and Federal regulatory agencies (i.e., the results of ongoing routine activities that could bring significant issues to Exelon Generation's attention), (5) a review for issues relevant to the LGS application of certain license renewal applications that have previously been submitted to the NRC by the operators of other nuclear plants, and (6) a review of information related to severe accident mitigation. The significance and materiality of the new information identified through this process was discussed further in ER Section 5.3.2, "Significance of New Information." Exelon used a methodical approach to identify new and significant information and the staff finds Exelon's process adequate to ensure a reasonable likelihood that the applicant would be aware of any new and significant information.

The following four items of new information were identified and evaluated by the applicant by comparing assumptions for the 1989 SAMDA Analysis with assumptions used for current-day assessments of SAMAs:

(1) population increase
(2) consideration of offsite economic cost risk
(3) changed criteria for assigning cost per person-rem averted
(4) changed seismic hazard proposed by GI-199

Each item of new information was evaluated by the applicant and reviewed by the staff to determine whether it would materially alter the NRC's conclusions, as documented in the 1989 SAMDA Analysis, which is one of the documents that supports the determination in 10 CFR 51.53(c)(3)(ii)(L). None of the items of new information led to the identification of a SAMA that was cost-beneficial. Consequently, the applicant's and staff's review of new and significant information with respect to the 1989 SAMA review did not uncover any cost beneficial plant improvements or SAMAs that would substantially decrease the risk of a severe accident. Instead, it confirmed that no plant improvements that led to a substantial reduction in risk would be cost-beneficial. Therefore, the staff finds that none of the new information identified by the applicant significantly affects the generic conclusion codified by the NRC that applicants need not reassess SAMAs for license renewal at facilities like LGS (10 CFR 51.53(c)(3)(ii)(L)).

Risk

As provided in the discussion earlier regarding LGS's IPE, the CDF in the 2009 PRA Update ($3.2 \times 10^{-6}$) is more than an order of magnitude less than the 1989 PRA Update (Exelon ER). Any change in the likelihood of accidents that release substantial amounts of radioactive material to the environment not only affects the human impact but also any environmental impact. For LGS, this decrease in CDF would demonstrate less impact to dose, economic, and environmental impact. The overall reduction in risk indicates that further SAMA analyses for

LGS would be unlikely to uncover cost-beneficial major plant improvements or plant improvements that could substantially reduce risk. In light of the significant reduction in CDF, no new information is likely to significantly affect the Commission's generic determination that the NRC need not reanalyze SAMAs at LGS for license renewal.

Population Increase

A summary of Exelon's evaluation of population increase provided in the ER is as follows. Exelon provided population values within 50 miles growing from 6,819,505 in 1980 to 9,499,925 in 2030. They further assumed that this 39 percent increase in population would yield an approximate 39 percent increase in dose values. Hence, even assuming 2030 population numbers, the highest benefit/cost ratio SAMDA (ATWS Vent) based on cost per person-rem averted would still not be cost beneficial in the 1989 SAMDA Analysis.

The staff reviewed the calculation provided by the applicant and agrees that the population increase would not make any of the 1989 SAMDA's cost effective. The staff acknowledges that a more precise estimate of this relationship could be obtained by using the MACCS2 code, performing a level III PRA, and completing a SAMA analysis. However, NEPA does not require the NRC to completely reanalyze issues it has resolved generically, only look for information that provides a "seriously different picture" of those considered generically. Notably, additional conservatisms not mentioned by the applicant include that converting the $3,000,000 cost of the anticipated transient without scram (ATWS) Vent SAMDA to 2012 dollars would increase the cost of the SAMDA to over $5,000,000(assuming similar construction and engineering practices) and the current CDF for LGS is nearly an order of magnitude smaller than the one used in the 1989 SAMDA Analysis. Considering the large conservatisms in the analysis with respect to CDF, the applicant's analysis is reasonable. Moreover, even if population increase led to another SAMA becoming cost beneficial, that SAMA would still not likely result in a substantial reduction in offsite risk, given the substantial reduction in CDF at Limerick since the 1989 SAMDA analysis. Consequently, the population increase within 50 miles of LGS does not suggest that additional cost beneficial SAMAs could substantially reduce the risk of severe accidents and therefore does not constitute new and significant information with respect to the generic conclusion codified by the NRC that SAMAs need not be reassessed at facilities like LGS for license renewal (10 CFR 51.53(c)(3)(ii)(L)).

Consideration of Offsite Economic Cost Risk

The applicant indicated that the 1989 SAMDA Analysis did not consider offsite economic cost risk. To account for the offsite economic cost risk, the applicant estimated these impacts by using data from the Three Mile Island (TMI) license renewal application (Amergen 2008). Using TMI data, the offsite economic cost risk was approximately 70 percent larger than the offsite exposure cost risk at TMI. In order to apply the TMI data to LGS, the applicant applied a factor of 3 (300 percent) to analyze the impact on the 1989 SAMDA Analysis for LGS. Applying a factor of 3 reduction to the closest potential cost beneficial SAMDA (ATWS Vent) would not result in a cost beneficial SAMDA (Exelon 2011c).

The staff assessed the calculation provided by the applicant. The staff also used similar ratios to evaluate the cost impact of onsite exposure and economic costs for LGS ($2,000 and $400,000, respectively) to obtain the total offsite and onsite economic and exposure cost. The net value was -$284,000, indicating the ATWS Vent SAMDA was still not cost effective. Since this was applied to the SAMDA (ATWS Vent) that was closest to being cost effective, none of the SAMDAs identified in the 1989 SAMDA Analysis would be cost effective. Additional conservatisms not mentioned by the applicant include converting the $3,000,000 cost of the ATWS Vent SAMA to 2012 dollars that would increase the cost of the SAMDA to over $5,000,000 (assuming similar engineering and construction practices). Considering the large conservatisms in the Exelon analysis, it is reasonable. Moreover, even if consideration of offsite economic risk increase led to another SAMA becoming cost beneficial, that SAMA would still not likely result in a substantial reduction in offsite risk, given the substantial reduction in CDF at Limerick since the 1989 SAMDA analysis. Therefore, consideration of offsite costs would not likely lead to discovery of a cost beneficial SAMA that would substantially reduce risk of severe accidents and, therefore, does not constitute new and significant information with respect to the generic conclusion codified by the NRC that applicants need not reassess SAMAs for facilities such as LGS for license renewal.

Changed Criterion for Assigning Cost per Person-Rem Averted

The 1989 SAMDA Analysis calculated the benefit of each proposed SAMDA based on a criterion of $1,000 per person-rem averted. Using a value of $2,000 per person-rem averted would increase the threshold and potentially result in new cost beneficial SAMDAs. As described in 1989 SAMDA Analysis, changing the cost/benefit threshold using the $2,000 per person-rem averted conversion would still not result in this or any other of the SAMDAs becoming cost beneficial. Therefore, Exelon concludes that changing the criterion for assigning benefit (i.e., cost per person-rem averted) from $1,000 per person-rem averted to $2,000 per person-rem averted would not change the conclusions in the 1989 SAMDA Analysis. Hence, the new information represented by the changed criterion for assigning cost per person-rem averted was judged not to be significant by Exelon.

The staff reviewed the LGS analysis provided in the License Renewal ER and agrees that changing the criterion for assigning cost per person-rem averted would not result in a cost beneficial SAMA. As provided above, the ATWS Vent has the lowest cost/benefit ratio for the set, and it represents the SAMDA with the largest benefit potential. Even for this limiting SAMDA, changing the cost/benefit threshold to $2,000 per person-rem averted would still not result in this or any other of the SAMDAs becoming cost beneficial. Since this was applied to the SAMDA (ATWS Vent) closest to being cost effective, none of the SAMDAs are cost effective. Additional conservatisms not mentioned by the applicant include that converting the $3,000,000 cost of the ATWS Vent SAMA to 2012 dollars would increase the cost of the SAMDA to over $5,000,000 (assuming similar engineering and construction practices). Considering all of the large conservatisms in the analysis, the applicant’s analysis is reasonable. Moreover, even if the increase in cost per person-rem averted led to another SAMA becoming cost beneficial, that SAMA would still not likely result in a substantial reduction in offsite risk, given the substantial reduction in CDF at Limerick since the 1989 SAMDA analysis. Therefore, consideration of offsite costs would not likely lead to discovery of a cost-beneficial SAMA, let alone one that would substantially reduce offsite risk and therefore does not constitute new and significant information with respect to the generic conclusion codified by the NRC that Exelon need not reassess LGS SAMAs for license renewal.

Changed Seismic Hazard Proposed in GI-199

The staff is investigating the implication of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States in GI-199.

The applicant indicated that GI-199 issues related to the seismic hazard will not result in postulated accident scenarios not already considered for LGS. Seismologists are frequently refining seismic methodologies and results, which may increase the estimated frequency of seismic events with very low probability. Results from the LGS June 1989 PRA Update indicate that the contribution from seismic risk to the total CDF is approximately 25 percent, with fire risk contributing 31 percent to the total risk (Exelon 2011c). Therefore, based on the June 1989 Update, the major risk contributors for external hazards are approximately equal to the CDF computed for internal events only. Based on the ER, total CDF for internal and external events can generally be approximated by multiplying the CDF for internal events by a factor of 2. With a multiplication factor of 2 applied to the CDF estimated by the current model of record (CDF=3.2 x$10^{-6}$), the revised CDF that accounts for both internal and external hazards (CDF=6.4 x$10^{-6}$) would still be a factor of 6.5 below the value used in the 1989 SAMDA Analysis (CDF=4.2 x$10^{-5}$ ). This demonstrates the excess margin in the 1989 SAMDA Analysis. A possible increase in risk beyond this assumption due to an even larger seismic CDF would be more than offset by the factor of 6.5 reduction in the current CDF. Therefore, Exelon concludes that the new information represented by the changed seismic hazard proposed in GI-199 is not significant because it would not materially alter the SAMDA conclusions in the 1989 SAMDA (Exelon 2011c).

The staff reviewed the method the applicant used in determining the external events multiplier and its use and determined that it was consistent with the guidance provided in NEI 05-01. The staff also confirmed that the risk has decreased since the 1989 SAMDA and agrees with Exelon's analysis that the new information represented by the changed seismic hazard proposed in GI-199 is not significant because it would not materially alter the SAMDA conclusions in the 1989 SAMDA Analysis. Considering the large conservatism in the 1989 SAMDA Analysis, the applicant's approach is reasonable. Moreover, even if the change in seismic hazard led to another SAMA becoming cost beneficial, that SAMA would still not likely result in a substantial reduction in offsite risk, given the substantial reduction in CDF at Limerick since the 1989 SAMDA analysis. Therefore, consideration of GI-199 is not likely to lead to the discovery of a cost-beneficial SAMA that would substantially reduce offsite risk and, therefore, does not constitute new and significant information with respect to the generic conclusion codified by the NRC that SAMAs need not be reassessed at LGS for license renewal.

**Additional staff evaluation for new and significant information**

The staff reviewed records of public meetings and correspondence related to the application and compared information presented by the public with information considered in NUREG-1437 to determine if there was any new and significant information with respect to the generic conclusion codified by the NRC, which indicates that SAMAs need not be reassessed at LGS for license renewal (10 CFR 51.53(c)(3)(ii)(L)).

Cost-effective SAMAs Identified at Other Plants

From the scoping comments (NRDC 2011), there was a recommendation that potential cost-effective SAMAs identified at other similar plants be addressed at LGS. Many of the SAMA recommendations identified from other plants are compiled in an NRC published paper (NRC 2009). The paper concludes that, "SAMAs that are found to be potentially cost-beneficial tend to be low-cost improvements such as modifications to plant procedures or training, minimal hardware changes, and use of portable equipment." These potential cost-beneficial SAMAs are further evaluated and many times not found cost beneficial because sufficient risk is not eliminated by the modification (which was assumed) or other factors. Furthermore, the staff found that SAMA analyses that have been performed to date have found SAMAs that were cost-beneficial, or at least possibly cost-beneficial subject to further analysis, in approximately half of the plants. In general, the cost-beneficial SAMAs were identified and considered by the licensee under the current operating license. In several cases, SAMA-related modifications were implemented at LGS, further reducing that probability of an additional SAMA substantially reducing severe accident risk. (PECO 1992)(Exelon 2011c)

As provided in the statement of considerations for 10 CFR 51.53(c)(3)(ii)(L), in forming its basis for determining which plants needed to submit a SAMA, the Commission noted that all licensees had undergone, or were in the process of undergoing, more detailed site-specific severe accident mitigation analyses through processes separate from license renewal, specifically the

CPI, IPE, and IPEEE programs (61 FR 28467). These programs for LGS were discussed earlier. In light of these studies, the Commission stated that it did not expect future SAMA analyses in the license renewal stage to uncover "major plant design changes or modifications that will prove to be cost-beneficial" (61 FR 28467). As discussed above, the NRC's experience in completed license renewal proceedings has confirmed this assumption (NRC 2009). As a result, potentially cost-beneficial SAMAs at other facilities do not constitute new and significant information with respect to the NRC's determination not to perform a second SAMA analysis at license renewal in the event the agency has previously considered the issue because even if cost beneficial the NRC staff's experience show that they will not likely yield a major reduction of risk, particularly in light of the many improvements already implemented at Limerick.

Current State of the Art Knowledge for Performing SAMA Analysis

A current detailed SAMA analysis has the ability to analyze numerous plant-specific variables and the sensitivity of a SAMA analysis to these variables. In the scoping comments, numerous variables were identified that might cast doubt on the results of the initial 1989 SAMDA Analysis. To thoroughly evaluate all of these variables would require a *de novo* SAMA analysis, which is not required by 51.53(c)(3)(ii)(L) and Table B-1. However, the applicant evaluated some of the changes at LGS that could have a significant impact on the SAMA evaluation such as population increase, consideration of offsite economic cost risk, changed criteria for assigning cost per person-rem averted, and changed seismic hazard proposed by GI-199 and concluded that the changes or new information did not have a significant effect on the analysis. As provided earlier, the staff independently confirmed this information to be reasonable and moreover determine that they would not lead to identification of a SAMA that would substantially reduce offsite risks but acknowledges that a more precise answer could be found with a detailed SAMA analysis. However, the staff believes that this more precise answer would still not identify significant cost beneficial SAMAs. As explained above, new and significant information must provide a seriously different picture of the consequences of the Federal action under consideration. With respect to SAMAs, new information may be significant if it indicated a given SAMA would substantially reduce the probability or consequences of a severe accident. None of the information identified by the applicant or the staff indicates that any SAMAs would be likely to result in such a reduction of risk. Instead, as discussed above, new information indicates that further SAMA analyses are unlikely to identify such major, cost-beneficial plant improvements particularly in light of the substantial reduction in the CDF for Limerick since the 1989 SAMDA analysis. Nonetheless, the staff discusses another significant variable in contemporary SAMA analyses, fuel enrichment, further below.

Enrichment of Fuel (Power Uprates)

Another potentially new and significant item that could impact the 1989 SAMA analysis is increases in the enrichment of the fuel in the core. The following is the staff's review for any significant changes to the fuel enrichment design basis at LGS by reviewing LGS docketed information regarding power uprates. Extended power uprates require using fuel with a higher percentage of uranium-235 or additional fresh fuel to derive more energy from the operation of the reactor. This results in a larger radionuclide inventory (particularly short-lived isotopes, assuming no change in burnup limits) in the core, than the same core at a lower power level. The larger radionuclide inventory represents a larger source term for accidents and can result in higher doses to offsite populations in the event of a severe accident. Typically, short-lived isotopes are the main contributor to early fatalities. As stated in NUREG-1449 (NRC 1993), short-lived isotopes make up 80 percent of the dose following early release. The staff found that LGS had received two power uprate approvals since 1989. One uprate occurred in 1995. In 1993, an amendment request was submitted to the NRC that would increase the licensed thermal power level of the reactor from 3,293 megawatts thermal (MWt) to 3,458 MWt, primarily by increasing the licensed core flow. In the staff's Environmental Assessment and Finding of No Significant Impact related to the LGS application for the amendment, the staff found, "the radiological and nonradiological environmental impacts associated with the proposed small increase in power are very small and do not change the conclusion in the FES that the operation of LGS, Units 1 and 2, would cause no significant adverse impact upon the quality of the human environment." Furthermore, in the January 23, 1995 submittal relating to increasing core flow, the licensee indicated that while fuel burnup and enrichment levels may increase as a result of operation at uprated power, the burnup and enrichment will remain within the 5 percent enrichment and 60,000 MWd/MT value previously evaluated by the staff. Thus, the fuel enrichment did not exceed the previously licensed value (NRC 1995).

By application dated March 25, 2010 (Exelon 2010), Exelon submitted a license amendment request for the LGS Units 1 and 2 Facility Operating Licenses and Technical Specifications. The proposed amendment consisted of a 1.65 percent measurement uncertainty recapture (MUR) power uprate that will increase each unit's rated thermal power from 3,458 megawatts (MWt) to 3,515 MWt. The proposed amendment was characterized as a MUR power uprate, which uses a Cameron International (formerly Caldon) CheckPlus™ Leading Edge Flow Meter (LEFM) system to improve plant calorimetric heat balance measurement accuracy. This flowmeter provides a more accurate measurement of feedwater (FW) flow and thus reduces the uncertainty in the FW flow measurement. This submittal did not change the fuel enrichment design basis.

Neither of these power uprates increased the fuel enrichment any higher than was previously evaluated by the staff before the 1989 SAMDA Analysis was completed. Since the fuel enrichment was not increased, further SAMA analyses for LGS would be unlikely to uncover cost-beneficial major plant improvements or plant improvements that could substantially result in lower doses to offsite populations in the event of a severe accident. Also, it reinforces the Commission's generic determination that the NRC need not reanalyze SAMAs at LGS for license renewal.

<u>Conclusion</u>

In conclusion, 10 CFR 51.53(c)(3)(ii)(L) states that, "[i]f the staff has not previously considered SAMAs for the applicant's plant, in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided." Table B-1 in 10 CFR Part 51, which governs the scope of the staff's environmental review for license renewal, echoes this regulation. Applicants for plants that have already had a SAMA analysis considered by the NRC as part of an EIS, supplement to an EIS, or EA, do not need to have a SAMA analysis reconsidered for license renewal. In forming its basis for determining which plants needed to submit a SAMA at license renewal, the Commission noted that all licensees had undergone, or were in the process of undergoing, more detailed site-specific severe accident mitigation analyses through processes separate from license renewal, specifically the CPI, IPE, and IPEEE programs (61 FR 28467). In light of these studies, the Commission stated that it did not expect future SAMA analyses to uncover "major plant design changes or modifications that will prove to be cost-beneficial" (61 FR 28467). The NRC's experience in completed license renewal proceedings has confirmed this assumption.

LGS is a plant that had a previous SAMA documented in a NEPA document. Therefore, Exelon was not required to, and did not, submit a SAMA in its license renewal ER. Exelon did evaluate whether there was new and significant information with respect to the Commission's prior determination not to require a SAMA analysis at license renewal for those plants that were already the subject of a SAMA analysis by the staff.

The staff analyzed information in the applicant's ER with respect to the 1989 SAMDA Analysis for LGS, public comments, and its own review of information relevant to LGS to search for new and significant information with respect to the NRC's determination not to conduct a second SAMA analysis at LGS for license renewal and the studies and assumptions underlying that determination. In conducting that search, the staff considered whether new information provided a seriously different view of the consequences of renewing the LGS operating license than previously contemplated. For a mitigation analysis, such as a SAMA analysis, such information would need to demonstrate a substantial change in the environmental impact sought to be mitigated, in this case severe accidents. Given the discussion above, it is unlikely that further SAMA analyses for LGS could uncover cost beneficial SAMAs that would substantially reduce the risk of severe accidents because the reduction in severe accident risk at Limerick from the use of new information outweighs any increases resulting from new considerations.

The staff also did not identify any new and significant information that rises to a level that requires staff to seek Commission approval to conduct a new SAMA analysis (similar to the waiver requirement that applies for Category 1 issues when staff identifies new and significant information). The impacts of all other new information do not contribute sufficiently to the environmental impacts to warrant their inclusion in a SAMA analysis, since the likelihood of finding cost-effective plant improvements that substantially reduce risk is small. Additionally, the staff did not identify a significant environmental issue not covered in the GEIS, or that was not considered in the analysis in the GEIS and leads to an impact finding that is different from the finding presented in the GEIS.

The staff identified no new and significant information related to postulated accidents during the review of LGS's ER (Exelon 2011c) or evaluation of other available information. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS. In accordance with 10 CFR 51.53(c)(3)(ii)(L), the staff did not repeat the review of SAMAs for LGS. While another SAMA is not required, the applicant provided and the staff reviewed considerations of new and significant information.

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# 6.0 ENVIRONMENTAL IMPACTS OF THE URANIUM FUEL CYCLE, SOLID WASTE MANAGEMENT, AND GREENHOUSE GAS EMISSIONS

This chapter addresses issues related to the uranium fuel cycle, solid waste management, and greenhouse gas emissions during the proposed 20-year period of extended operation.

## 6.1. The Uranium Fuel Cycle

The uranium cycle includes uranium mining and milling, the production of uranium hexafluoride, isotopic enrichment, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level wastes and high-level wastes related to uranium fuel cycle activities. The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in NUREG–1437, *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants* (NRC 1996, 1999) based, in part, on the generic impacts given in Table S–3, "Table of Uranium Fuel Cycle Environmental Data," located in Title 10 of the *Code of Federal Regulations* 51.51 (10 CFR 51.51) and in 10 CFR 51.52(c), Table S-4, "Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor."

In the GEIS, the U.S. Nuclear Regulatory Commission staff (the staff) identified nine Category 1 issues related to the fuel cycle and waste management, which appear in Table 6–1. There are no Category 2 issues related to the fuel cycle and waste management.

**Table 6–1. Issues Related to the Uranium Fuel Cycle and Waste Management**

| Issues | GEIS Sections | Category |
|---|---|---|
| Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste) | 6.1; 6.2.1; 6.2.2.1; 6.2.2.3; 6.2.3; 6.2.4; 6.6 | 1 |
| Offsite radiological impacts (collective effects) | 6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6 | 1 |
| Offsite radiological impacts (spent fuel and high-level waste disposal) | 6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6 | 1 |
| Nonradiological impacts of the uranium fuel cycle | 6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6 | 1 |
| Low-level waste storage and disposal | 6.1; 6.2.2.2;6.4.2; 6.4.3; 6.4.3.1; 6.4.3.2; 6.4.3.3; 6.4.4; 6.4.4.1; 6.4.4.2; 6.4.4.3; 6.4.4.4; 6.4.4.5; 6.4.4.5.1; 6.4.4.5.2; 6.4.4.5.3; 6.4.4.5.4; 6.4.4.6;6.6 | 1 |
| Mixed waste storage and disposal | 6.4.5.1; 6.4.5.2; 6.4.5.3; 6.4.5.4; 6.4.5.5; 6.4.5.6; 6.4.5.6.1; 6.4.5.6.2; 6.4.5.6.3; 6.4.5.6.4; 6.6 | 1 |
| Onsite spent fuel | 6.1; 6.4.6; 6.4.6.1; 6.4.6.2; 6.4.6.3; 6.4.6.4; 6.4.6.5; 6.4.6.6; 6.4.6.7; 6.6 | 1 |
| Nonradiological waste | 6.1; 6.5; 6.5.1; 6.5.2; 6.5.3; 6.6 | 1 |
| Transportation | 6.1; 6.3.1; 6.3.2.3; 6.3.3; 6.3.4; 6.6, Addendum 1 | 1 |

The NRC staff's evaluation of the environmental impacts associated with spent nuclear fuel is addressed in two issues in Table 6-1, "Offsite radiological impacts (spent fuel and high-level waste disposal)" and "Onsite spent fuel." However, as explained later in this section, the scope of the evaluation of these two issues in this SEIS has been revised. The issue, "Offsite radiological impacts (spent fuel and high-level waste disposal)," is not evaluated in this SEIS. In addition, the issue, "Onsite spent fuel" only evaluates the environmental impacts during the license renewal term.

For the term of license renewal, the staff did not find any new and significant information related to the remaining uranium fuel cycle and solid waste management issues listed in Table 6–1 during its review of the Limerick Generating Station environmental report (ER) (Exelon 2011), the site visit, and the scoping process. Therefore, there are no impacts related to these issues beyond those discussed in the GEIS. For these Category 1 issues, the GEIS concludes that the impacts are SMALL, except for the issue, "Offsite radiological impacts (collective effects)," which the NRC concluded are acceptable.

However, the offsite radiological impacts resulting from spent fuel and high-level waste disposal and the onsite storage of spent fuel, which will occur after the reactors have been permanently shutdown, are addressed in the Commission's Waste Confidence Decision Rule (WCD), 10 CFR 51.23. In 2010, the Commission revised the WCD (i.e., WCD Update) to reflect information gained based on experience in the storage of spent nuclear fuel and the increased uncertainty in the siting and construction of a permanent geologic repository for the disposal of spent nuclear fuel.

On June 8, 2012, in response to a legal challenge to the WCD, the U.S. Court of Appeals for the District of Columbia Circuit (New York v. NRC, 681 F.3d 471 (D.C. Cir. 2012)) vacated the NRC's WCD Update (75 *Federal Register* (FR) 81032, 75 FR 81037). The court decision was based on grounds relating to aspects of the National Environmental Policy Act (NEPA). The court decision held that the WCD Update is a major Federal action necessitating either an environmental impact statement (EIS) or a finding of no significant environmental impact (FONSI), and the Commission's evaluation of the risks associated with the storage of spent nuclear fuel for at least 60 years beyond the licensed life for reactor operation is deficient.

In response to the court's ruling, the Commission, in CLI-12-16 (NRC 2012a), determined that it would not issue licenses dependent upon the WCD, until the issues identified in the court's decision are appropriately addressed. In CLI-12-16, the Commission also noted that this determination extends only to final license issuance; all current licensing reviews and proceedings should continue to move forward.

In addition, the Commission directed in SRM-COMSECY-12-0016 (NRC 2012b) that the NRC staff proceed with a rulemaking that includes the development of an EIS to support an updated WCD within 24 months (by September 2014). The Commission indicated that the EIS used to support the revised rule should build on the information already documented in various NRC studies and reports on the impacts associated with the storage of spent nuclear fuel that were developed as part of the 2010 WCD Update, and should primarily focus additional analyses on the deficiencies identified in the D.C. Circuit's decision. The NRC considers the WCD to be a generic issue that is best addressed through rulemaking, and that the NRC rulemaking process provides an appropriate forum for public review and comment on both the draft EIS and the proposed WCD.

The updated rule and supporting EIS will provide the necessary NEPA analyses of waste confidence-related human health and environmental issues. As directed by the Commission, the NRC will not issue a renewed license before the resolution of waste confidence-related issues. This will ensure that there would be no irretrievable or irreversible resource commitments or potential harm to the environment before waste confidence impacts have been addressed.

If the results of the WCD EIS identify information that requires a supplement to this EIS, the NRC staff will perform any appropriate additional NEPA review for those issues before the NRC makes a final licensing decision.

## 6.2. Greenhouse Gas Emissions

This section discusses the potential impacts from greenhouse gases (GHGs) emitted from the nuclear fuel cycle. The GEIS does not directly address these emissions, and its discussion is limited to an inference that substantial carbon dioxide ($CO_2$) emissions may occur if coal- or oil-fired alternatives to license renewal are carried out.

### 6.2.1. Existing Studies

Since the development of the GEIS, the relative volumes of GHGs emitted by nuclear and other electricity generating methods have been widely studied. However, estimates and projections of the carbon footprint of the nuclear power lifecycle vary depending on the type of study done. Additionally, considerable debate also exists among researchers on the relative effects of nuclear and other forms of electricity generation on GHG emissions. Existing studies on GHG emissions from nuclear power plants generally take two different forms:

(1) qualitative discussions of the potential to use nuclear power to reduce GHG emissions and mitigate global warming, and

(2) technical analyses and quantitative estimates of the actual amount of GHGs generated by the nuclear fuel cycle or entire nuclear power plant life cycle and comparisons to the operational or life cycle emissions from other energy generation alternatives.

#### *6.2.1.1. Qualitative Studies*

The qualitative studies consist primarily of broad, large-scale public policy, or investment evaluations of whether an expansion of nuclear power is likely to be a technically, economically, or politically workable means of achieving global GHG reductions. Studies the staff found during the subsequent literature search include the following:

- Evaluations to determine if investments in nuclear power in developing countries should be accepted as a flexibility mechanism to assist industrialized nations in achieving their GHG reduction goals under the Kyoto Protocols (IAEA 2000, NEA 2002, Schneider 2000). Ultimately, the parties to the Kyoto Protocol did not approve nuclear power as a component under the clean development mechanism (CDM) because of safety and waste disposal concerns (NEA 2002).

- Analyses developed to assist governments, including the United States, in making long-term investment and public policy decisions in nuclear power (Hagen et al. 2001, Keepin 1988, MIT 2003).

Although the qualitative studies sometimes reference and critique the existing quantitative estimates of GHGs produced by the nuclear fuel cycle or life cycle, their conclusions generally rely heavily on discussions of other aspects of nuclear policy decisions and investment, such as safety, cost, waste generation, and political acceptability. Therefore, these studies typically are not directly applicable to an evaluation of GHG emissions associated with the proposed license renewal for a given nuclear power plant.

*6.2.1.2. Quantitative Studies*

A large number of technical studies, including calculations and estimates of the amount of GHGs emitted by nuclear and other power generation options, are available in the literature and were useful in the staff's efforts to address relative GHG emission levels. Examples of these studies include—but are not limited to—Mortimer (1990), Andseta et al. (1998), Spadaro (2000), Storm van Leeuwen and Smith (2008), Fritsche (2006), Parliamentary Office of Science and Technology (POST) (2006), Atomic Energy Authority (AEA) (2006), Weisser (2006), Fthenakis and Kim (2007), and Dones (2007). In addition, Sovacool (2008) provides a review and synthesis of studies in existence through 2008; however, the Sovacool synthesis ultimately uses only 19 of the 103 studies initially considered (the remaining 84 were excluded because they were more than 10 years old, not publicly available, available only in a language other than English, or they presented methodological challenges by relying on inaccessible data, providing overall GHG estimates without allocating relative GHG impacts to different parts of the nuclear lifecycle, or they were otherwise not methodologically explicit).

Comparing these studies and others like them is difficult because the assumptions and components of the lifecycles that the authors evaluate vary widely. Examples of areas in which differing assumptions make comparing the studies difficult include the following:

- energy sources that may be used to mine uranium deposits in the future,
- reprocessing or disposal of spent nuclear fuel,
- current and potential future processes to enrich uranium and the energy sources that will power them,
- estimated grades and quantities of recoverable uranium resources,
- estimated grades and quantities of recoverable fossil fuel resources,
- estimated GHG emissions other than $CO_2$, including the conversion to $CO_2$ equivalents per unit of electric energy produced,
- performance of future fossil fuel power systems,
- projected capacity factors for alternatives means of generation, and
- current and potential future reactor technologies.

In addition, studies may vary with respect to whether all or parts of a power plant's lifecycle are analyzed (i.e., a full lifecycle analysis will typically address plant construction, operations, resource extraction—for fuel and construction materials, and decommissioning), whereas a partial lifecycle analysis primarily focuses on operational differences. In addition, as Sovacool (2008) noted, studies vary greatly in terms of age, data availability, and methodological transparency.

In the case of license renewal, a GHG analysis for the portion of the plant's lifecycle attributable to license renewal (operation for an additional 20 years) would not involve GHG emissions associated with construction because construction activities already have been completed at the time of relicensing. In addition, the proposed action of license renewal also would not involve additional GHG emissions associated with facility decommissioning because that decommissioning must occur whether the facility is relicensed or not. However, in many studies, the specific contribution of GHG emissions from construction, decommissioning, or other portions of a plant's lifecycle cannot be clearly separated from one another. In such cases, an analysis of GHG emissions would overestimate the GHG emissions attributed to a specific portion of a plant's lifecycle. As Sovacool (2008) noted, many of the available analyses provide markedly lower GHG emissions per unit of plant output when one assumes that a power plant operates for a longer period of time. Nonetheless, available studies supply some meaningful information on the relative magnitude of the emissions among nuclear power plants and other forms of electric generation, as discussed in the following sections.

In Tables 6–2, 6–3, and 6–4, the staff presents the results of the above-mentioned quantitative studies to supply a weight-of-evidence evaluation of the relative GHG emissions that may result from the proposed license renewal compared to the potential alternative use of coal-fired, natural gas-fired, and renewable generation. Most studies from Mortimer (1990) onward (through Sovacool 2008) indicate that uranium ore grades and uranium enrichment processes are leading determinants in the ultimate GHG emissions attributable to nuclear power generation. These studies show that the relatively lower order of magnitude of GHG emissions from nuclear power, when compared to fossil-fueled alternatives (especially natural gas), could potentially disappear if available uranium ore grades drop sufficiently while enrichment processes continued to rely on the same technologies.

Sovacool's synthesis of 19 existing studies found that nuclear power generation causes carbon emissions in a range of 1.4 grams of carbon equivalent per kilowatt-hour (g $C_{eq}$/kWh) to 288 g $C_{eq}$/kWh, with a mean value of 66 g $C_{eq}$/kWh. The results of his synthesis and the results of others' efforts are included in the tables in this section.

### *6.2.1.3. Summary of Nuclear Greenhouse Gas Emissions Compared to Coal*

Considering that coal fuels the largest share of electricity generation in the United States and that its burning results in the largest emissions of GHGs for any of the likely alternatives to nuclear power generation, including CGS, many of the available quantitative studies focused on comparing the relative GHG emissions of nuclear to coal-fired generation. The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle (and, in some cases, the nuclear lifecycle), as compared to an equivalent coal-fired plant, are presented in Table 6–2. The following table does not include all existing studies, but it gives an illustrative range of estimates that various sources have developed.

**Table 6–2. Nuclear Greenhouse Gas Emissions Compared to Coal**

| Source | GHG Emission Results |
|---|---|
| Mortimer (1990) | Nuclear—230,000 tons $CO_2$<br>Coal—5,912,000 tons $CO_2$<br>Note: Future GHG emissions from nuclear to increase because of declining ore grade. |
| Andseta et al. (1998) | Nuclear energy produces 1.4% of the GHG emissions compared to coal.<br>Note: Future reprocessing and use of nuclear-generated electrical power in the mining and enrichment steps are likely to change the projections of earlier authors, such as Mortimer (1990). |
| Spadaro (2000) | Nuclear—2.5–5.7 g $C_{eq}$/kWh<br>Coal—264–357 g $C_{eq}$/kWh |
| Storm van Leeuwen and Smith (2008) | Authors did not evaluate nuclear versus coal. |
| Fritsche (2006) (values estimated from graph in Figure 4) | Nuclear—33 g $C_{eq}$/kWh<br>Coal—950 g $C_{eq}$/kWh |
| POST (2006) (nuclear calculations from AEA, 2006) | Nuclear—5 g $C_{eq}$/kWh<br>Coal—>1,000 g $C_{eq}$/kWh<br>Note: Decrease of uranium ore grade to 0.03% would raise nuclear to 6.8 g $C_{eq}$/kWh. Future improved technology and carbon capture and storage could reduce coal-fired GHG emissions by 90%. |
| Weisser (2006) (compilation of results from other studies) | Nuclear—2.8–24 g $C_{eq}$/kWh<br>Coal—950–1,250 g $C_{eq}$/kWh |
| Fthenakis and Kim (2007) | Authors did not evaluate nuclear versus coal. |
| Dones (2007) | Author did not evaluate nuclear versus coal. |
| Sovacool (2008) | Nuclear—66 g Ceq/kWh<br>Coal —960 to 1,050 g Ceq/kWh<br>(coal adopted from Gagnon et al. 2002) |

#### *6.2.1.4. Summary of Nuclear Greenhouse Gas Emissions Compared to Natural Gas*

The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle (and, in some cases, the nuclear lifecycle), as compared to an equivalent natural gas-fired plant, are presented in Table 6–3. The following table does not include all existing studies, but it gives an illustrative range of estimates various sources have developed.

**Table 6–3. Nuclear Greenhouse Gas Emissions Compared to Natural Gas**

| Source | GHG Emission Results |
|---|---|
| Mortimer (1990) | Author did not evaluate nuclear versus natural gas. |
| Andseta et al. (1998) | Author did not evaluate nuclear versus natural gas. |
| Spadaro (2000) | Nuclear—2.5–5.7 g $C_{eq}$/kWh<br>Natural gas—120–188 g $C_{eq}$/kWh |
| Storm van Leeuwen and Smith (2008) | Nuclear fuel cycle produces 20–33% of the GHG emissions compared to natural gas (at high ore grades).<br>Note: Future nuclear GHG emissions will increase because of declining ore grade. |
| Fritsche (2006) (values estimated from graph in Figure 4) | Nuclear—33 g $C_{eq}$/kWh<br>Cogeneration combined cycle natural gas—150 g $C_{eq}$/kWh |
| POST (2006) (nuclear calculations from AEA, 2006) | Nuclear—5 g $C_{eq}$/kWh<br>Natural gas—500 g $C_{eq}$/kWh<br>Note: Decrease of uranium ore grade to 0.03% would raise nuclear to 6.8 g Ceq/kWh. Future improved technology and carbon capture and storage could reduce natural gas GHG emissions by 90%. |
| Weisser (2006) (compilation of results from other studies) | Nuclear—2.8–24 g $C_{eq}$/kWh<br>Natural gas—440–780 g $C_{eq}$/kWh |
| Fthenakis and Kim (2007) | Authors did not evaluate nuclear versus natural gas. |
| Dones (2007) | Author critiqued methods and assumptions of Storm van Leeuwen and Smith (2005), and concluded that the nuclear fuel cycle produces 15-27% of the GHG emissions of natural gas. |
| Sovacool (2008) | Nuclear—66 g Ceq/kWh<br>Natural gas—443 g Ceq/kWh<br>(natural gas adopted from Gagnon et al. 2002) |

#### *6.2.1.5. Summary of Nuclear Greenhouse Gas Emissions Compared to Renewable Energy Sources*

The quantitative estimates of the GHG emissions associated with the nuclear fuel cycle (and, in some cases, the nuclear lifecycle), as compared to equivalent renewable energy sources, are presented in Table 6–4. Calculation of GHG emissions associated with these sources is more difficult than the calculations for nuclear energy and fossil fuels because of the large variation in efficiencies and capacity factors because of their different technologies, sources, and locations. For example, the efficiency of solar and wind energy is highly dependent on the wind or solar resource in a particular location. Similarly, the range of GHG emissions estimates for hydropower varies greatly depending on the type of dam or reservoir involved (if used at all). Therefore, the GHG emissions estimates for these energy sources have a greater range of variability than the estimates for nuclear and fossil fuel sources. As noted in Section 6.2.1.2, the following table does not include all existing studies, but it gives an illustrative range of estimates various sources have developed.

**Table 6–4. Nuclear Greenhouse Gas Emissions Compared to Renewable Energy Sources**

| Source | GHG Emission Results |
|---|---|
| Mortimer (1990) | Nuclear—230,000 tons $CO_2$<br>Hydropower—78,000 tons $CO_2$<br>Wind power—54,000 tons $CO_2$<br>Tidal power—52,500 tons $CO_2$<br>Note: Future GHG emissions from nuclear are expected to increase because of declining ore grade. |
| Andseta et al. (1998) | Author did not evaluate nuclear versus renewable energy sources. |
| Spadaro (2000) | Nuclear—2.5–5.7 g $C_{eq}$/kWh<br>Solar PV—27.3–76.4 g $C_{eq}$/kWh<br>Hydroelectric—1.1–64.6 g $C_{eq}$/kWh<br>Biomass—8.4–16.6 g $C_{eq}$/kWh<br>Wind—2.5–13.1 g $C_{eq}$/kWh |
| Storm van Leeuwen and Smith (2008) | Author did not evaluate nuclear versus renewable energy sources. |
| Fritsche (2006) (values estimated from graph in Figure 4) | Nuclear—33 g $C_{eq}$/kWh<br>Solar PV—125 g $C_{eq}$/kWh<br>Hydroelectric—50 g $C_{eq}$/kWh<br>Wind—20 g $C_{eq}$/kWh |
| POST (2006) (nuclear calculations from AEA, 2006) | Nuclear—5 g $C_{eq}$/kWh<br>Biomass—25–93 g $C_{eq}$/kWh<br>Solar PV—35–58 g $C_{eq}$/kWh<br>Wave/Tidal—25–50 g $C_{eq}$/kWh<br>Hydroelectric—5–30 g $C_{eq}$/kWh<br>Wind—4.64–5.25 g $C_{eq}$/kWh<br>Note: Decrease of uranium ore grade to 0.03% would raise nuclear to 6.8 g $C_{eq}$/kWh. |
| Weisser (2006) (compilation of results from other studies) | Nuclear—2.8–24 g $C_{eq}$/kWh<br>Solar PV—43–73 g $C_{eq}$/kWh<br>Hydroelectric—1–34 g $C_{eq}$/kWh<br>Biomass—35–99 g $C_{eq}$/kWh<br>Wind—8–30 g $C_{eq}$/kWh |
| Fthenakis and Kim (2007) | Nuclear—16–55 g $C_{eq}$/kWh<br>Solar PV—17–49 g $C_{eq}$/kWh |
| Dones (2007) | Author did not evaluate nuclear versus renewable energy sources. |
| Sovacool (2008) (adopted from other studies) | Nuclear—66 g $C_{eq}$/kWh<br>Wind—9–10 g $C_{eq}$/kWh<br>Hydroelectric (small, distributed)—10–13 g $C_{eq}$/kWh<br>Biogas digester—11 g $C_{eq}$/kWh<br>Solar thermal—13 g $C_{eq}$/kWh<br>Biomass—14–35 g $C_{eq}$/kWh<br>Solar PV—32 g $C_{eq}$/kWh<br>Geothermal (hot, dry rock)—38 g $C_{eq}$/kWh<br>(solar PV value adopted from Fthenakis et al. 2008; all other renewable generation values adopted from Pehnt 2006) |

### 6.2.2. Conclusions: Relative Greenhouse Gas Emissions

The sampling of data presented in Tables 6–2, 6–3, and 6–4 demonstrates the challenges of any attempt to determine the specific amount of GHG emission attributable to nuclear energy production sources because different assumptions and calculation methods will yield differing results. The differences and complexities in these assumptions and analyses will further increase when they are used to project future GHG emissions. Nevertheless, several conclusions can be drawn from the information presented.

First, the various studies show a general consensus that nuclear power currently produces fewer GHG emissions than fossil-fuel-based electrical generation (e.g., GHG emissions from a complete nuclear fuel cycle currently range from 2.5–66 grams of carbon equivalent per kilowatt hour (g $C_{eq}$/kWh), as compared to the use of coal plants (264–1,250 g $C_{eq}$/kWh) and natural gas plants (120-780 g $C_{eq}$/kWh)). The studies also provide estimates of GHG emissions from five renewable energy sources based on current technology. These estimates included solar-photovoltaic (17–125 g $C_{eq}$/kWh), hydroelectric (1–64.6 g $C_{eq}$/kWh), biomass (8.4–99 g $C_{eq}$/kWh), wind (2.5–30 g $C_{eq}$/kWh), and tidal (25–50 g $C_{eq}$/kWh). The range of these estimates is wide, but the general conclusion is that current GHG emissions from nuclear power generation are of the same order of magnitude as from these renewable energy sources.

Second, the studies show no consensus on future relative GHG emissions from nuclear power and other sources of electricity. There is substantial disagreement among the various authors about the GHG emissions associated with declining uranium ore concentrations, future uranium enrichment methods, and other factors, including changes in technology. Similar disagreement exists about future GHG emissions associated with coal and natural gas for electricity generation. Even the most conservative studies conclude that the nuclear fuel cycle currently produces fewer GHG emissions than fossil-fuel-based sources and is expected to continue to do so in the near future. The primary difference between the authors is the projected cross-over date (the time at which GHG emissions from the nuclear fuel cycle exceed those of fossil-fuel-based sources) or whether cross-over will actually occur.

Considering current estimates and future uncertainties, it appears that GHG emissions associated with the proposed LGS relicensing action are likely to be lower than those associated with fossil-fuel–based energy sources. The staff bases this conclusion on the following rationale:

- As shown in Tables 6–2 and 6–3, current estimates of GHG emissions from the nuclear fuel cycle are far below those for fossil-fuel-based energy sources.
- License renewal of a nuclear power plant such as LGS may involve continued GHG emissions caused by uranium mining, processing, and enrichment, but will not result in increased GHG emissions associated with plant construction or decommissioning (since the plant will have to be decommissioned at some point whether the license is renewed or not).
- Few studies predict that nuclear fuel cycle emissions will exceed those of fossil fuels within a timeframe that includes the LGS periods of extended operation. Several studies suggest that future extraction and enrichment methods, the potential for higher-grade resource discovery, and technology improvements could extend this timeframe.

With respect to the comparison of GHG emissions among the proposed LGS license renewal action and renewable energy sources:

- It appears likely that there will be future technology improvements and changes in the type of energy used for mining, processing, manufacturing, and constructing facilities of all types.
- Currently, the GHG emissions associated with the nuclear fuel cycle and renewable energy sources are within the same order of magnitude.
- Because nuclear fuel production is the most significant contributor to possible future increases in GHG emissions from nuclear power—and since most renewable energy sources lack a fuel component—it is likely that GHG emissions from renewable energy sources will be lower than those associated with LGS at some point during the period of extended operation.

The staff provides additional discussion on the contribution of GHG to cumulative air quality impacts in Section 4.11.2 of this supplemental EIS.

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# 7.0 ENVIRONMENTAL IMPACTS OF DECOMMISSIONING

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in Supplement 1 of NUREG-0586, *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities Regarding the Decommissioning of Nuclear Power Reactors* (NRC 2002). The U.S. Nuclear Regulatory Commission (NRC) staff's evaluation of the environmental impacts of decommissioning—presented in NUREG–0586, Supplement 1—notes a range of impacts for each environmental issue.

Additionally, the incremental environmental impacts associated with decommissioning activities resulting from continued plant operation during the renewal term are discussed in NUREG-1437, *Generic Environmental Impact Statement* (GEIS) *for License Renewal of Nuclear* Plants (NRC 1996, 1999). The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues were then assigned a Category 1 or a Category 2 designation. Section 1.4 in Chapter 1 explains the criteria for Category 1 and Category 2 issues and defines the impact designations of SMALL, MODERATE, and LARGE. The NRC staff analyzed site-specific issues (Category 2) for Limerick Generating Station, Units 1 and 2 (LGS) and assigned them a significance level of SMALL, MODERATE, or LARGE, or not applicable to LGS because of site characteristics or plant features. There are no Category 2 issues related to decommissioning.

## 7.1. Decommissioning

Table 7–1 lists the Category 1 issues in Table B–1 of Title 10, Part 51 of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B that are applicable to LGS decommissioning following the renewal term.

**Table 7–1. Issues Related to Decommissioning**

| Issues | GEIS section | Category |
|---|---|---|
| Radiation doses | 7.3.1; 7.4 | 1 |
| Waste management | 7.3.2; 7.4 | 1 |
| Air quality | 7.3.3; 7.4 | 1 |
| Water quality | 7.3.4; 7.4 | 1 |
| Ecological resources | 7.3.5; 7.4 | 1 |
| Socioeconomic impacts | 7.3.7; 7.4 | 1 |

Decommissioning would occur either if LGS were shut down at the end of its current operating license or at the end of the period of extended operation. There are no site-specific issues related to decommissioning.

A brief description of the NRC staff's review and the GEIS conclusions, as codified in Table B-1 of 10 CFR Part 51, for each of the issues follows:

Radiation doses. Based on information in the GEIS, the NRC noted that "[d]oses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 person-rem (1 person-millisievert) caused by buildup of long-lived radionuclides during the license renewal term."

Waste management. Based on information in the GEIS, the NRC noted that "[d]ecommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected."

Air quality. Based on information in the GEIS, the NRC noted that "[a]ir quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term."

Water quality. Based on information in the GEIS, the NRC noted that "[t]he potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts."

Ecological resources. Based on information in the GEIS, the NRC noted that "[d]ecommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts."

Socioeconomic Impacts. Based on information in the GEIS, the NRC noted that "[d]ecommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth."

Exelon Generation Company, LLC (Exelon) stated in its environmental report (ER) (Exelon 2011) that it is not aware of any new and significant information on the environmental impacts of LGS license renewal. The NRC staff has not found any new and significant information during its independent review of Exelon's ER, the site visit, the scoping process, or its evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues, beyond those discussed in the GEIS. For all of these issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

## 7.2. References

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# 8.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The National Environmental Policy Act (NEPA) requires that Federal agencies consider reasonable alternatives to the proposed action in an environmental impact statement (EIS). In this case, the proposed action is the issuance of renewed licenses for the Limerick Generating Station (LGS), which will allow the plant to operate for 20 years beyond its current license expiration dates.

An operating license, however, is just one of a number of authorizations that an applicant must obtain to operate a nuclear plant. Energy-planning decisionmakers and owners of the nuclear power plant ultimately decide whether the plant will continue to operate, and economic and environmental considerations play important roles in this decision. In general, the U.S. Nuclear Regulatory Commission's (NRC's) responsibility is to ensure the safe operation of nuclear power facilities and not to formulate energy policy or encourage or discourage the development of alternative power generation.

The license renewal review process is designed to ensure safe operation of the nuclear power plant during the license renewal term. Under the NRC's environmental protection regulations in Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), which implement Section 102(2) of NEPA, renewal of a nuclear power plant operating license also requires the preparation of an EIS.

To support the preparation of these EISs, the NRC prepared the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG–1437, in 1996. The license renewal GEIS was prepared to assess the environmental impacts of continued nuclear power plant operations during the license renewal term. The intent was to determine which environmental impacts would result in essentially the same impact at all nuclear power plants and which ones could result in different levels of impacts at different plants and would require a plant-specific analysis to determine the impacts. For those issues that could not be generically addressed, the NRC develops a plant-specific supplemental environmental impact statement (SEIS) to the GEIS.

NRC regulations in 10 CFR 51.71(d) implementing NEPA for license renewal require that a SEIS must do the following:

> …include a preliminary analysis that considers and weighs the environmental effects of the proposed action [license renewal]; the environmental impacts of alternatives to the proposed action; and alternatives available for reducing or avoiding adverse environmental effects.

While the 1996 GEIS reached generic conclusions on many environmental issues associated with license renewal, it did not determine which alternatives are reasonable and did not reach conclusions about site-specific environmental impact levels. As such, the NRC must evaluate the environmental impacts of alternatives on a site-specific basis.

As stated in Chapter 1 of this document, alternatives to renewing the LGS operating licenses must meet the purpose and need for the proposed action; they must do the following:

> …provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet other future system generating needs, as such needs may be determined by State, utility, and where authorized, Federal (other than NRC) decision makers. (NRC 1996)

The NRC ultimately makes no decision about which alternative (or the proposed action) to carry out because that decision falls to utility, state, or other Federal officials. Comparing the environmental effects of these alternatives, however, will help the NRC decide whether the adverse environmental impacts of license renewal are so great as to deny the option of license renewal for energy-planning decisionmakers (10 CFR 51.95(c)(4)). If the NRC acts to issue a renewed license, then all of the alternatives considered in this SEIS, including the proposed action, will be available to energy-planning decisionmakers. If the NRC decides not to renew the license (or takes no action at all), then energy-planning decisionmakers may no longer elect to continue operating LGS and will have to resort to another alternative (or combination of alternatives)—which may or may not be one of the alternatives considered in this section—to meet the energy needs that LGS now satisfies.

In evaluating alternatives to license renewal, the NRC considered energy technologies or options currently in commercial operation, as well as some technologies not currently in commercial operation but likely to be commercially available by the time the current LGS operating licenses expire. The current operating licenses for LGS reactors will expire on October 26, 2024, and June 22, 2029, and reasonable alternatives must be available (constructed, permitted, and connected to the grid) by the time the current LGS licenses expire to be considered likely to become available.

**Alternatives Evaluated In-Depth:**

- natural-gas-fired combined-cycle (NGCC)
- supercritical pulverized coal (SCPC)
- new nuclear
- wind power
- purchased power

**Other Alternatives Considered:**

- solar power,
- combination alternative of wind, solar, and NGCC,
- combination alternative of wind and compressed-air energy storage (CAES),
- wood waste,
- conventional hydroelectric power,
- ocean wave and current energy,
- geothermal power,
- municipal solid waste (MSW),
- biofuels,
- oil-fired power,
- fuel cells,
- demand-side management (DSM), and
- delayed retirement.

Alternatives that cannot meet future system needs by providing amounts of baseload power equivalent to LGS's current generating capacity and, in some cases, those alternatives whose costs or benefits do not justify inclusion in the range of reasonable alternatives, were eliminated from detailed study. The staff evaluated the environmental impacts of the remaining alternatives and discusses them in depth in this chapter. Each alternative eliminated from detailed study is briefly discussed, and a basis for its removal is provided at the end of this section. In total, 18 alternatives to the proposed action were considered (see text box) and then narrowed to the 5 alternatives considered in Sections 8.1–8.5.

The 1996 GEIS presents an overview of some energy technologies but does not reach any conclusions about which alternatives are most appropriate. Since 1996, many energy technologies have evolved significantly in capability and cost while regulatory structures have changed to either promote or impede development of particular alternatives.

As a result, the analyses may include updated information from the following sources:

- Energy Information Administration (EIA),
- other offices within the U.S. Department of Energy (DOE),
- U.S. Environmental Protection Agency (EPA),
- industry sources and publications, and
- information submitted by Exelon Generation Company, LLC (Exelon) in its environmental report (ER).

The evaluation of each alternative considers the environmental impacts across several impact categories: air quality, groundwater use and quality, surface water use and quality, terrestrial ecology, aquatic ecology, human health, land use, socioeconomics, transportation, aesthetics, historic and archaeological resources, environmental justice, and waste management. A three-level standard of significance—SMALL, MODERATE, or LARGE—is used to indicate the intensity of environmental effects for each alternative undergoing in-depth evaluation. The order of presentation is not meant to imply increasing or decreasing level of impact. Nor does it imply that an energy-planning decisionmaker would be more likely to select any given alternative.

In some cases, the NRC considers the environmental effects of locating a replacement power alternative at the existing nuclear plant site. Selecting the existing plant site allows for the maximum use of existing transmission and cooling system infrastructures and minimizes the overall environmental impact. However, LGS does not have a sufficient amount of land available for all the replacement power alternatives because LGS would continue to operate while the replacement alternative is being built to prevent a gap in energy generation during the period of construction, which would take several years. As a result, the NRC evaluated the impacts of locating replacement power facilities at other existing power plant sites within the PJM Interconnection (PJM). Installing replacement power facilities at existing power plants and connecting to existing transmission and cooling system infrastructure would reduce the overall environmental impact.

To ensure that the alternatives analysis is consistent with state or regional energy policies, the NRC reviewed energy-related statutes, regulations, and policies within the Commonwealth of Pennsylvania and PJM, including, for example, state renewable portfolio standards (RPSs). As a result, the staff considers several alternatives that include wind power or solar photovoltaic power, as well as combinations that include them.

Exelon is wholly-owned by Exelon Corporation, which also owns companies that provide electric transmission, power marketing, and energy delivery. Exelon Generation does not directly serve any customers, but sells its output through existing markets, and in particular, through PJM.

The NRC considered the current generation capacity and electricity production within the Commonwealth of Pennsylvania, as well as, where pertinent, the territory covered by PJM. Pennsylvania is similar to the U.S. average in reliance on coal, natural gas, and nuclear power as its primary electric generation fuels. Pennsylvania is slightly more reliant on coal, less reliant on natural gas, and more reliant on nuclear power than the U.S. average. Pennsylvania diverged most from national averages in renewable generation. Pennsylvania hydropower and other renewables provided 2.8 percent of electricity in the Commonwealth compared to 10.4 percent nationwide (EIA 2012).

Pennsylvania is one of the nation’s top generators of electricity and a net exporter of power. While the staff generally considers alternatives located within Pennsylvania, it acknowledges that alternatives could also be located elsewhere in PJM.

The Commonwealth of Pennsylvania has established an alternative energy portfolio standard (AEPS, similar to a renewable portfolio standard) that requires electricity providers to obtain a minimum percentage of their power through renewable energy resources, energy efficiency measures, or one of several nonconventional coal-fired or natural-gas-fired alternatives, including waste coal, coal-mine methane, coal gasification, and combined-heat-and-power generation. The AEPS also includes a solar-power set-aside. Pennsylvania first adopted the AEPS requirement in 2004. It currently requires 18 percent of all electricity sold in the Commonwealth to come from qualifying sources by 2020–2021. The standard allows renewable energy credit trading within PJM (DSIRE 2011). Other states in PJM also have similar policies, which typically take the form of binding standards. Some, however, have implemented non-binding goals, as Virginia has done.

Sections 8.1–8.7 describe the environmental impacts of alternatives to license renewal. These include a natural gas combined-cycle (NGCC) in Section 8.1; a supercritical pulverized coal (SCPC) alternative in Section 8.2; a new nuclear alternative in Section 8.3; and a wind-power alternative in Section 8.4. A summary of these alternatives considered in depth is provided in Table 8-1. In Section 8.5, the staff discusses purchased power as an alternative, and in Section 8.6, the staff addresses alternatives considered but dismissed. Finally, the environmental effects that may occur if NRC takes no action and does not issue renewed licenses for LGS are described in Section 8.7. Section 8.8 summarizes the impacts of each of the alternatives considered.

**Table 8–1. Summary of Alternatives Considered In Depth**

| | Natural Gas (NGCC) Alternative | Supercritical Pulverized Coal (SCPC) Alternative | New Nuclear Alternative | Wind Alternative |
|---|---|---|---|---|
| Summary of Alternative | Four 530-MW units, for a total of 2,120 MW | Two to four SCPC Units, for a total of 2,120 MW | Two unit nuclear plant | 2,250 to 9,000 2-MW wind turbines, for a total of 4,500 to 18,000 MW |
| Location | An existing power plant site (other than LGS) in PJM. Some infrastructure upgrades may be required; would require construction of a new or upgraded pipeline. | An existing power plant site (other than LGS) in PJM. Some infrastructure upgrades may be required. | An existing nuclear plant site (other than LGS) in PJM. Some infrastructure upgrades may be required. | Spread across multiple sites throughout PJM. |
| Cooling System | Closed-cycle with mechanical-draft cooling towers. Consumptive water use would be approximately 1/3 less than LGS. | Closed-cycle with natural-draft cooling towers. Consumptive water use would be slightly less than LGS. | Closed-cycle with natural-draft cooling towers. Consumptive water use would be similar to LGS. | N/A |
| Land Requirements | 35 ac (14 ha) for the plant (Exelon 2011); 7,630 ac (3,090 ha) for wells, collection site, pipeline (NRC 1996) | 280 ac (113 ha) for the plant (Exelon 2011); 49,600 ac (20,100 ha) for coal mining and waste disposal (NRC 1996); 464 ac (188 ha) for ash and scrubber sludge (Exelon 2011) | 630 ac to 1,260 ac (255 ha to 510 ha) (Exelon 2011); 1,000 ac (400 ha) for uranium mining and processing (NRC 1996) | Wind farms would be spread across 130,000 to 534,000 ac (53,000 to 216,000 ha) of land, but only 3,200 to 13,300 ac (1,300 to 5,400 ha), would be directly affected by the wind turbines (Exelon 2011, NREL 2009) |
| Work Force | 800 during construction; 45 during operations (Exelon 2011) | 2,500 during construction; 141 during operations (Exelon 2011) | 3,650 during construction; 820 during operations (Exelon 2011) | 200 during construction; 50 during operations (Exelon 2011) |

## 8.1 Natural Gas Combined-Cycle Alternative

Natural gas combined-cycle (NGCC) systems represent the large majority of the total number of plants currently under construction or planned in the United States. Factors that contribute to the popularity of NGCC facilities include high capacity factors, low relative construction costs, low gas prices, and relatively low air emissions. Development of new NGCC plants may be affected by uncertainties about the continued availability and price of natural gas (though less so than in the recent past) and future regulations that may limit greenhouse gas (GHG) emissions. A gas-fired power plant, however, produces markedly fewer GHGs per unit of electrical output than a coal-fired plant of the same electrical output.

Combined-cycle power plants differ significantly from most coal fired and all existing nuclear power plants. Combined-cycle plants derive the majority of their electrical output from a gas turbine and then generate additional power—without burning any additional fuel—through a second, steam turbine cycle. The exhaust gas from the gas turbine is still hot enough to boil water to steam. Ducts carry the hot exhaust to a heat recovery steam generator, which produces steam to drive a steam turbine and produce additional electrical power. The combined-cycle approach is significantly more efficient than any one cycle on its own; thermal efficiency can exceed 60 percent versus 38 percent for conventional single-cycle facilities (NETL 2007, Siemens 2007). In addition, because the natural gas-fired alternative derives much of its power from a gas-turbine cycle, and because it wastes less heat than the existing LGS unit, it requires significantly less cooling water.

While nuclear reactors, on average, operate with capacity factors above 90 percent (LGS Units 1 and 2 operated at 97 percent and 96 percent capacity factors, respectively, from 2003 to 2010 [NRC 2011]), the staff expects that an NGCC alternative would operate with roughly an 85 percent capacity factor. Nonetheless, the staff assumes that a similar-sized NGCC facility would be capable of providing adequate replacement power for the purposes of this NEPA analysis.

Typical power trains for large-scale NGCC power generation would involve one, two, or three combined-cycle units, available in a variety of standard sizes, mated to a heat-recovery steam generator. To complete the assessment of an NGCC alternative, the NRC presumes that appropriately sized units could be assembled to annually produce electrical power in amounts equivalent to LGS. For purposes of this review, the staff evaluated an alternative that consists of four General Electric (GE) Advanced F Class units, 530 MW(e) each, equipped with dry-low-nitrogen-oxide combustors to suppress nitrogen oxide formation and selective catalytic reduction (SCR) of the exhaust with ammonia for post-combustion control of nitrogen oxide emissions. This alternative provides 2,120 MW(e) of capacity, and thus slightly underestimates the potential environmental impacts of replacing the full 2,340 MW(e) produced by LGS.

While siting an alternative on the LGS site would allow for the fullest use of existing ancillary infrastructure, such as transmission and support buildings, and minimizes the use of undisturbed land, space constraints on the LGS site preclude that option. In its ER, Exelon proposed that the NGCC alternative could be constructed at another existing power plant site elsewhere in Pennsylvania or PJM, which would mitigate construction impacts in a similar way to building the alternative at the LGS site (Exelon 2011). The staff finds this to be a reasonable approach and adopts it for purposes of this analysis. It is possible that an NGCC alternative constructed at an existing power plant site would require some infrastructure upgrades, such as improved transmission lines or modifications to existing intake or cooling systems, but the staff expects that these impacts would be smaller than those necessary to support an NGCC alternative constructed on an undeveloped site.

Wherever the NGCC alternative is constructed, it is likely to require a new or upgraded pipeline to supply natural gas to the facility. Some of the natural gas supplied to this alternative is likely to come from Pennsylvania or neighboring states, but the NGCC alternative is unlikely to directly trigger new natural gas development in Pennsylvania or the region.

NGCC power plants are feasible, commercially available options for providing electric generating capacity beyond the current LGS license expiration dates. Environmental impacts from the NGCC alternative are summarized in Table 8–2 and discussed in depth in Sections 8.1.1–8.1.9.

### 8.1.1. Air Quality

As discussed in Section 2.2.2.1, the LGS site is located in Montgomery and Chester Counties, Pennsylvania, which is part of the Metropolitan Philadelphia Interstate Air Quality Control Region (AQCR, 40 CFR 81.15). With regard to the National Ambient Air Quality Standards (NAAQS), EPA has designated Montgomery and Chester Counties as unclassified or in attainment for carbon monoxide (CO), lead, sulfur dioxide ($SO_2$), and $PM_{10}$ (particulate matter 10 microns or less in diameter) and nonattainment for ozone and $PM_{2.5}$ (particulate matter 2.5 microns or less in diameter) (40 CFR 81.339).

A new NGCC generating plant would qualify as a new major-emitting industrial facility and would be subject to Prevention of Significant Deterioration (PSD) under requirements of the Clean Air Act (CAA) (EPA 2012a). The Pennsylvania Department of Environmental Protection (PADEP) has adopted 25 Pa. Code Chapter 127, which implements the EPA's PSD review. The NGCC plant would need to comply with the standards of performance for stationary combustion turbines set forth in 40 CFR Part 60 Subpart KKKK.

Subpart P of 40 CFR Part 51.307 contains the visibility protection regulatory requirements, including review of the new sources that may affect visibility in any Federal Class I area. If an NGCC alternative was located close to a mandatory Class I area, additional air pollution control requirements would be required. As noted in Section 2.2.2.1, there are no mandatory Class I Federal areas within 50 miles (80 km) of the LGS site. However, there are a total of 13 designated Class 1 Federal areas (40 CFR 81) located in the following PJM states: Kentucky, Michigan, New Jersey, North Carolina, Tennessee, Virginia, and West Virginia.

A new NGCC plant would have to comply with Title IV of the CAA (42 USC §7651) reduction requirements for sulfur dioxides ($SO_2$) and nitrogen oxides ($NO_x$), which are the main precursors of acid rain and the major causes of reduced visibility. Title IV establishes maximum $SO_2$ and $NO_x$ emission rates from the existing plants and a system of $SO_2$ emission allowances that can be used, sold, or saved for future use by the new plants.

More recently, EPA has promulgated additional rules and requirements that apply to certain fossil-fuel-based power plants, such as NGCC generation. The Cross-State Air Pollution Rule (CSAPR) and the Prevention of Significant Deterioration and Title V Greenhouse Gas (GHG) Tailoring Rule impose several additional standards to limit ozone, particulate, and GHG emissions from fossil-fuel based power plants (EPA 2012c). A new NGCC plant would be subject to these additional rules and regulations.

The EPA has developed standard emission factors that relate the quantity of released air pollutants to a variety of regulated activities (EPA 2012b). Using these emission factors, the staff projects the following air emissions for the NGCC alternative:

- sulfur oxides ($SO_x$) – 167 tons (151 MT) per year,
- nitrogen oxides ($NO_x$) – 485 tons (440 MT) per year,
- carbon monoxide (CO) – 735 tons (667 MT) per year,
- $PM_{10}$ and $PM_{2.5}$– 323 tons (293 MT) per year, and
- carbon dioxide ($CO_2$) – 5,390,097 tons (4,889,896 MT) per year

Activities associated with the construction of the new NGCC plant on or off the LGS site would cause some additional, temporary air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material-handling equipment. Emissions from workers' vehicles and motorized construction equipment exhaust would be temporary. The construction crews would use dust-control practices to control and reduce fugitive dust. The staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of the earth-moving and material-handling equipment would be SMALL.

*Greenhouse Gas Emissions*

Combustion of fossil fuels, including natural gas, is the greatest anthropogenic source of GHG emissions in the United States. Greenhouse gas emissions during construction of an NGCC alternative would result primarily from the consumption of fossil fuels in the engines of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. Analogous impacts would occur in association with offsite pipeline construction. All such impacts, however, would be temporary.

Although natural gas combustion in the combustion turbines (CTs) would be the primary source of GHGs during operations, other miscellaneous ancillary sources such as truck and rail deliveries of materials to the site and commuting of the workforce would make minor contributions.

The National Energy Technology Laboratory (NETL) estimates that carbon capture and storage (CCS) will capture and remove as much as 90 percent of the $CO_2$ from the exhausts of CTs, but it will result in a power production capacity decrease of approximately 14 percent, a reduction in net overall thermal efficiency of the CTs studied from 50.8 percent to 43.7 percent, and a potential increase in the levelized cost of electricity produced in NGCC units so equipped by as much as 30 percent (NETL 2007). Further, permanent sequestering of the $CO_2$ would involve removing impurities (including water) and pressurizing it to meet pipeline specifications and transferring the gas by pipeline to acceptable geologic formations. Even when opportunities exist to use the $CO_2$ for enhanced oil recovery (rather than simply dispose of the $CO_2$ in geologic formations), permanent disposal costs could be substantial, especially if the NGCC units are far removed from acceptable geologic formations. With CCS in place, the NGCC alternative would release 539,000 tons per year (489,000 MT) of $CO_2$. Without CCS in place, the staff's projected CO2 emissions for the NGCC alternative would be 5,390,097 tons (4,889,896 MT) per year.

Given the expected relatively small workforce, relatively short construction period for both the NGCC facility and the pipeline, and $CO_2$ emissions of operation for the NGCC alternative, the overall impact from the releases of GHGs of a natural gas-fired alternative would be SMALL to MODERATE.

*Conclusion*

Based on the above review, the overall air quality impacts of a new NGCC plant located at the LGS site are SMALL to MODERATE and based largely on operational impacts.

### 8.1.2. Groundwater Resources

Construction activities associated with the NGCC alternative could require groundwater dewatering of foundation excavations. This activity might require the use of cofferdams, sumps, wells, or other methods to address high water-table conditions. However, because of the relatively shallower depth of excavation for the NGCC plant as compared to other alternatives, any impacts would be expected to be minor at most sites; however, dewatering needs could be greater at some sites. Facility construction would increase the amount of impervious surface at the site location as well as alter the subsurface strata because of excavation work and the placement of backfill following facility completion. While an increase in impervious surface would reduce infiltration and reduce groundwater recharge, the effects on water-table elevations at most sites would likely be very small. Below-grade portions of the new NGCC plant could also alter the direction of groundwater flow beneath a site. Such effects would likely be very localized at most site locations and would not be expected to affect offsite wells. Application of best management practices (BMPs) in accordance with a state-issued NPDES general permit, including appropriate waste management, water discharge, and spill prevention practices, would prevent or minimize any groundwater quality impacts during construction.

For the construction period, the NRC has conservatively assumed that groundwater would be used. However, it is more likely that water would be supplied via a temporary utility connection, if available, or trucked to the point of use from offsite sources. Regardless, groundwater use for construction of a new NGCC plant would be substantially less than the volume required for the coal-fired or nuclear alternatives because of the smaller footprint involved for excavation, earthwork, and structural work. This would encompass such uses as potable and sanitary uses, concrete production, dust suppression, and soil compaction. The workforce at the NGCC would be slightly smaller than the existing LGS workforce, which uses substantially less than 100 gpm (380 L/min) for both potable water supply and fire suppression uses. The GEIS has found that pumping rates of less than 100 gpm (380 L/min) have not been shown to adversely affect groundwater availability (NRC 1996).

For NGCC plant operations, the NRC assumed that the NGCC alternative would entail the same relative ratio of groundwater use to surface water use as that used at LGS Units 1 and 2. This includes the use of groundwater for service water makeup and potable and sanitary uses. Consequently, the staff expects that total groundwater usage and associated aquifer effects would be much less under this alternative than those under current LGS operations because of the smaller number of auxiliary systems requiring groundwater and the much smaller operational workforce under the NGCC alternative. Based on this assessment, the impacts on groundwater use and quality under the NGCC alternative would be SMALL.

### 8.1.3. Surface Water Resources

Construction activities associated with the NGCC alternative would be similar to construction activities for most large industrial facilities. A new NGCC plant would occupy a much smaller footprint (about 35 ac [14 ha]) than the current LGS or the proposed coal-fired or new nuclear alternatives. This would also result in less extensive excavation and earthwork than under either of the other conventional replacement power facility alternatives. The staff assumes that no surface water would be used during construction for the NGCC alternative because the staff assumed groundwater would be used or water would be supplied by a water utility or trucked in, as explained above in Section 8.1.2.

Some temporary impacts to surface water quality may result from increased sediment loading and from any pollutants in stormwater runoff from disturbed areas and from dredging activities. During facility construction, runoff from disturbed areas in the plant footprint would be controlled under a state-issued NPDES general permit that would require implementation of a stormwater pollution prevention plan and associated BMPs to prevent or significantly mitigate soil erosion and contamination of stormwater runoff. Depending on the path of the gas pipeline to supply the NGCC plant, some creeks and streams would likely be crossed. However, because of the short-term nature of the dredging activities, the hydrologic alterations and sedimentation would be localized and temporary. In addition, modern pipeline construction techniques, such as horizontal directional drilling, would further minimize the potential for water quality impacts in the affected streams. Dredging would be conducted under a permit from the U.S. Army Corps of Engineers (COE) requiring the implementation of BMPs to minimize impacts.

For facility operations, the NGCC alternative would require much less cooling water than LGS Units 1 and 2, and consumptive water use would be much less. Assuming a typical ratio of 2 to 1 for electrical generation from gas turbine (Brayton cycle) to electrical generation from steam turbine (Rankine cycle) for a combined-cycle plant, the staff estimated that the consumptive water loss for an equivalent-sized combined-cycle plant would be about one-third the LGS water use. For the purposes of comparison, and as described in Section 2.2.4.1, the mean annual flow and 90 percent exceedance flows of the Schuylkill River are 1,935 cfs (54.8 $m^3$/s) and 482 cfs (13.6 $m^3$/s), respectively. At the mean annual flow and the 90 percent exceedance flow, the projected rate of consumptive water use for the NGCC plant (i.e., 22 cfs [0.62 $m^3$/s]) represents a 1 percent and a 4 percent reduction in the streamflow in the Schuylkill River downstream of the NGCC alternative location, if sited at or near the LGS site. This reduced demand for water would substantially reduce the need for low-flow augmentation from either the Delaware River or the Wadesville Mine Pool. Effects may vary at other sites, but the net consumption of water would be less than that associated with existing LGS operations.

The NRC assumed that water treatment additives for the NGCC alternative would be essentially identical to LGS because similar additives are required for water conditioning to operate NGCC and nuclear plants. The NRC also assumed that the proposed site's existing intake and discharge infrastructure would be used, as described above. While the quality would be chemically similar, the discharge volume would be about one-third less than current LGS operations. Surface water withdrawals would be subject to applicable water allocation requirements in Pennsylvania and other states, and effluent discharges and stormwater discharges associated with industrial activity would be subject to a state-issued NPDES permit under this alternative. The NRC also assumes that facility operations would be subject to and would be conducted in accordance with a spill prevention, control, and countermeasures (SPCC) plan, stormwater pollution prevention plan, or equivalent plans and associated BMPs and procedures to prevent and respond to accidental releases of non-nuclear fuels, chemicals, and other materials to soil, surface water, and groundwater.

Therefore, based on the above assessment, the impacts on surface water use and quality under the NGCC alternative would be SMALL.

### 8.1.4. Aquatic Resources

Construction activities for the NGCC alternative (such as construction of heavy-haul roads, a new pipeline, and the power block) could affect drainage areas or other onsite aquatic features. Minimal impacts on aquatic ecology resources are expected because the plant operator would likely implement BMPs to minimize erosion and sedimentation. Stormwater control measures, which would be required to comply with Pennsylvania NPDES permitting, would minimize the flow of disturbed soils into aquatic features. Depending on the available infrastructure at the selected site, the NGCC alternative may require modification or expansion of the existing intake or discharge structures. Because of the relatively low withdrawal rates compared to the SCPC or new nuclear alternatives, it is unlikely that the operators would need to construct new intake and discharge structures for the NGCC alternative at an existing power plant site. Dredging activities that result from infrastructure construction would require BMPs for in-water work to minimize sedimentation and erosion. Because of the short-term nature of the dredging activities, the hydrological alterations to aquatic habitats likely would be localized and temporary.

During operations, the NGCC alternative would require approximately one-third less cooling water to be withdrawn from the Schuylkill River, or other similar water body, than required for LGS Units 1 and 2. Because of the lower withdrawal rates, the number of fish and other aquatic resources affected by cooling-water intake and discharge operations, such as entrainment, impingement, and thermal stress, would be less for an NGCC alternative than for those associated with license renewal. The cooling system for a new NGCC plant would have similar chemical discharges as LGS, but the air emissions from the NGCC plant would emit particulates that could settle onto the river surface and introduce a new source of pollutants as described in Section 8.1.1. However, the flow of the Schuylkill River (or other water source) would likely dissipate and dilute the concentration of pollutants, resulting in minimal exposure to aquatic biota.

The impacts on aquatic ecology would be minor because construction activities would require BMPs and stormwater management permits, and because surface water withdrawal and discharge for this alternative would be less than for LGS Units 1 and 2. Deposition of pollutants into aquatic habitats from the plant's air emissions would be minimal because the concentration of pollutants would be diluted with the river flow. Therefore, the staff concluded that impacts on aquatic ecology would be SMALL.

Consultation with National Marine Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (FWS) under the Endangered Species Act (ESA) would ensure that the construction and operation of an NGCC plant would not adversely affect any Federally listed species or adversely modify or destroy designated critical habitat. Consultation with NMFS under the Magnuson-Stevens Act would require the NRC to evaluate impacts to essential fish habitat (EFH). NMFS would provide conservation recommendations if there would be adverse impacts to EFH. Coordination with state natural resource agencies would further ensure that the plant operator would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of an NGCC plant on protected species and habitats would be SMALL.

### 8.1.5. Terrestrial Resources

Construction of an NGCC plant would occur at the site of an existing power station other than LGS and would require about 35 ac (14 ha) of land for the plant itself and about 7,630 ac (3,090 ha) of additional land off site for wells, collection stations, and pipelines to bring the gas to the plant (see Section 8.1.7). Because the onsite land requirement is relatively small, Exelon would likely be able to site most of the construction footprint in previously disturbed, degraded habitat, which would minimize impacts to terrestrial habitats and species. Offsite construction would occur mostly on land where gas extraction is occurring already. To the extent practicable, Exelon would route gas pipelines along existing, previously disturbed utility corridors (Exelon 2011). Erosion and sedimentation, fugitive dust, and construction debris impacts would be minor with implementation of appropriate BMPs (Exelon 2011). Impacts to terrestrial habitats and species from transmission line operation and corridor vegetation maintenance, and operation of the mechanical draft cooling towers would be similar in magnitude and intensity as those resulting from operating nuclear reactors and would, therefore, be SMALL (NRC 1996). Overall, the impacts of construction and operation of an NGCC plant to terrestrial habitats and species would be SMALL.

Consultation with FWS under the ESA would ensure that the construction and operation of an NGCC plant would not adversely affect any Federally listed terrestrial species or adversely modify or destroy designated critical habitat. Coordination with state natural resource agencies would further ensure that Exelon would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of an NGCC plant on protected species and habitats would be SMALL.

### 8.1.6. Human Health

Impacts on human health from construction of the NGCC alternative would be similar to effects associated with the construction of any major industrial facility. Compliance with worker protection rules would control those impacts on workers at acceptable levels. Impacts from construction on the general public would be minimal since crews would limit active construction area access to authorized individuals. Impacts on human health from the construction of the NGCC alternative would be SMALL.

Human health effects of gas-fired generation are generally low, although in Table 8–2 of the GEIS (NRC 1996), the staff identified cancer and emphysema as potential health risks from gas-fired plants. Nitrogen oxide emissions contribute to ozone formation, which in turn contributes to human health risks. Emission controls for the NGCC alternative can be expected to maintain $NO_x$ emissions well below air quality standards established for the purposes of protecting human health, and emissions trading or offset requirements mean that overall $NO_x$ releases in the region will not increase. Health risks for workers may also result from handling spent catalysts used for $NO_x$ control that may contain heavy metals. Impacts on human health from the operation of the NGCC alternative would be SMALL.

### 8.1.7. Land Use

The GEIS generically evaluates the impacts of constructing and operating various replacement power plant alternatives on land use, both on and off each power plant site. The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a four-unit NGCC plant at the LGS site. Locating the new NGCC power plant near an existing power plant site would maximize the availability of support infrastructure and reduce the need for additional land.

Exelon estimated 35 ac (14 ha) for new unit construction (Exelon 2011). Based on GEIS estimates, approximately 243 ac (98.3 ha) of land would be needed to support an NGCC alternative to replace the LGS (NRC 1996). This amount of land use would include other plant structures and associated infrastructure and is unlikely to exceed the 243 ac (98.3 ha) estimate, excluding land for natural-gas wells and collection stations. Exelon's estimate appears reasonable and is a more site-specific estimate than the GEIS estimate. Depending on the site location and availability of existing natural gas pipelines, a 100-feet (ft)-wide (30.5-meter [m]-wide) right-of-way would be needed for a new pipeline. Land-use impacts from NGCC construction would be SMALL to MODERATE depending on location.

In addition to onsite land requirements, land would be required off site for natural-gas wells and collection stations. Scaling from GEIS (NRC 1996) estimates, approximately 7,630 ac (3,090 ha) would be required for wells, collection stations, and pipelines to bring the gas to the plant. Most of this land requirement would occur on land where gas extraction already occurs. Some natural gas could come from within Pennsylvania or nearby states.

The elimination of uranium fuel for LGS could partially offset some, but not all, of the land requirements for the NGCC. Scaling from GEIS (NRC 1996) estimates, approximately 1,640 ac (664 ha) would no longer be needed for mining and processing uranium during the operating life of the plant. Operational land-use impacts from a NGCC power plant would be SMALL.

### 8.1.8. Socioeconomics

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the construction and operation of a power plant could affect regional employment, income, and expenditures. Two types of jobs would be created by this alternative: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) power plant operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements for the construction and operation of the NGCC alternative were evaluated to measure their possible effects on current socioeconomic conditions.

Scaling from GEIS estimates, the construction workforce would peak at 2,650 workers. Exelon estimated 800 workers at the peak of construction (Exelon 2011). Exelon's estimate appears to be reasonable and is consistent with trends toward lowering labor costs by reducing the size of plant workforces. Therefore, Exelon's estimate of 800 workers is used throughout this analysis. The relative economic impact of this many workers on the local economy and tax base would vary, with the greatest impacts occurring in the communities where the majority of construction workers would reside and spend their income. As a result, local communities could experience a short-term economic "boom" from increased tax revenue and income generated by construction expenditures and the increased demand for temporary (rental) housing and business services. Some construction workers could relocate in order to be closer to the construction work site. However, given the proximity of many existing power plants to metropolitan areas, workers could commute to the construction site, thereby reducing the need for rental housing.

After completing the installation of the four-unit NGCC plant, local communities could experience a return to pre-construction economic conditions. Based on this information and given the number of construction workers, socioeconomic impacts during construction in communities near the new NGCC site could range from SMALL to MODERATE.

Scaling from GEIS estimates, the plant operations workforce would be 331 workers. Exelon estimated a plant operations workforce of approximately 45 workers (Exelon 2011). Exelon's estimate appears to be reasonable and is consistent with trends toward lowering labor costs by reducing the size of plant operations workforces. Therefore, Exelon's estimate of 45 workers is used throughout this analysis. The reduction in employment at LGS from operations to decommissioning and shut down could affect property tax revenue and income in local communities and businesses. In addition, the permanent housing market could also experience increased vacancies and decreased prices if operations workers and their families move out of the region. However, the amount of property taxes paid to local jurisdictions under the NGCC alternative may increase if additional land is required to support this alternative. Based on the above discussion, socioeconomic impacts during operations could range from SMALL to MODERATE.

### 8.1.9. Transportation

Transportation impacts associated with construction and operation of a four-unit, NGCC power plant would consist of commuting workers and truck deliveries of construction materials to the power plant site. During periods of peak construction activity, up to 800 workers could be commuting daily to the site (Exelon 2011), as described in Section 8.1.8. Workers commuting to the construction site would arrive by site access roads, and the volume of traffic on nearby roads could increase substantially during shift changes. In addition to commuting workers, trucks would be transporting construction materials and equipment to the worksite, thus increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary levels of service impacts and delays at intersections. Pipeline construction and modification to existing natural gas pipeline systems could also have a temporary impact. Some power plant components and materials could also be delivered by train or barge, depending on location. Train deliveries could cause additional traffic delays at railroad crossings. Based on this information, traffic-related transportation impacts during construction could range from SMALL to MODERATE.

Traffic-related transportation impacts would be greatly reduced after completing the installation of the new NGCC units. Transportation impacts would include daily commuting by the operating workforce, equipment and materials deliveries, and the removal of commercial waste material to offsite disposal or recycling facilities by truck. The NGCC alternative is estimated to require an operational workforce of 45 (Exelon 2011), as described in Section 8.1.8. Since fuel is transported by pipeline, the transportation infrastructure would experience little to no increased traffic from plant operations. Overall, transportation impacts would be SMALL during power plant operations.

### 8.1.10. Aesthetics

The analysis of aesthetic impacts focuses on the degree of contrast between the NGCC alternative and the surrounding landscape and the visibility of the new NGCC plant at an existing power plant site. During construction, all of the clearing and excavation would occur on the existing power plant site. These activities could be visible from offsite roads. Since the existing power plant site would already appear industrial, construction of the NGCC power plant would appear similar to other ongoing onsite activities. The power block of the NGCC alternative could look similar to the existing power plant.

The four NGCC units could be approximately 100 ft (30 m) tall, with two exhaust stacks up to 150 ft (46 m) tall with two cooling towers over 500 ft (152 m) high (Exelon 2011). The facility would be visible off site during daylight hours, and some structures may require aircraft warning lights. The addition of mechanical draft cooling towers and associated condensate plumes could add to the visual impact. Noise generated during NGCC power plant operations would be limited to routine industrial processes and communications. Pipelines delivering natural gas fuel could be audible offsite near gas compressor stations.

In general, given the industrial appearance of the existing power plant site, the new NGCC power plant would blend in with the surroundings and the NGCC power plant could be similar in appearance to the existing power plant. Aesthetic changes therefore would be limited to the immediate vicinity of the existing power plant site, and any impacts would be SMALL depending on its location and surroundings.

### 8.1.11. Historic and Archaeological Resources

To consider effects on historic and archaeological resources, any areas potentially affected by the construction of the NGCC alternative would need to be surveyed to identify and record historic and archaeological resources. An inventory of a previously disturbed former plant (brownfield) site may still be necessary if the site has not been previously surveyed or to verify the level of disturbance and evaluate the potential for intact subsurface resources. Plant operators would need to survey all areas associated with operation of the alternative (e.g., a new pipeline, roads, transmission corridors, other ROWs). Any resources found in these surveys would need to be evaluated for eligibility on the National Register of Historic Properties (NRHP), and mitigation of adverse effects would need to be addressed if eligible resources were encountered. Areas with the greatest sensitivity should be avoided. Visual impacts on significant cultural resources—such as the viewsheds of historic properties near the site—also should be assessed.

The potential for impacts on historic and archaeological resources from the NGCC alternative would vary greatly depending on the location of the proposed site. Given that the preference is to use a previously disturbed former plant site, avoidance of significant historic and archaeological resources should be possible and effectively managed under current laws and regulations. However, historic and archaeological resources could potentially be affected, depending on the resource richness of the land required for a new pipeline. Therefore, the impacts on historic and archaeological resources from the NGCC alternative would range from SMALL to MODERATE.

### 8.1.12. Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health, environmental, and socioeconomic effects on minority and low-income populations that could result from the construction and operation of a new power plant. Minority and low-income populations are subsets of the general public living near the proposed power plant site.

Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. For example, increased demand for rental housing during replacement power plant construction could disproportionately affect low-income populations that rely on the previously inexpensive rental housing market.

Potential impacts to minority and low-income populations would mostly consist of environmental and socioeconomic effects during construction (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be directly affected by increased commuter vehicle and truck traffic. However, because of the temporary nature of construction, these effects are not likely to be high and adverse and would be contained to a limited time period during certain hours of the day. Increased demand for rental housing during construction could cause rental costs to rise disproportionately affecting low-income populations living near the site who rely on inexpensive housing. However, given the proximity of some existing power plant sites to metropolitan areas, workers could commute to the construction site, thereby reducing the need for rental housing.

Emissions from the operation of a NGCC plant could affect minority and low-income populations as well as the general population living in the vicinity of the new power plant. However, all would be exposed to the same potential effects from NGCC power plant operations, and any impacts would depend on the magnitude of the change in ambient air quality conditions. Permitted air emissions are expected to remain within regulatory standards.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the construction and operation of a new NGCC power plant would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

### 8.1.13. Waste Management

During the construction stage of the NGCC generation alternative, land clearing and other construction activities would generate waste that could be recycled, disposed of on site, or shipped to an offsite waste disposal facility. Because the alternative would be constructed at power plant sites with existing infrastructure, the amount of wastes produced during land clearing would be reduced.

During the operational stage, spent selective catalytic reduction (SCR) catalysts, which are used to control $NO_x$ emissions from natural gas−fired plants, would make up most of the waste generated by this alternative (see Air Quality, Section 8.1.1)

According to the GEIS (NRC 1996), a natural gas-fired plant would generate minimal waste. Waste impacts therefore would be SMALL for an NGCC alternative.

**Table 8–2. Summary of Environmental Impacts of the NGCC Alternative Compared to Continued Operation of the Existing LGS**

| | New NGCC at an Existing Power Plant Site | Continued LGS Operation |
|---|---|---|
| Air Quality | SMALL to MODERATE | SMALL |
| Groundwater | SMALL | SMALL |
| Surface Water | SMALL | SMALL |
| Aquatic Resources | SMALL | SMALL |
| Terrestrial Resources | SMALL | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | SMALL to MODERATE | SMALL |
| Socioeconomics | SMALL to MODERATE | SMALL |
| Transportation | SMALL to MODERATE | SMALL |
| Aesthetics | SMALL | SMALL |
| Historic and Archaeological | SMALL to MODERATE | SMALL |
| Waste Management | SMALL | SMALL[a] |

[a] As described in Chapter 6, the issue, “offsite radiological impacts (spent fuel and high level waste disposal),” is not evaluated in this EIS.

## 8.2. Supercritical Pulverized Coal-Fired Alternative

In this section, the NRC evaluates the environmental impacts of a supercritical pulverized coal-fired alternative to the continued operation of LGS. In the Commonwealth of Pennsylvania, 48 percent of electricity was generated using coal-fired power plants in 2010 (EIA 2012). Throughout PJM, coal-fired units provided 47 percent of electricity in 2011 (Monitoring Analytics 2012). As noted by EIA in its Annual Energy Outlook (EIA 2011b), coal-fired generation historically has been the largest source of electricity in the United States and is expected to remain so through 2035. Baseload coal units have proven their reliability and can routinely sustain capacity factors of 85 percent or greater. Among the various boiler designs available, pulverized coal boilers producing supercritical steam (SCPC boilers) are the most likely variant for a coal-fired alternative given their generally high thermal efficiencies and overall reliability.

While nuclear reactors, on average, operate with capacity factors above 90 percent, the new SCPC coal-fired power plant would operate with roughly an 85 percent capacity factor. Despite the slightly lower capacity factor, a SCPC plant would be capable of providing adequate replacement power for a nuclear plant for the purposes of this NEPA analysis.

A myriad of sizes of pulverized coal boilers and steam turbine generators (STGs) are available; however, the staff presumes that four equal-sized boiler/STG powertrains, operating independently and simultaneously, would likely be used to match the power output of LGS. To complete this analysis, the staff presumes that all powertrains would have the same features, operate at generally the same conditions, have similar impacts on the environment, and be equipped with the same pollution-control devices such that once all parasitic loads are overcome, the net power available would be equal to 2,120 MWe. The staff assumes that 6 percent of an SCPC boiler's gross capacity is needed to supply typical parasitic loads (plant operation plus control devices for criteria pollutants to meet New Source Performance Standards). Introducing controls for GHG emissions (i.e., CCS) would cause the parasitic load to increase to 27 percent of the boiler's gross rated capacity (NETL 2010). However, because of uncertainty regarding future GHG regulations and the limited real-world experience in CCS at utility-scale power plants, parasitic loads associated with CCS are not considered. Various bituminous coal sources are available to coal-fired power plants in Pennsylvania. EIA reports that, in 2008, Pennsylvania produced electricity from coal with heating values of 11,549 British thermal units per pound (Btu/lb), sulfur content of 2.07 percent, and ash of 16.29 percent (EIA 2010a). For the purpose of this evaluation, the NRC presumes that coal burned in 2008 will be representative of coal that would be burned in a coal-fired alternative regardless of where it was located. Approximately 74 percent of the coal burned in Pennsylvania in 2008 came from mines in Pennsylvania. West Virginia, Wyoming, and Ohio supplied most of the remaining coal (EIA 2010a). Bituminous coals from Appalachian mines have $CO_2$ emission factors ranging from 202.8 to 210.2 lb per million Btu of heat input (Hong and Slatick 1994).

Exelon determined that the current LGS site was not viable to accommodate a coal-fired alternative with net generating capacity sufficient to meet the power production of LGS because of limited space on the LGS site, as explained in Section 8.0 (Exelon 2011). The staff concurs with that assessment and the analysis of the impacts of the coal-fired alternative assumes that the SCPC coal-fired power plant would be sited at an existing power plant site to take advantage of existing infrastructure. The site could be located in Pennsylvania or elsewhere in PJM.

> **Supercritical Steam**
>
> "Supercritical" refers to the thermodynamic properties of the steam being produced. Steam whose temperature and pressure is below water's "critical point" (3,200 pounds per square inch absolute [psia; 221 bar] and 705 °F [374 °C]) is subcritical. Subcritical steam forms as water boils and both liquid and gas phases are observable in the steam. The majority of coal boilers currently operating in the United States produce subcritical steam with pressures around 2,400 psia (165 bar) and temperatures as high as 1,050 °F (566 °C). Above the critical point pressure, water expands rather than boils, and the liquid and gaseous phases of water are indistinguishable in the supercritical steam that results. More than 150 coal boilers currently operating in the United States produce supercritical steam with pressures between 3,300–3,500 psia (228 to 241 bar) and temperatures between 1,000–1,100 °F (538–593 °C). Ultrasupercritical boilers produce steam at pressures above 3,600 psia (248 bar) and temperatures exceeding 1,100 °F (593 °C). There are only a few of these boilers in operation worldwide, and none in the United States.

It is reasonable to assume that a coal-fired alternative would use supercritical steam (see text box). Supercritical steam technologies are increasingly common in new coal-fired plants. They are commercially available and feasible. Supercritical plants operate at higher temperatures and pressures than older subcritical coal-fired plants and, therefore, can attain higher thermal efficiencies. While supercritical facilities are more expensive to construct than subcritical facilities, they consume less fuel for a given output, reducing environmental impacts throughout the fuel life cycle. The staff expects that a new, supercritical coal-fired plant would operate at a heat rate of 8,844 Btu/kWh (EIA 2010b), or approximately 38 to 39 percent thermal efficiency. However, heat inputs could be less, depending on the coal source and whether fuel blending is practiced in order to remain compliant with emission limitations.

SCPC coal-fired power plants are currently commercially available and currently are feasible alternatives to LGS license renewal. The overall environmental impacts of a coal-fired alternative, as well as the environmental impacts of proposed LGS license renewal, are shown in Table 8–3. Additional details of the impacts on individual resources of the coal-fired alternative are provided in subsequent sections.

### 8.2.1. Air Quality

As discussed in Section 2.2.2.1, the LGS site is located in Montgomery and Chester Counties, Pennsylvania, which is part of the Metropolitan Philadelphia Interstate Air Quality Control Region AQCR (40 CFR 81.15). With regard to the National Ambient Air Quality Standards (NAAQS), EPA has designated Montgomery and Chester Counties as unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$; and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339).

A new SCPC generating plant would qualify as a new major-emitting industrial facility and would be subject to PSD under requirements of the CAA (EPA 2012a). The PADEP has adopted 25 Pa. Code Chapter 127, which implements the EPA's PSD review. The SCPC plant would need to comply with the standards of performance for electric utility steam generating units set forth in 40 CFR Part 60 Subpart Da.

Subpart P of 40 CFR Part 51.307 contains the visibility protection regulatory requirements, including the review of the new sources that may affect visibility in any Federal Class I area. If an SCPC alternative was located close to a mandatory Class I area, additional air pollution control requirements would be required. As noted in Section 2.2.2.1, there are no mandatory Class I Federal areas within 50 miles (80 km) of the LGS site. There are a total of 13 designated Class 1 Federal areas (40 CFR 81) located in the following PJM states: Kentucky, Michigan, New Jersey, North Carolina, Tennessee, Virginia, and West Virginia.

A new SCPC plant would have to comply with Title IV of the CAA (42 USC §7651) reduction requirements for $SO_2$ and $NO_x$, which are the main precursors of acid rain and the major cause of reduced visibility. Title IV establishes maximum $SO_2$ and $NO_x$ emission rates from the existing plants and a system of $SO_2$ emission allowances that can be used, sold, or saved for future use by the new plants.

More recently, the EPA has promulgated additional rules and requirements for certain fossil-fuel based power plants, such as coal. The Cross-State Air Pollution Rule (CSAPR), the Prevention of Significant Deterioration and Title V Greenhouse Gas (GHG) Tailoring Rule, and the Mercury and Air Toxics Standards (MATS) for Power Plants impose several additional standards to limit ozone, particulate, mercury, and GHG emissions from fossil-fuel based power plants (EPA 2012c). A new SCPC plant would be subject to these additional rules and regulations.

The EPA has developed standard emission factors that relate the quantity of released air pollutants to a variety of regulated activities (EPA 2012b). Using these emission factors, the staff projects the following air emissions for the SCPC alternative:

- sulfur oxides ($SO_x$) – 14,876 tons (13,495 MT) per year,
- nitrogen oxides ($NO_x$) – 1,891 tons (1,716 MT) per year,
- carbon monoxide (CO) – 1,891 tons (1,716 MT) per year,
- $PM_{10}$ – 1,232 tons (1,118 MT) per year,
- $PM_{2.5}$ – 616 tons (559 MT) per year
- carbon dioxide ($CO_2$) – up to 18,363,843 tons (16,659,678 MT) per year, and
- mercury (Hg) – 0.31 tons (0.28 MT) per year.

The above emission estimates assume that the SCPC plant implements certain pollution control devices, including wet calcium carbonate scrubbers for $SO_2$ control (operating at 95 percent removal efficiency), low-$NO_x$ burners with overfire air and selective catalytic reduction for nitrogen oxide controls capable of attaining a $NO_x$ removal of 86 percent, and fabric particulate filters with 99.9 percent removal efficiency.

Activities associated with the construction of the new SCPC plant would cause some additional, temporary air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material-handling equipment. Emissions from workers' vehicles and motorized construction equipment exhaust would be temporary. The construction crews would use dust-control practices to control and reduce fugitive dust. The staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of the earth-moving and material-handling equipment would be SMALL.

*Greenhouse Gas Emissions*

The largest anthropogenic source of $CO_2$ emissions is the combustion of fossil fuels, especially coal. After a thorough examination of the scientific evidence and careful consideration of public comments, the EPA announced on December 7, 2009, that GHGs threaten the public health and welfare of the American people and meet the CAA definition of air pollutants. The construction and operation of the coal-fired alternative would emit GHGs that likely contribute to climate change.

Greenhouse gas emissions from the construction of a coal-fired alternative would result primarily from the consumption of fossil fuels in the engines of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. All such impacts would be temporary.

The staff estimates that uncontrolled emissions of $CO_2$-e (carbon dioxide equivalents) from operation of the coal-fired alternative would amount to 18.36 million tons per year (16.66 million metric tons per year). From a life-cycle perspective, Sovacool (2008) found that coal-burning plants can have GHG footprints as high as 1,050 grams of carbon dioxide equivalent per kWh. For comparison, nuclear facilities and NGCC facilities have life-cycle GHG footprints of 66 grams of $CO_2$-e/kWh and 443 grams of $CO_2$-e/kWh, respectively. Although coal combustion in the boilers would be the primary source, other miscellaneous ancillary sources, such as truck and rail deliveries of materials to the site, commuting of the workforce, and deliveries of wastes to offsite disposal or recycling facilities, would contribute to the $CO_2$-e emissions from continued operations.

NETL estimates that further development could yield technologies that could capture and remove as much as 90 percent of the $CO_2$ from the exhausts of SCPC boilers. However, NETL also estimates that such equipment imposes a significant parasitic load that would result in a power production capacity decrease of approximately 27 percent (NETL 2010). In addition, permanent sequestering of the $CO_2$ would involve removing impurities (including water) and pressurizing it to meet pipeline specifications to transfer the gas, by pipeline, to acceptable geologic formations. Even when opportunities exist to use the $CO_2$ for enhanced oil recovery (rather than simply disposing of the $CO_2$ in geologic formations), permanent disposal costs could be substantial, especially if the SCPC units are far removed from acceptable geologic formations. With CCS in place, the coal-fired alternative would release 1.84 million tons of $CO_2$ per year (1.67 million metric tons per year). Without CCS in place, the staff's projected CO2 emissions for the SCPC alternative would be 18,363,843 tons (16,659,678 MT) per year

The overall impact from the releases of GHGs of a coal-fired alternative would be MODERATE. Construction impacts would be temporary, but GHG emissions during operation would be noticeable.

*Conclusion*

Based on the above discussion, the overall air emissions and associated quality impacts from a new SCPC plant located at the LGS site would be MODERATE, primarily because of the noticeable impact during operations.

### 8.2.2. Groundwater Resources

Construction activities associated with the SCPC alternative could require more extensive groundwater dewatering as compared to the NGCC alternative, depending on the hydrogeologic conditions of the selected site. This is because of the more extensive excavation that would be required for the SCPC power block and the onsite disposal facility. Nevertheless, engineering measures, as described in Section 8.1.2, can be used to minimize impacts to facilitate construction. Facility construction would increase the amount of impervious surface at the site location and alter the subsurface strata because of excavation work and the placement of backfill following facility completion. At some sites, this could cause a localized decline in water-table elevation in a surficial aquifer, if present. However, recharge basins incorporated into the stormwater management system design can make such alterations undetectable at the site boundary. Below-grade portions of a new SCPC plant also could alter the direction of groundwater flow beneath a site, although such effects would likely be very localized at most site locations. Finally, application of BMPs in accordance with a state-issued NPDES general permit, including appropriate waste management, water discharge, and spill prevention practices, would prevent or minimize any groundwater quality impacts during construction.

During the construction period, groundwater could be used to provide water for potable and sanitary uses, concrete production, dust suppression, and soil compaction. However, it is more likely that water would be supplied via a temporary utility connection, if available, or trucked to the point of use from offsite sources. The SPCP alternative would require a peak construction workforce of 2,500 (Exelon 2011), as described in Section 8.2.8. While the potential demands for groundwater based on this workforce combined with construction uses might result in water demands nearing 100 gpm (380 L/min) during the peak construction period, the staff determined that any impacts would be very temporary and localized.

For SCPC plant operations, the NRC assumed that the SCPC alternative would entail the same relative ratio of groundwater use to surface water use as that used at LGS Units 1 and 2. This includes the use of groundwater for service water makeup and potable and sanitary uses. Consequently, it is expected that total groundwater usage and potential aquifer effects would be much less under this alternative than those under current LGS operations. This is because of the smaller number of auxiliary systems requiring groundwater and the much smaller workforce under this alternative. The only mechanism identified that could adversely affect groundwater quality under normal operations would be operation of the disposal facility. However, the leaching of contaminants from the fly ash and scrubber sludge and impacts to groundwater can be minimized in modern facilities with protective barriers, disposal cell liners, and leachate collection and treatment systems, along with groundwater monitoring systems. Therefore, based on the above assessment, the impacts on groundwater use and quality under this alternative would be SMALL.

### 8.2.3. Surface Water Resources

Impacts from construction activities associated with the SCPC alternative on surface water resources would be expected to be similar to but somewhat greater than those under the NGCC alternative. This is attributable to the additional land required for construction of the power block and for excavation and construction of an onsite disposal facility for coal ash and scrubber sludge. However, additional offsite impacts, including hydrologic changes in affected streams and contaminant runoff, would occur from coal mining (see Section 8.2.7). At the SCPC site, some temporary impacts to surface water quality may result from increased sediment loading and from any pollutants in stormwater runoff from disturbed areas and from dredging activities. There also would be the potential for water quality effects to occur from the extension or refurbishment of a rail spur to transport coal to the site location. Nevertheless, as described in Section 8.1.3, water quality impacts would be minimized by the application of BMPs and compliance with state-issued NPDES permits. Any dredging would be conducted under a permit from the COE requiring the implementation of BMPs to minimize impacts.

During operations, the SCPC alternative would use slightly less water than LGS because of the greater generation-efficiency of the SCPC technology. Therefore, the water resources impact assessment presented in Section 4.3.2 of this SEIS generally applies to the SCPC alternative. The NRC assumed that water treatment additives for the SCPC alternative would be essentially identical to LGS. Existing intake and discharge infrastructure would be used at the selected power plant site but it could require refurbishment or expansion. Similar to LGS, surface water withdrawals would be subject to applicable state water allocation requirements, and effluent discharges and stormwater discharges associated with industrial activity would be subject to a state-issued NPDES permit under this alternative. The NRC further assumes that the SCPC plant and waste disposal facility would be operated in accordance with appropriate management plans with adherence to appropriate BMPs and procedures to minimize the release of non-nuclear fuels, chemicals, and other materials to soil, surface water, and groundwater (see Section 8.1.3). As a result, the overall impacts on surface water use and quality from construction and operations under the SCPC alternative would be SMALL.

### 8.2.4. Aquatic Resources

Construction activities for the SCPC alternative (such as construction of heavy-haul roads and the power block) could affect drainage areas or other onsite aquatic features. Minimal impacts on aquatic ecology resources are expected because the plant operator would likely implement BMPs to minimize erosion and sedimentation. Stormwater control measures, which would be required to comply with Pennsylvania NPDES permitting, would minimize the flow of disturbed soils into aquatic features. Depending on the available infrastructure at the selected site, the SCPC alternative may require modification or expansion of the existing intake or discharge structures, or construction of new intake and discharge structures. Dredging activities that result from infrastructure construction would require BMPs for in-water work to minimize sedimentation and erosion. Because of the short-term nature of the dredging activities, the hydrological alterations to aquatic habitats likely would be localized and temporary.

During operations, the SCPC alternative would require slightly less cooling water to be withdrawn from the Schuylkill River or other similar water body than required for LGS Units 1 and 2. The number of fish and other aquatic resources affected by cooling water intake and discharge operations, such as entrainment, impingement, and thermal stress, would be equal or less for an SCPC alternative compared to LGS. The cooling system for a new SCPC plant would have similar chemical discharges as LGS, but the SCPC plant would emit small amounts of ash and particulates that would settle onto the river surface and introduce a new source of pollutants as described in Section 8.2.1.

The impacts on aquatic ecology would be minor because construction activities would require BMPs and stormwater management permits, and because the surface water withdrawal and discharge for this alternative would be slightly less compared to LGS Units 1 and 2. Therefore, impacts on aquatic ecology would be SMALL.

Consultation with NMFS and FWS under ESA would ensure that the construction and operation of an SCPC plant would not adversely affect any Federally listed species or adversely modify or destroy designated critical habitat. Consultation with NMFS under the Magnuson-Stevens Act would require the NRC to evaluate impacts to EFH. NMFS would provide conservation recommendations if there would be adverse impacts to EFH. Coordination with state natural resource agencies would further ensure that the plant operator would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation on protected species and habitats would be SMALL.

### 8.2.5. Terrestrial Resources

Construction of an SCPC plant would require approximately 280 ac (113 ha), as described in Section 8.2.7. The SCPC alternative may require up to 46,600 ac (18,860 ha) of additional land for coal mining and processing (NRC 1996). Approximately 464 ac (188 ha) of land also would be required for disposal of ash and scrubber sludge (Exelon 2011). However, land for disposal would likely be located on site (see Section 8.2.7). Because of the relatively large land requirement for the site, a portion of the site would likely be land that had not been previously disturbed, which would directly affect terrestrial habitat by removing existing vegetative communities and displacing wildlife. The level of direct impacts would vary substantially based on site selection. Offsite construction would occur mostly on land where coal extraction is ongoing. To the extent practicable, Exelon would route the railroad spur along an existing, previously disturbed railroad corridor. Erosion and sedimentation, fugitive dust, and construction debris impacts would be minor with implementation of appropriate BMPs (Exelon 2011). Impacts to terrestrial habitats and species from transmission line operation and corridor vegetation maintenance, and operation of the cooling system would be similar in magnitude and intensity as those resulting from operating nuclear reactors and would, therefore, be SMALL (NRC 1996). Because of the potentially large area of undisturbed habitat that could be affected from construction of an SCPC plant, the impacts of construction on terrestrial habitats and species could range from SMALL to MODERATE depending on the specific site location. The impacts of operation would be SMALL.

As with the NGCC alternative, consultation with FWS under the ESA would avoid potential adverse impacts to Federally listed species or adverse modification or destruction of designated critical habitat. Coordination with state natural resource agencies would further ensure that Exelon would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of an SCPC plant on protected species and habitats would be SMALL.

### 8.2.6. Human Health

Impacts on human health from construction of the SCPC alternative would be similar to impacts associated with the construction of any major industrial facility. Compliance with worker protection rules would control those impacts on workers at acceptable levels. Impacts from construction on the general public would be minimal since limiting active construction area access to authorized individuals is expected. Therefore, impacts on human health from the construction of the SCPC alternative would be SMALL.

Coal-fired power plants introduce worker risks from coal and limestone mining, coal and limestone transportation, and disposal of coal combustion residues and scrubber wastes. In addition, there are public risks from inhalation of stack emissions and the secondary effects of eating foods grown in areas subject to deposition from plant stacks.

Human health risks of coal-fired power plants are described, in general, in Table 8–2 of the GEIS (NRC 1996). Cancer and emphysema as a result of the inhalation of toxins and particulates are identified as potential health risks to occupational workers and members of the public (NRC 1996). The human health risks associated with coal-fired power plants, both for occupational workers and members of the public, are greater than those of the current LGS reactors because of exposures to chemicals such as mercury, $SO_x$, $NO_x$, radioactive elements such as uranium and thorium contained in coal and coal ash, and polycyclic aromatic hydrocarbon (PAH) compounds, including benzo(a)pyrene.

Regulations restricting emissions enforced by either EPA or delegated state agencies have reduced potential health effects, but have not entirely eliminated them. These agencies also impose site-specific emission limits as needed to protect human health. Even if the coal-fired alternative were located in a nonattainment area, emission controls and trading or offset mechanisms could prevent further regional degradation; however, local effects could be visible. Many of the byproducts of coal combustion responsible for health effects are largely controlled, captured, or converted in modern power plants, although some level of health effects may remain.

Aside from emissions impacts, the coal-fired alternative introduces the risk of coal pile fires and for those plants that manage coal combustion residue liquids and sludge in waste impoundments, the release of the waste may result because of a failure of the impoundment.

Good housekeeping practices to control coal dust greatly reduce the potential for coal dust explosions or coal pile fires. Although there have been several instances in recent years, sludge impoundment failures are still rare. Free water also could be recovered from such waste streams and recycled and the solid or semi-solid portions removed to permitted offsite disposal facilities.

Overall, given extensive health-based regulation and controls likely to be imposed as permit conditions applicable to waste handling and disposal, the staff expects human health impacts from operation of the coal-fired alternative at an alternate site to be SMALL.

### 8.2.7. Land Use

The GEIS generically evaluates the impact of constructing and operating various replacement power plant alternatives on land use, both on and off each power plant site. The analysis of land-use impacts focuses on the amount of land area that would be affected by the construction and operation of an SCPC power plant at an existing power plant site.

Based on scaled GEIS estimates, more than 3,800 ac (1,540 ha) of land could be needed to support a coal-fired alternative to replace the LGS. This amount of land use would include other plant structures and associated infrastructure and is unlikely to exceed the 3,800 ac (1,540 ha) estimate, excluding land needed for coal mining and processing. Exelon estimated 280 ac (113 ha) for new unit construction (Exelon 2011). The NRC determined that this estimate is reasonable because it is consistent with land requirements for modern coal-fired facilities. It is expected that the SCPC alternative would be located at an existing power plant site or otherwise disturbed industrial site, and thus the land-use impacts from construction would range from SMALL to MODERATE. Depending on existing power plant infrastructure, additional land may be needed for frequent coal and limestone deliveries by rail or barge.

Offsite land-use impacts would occur from coal mining, in addition to land-use impacts from the construction and operation of the new power plant. Using the GEIS figure, the SCPC alternative might require up to 49,600 ac (20,100 ha) of land for coal mining and waste disposal during power plant operations. However, much of the land in existing coal mining areas already has experienced some level of disturbance. An additional 464 ac (188 ha) of land would be required for disposal of ash and scrubber sludge (Exelon 2011). It is likely that most of the land needed for disposal would be found within the 22,000 ac (8,900 ha) requirement estimated in the GEIS.

The elimination of uranium fuel for the LGS could partially offset some, but not all, of the land requirements for the SCPC alternative. Scaling from GEIS estimates, approximately 1,640 ac (660 ha) no longer would be needed for mining and processing uranium during the operating life of the SCPC plant. Since a substantial amount of land could be converted for coal and limestone delivery and waste disposal, land-use impacts could range from SMALL to MODERATE.

### 8.2.8. Socioeconomics

As previously explained in Section 8.1.8, two types of jobs would be created by this alternative: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) power plant operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements for the construction and operation of the SCPC alternative were evaluated to measure their possible effects on current socioeconomic conditions.

Scaling from GEIS estimates, the construction workforce would peak at 5,638 workers. Exelon estimated 2,500 workers at the peak of construction (Exelon 2011). This estimate appears to be reasonable and is consistent with trends toward lowering labor costs by reducing the size of plant workforces. Therefore, Exelon's estimate of 2,500 workers is used throughout this analysis. The relative economic impact of this many workers on the local economy and tax base would vary, with the greatest impacts occurring in communities where the majority of construction workers reside and spend their income. As a result, local communities could experience a short-term "boom" from increased tax revenue and income generated by construction expenditures and the increased demand for temporary (rental) housing and business services. Some construction workers could relocate in order to be closer to the construction work site. However, given the proximity of many existing power plants to metropolitan areas, workers could commute to the construction site, thereby reducing the need for rental housing. After completing the installation of the subcritical coal-fired power plant, local communities could experience a return to pre-construction economic conditions. Based on this information and given the number of construction workers, socioeconomic impacts during construction in local communities could range from SMALL to MODERATE.

Scaling from GEIS estimates, the plant operations workforce would be 564 workers. Exelon estimated a plant operations workforce of approximately 141 workers (Exelon 2011). This estimate appears to be reasonable and is consistent with trends toward lowering labor costs by reducing the size of plant operations workforces. Therefore, Exelon's estimate of 141 workers is used throughout this analysis. This alternative would result in a loss of approximately 700 relatively high-paying jobs at LGS, with a corresponding reduction in purchasing activity and tax contributions to the regional economy. In addition, the permanent housing market also could experience increased vacancies and decreased prices if operations workers and their families move out of the region. However, a larger amount of property taxes may be paid to local jurisdictions under the SCPC alternative as more land may be required for coal-fired power plant operations than LGS. Therefore, socioeconomic impacts during operations could range from SMALL to MODERATE.

### 8.2.9. Transportation

Transportation impacts associated with construction and operation of a four-unit, SCPC power plant would consist of commuting workers and truck deliveries of construction materials to the power plant site. During periods of peak construction activity, up to 2,500 workers could be commuting daily to the site (Exelon 2011), as described in Section 8.2.8. Workers commuting to the construction site would arrive by site access roads and the volume of traffic on nearby roads could increase substantially during shift changes. In addition to commuting workers, trucks would be transporting construction materials and equipment to the worksite, thus increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary levels of service impacts and delays at intersections. Some power plant components and materials could also be delivered by train or barge, depending on location. Train deliveries could cause additional traffic delays at railroad crossings. Based on this information, traffic-related transportation impacts during construction could range from MODERATE to LARGE.

Traffic-related transportation impacts on local roads would be greatly reduced after the completion of the power plant. Transportation impacts would include daily commuting by the operating workforce, equipment and materials deliveries, and the removal of commercial waste material to offsite disposal or recycling facilities by truck. During operations, the estimated number of operations workers commuting to and from the power plant would be 141 workers (Exelon 2011), as described in Section 8.2.8. The increase in traffic on roadways would peak during shift changes, resulting in temporary levels of service impacts and delays at intersections. Frequent deliveries of coal and limestone by rail would add to the overall transportation impact. Onsite coal storage would make it possible to receive several trains per day. Limestone delivered by rail could also add additional traffic (though considerably less traffic than that generated by coal deliveries). Coal and limestone delivery and ash removal by rail would cause levels of service impacts on certain roads because of delays at railroad crossings. Overall, transportation impacts would be SMALL to MODERATE during power plant operations.

### 8.2.10. Aesthetics

The analysis of aesthetic impacts focuses on the degree of contrast between the SCPC alternative and the surrounding landscape and the visibility of the new SCPC plant at an existing power plant site. During construction, all of the clearing and excavation would occur on the existing power plant site. These activities could be visible from offsite roads. The coal-fired power plant could be approximately 100 ft (30 m) tall, with two to four exhaust stacks several hundred feet tall with natural-draft cooling towers approximately 400 to 500 ft (122 to 152 m) in height. The facility would be visible off site during daylight hours, and some structures may require aircraft warning lights. The condensate plumes from the cooling towers could add to the visual impact. Noise generated during power plant operations would be limited to routine industrial processes and communications.

In general, given the industrial appearance of the existing power plant site on which it would be built, the new SCPC power plant would blend in with the surroundings. The power block of the SCPC alternative could look very similar to the existing power plant and construction would appear similar to other ongoing onsite activities. Aesthetic changes would therefore be limited to the immediate vicinity of the existing power plant site, and any impacts would be SMALL depending on its location and surroundings.

### 8.2.11. Historic and Archaeological Resources

The impacts of the construction of a new SCPC alternative on historic and archaeological resources are similar to those impacts associated with activities for constructing an NGCC facility. Any areas potentially affected by the construction of the SCPC alternative would need to be surveyed to identify and record historic and archaeological resources. An inventory of a previously disturbed former plant (brownfield) site may still be necessary if the site has not been previously surveyed or to verify the level of disturbance and evaluate the potential for intact subsurface resources. Plant operators would need to survey all areas associated with operation of the alternative (e.g., roads, transmission corridors, other ROWs). Any resources found in these surveys would need to be evaluated for eligibility on the NRHP and mitigation of adverse effects would need to be addressed if eligible resources were encountered. Areas with the greatest sensitivity should be avoided. Visual impacts on significant cultural resources—such as the viewsheds of historic properties near the site—should also be assessed.

The potential for impacts on historic and archaeological resources from the SCPS alternative would vary greatly depending on the location of the proposed site. However, given that the preference is to use a previously disturbed former plant site, avoidance of significant historic and archaeological resources should be possible and effectively managed under current laws and regulations. Therefore, the impacts on historic and archaeological resources from the SCPC alternative would be SMALL.

### 8.2.12. Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health, environmental, and socioeconomic effects on minority and low-income populations that could result from the construction and operation of a new power plant. As previously discussed in Section 8.1.12, such effects may include human health, biological, cultural, economic, or social impacts.

Potential impacts to minority and low-income populations would mostly consist of environmental and socioeconomic effects during construction (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be directly affected by increased commuter vehicle and truck traffic. However, because of the temporary nature of construction, these effects are not likely to be high and adverse and would be contained to a limited time period during certain hours of the day. Increased demand for rental housing during construction could cause rental costs to rise disproportionately affecting low-income populations who rely on inexpensive housing. However, given the proximity of some existing power plant sites to metropolitan areas, workers could commute to the construction site, thereby reducing the need for rental housing.

Emissions from the operation of a SCPC plant could affect minority and low-income populations as well as the general population living in the vicinity of the new power plant. However, all would be exposed to the same potential effects from SCPC power plant operations and any impacts would depend on the magnitude of the change in ambient air quality conditions. Permitted air emissions are expected to remain within regulatory standards.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the construction and operation of a new SCPC power plant would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

### 8.2.13. Waste Management

Coal combustion generates several waste streams, including ash (a dry solid) and sludge (a semi-solid byproduct of emission control system operation). The staff estimates that a 2,120-MW(e) power plant would use approximately 7,340,000 tons (6,659,000 MT) of coal annually with an ash content of 16.29 percent. This would generate approximately 1,196,000 tons (1,085,000 MT) of ash and 559,000 tons (507,125 MT) of scrubber sludge each year. About 538,059 tons (488,119 MT) or 45 percent of the ash waste would be marketed for beneficial use (Exelon 2011). Therefore, approximately 559,000 tons (507,125 MT) of ash would be disposed of on site if space were available. According to Exelon (2011), disposal of the ash and sludge would require approximately 464 ac (187 ha) over 20 years. Disposal of the remaining waste could noticeably affect land use and ground water quality, but with proper siting and implementation of groundwater monitoring and management practices, in accordance with 25 Pa. Code 290, it would not destabilize important resources. After closure of the waste site and revegetation, the land could be available for other uses.

The impacts from waste generated during construction would be minor, although the waste generated during operation of this coal-fired alternative would be MODERATE; the impacts would be clearly visible, but would not destabilize any important resource. The amount of the construction waste would be small compared to the amount of waste generated during the operational stage and much of it could be recycled (i.e, marketed for beneficial use). Therefore, the staff concludes that the overall waste management impacts from construction and operation of this alternative would be MODERATE.

**Table 8–3. Summary of Environmental Impacts of the Supercritical Coal-Fired Alternative Compared to Continued Operation of LGS**

| | Supercritical Coal-Fired Generation | Continued LGS Operation |
|---|---|---|
| Air Quality | MODERATE | SMALL |
| Groundwater | SMALL | SMALL |
| Surface Water | SMALL | SMALL |
| Aquatic Resources | SMALL | SMALL |
| Terrestrial Resources | SMALL to MODERATE | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | SMALL to MODERATE | SMALL |
| Socioeconomics | SMALL to MODERATE | SMALL |
| Transportation | SMALL to LARGE | SMALL |
| Aesthetics | SMALL | SMALL |
| Historic and Archaeological | SMALL | SMALL |
| Waste Management | MODERATE | SMALL[(a)] |

[(a)] As described in Chapter 6, the issue, "offsite radiological impacts (spent fuel and high level waste disposal)," is not evaluated in this EIS.

## 8.3. New Nuclear

In this section, the NRC evaluates the environmental impacts of a new nuclear alternative to LGS. In the Commonwealth of Pennsylvania, 34 percent of electricity was generated using nuclear power plants in 2010 (EIA 2012). Throughout PJM, nuclear units also provided 34 percent of electricity in 2011 (Monitoring Analytics 2012). As noted by EIA in its Annual Energy Outlook (EIA 2011b), nuclear generation is expected to account for 3 percent of capacity additions through 2035. A new nuclear power plant is likely to be similar to LGS in terms of capacity factor.

Several designs are possible for a new nuclear facility. However, a two-unit nuclear power plant similar to the existing LGS in output is most likely. While two Westinghouse AP1000 reactors would provide an approximately equivalent output, it is possible that other designs also would be available. The new nuclear alternative would rely on a closed-cycle cooling system, similar to the cooling system currently in place at LGS.

In its ER, Exelon determined that the current LGS site was not viable to accommodate a new nuclear alternative with net generating capacity sufficient to meet the power production of LGS because of insufficient space at the LGS site (ER 2011). Exelon also indicated that a new nuclear alternative was most likely to be constructed on a site that already hosts a nuclear power plant. This placement would allow the new nuclear alternative to take advantage of existing site infrastructure, including transmission lines and some support facilities. The staff concurs that a new nuclear facility is most likely to be sited at the location of an existing nuclear power plant. Utilities in PJM have expressed interest in either early site permits or combined licenses for new nuclear facilities at several sites, including Calvert Cliffs (in Maryland), Hope

Creek (New Jersey), North Anna (Virginia), and Bell Bend (adjacent to the Susquehanna site in Pennsylvania).

New nuclear power plants are commercially available and feasible alternatives to LGS license renewal. The overall environmental impacts of a nuclear alternative, as well as the environmental impacts of proposed LGS license renewal, are shown in Table 8–4. Additional details of the impacts on individual resources of the new nuclear alternative are provided in subsequent section.

### 8.3.1. Air Quality

As discussed in Section 2.2.2.1, the LGS site is located in Montgomery and Chester Counties, Pennsylvania, which is part of the Metropolitan Philadelphia Interstate Air Quality Control Region AQCR (40 CFR 81.15). With regard to the National Ambient Air Quality Standards (NAAQS), EPA has designated Montgomery and Chester Counties as unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$; and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339).

A new nuclear generating plant would have similar air emissions to those of the existing LGS site; air emissions would be primarily from backup diesel generators and boilers as well as particulates from the cooling towers. As noted in Section 2.2.2.1, Exelon maintains a Title V operating permit (TVOP-46-00038) for sources of air pollution at the LGS site (Exelon 2011). Because air emissions would be similar for a new nuclear plant, the staff expects similar air permitting conditions and regulatory requirements.

Subpart P of 40 CFR Part 51.307 contains the visibility protection regulatory requirements, including the review of the new sources that may affect visibility in any Federal Class I area. If a new nuclear plant were located close to a mandatory Class I area, additional air pollution control requirements may be required. As noted in Section 2.2.2.1, there are no Mandatory Class I Federal areas within 50 miles (80 km) of the LGS site. There are a total of 13 designated Class 1 Federal areas (40 CFR 81) located in the following PJM states: Kentucky, Michigan, New Jersey, North Carolina, Tennessee, Virginia, and West Virginia. The following air emissions were reported by Exelon and are from the year 2011 for the existing LGS site (Exelon 2012).

- sulfur oxides ($SO_x$) – 7.8 T (7.1 MT) per year,
- nitrogen oxide ($NO_x$) – 32.8 T (29.8 MT) per year,
- carbon monoxide (CO) – 24.2 tons (21.9 MT) per year, and
- $PM_{10}$ and $PM_{2.5}$ – 166.3 T (150.9 MT) per year.

The staff expects similar air emissions from a new nuclear plant because these emissions are primarily from backup diesel generators that would also be used at a new nuclear plant.

Activities associated with the construction of the new nuclear plant would cause some additional, temporary air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material-handling equipment. Emissions from workers' vehicles and motorized construction equipment exhaust would be temporary. The construction crews could use dust-control practices to control and reduce fugitive dust. The staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of the earth-moving and material-handling equipment would be SMALL.

*Greenhouse Gas Emissions*

In Chapter 6, the staff discussed the relative GHG emissions of nuclear power compared to other electric generation technologies. This discussion, where applicable, addressed the nuclear lifecycle, including construction and operation. Impacts during construction of this alternative would result primarily from the consumption of fossil fuels in the engines of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. However, all such impacts would be temporary.

Greenhouse gas emissions from the new nuclear alternative during operation arise primarily from operation of onsite diesel generators and other auxiliary equipment. For additional discussion of GHG emissions from nuclear generation, see Chapter 6.

Given the expected workforces, relatively short construction period , and minor GHG emissions during operation, the overall impact from the releases of GHGs of the new nuclear alternative would be SMALL.

*Conclusion*

The overall air quality impacts of a new nuclear plant located at the LGS site would be designated as SMALL.

### 8.3.2. Groundwater Resources

Under this alternative, deep excavation work on the order of 70 ft (21 m) below ground surface for the nuclear island may require active dewatering during construction. Depending on the site and local hydrogeology, this dewatering could have localized drawdown effects on local wells and require the use of cofferdams, sumps, wells, or other methods to address high water-table conditions. However, grout injection and diaphragm walls can be installed to effectively eliminate offsite drawdown impacts and reduce the need for dewatering. Facility construction also would increase the amount of impervious surface at the site location and alter the subsurface strata because of excavation work and the placement of backfill following facility completion. This could cause a localized decline in water-table elevation in the surficial aquifer, but the incorporation of recharge basins into the stormwater management system design can make such alterations undetectable at the site boundary. Below-grade portions of a new nuclear power plant also could alter the direction of groundwater flow beneath a site. Such effects would likely be very localized at most site locations, encompassing the area around the nuclear island, and would not be expected to affect offsite wells at most sites. In addition, application of BMPs in accordance with a state-issued NPDES general permit, including appropriate waste management, water discharge, and spill prevention practices, would prevent or minimize any groundwater quality impacts during construction.

During the construction period, groundwater could be used to provide potable water for potable and sanitary uses, concrete production, dust suppression, and soil compaction. However, it is more likely that water would be supplied via a temporary utility connection, if available, or trucked to the point of use from offsite sources. Exelon (2011) estimated a peak construction workforce of 3,650. While the potential demands for groundwater based on this workforce combined with construction uses might result in water demands nearing 100 gpm (380 L/min) during the peak construction period, the staff determined that any effects would be temporary and localized. To support operations of a new nuclear power plant, the NRC assumed that this alternative would entail the same relative ratio of groundwater use to surface water use as that at LGS Units 1 and 2, along with a similar-sized workforce and operational activities. This includes the use of groundwater for service water makeup and potable and sanitary uses. Therefore, the groundwater resources impact assessment presented in Section 4.4 of this SEIS generally applies to the new nuclear alternative. Based on this assessment, impacts on groundwater use and quality under this alternative would be SMALL.

### 8.3.3. Surface Water Resources

Surface water resources impacts from construction activities associated with the new nuclear alternative at an alternative site would be similar to but somewhat greater in scale than those described for the SCPC alternative (see Section 8.2.3). While no ash and sludge disposal facility would be required as under the SCPC alternative, deep excavation work for the nuclear island and more extensive site clearing and larger laydown area for facility construction would have potentially greater impacts to water resources from water use and stormwater runoff. Thus, temporary impacts to surface water quality may result from increased sediment loading and from any pollutants in stormwater runoff from disturbed areas and from any required dredging activities. Nevertheless, as described in Section 8.1.3, water quality impacts would be minimized by the application of BMPs and compliance with state-issued NPDES permits. Any dredging would be conducted under a permit from the COE requiring the implementation of BMPs to minimize impacts. To support operations of a new nuclear power plant, the NRC has assumed that the new facility would consumptively use and discharge the same amount of water as LGS. Therefore, the water resources impact assessment presented in Section 4.3.2 of this SEIS applies to the new nuclear alternative. In Section 4.3.2, the NRC determined that the impacts of LGS operations on surface water resources are SMALL. The NRC assumed that water treatment additives for this alternative would be essentially identical to LGS. Existing intake and discharge infrastructure would be used at the selected power plant site, but it could require refurbishment or expansion. Similar to LGS, surface water withdrawals would be subject to applicable state water allocation requirements, and effluent discharges and stormwater discharges associated with industrial activity would be subject to a state-issued NPDES permit. The NRC further assumes that the new nuclear plant would be operated in accordance with appropriate management plans with adherence to appropriate BMPs and procedures to minimize the release of non-nuclear fuels, chemicals, and other materials to soil, surface water, and groundwater (see Section 8.1.3). Therefore, based on this assessment, the overall impacts on surface water use and quality from construction and operations under the new nuclear alternative would be SMALL.

### 8.3.4. Aquatic Resources

Construction activities for the new nuclear alternative (such as construction of heavy-haul roads and the power block) could affect drainage areas or other onsite aquatic features. Minimal impacts on aquatic ecology resources are expected because the plant operator would likely implement BMPs to minimize erosion and sedimentation. Stormwater control measures, which would be required to comply with state NPDES permitting, would minimize the flow of disturbed soils into aquatic features. Depending on the available infrastructure at the selected site, the new nuclear alternative may require modification or expansion of the existing intake or discharge structures, or construction of new intake and discharge structures. Dredging activities that result from infrastructure construction would require BMPs for in-water work to minimize sedimentation and erosion. Because of the short-term nature of the dredging activities, the hydrological alterations to aquatic habitats would likely be localized and temporary.

During operations, the new nuclear alternative would require a similar amount of water from the Schuylkill River, or other similar water body, as is required for LGS Units 1 and 2. The number of fish and other aquatic resources affected by cooling water intake and discharge operations, such as entrainment, impingement, and thermal stress, would be similar for a new nuclear alternative as for those associated with LGS Units 1 and 2, provided the cooling-water intake and blowdown operations involve a water body similar in species composition and populations to the Schuylkill River.

The impacts on aquatic ecology would be minor because construction activities would require BMPs and stormwater management permits, and because the surface water withdrawal and discharge for this alternative would be similar to LGS Units 1 and 2 (as discussed in Section 4.5). Therefore, the staff concluded that impacts on aquatic ecology would be SMALL.

Consultation with NMFS and FWS under ESA would ensure that the construction and operation of a new nuclear plant would not adversely affect any Federally listed species or adversely modify or destroy designated critical habitat. Consultation with NMFS under the Magnuson-Stevens Act would require the NRC to evaluate impacts to EFH. NMFS would provide conservation recommendations if there would be adverse impacts to EFH. Coordination with state natural resource agencies would further ensure that the plant operator would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation on protected species and habitats would be SMALL.

### 8.3.5. Terrestrial Resources

The new nuclear alternative, including the new reactor units and auxiliary facilities, would affect 630 ac to 1,260 ac (255 ha to 510 ha) of land at the site of an existing power station other than LGS (Exelon 2011), as described in Section 8.3.7. Because of the significant land requirement for the site, impacts to terrestrial species and habitats would vary depending on the amount of previously undisturbed land that would be cleared for the new nuclear alternative. By siting the new nuclear alternative at an existing nuclear site or adjacent to an existing site, the majority of land that would be affected by construction would be developed or previously disturbed. However, as with the SCPC alternative, the level of direct impacts would vary based on site selection. Erosion and sedimentation, fugitive dust, and construction debris impacts would be minor with implementation of appropriate BMPs (Exelon 2011). Impacts to terrestrial habitats and species from transmission line operation and corridor vegetation maintenance, and operation of the cooling system would be similar in magnitude and intensity to those resulting from operating nuclear reactors and would, therefore, be SMALL (NRC 1996). The offsite land requirement (1,000 ac (400 ha)) (NRC 1996) and impacts associated with uranium mining and fuel fabrication to support the new nuclear alternative would be no different from those occurring in support of LGS (see Section 8.3.7). Overall, the impacts of construction of a new nuclear facility on terrestrial species and habitats would be SMALL to MODERATE, and the impacts of operation would be SMALL.

As with the previously discussed alternatives, consultation with FWS under the ESA would avoid potential adverse impacts to Federally listed species or adverse modification or destruction of designated critical habitat. Coordination with state natural resource agencies would further ensure that Exelon would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of new nuclear generation on protected species and habitats would be SMALL.

### 8.3.6. Human Health

Impacts on human health from construction of two new nuclear units would be similar to impacts associated with the construction of any major industrial facility. Compliance with worker protection rules would control those impacts on workers at acceptable levels. Impacts from construction on the general public would be minimal since limiting active construction area access to authorized individuals is expected. Impacts on human health from the construction of two new nuclear units would be SMALL.

The human health effects from the operation of two new nuclear power plants would be similar to those of the existing LGS Units 1 and 2. Most other noises during power plant operations would be limited to industrial processes and communications. Impacts on human health from the operation of two new nuclear units would be SMALL.

### 8.3.7. Land Use

As discussed in Section 8.1.7, the GEIS generically evaluates the impact of constructing and operating various replacement power plant alternatives on land use, both on and off each plant site. The analysis of land-use impacts focuses on the amount of land area that would be affected by the construction and operation of a new two-unit nuclear power plant at or adjacent to an existing nuclear power plant site.

Based on GEIS estimates, approximately 1,000 ac (400 ha) of land would be needed for the new nuclear alternative. Exelon estimated 630 ac to 1,260 ac (255 ha to 510 ha) of land would be needed to construct and operate a new two-unit nuclear power plant (Exelon 2011). The NRC determined that Exelon's estimate is reasonable because it is consistent with land requirements for proposed new nuclear plants.

Locating the new units at or adjacent to an existing nuclear power plant would mean that the majority of the affected land area would already be zoned for industrial use. Making use of the existing infrastructure would reduce the amount of land needed to support the new units. Local residents are already accustomed to living near a nuclear power plant. Land-use impacts from constructing two new units at an existing nuclear power plant site would be SMALL.

The amount of land required to mine uranium and fabricate nuclear fuel during rector operations would be similar to the amount of land required to support LGS, although an additional amount of land would be required during the license renewal term. According to GEIS estimates, an additional 1,000 ac (400 ha) of land would be affected by uranium mining and processing during the life of the new nuclear power plant. Impacts associated with uranium mining and fuel fabrication to support the new nuclear alternative would generally be no different from those occurring in support of the existing LGS reactors. Overall land-use impacts from nuclear power plant operations would range from SMALL to MODERATE depending on whether the nuclear plant is sited entirely contained within an existing nuclear power plant site or if it located on open land.

### 8.3.8. Socioeconomics

As previously explained in Section 8.1.8, two types of jobs would be created by this alternative: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) power plant operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements for the construction and operation of a new nuclear power plant were evaluated in order to measure their possible effects on current socioeconomic conditions.

Exelon estimated 3,650 workers at the peak of construction (Exelon 2011). The relative economic impact of this many workers on the local economy and tax base would vary, with the greatest impacts occurring in communities where the majority of construction workers reside and spend their income. As a result, local communities could experience a short-term economic "boom" from increased tax revenue and income generated by construction expenditures and the increased demand for temporary (rental) housing and business services. Some construction workers could relocate in order to be closer to the construction work site. However, given the proximity of many existing power plants to metropolitan areas, workers could commute to the construction site, thereby reducing the need for rental housing.

After completing the installation of the two new reactor units, local communities could experience a return to pre-construction economic conditions. Based on this information and given the number of construction workers, socioeconomic impacts during construction in local communities could range from SMALL to LARGE.

Exelon estimated that the number of operations workers at the new nuclear power plant would be similar to the number of operations workers at LGS (Exelon 2011). The amount of property taxes paid under the new nuclear alternative may increase if additional land is required to support this alternative. However, the reduction in employment at LGS from operations to decommissioning and shut down could affect property tax revenue and income in local communities and businesses. In addition, the permanent housing market could also experience increased vacancies and decreased prices if operations workers and their families move out of the region. Therefore, socioeconomic impacts during operations could range from SMALL to MODERATE.

### 8.3.9. Transportation

Transportation impacts associated with construction and operation of a new nuclear power plant would consist of commuting workers and truck deliveries of construction materials to the power plant site. During periods of peak construction activity, up to 3,650 workers could be commuting daily to the site (Exelon 2011). Workers commuting to the construction site would arrive by site access roads and the volume of traffic on nearby roads could increase substantially during shift changes. In addition to commuting workers, trucks would be transporting construction materials and equipment to the worksite, thus increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary levels of service impacts and delays at intersections. Some power plant components and materials could also be delivered by train or barge, depending on location. Train deliveries could cause additional traffic delays at railroad crossings. Based on this information, traffic-related transportation impacts during construction could range from MODERATE to LARGE.

Traffic-related transportation impacts on local roads would be greatly reduced after the completion of the power plant. Transportation impacts would include daily commuting by the operating workforce, equipment and materials deliveries, and the removal of commercial waste material to offsite disposal or recycling facilities by truck. During operations, the estimated number of operations workers commuting to and from the power plant would be 820 workers (Exelon 2011). Traffic-related transportation impacts would be similar to current operations at LGS, because the new units would employ the same number of workers as currently employed at LGS. Overall, transportation impacts would be SMALL to MODERATE during power operations.

### 8.3.10. Aesthetics

The analysis of aesthetic impacts focuses on the degree of contrast between the new nuclear power plant and the surrounding landscape and the visibility of the new units at an existing nuclear power plant site. The power block of the two new units would look very similar to the power block(s) at the existing nuclear power plant.

During construction, all of the clearing and excavation would occur on site. These activities may be visible from offsite roads. Since the existing power plant site already appears industrial, construction of the new nuclear power plant would appear similar to other ongoing onsite activities.

Located near an existing power plant, the tallest power plant structures, the natural draft cooling towers could be 400 to 500 ft (122 to 152 m) tall. Visible off site during daylight hours, they may require aircraft warning lights. Associated condensate plumes could add to the visual impact. Noise generated during power plant operations would mostly be limited to routine industrial processes and communications. Natural draft cooling towers would also generate noise.

In general, given the industrial appearance of an existing power plant site, the new nuclear power plant would blend in with the surroundings. Aesthetic changes would therefore be limited to the immediate vicinity of the existing power plant site, and any impacts would be SMALL to MODERATE, depending on its location and surroundings.

### 8.3.11. Historic and Archaeological Resources

The impacts of constructing the new nuclear alternative on historic and archaeological resources are similar to those impacts associated with activities for constructing an NGCC facility. Any areas potentially affected by the construction of the SCPC alternative would need to be surveyed to identify and record historic and archaeological resources. An inventory of a previously disturbed former plant (brownfield) site may still be necessary if the site has not been previously surveyed or to verify the level of disturbance and evaluate the potential for intact subsurface resources. Plant operators would need to survey all areas associated with operation of the alternative (e.g., roads, transmission corridors, other ROWs). Any resources found in these surveys would need to be evaluated for eligibility on the NRHP, and mitigation of adverse effects would need to be addressed if eligible resources were encountered. Areas with the greatest sensitivity should be avoided. Visual impacts on significant cultural resources—such as the viewsheds of historic properties near the site—should also be assessed.

The potential for impacts on historic and archaeological resources from the new nuclear alternative would vary greatly depending on the location of the proposed site. However, given that the preference is to use a previously disturbed former plant site, avoidance of significant historic and archaeological resources should be possible and effectively managed under current laws and regulations. Therefore, the impacts on historic and archaeological resources from the new nuclear alternative would be SMALL.

### 8.3.12. Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health, environmental, and socioeconomic effects on minority and low-income populations that could result from the construction and operation of a new power plant. As previously discussed in Section 8.1.12, such effects may include human health, biological, cultural, economic, or social impacts.

Potential impacts to minority and low-income populations would mostly consist of environmental and socioeconomic effects during construction (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be directly affected by increased commuter vehicle and truck traffic. However, because of the temporary nature of construction, these effects are not likely to be high and adverse and would be contained to a limited time period during certain hours of the day. During construction, increased demand for rental housing in the vicinity of the site could affect low-income populations living near the plant site. However, given the proximity of some existing nuclear power plant sites to metropolitan areas, workers could commute to the construction site, thereby reducing the need for rental housing.

Potential impacts to minority and low-income populations from new nuclear power plant operations would mostly consist of radiological effects; however, radiation doses are expected to be well below regulatory limits. All people living near the nuclear power plant would be exposed to the same potential effects from power plant operations, and any impacts would depend on the magnitude of the change in ambient air quality conditions. Permitted air emissions are expected to remain within regulatory standards.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the construction and operation of a new nuclear power plant would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

### 8.3.13. Waste Management

During the construction stage of the new nuclear alternative, land clearing and other construction activities would generate waste that could be recycled, disposed of on site, or shipped to the offsite waste disposal facility. Because the new nuclear plants would be constructed at a location on and adjacent to an existing nuclear power plant (although not at LGS because of space limitations), the amount of wastes produced during land clearing would be reduced.

During the operational stage, normal plant operations, routine plant maintenance, and cleaning activities would generate nonradioactive waste as well as mixed waste, low-level waste, and high-level waste. Quantities of nonradioactive waste (discussed in Section 2.3.1 of this SEIS) and radioactive waste (discussed in Section 6.1 of this SEIS) generated by Units 1 and 2 would be comparable to that generated by the new nuclear plants.

According to the GEIS (NRC 1996), the generation and management of solid nonradioactive waste during the terms of an extended license are not expected to result in significant environmental impacts. Two new nuclear plants would generate waste streams similar to those at nuclear plants that have undergone license renewal. Based on this information, the waste impacts would be SMALL for the new nuclear alternative.

**Table 8–4. Summary of Environmental Impacts of the New Nuclear Alternative Compared to Continued Operation of the Existing LGS**

| | New Nuclear Alternative | Continued LGS Operation |
|---|---|---|
| Air Quality | SMALL | SMALL |
| Groundwater | SMALL | SMALL |
| Surface Water | SMALL | SMALL |
| Aquatic Resources | SMALL | SMALL |
| Terrestrial Resources | SMALL to MODERATE | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | SMALL to MODERATE | SMALL |
| Socioeconomics | SMALL to LARGE | SMALL |
| Transportation | SMALL to MODERATE | SMALL |
| Aesthetics | SMALL to MODERATE | SMALL |
| Historic and Archaeological | SMALL | SMALL |
| Waste Management | SMALL[a] | SMALL[a] |

[a] As described in Chapter 6, the issue, "offsite radiological impacts (spent fuel and high level waste disposal)," is not evaluated in this EIS.

## 8.4. Wind Alternative

The feasibility of wind as a baseload power source depends on the availability, accessibility, and constancy of the wind resource within the region of interest. Wind power, in general, cannot be stored without first being converted to electrical energy.

Wind power installations, which may consist of several hundred turbines, produce variable amounts of electricity. LGS, however, produces electricity almost constantly. Because wind power installations deliver variable output when wind conditions change, wind power cannot substitute for existing baseload generation on a one-to-one basis. In its ER, Exelon discusses the need for "firming capacity" to provide support to the variable wind resource and provide consistent baseload power. Firming capacity could come from other generators, from compressed air energy storage (CAES), from pumped hydroelectric storage, or from interconnected wind installations. Archer and Jacobsen (2007), indicates that an array of interconnected wind sites (19 in their study), spread across significant distances (with approximately 850 km (530 mi) distance from north to south and east to west) could provide 21 percent of installed capacity 79 percent of the time. While the sites in Archer and Jacobsen's study, in most cases, accessed higher power-class wind resources than are readily available onshore in PJM, the approach suggests that approximately 20 percent of the installed capacity in a series of interconnected wind installations could provide baseload power. Therefore, this study indicates that interconnecting windfarms, as assumed in this alternative, may provide a source of consistent, baseload power. In this alternative, the staff considers a wind alternative that relies on numerous, interconnected wind installations scattered across PJM. This arrangement ensures that generators are sufficiently dispersed so that low-wind or no-wind conditions are unlikely to occur at all or most locations at any given time.

Wind farms currently operate at much lower capacity factors than nuclear power. For example, LGS Unit 1 has operated at a 97 percent capacity factor over the years 2003 to 2010, while LGS Unit 2 has operated at a 96 percent capacity factor over the same period (NRC 2011). Currently, Department of Energy (DOE) estimates that wind turbine installations operate at 39 percent or lower capacity factors because of the variability of wind resources. As Exelon indicated in its ER, this capacity factor is likely to increase as wind turbine technology advances and as operators become more experienced in maximizing output. DOE indicates that, by 2020, onshore wind turbines may reach a 52 percent capacity factor, while offshore units may reach a 55 percent capacity factor (DOE 2008). As described in more detail below, the staff finds it likely that all wind turbines in this alternative will be land-based and, therefore, used the 52 percent capacity factor as an upper range of the capacity factor for this analysis.

For a lower range of the capacity factor used in this analysis, the staff reviewed PJM's 13 percent "capacity credit" to wind power. Capacity credit is the amount of a generator's nameplate capacity that counts toward the total generating capacity of the PJM system for system planning purposes. Assuming a 13 percent "capacity credit" for wind power, 18,000 MW(e) of wind power would be necessary to replace 2,340 MW(e) of LGS because of the intermittency of wind power.

Wind power is a commercially available and feasible means of generating electricity. Assuming a range of 13 to 52 percent capacity factor, the staff, in this alternative, evaluates a wind-powered alternatives that contains between 4,500 MW(e) and 18,000 MW(e) of installed capacity. Relying on commonly available 2-MW(e) turbines, 2,250 to 9,000 turbines would be required to replace LGS. The NRC staff determined this was a reasonable alternative because wind power is currently a source of energy generation within PJM. As of October 2012, approximately 6,000 MW of installed wind capacity exists within PJM (PJM 2012a). The installed wind capacity within Pennsylvania, Delaware, Maryland, New Jersey, Ohio, and West Virginia has grown on average 50 percent per year from 2000 through 2011 (DOE 2012). Similar growth is likely within the next several years. For example, as of January 2012, a total of 37,792 MW of wind energy generation is proposed within PJM (PJM 2012b). Similarly, in a recent update of PJM's renewable portfolio standards, PJM (2012a) estimated that 35,600 MW of wind energy would be installed by 2027.

As described above, this alternative assumes all wind power would be generated onshore because it is currently commercially available and a feasible means of generating electricity. While some offshore wind development is possible by 2024, no commercial offshore wind installations currently operate in the United States, despite more than a decade of development efforts. In the Atlantic Ocean, several commercial wind-power projects have been proposed, but none have yet received final approvals or begun construction. The most prominent of these projects, Cape Wind would consist of 130 turbines with a maximum installed capacity of 468 MW. The project was initially proposed in 2001; however, because of significant delays related to permitting and the NEPA process, the project is currently scheduled to begin construction in 2013. Cape Wind is the first and only U.S. offshore wind farm to have received all required Federal and State approvals, a commercial lease, and an approved construction and operations plan (BOEMRE, 2012b). Other projects offshore of Rhode Island and New Jersey are smaller than Cape Wind (Wald 2011), and another organization has proposed—though not yet constructed—a high-voltage direct-current powerline on the seafloor to connect offshore projects (Atlantic Wind Connection undated, Wald 2011). Finally, a group working near Long Island proposed an installation of 700 MW(e) of wind capacity (Con Edison 2009). While wind data suggest there is potential for offshore wind farms along the coast of the mid-Atlantic and in the Great Lakes, project costs likely limit the future potential of large-scale projects (NREL 2010). NREL (2010) estimated that offshore project costs would run approximately

200 to 300 percent higher than land-based systems. Also, based on current prices for wind turbines, the 20-year levelized cost of electricity produced from an offshore wind farm would be above the current production costs from existing power generation facilities. In addition to cost, other barriers include the immature status of the technology, limited resource area, and high risks and uncertainty (NREL 2010).

Environmental impacts from the wind alternative are summarized in Table 8–5.

### 8.4.1. Air Quality

As discussed in Section 2.2.2.1, the LGS site is located in Montgomery and Chester Counties, Pennsylvania, which is part of the Metropolitan Philadelphia Interstate Air Quality Control Region AQCR (40 CFR 81.15). With regard to the National Ambient Air Quality Standards (NAAQS), EPA has designated Montgomery and Chester Counties as unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$; and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339).

Beyond maintenance of the wind turbines, there would be no routine air emissions associated with operations from wind generation. Activities associated with the construction and installation of the wind turbines would cause some temporary air pollutant emissions. However, emissions from workers' vehicles and construction equipment exhaust would be temporary. The staff concludes that the air quality impact from construction would be SMALL.

*Greenhouse Gas Emissions*

Wind power releases no GHGs during operation, although some GHG emissions occur during component manufacturing, transportation, and installation, as well as during site preparation. Impacts from the construction of components of this alternative would result primarily from the consumption of fossil fuels in the engines of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. However, all such impacts would be temporary.

In general, wind power is one of the least carbon-intensive electric generation options available. For a comparison to other means of electric generation, see the discussion in Chapter 6.

Given the expected relatively small workforces, short construction period, and GHG emissions resulting from site preparation and installation, ,the overall impact from the release of GHGs of the wind alternative would be SMALL.

*Conclusions*

Based on the above discussion, the overall air emissions and air quality impacts from the wind alternative would be designated as SMALL.

### 8.4.2. Groundwater Resources

Groundwater dewatering, where required for installation of wind turbines on land, would be minimal because of the small footprint of foundation structures and piling emplacements. For all construction activities, appropriate BMPs, including spill prevention practices, would be used during wind turbine construction to prevent or minimize impacts on groundwater quality.

Little or no groundwater use would be expected for operation of wind turbines, and no impacts on groundwater quality would be expected from routine operations. Consequently, the impacts on groundwater use and quality under this alternative would be SMALL.

### 8.4.3. Surface Water Resources

Small amounts of water would be required during the construction phase for each of the 2,250 wind turbines, including for dust suppression and soil compaction during site clearing and for concrete production for pad and piling construction, as appropriate. Although surface water from nearby water bodies may be used for pad site construction at some locations, it is likely that water would be procured from offsite sources and trucked to the point of use on an as needed basis. Use of ready-mix concrete also would reduce the need for onsite use of nearby water sources.

Further, the installation of land-based wind turbines would require installation of access roads and possibly transmission lines (especially for turbine sites not already proximal to transmission line corridors). Access road construction also would require some water for dust suppression and roadbed compaction and would have the potential to result in soil erosion and stormwater runoff from cleared areas. Water would likely be trucked to the point of use from offsite locations along with road construction materials. Construction activities would be conducted in accordance with state-issued NPDES or equivalent permits for stormwater discharges associated with construction activity, which would require the implementation of appropriate BMPs to prevent or mitigate water quality impacts.

To support operations of individual wind turbine installations, only very small amounts of water would be needed to periodically clean turbine blades and motors as part of routine servicing. It would be expected that water would be trucked to the point of use and procured from nearby sources. Adherence to appropriate waste management and minimization plans, spill prevention practices, and pollution prevention plans during servicing would minimize the risks to soils and surface water resources from spills of petroleum, oil, and lubricant products and runoff associated with the turbine installations. Therefore, the impacts on surface water use and quality under the wind alternative would be SMALL.

### 8.4.4. Aquatic Resources

Construction activities for the land-based wind alternative (such as construction of heavy-haul roads and the wind turbines) could affect drainage areas and other onsite aquatic features. Minimal impacts on aquatic ecology resources are expected because the plant operator would likely implement BMPs to minimize erosion and sedimentation. Stormwater control measures, which would be required if an NPDES permit was necessary, would minimize the flow of disturbed soils into aquatic features. During operations, the land-based wind alternative would not require consumptive water use.

The impacts on aquatic ecology would be minor because construction activities would likely require BMPs and stormwater management permits. During operations, the land-based wind alternative would not require consumptive water use. Therefore, impacts on aquatic ecology from the land-based wind alternative would be SMALL.

Consultation with NMFS and FWS under ESA would ensure that the construction and operation of wind farms would not adversely affect any Federally listed species or adversely modify or destroy designated critical habitat. If wind farms were located near EFH, consultation with NMFS under the Magnuson-Stevens Act would require the NRC to evaluate impacts to EFH. NMFS would provide conservation recommendations if there would be adverse impacts to EFH. Coordination with state natural resource agencies would further ensure that the wind farm operators would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation on protected species and habitats would be SMALL.

### 8.4.5. Terrestrial Resources

The wind alternative would contain between 2,250 and 9,000 wind turbines requiring approximately 3,200 to 13,300 ac (1,300 to 5,400 ha) of land. This land estimate includes only the area directly affected by placement of turbines, and about two-thirds of this land area would only experience temporary disturbance during construction. The logistics of delivering heavy or oversized components to ideal locations such as hilltops or ridgelines would be challenging and might require extensive modifications to existing road infrastructures and construction of access roads that take circuitous routes to their destination to avoid unacceptable grades. However, once construction was completed, many access roads could be reclaimed and replaced with more-direct access to the wind farm for maintenance purposes. Likewise, land used for equipment laydown and turbine component assembly and erection could be returned to its original state. BMPs following construction that include plans to restore disturbed land would also reduce the impact of construction on terrestrial habitats. Because wind turbines require ample spacing between one another to avoid inter-turbine air turbulence, the footprint of utility-scale wind farms could be quite large. The turbines would be spread across a total area of 200 to 830 $mi^2$ (520 to 2,150 $km^2$), and most of this area will remain in compatible land uses, such as agriculture and forests (Exelon, 2011). During operations, only 5 to 10 percent of the total acreage within the footprint of wind installations would actually be occupied by turbines, access roads, support buildings, and associated infrastructure while the remaining land areas could be put to other compatible uses, including agriculture. Habitat loss and some habitat fragmentation may occur as a result, especially for wind turbines installed in forested areas. Overall, construction impacts on terrestrial species and habitats could range from SMALL to MODERATE.

Operation of wind turbines could uniquely affect terrestrial species through noise, collision with turbines and meteorological towers, site maintenance activities, disturbance associated with activities of the project workforce, and interference with migratory behavior. Bat and bird mortality from turbine collisions is a concern for operating wind farms; however, recent developments in turbine design have reduced the potential for bird and bat strikes. Additionally, impacts to those bird and bat species protected by the ESA, the Migratory Bird Treaty Act, or the Bald and Golden Eagle Protection Act would be mitigated through consultation with the appropriate agencies as discussed below. Impacts to terrestrial habitats and species from transmission line operation and corridor vegetation maintenance would be similar in magnitude and intensity to those resulting from operating nuclear reactors and would, therefore, be SMALL (NRC 1996). Overall, operation impacts to terrestrial species and habitats could range from SMALL to MODERATE.

As with the previously discussed alternatives, consultation with FWS under the ESA would avoid potential adverse impacts to Federally listed species or adverse modification or destruction of designated critical habitat. Coordination with state natural resource agencies would further ensure that Exelon would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of a wind alternative on protected species and habitats would be SMALL.

### 8.4.6. Human Health

Impacts on human health from construction of the wind alternative would be similar to impacts associated with the construction of any major industrial facility. Compliance with worker protection rules would control those impacts on workers at acceptable levels. Impacts from construction on the general public would be minimal since limiting active construction area access to authorized individuals is expected. Impacts on human health from the construction of the wind alternative would be SMALL.

The Massachusetts Department of Environmental Protection (MassDEP), in collaboration with the Massachusetts Department of Public Health (MDPH), convened a panel of independent experts to identify any documented or potential health impacts of risks that may be associated with exposure to wind turbines (MassDEP and MDPH 2012). The panel conducted an extensive literature review of scientific literature as well as other reports, popular media, and the public comments received by MassDEP to write its report. Based on its review, the panel presented findings relative to three factors associated with the operation of wind turbines: noise and vibration, shadow flicker, and ice throw.

Noise and Vibration

Noise produced by wind turbines during operation depends on the design of the wind turbine. Propagation of the sound is primarily a function of distance from the wind turbine, but can also be affected by placement of the wind turbine, surrounding terrain, and atmospheric conditions. Infrasound refers to vibrations with frequencies below 20 Hertz (Hz). Infrasound at amplitudes over 100-110 Decibels (dB) can be heard and felt. Research has shown that vibrations below these amplitudes are not felt. Through its research, the panel found that the highest infrasound levels measured near turbines are under 90 dB at 5 Hz and lower at higher frequencies for locations as close as 100 meters (m). The panel found that there was not sufficient evidence to conclude that noise and vibration from wind turbines cause negative impacts on human health (MassDEP and MDPH 2012).

Shadow Flicker

Shadow flicker results from the passage of the blades of a rotating wind turbine between the sun and the observer. The occurrence of shadow flicker depends on the location of the observer relative to the turbine and the time of day and year, and is found to only be present at distances of less than 1,400 m (4,600 ft) from the turbine. The panel found through its research that there was not sufficient evidence to conclude that shadow flicker causes negative impacts (such as seizures from photic stimulation) on human health (MassDEP and MDPH 2012).

Ice Throw

Ice can fall or be thrown from a wind turbine during or after an event when ice forms or accumulates on the blades. The distance that a piece of ice may travel from the turbine is a function of the wind speed, the operating conditions, and the shape of the ice. The panel found that in most documented cases of ice throw, the ice falls within a distance from the turbine equal to the tower height, and very seldom does the distance exceed twice the total height of the turbine (tower height plus blade length). The panel found that there is sufficient evidence that falling ice is a human health impact, and measures should be taken to ensure proper hazard minimization. Proper siting of the wind turbines, limitation of access by members of the public, and adequate training of persons in charge of maintenance of the facility will help to minimize the danger of ice throw (MassDEP and MDPH 2012).

Overall, given proper health-based regulation through procedures and access limitations, the staff expects human health impacts from operation of the wind alternative at an alternate site to be SMALL.

### 8.4.7. Land Use

As discussed in Section 8.1.7, the GEIS generically evaluates the impact of constructing and operating various replacement power plant alternatives on land use, both on and off each power plant site. The analysis of land-use impacts focuses on the amount of land area that would be affected by the construction and operation of new land-based wind farms in the PJM territory. Most of the wind farms would likely be located on open agricultural cropland, which would remain largely unaffected by the wind turbines.

Since wind turbines require ample spacing between one another to avoid air turbulence, the footprint of a utility scale wind farm could be quite large. Under the wind alternative, land-based turbines would be located on multiple wind farms spread across approximately 130,000 to 534,000 ac (53,000 to 216,000 ha or 200 to 830 $mi^2$ [520 to 2,150 $km^2$]) of land. A small portion of this land, approximately 3,200 to 13,300 ac (1,300 to 5,400 ha), would be directly affected by the placement of the wind turbines (Exelon 2011). This land would be temporarily affected during the installation of the turbines and the construction of support facilities, and about one-third of the land across a very wide area would be permanently impacted during the operation. Land in between the turbines can be used for farming or grazing.

Delivering heavy and oversized wind turbine components would also require the construction of temporary site access roads, some of which may require a circuitous route to their destination. However, once construction is completed, many temporary access roads can be reclaimed and replaced with more direct access to the wind turbines for maintenance purposes. Likewise, land used for equipment and material lay down areas, turbine assembly, and installation could be returned to its original state. During operations, however, only 5–10 percent of the total acreage within the wind farm is actually occupied by turbines, access roads, support buildings, and associated infrastructure while the remaining land area can be returned to its original condition or some other compatible use, such as farming or grazing.

The elimination of uranium fuel for LGS could partially offset some, but not all, of the land requirements for the wind farms. Scaling from GEIS estimates, approximately 1,640 ac (660 ha) would no longer be needed for mining and processing uranium during the operating life of the wind farms.

The wind farms would require a substantial amount of open land, although only a small portion would be used for wind turbines, access roads, and infrastructure. Therefore, land use impacts from the wind alternative would range from MODERATE to LARGE.

### 8.4.8. Socioeconomics

As previously explained in Section 8 1.8, two types of jobs would be created by this alternative: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements for the construction and operation of the wind alternative were evaluated in order to measure their possible effects on current socioeconomic conditions.

Exelon estimated 200 construction and 50 operations workers would be required for this alternative (Exelon 2011). These numbers appear reasonable and in line with current construction and operational trends. Because of the relatively small number of construction workers and the large area covered by the wind farms (i.e., 200 to 830 $mi^2$ [520 to 2,160 $km^2$]), the relative economic impact of this many workers on local communities and the tax base would be SMALL. Given the small number of operations workers, socioeconomic impacts associated with operation of the wind farms would also be SMALL.

The reduction in employment at LGS could affect property tax revenue and income in local communities and businesses. In addition, the permanent housing market could also experience increased vacancies and decreased prices if operations workers and their families move out of the LGS region. However, the increased property taxes paid by wind farms may offset lost tax revenues in local jurisdictions. Based on this information, socioeconomic impacts during wind farm operations could range from SMALL to MODERATE.

### 8.4.9. Transportation

Transportation impacts during the construction and operation of the wind alternative would be less than the impacts for the NGCC, SCPC, and new nuclear alternatives, discussed in the previous sections, because of a smaller construction workforce and smaller volume of materials and equipment needed to be transported to the construction site.

As described in 8.4.7, up to 200 workers could be commuting daily to the site during periods of peak construction activity (Exelon 2011). Workers commuting to the construction site would arrive by site access roads and the volume of traffic on nearby roads could increase during shift changes. In addition to commuting workers, trucks would be transporting construction materials and equipment to the worksite, thus increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary levels of service impacts and delays at intersections. Transporting heavy and oversized wind turbine components on local roads could have a noticeable impact over a large area. Some components and materials could also be delivered by train or barge, depending on location. Train deliveries could cause additional traffic delays at railroad crossings. Based on this information, traffic-related transportation impacts during construction could range from SMALL to MODERATE depending on the location of the wind farm site, road capacities, and traffic volumes.

During plant operations, transportation impacts would not be noticeable. Exelon estimated an operational workforce of 50 workers (Exelon 2011). Given the small number of operations workers, transportation impacts on local roads would be SMALL.

### 8.4.10. Aesthetics

The analysis of aesthetic impacts focuses on the degree of contrast between the wind farms and the surrounding landscape and the visibility of wind turbines. In general, aesthetic changes would be limited to the immediate vicinity of the wind farms. However, wind turbines would have the greatest visual impact. At 400 ft (122 m) tall (Exelon 2011) and spread across multiple sites, wind turbines would dominate the view and would likely become the major focus of attention. Because wind farms are generally located in rural or remote areas, the introduction of wind turbines will be in sharp contrast to the visual appearance of the surrounding environment. Placing turbines along ridgelines would maximize their visibility. Wind turbines also generate noise. Most other noises would be limited to industrial processes and communications. Based on this information, aesthetic impacts from the construction and operation of a land-based wind alternative would range from MODERATE to LARGE depending on location and surroundings.

### 8.4.11. Historic and Archaeological Resources

To consider effects on historic and archaeological resources, any areas potentially affected by the construction of a wind alternative would need to be surveyed to identify and record historic and archaeological resources. Any resources found in these surveys would need to be evaluated for eligibility on the NRHP, and mitigation of adverse effects would need to be addressed if eligible resources were encountered. The owner of the wind farms would need to survey all areas associated with operation of the alternative (e.g., roads, transmission corridors, other ROWs). Areas with the greatest sensitivity should be avoided. Visual impacts on significant cultural resources—such as the viewsheds of historic properties near the sites—also should be assessed.

The potential for impacts on historic and archaeological resources from the wind alternative would vary greatly, depending on the location of the proposed sites. Areas with the greatest sensitivity could be avoided or effectively managed under current laws and regulations. However, construction of wind farms and their support infrastructure have the potential to notably impact historic and archaeological resources because of earthmoving activities (e.g., grading and digging) and the aesthetic changes they may bring to the viewshed of historic properties located nearby. Therefore, depending on the resource richness of the site chosen for the wind farms and associated infrastructure, the impacts could range from SMALL to LARGE.

### 8.4.12. Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health, environmental, and socioeconomic effects on minority and low-income populations that could result from the construction and operation of new wind farms. As previously discussed in Section 8.1.12, such effects may include human health, biological, cultural, economic, or social impacts.

Potential impacts to minority and low-income populations would mostly consist of environmental and socioeconomic effects (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be affected by increased commuter vehicle and truck traffic. However, because of the temporary nature of construction, these effects are not likely to be high and adverse and would be contained to a limited time period during certain hours of the day. Increased demand for rental housing during construction could affect low-income populations. However, given the small number of construction workers and the possibility that workers could commute to the construction site, the need for rental housing would not be significant. Minority and low-income populations living in close proximity to the wind farms could be disproportionately affected by wind farm operations. However, operational impacts would mostly be limited to noise and aesthetic effects. The general public living near the wind farms would also be exposed to the same effects.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the construction and operation of new wind farms would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

### 8.4.13. Waste Management

During the construction stage of the wind alternative facility, land clearing and other construction activities would produce minor quantities of waste. Only small quantities of waste, such as dielectric fluids used during maintenance activities, would be produced during operation (Exelon 2011). In addition, Table 8–2 of the GEIS (NRC 1996), the staff identified very minor amounts of waste from maintenance of equipment and potentially removing vegetation. Based on this information, waste impacts would be SMALL for a wind turbine site.

**Table 8–5. Summary of Environmental Impacts of the Wind Alternative Compared to Continued Operation of the Existing LGS**

| | Wind Power | Continued LGS Operation |
|---|---|---|
| Air Quality | SMALL | SMALL |
| Groundwater | SMALL | SMALL |
| Surface Water | SMALL | SMALL |
| Aquatic Resources | SMALL | SMALL |
| Terrestrial Resources | SMALL to MODERATE | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | MODERATE to LARGE | SMALL |
| Socioeconomics | SMALL to MODERATE | SMALL |
| Transportation | SMALL to MODERATE | SMALL |
| Aesthetics | MODERATE to LARGE | SMALL |
| Historic and Archaeological | SMALL to LARGE | SMALL |
| Waste Management | SMALL | SMALL[(a)] |

(a) As described in Chapter 6, the issue, “offsite radiological impacts (spent fuel and high level waste disposal),” is not evaluated in this EIS.

## 8.5. Purchased Power

The impacts from purchased power would depend substantially on the generation technologies used to supply the purchased power. Given PJM’s market-based system operations, replacement power could come from different generators at different times of the year, so impacts are not necessarily predictable. Impacts from operation of other generators would likely occur in Pennsylvania or elsewhere in PJM.

Exelon assumed that purchased power would be available as a reasonable alternative for meeting load obligations if the LGS licenses are not renewed (Exelon 2011). The NRC staff finds this assessment reasonable given the large size of PJM and wide range of existing and potential energy-producing facilities available to purchase power. Purchased power would likely come from one or more of the other types of alternatives considered in this chapter. As a result, operational impacts would be similar to the operational impacts of the alternatives considered in this chapter. Unlike the alternatives considered in this chapter, however, facilities from which power would be purchased would not likely be constructed solely to replace LGS. Purchased power may, however, require new transmission lines (which may require new construction), and may also rely on slightly older and less efficient power plants’ operating at higher capacities than they currently operate. Exelon, in the ER, states that impacts would be “incremental and reflective of the increased amount of power being produced,” and may vary based on fuels used, waste management practices, and facility locations (Exelon 2011).

At some times, some portion of replacement power needs may be addressed by PJM’s demand-response program, which the staff discusses in Section 8.6.14. As noted in Section 8.6.14, impacts from DSM programs are generally small, although backup generators could impact air quality.

During operations, impacts from new nuclear, coal-fired, and natural gas-fired plants and wind energy projects would be similar to that described under the new nuclear, coal, natural gas, and wind alternatives described in the previous sections. Impacts from the operations of existing coal and natural gas-fired plants would likely be greater than the operations of new plants because older plants are more likely to be less efficient and without modern emissions controls. Air quality impacts from the combination of all sources would likely be greater than license renewal because a large portion of the purchased power would likely be from coal- and natural gas-fired plants.

While purchased power is a reasonable alternative, the potential impacts of constructing and operating new power generating facilities are addressed elsewhere in this chapter. In general, the impacts would likely be greater than license renewal because of potential new construction and because continued operation of older plants could result in higher emissions. A brief summary of the impacts for each resource area is provided below:

*Air Quality*: SMALL to MODERATE

New and continued nuclear and wind energy generation would not have noticeable impacts on air quality. New and continued natural gas- and coal-fired plants would have noticeable impacts on air quality; both natural gas- and coal-fired plants emit higher amounts of $NO_x$, $SO_x$, PM, PAHs, CO, $CO_2$, and mercury as compared to LGS Units 1 and 2, and would have noticeable impacts.

*Groundwater and Surface Water*: SMALL

New and continued operation of nuclear, coal-fired, and natural gas-fired plants and wind energy projects would not have noticeable impacts on water resources assuming all energy generating facilities operate within their associated water quality and water use permits.

*Terrestrial and Aquatic*: SMALL to MODERATE

New and continued operation of existing natural gas-fired and nuclear plants would not have noticeable impacts on aquatic and terrestrial resources assuming plants are built in areas that avoid sensitive species and habitats. New land-based wind energy projects would not have noticeable impacts on aquatic resources assuming projects are built in areas that avoid sensitive species and habitats. New wind energy projects would have noticeable impacts on avian and bat communities. Any new transmission lines would likely be collocated with existing right-of-way, which would minimize impacts to ecological resources. New and continued operation of coal-fired plants would have noticeable impacts primarily because of the deposition of ash and other pollutants and because of the extent of terrestrial habitat disturbance associated with coal mining.

*Human Health*: SMALL

New and continued operation of existing nuclear, coal-fired, and natural gas-fired plants and wind energy projects would not have noticeable impacts on human health because of the extent of regulations to protect public health.

*Land Use*: SMALL to LARGE

Purchased power from existing nuclear power plants would not cause any land use changes. New power plants would be constructed at existing power plant sites. Purchased power from coal- and natural gas-fired plants could have a noticeable impact on land use because of the amount of land required for coal mining and gas drilling. Wind energy projects would have a noticeable land-use impact because of the large amount of land required for wind farms. Any new transmission lines would likely be collocated with existing right-of-way, which would minimize any land use impacts.

*Socioeconomics, Transportation, and Aesthetics*: SMALL to LARGE

Purchased power from existing power plants would not have any socioeconomic impact, because there would be no change in power plant operations or workforce. Construction of new electrical power generating facilities could cause noticeable short-term socioeconomic and transportation impacts because of the number of construction workers required to build the new power plant. Traffic volumes would increase on local roads during shift changes. Continued operations of existing power plants would not have noticeable increased socioeconomic impacts as there would be no change in the number of workers at existing power generation facilities.

Wind energy projects would have the greatest visual impact; wind turbines would dominate the view and would likely become the major focus of attention.

*Archaeological and Historic Properties*: SMALL to LARGE

No direct impacts on historic and archaeological resources are expected from purchased power. If new transmission lines were needed to convey power to the PJM area, surveys similar to those discussed in Section 8.1.11 would need to be performed. However, transmission lines would likely be collocated with existing right-of-ways minimizing any impacts to historic and archaeological resources.

Indirectly, construction of new nuclear, coal-fired, and natural gas-fired plants, wind energy projects and any new transmission lines to support the purchased power alternative could affect archaeological and historic resources. Any areas potentially affected by the construction would need to be surveyed to identify and record historic and archaeological resources. Resources found in these surveys would need to be evaluated for eligibility on the NRHP and mitigation of adverse effects would need to be addressed if eligible resources were encountered. Plant operators would need to survey all areas associated with operation of the alternative (e.g., roads, transmission corridors, other ROWs). The potential for impacts on historic and archaeological resources would vary greatly depending on the location of the proposed sites; however, using previously disturbed sites could greatly minimize impacts to historic and archaeological resources. Areas with the greatest sensitivity could be avoided or effectively managed under current laws and regulations. Therefore, depending on the resource richness of the sites chosen, the impacts could range from SMALL to LARGE.

*Environmental Justice*

Low-income populations could be disproportionately affected by increased utility bills because of the cost of purchased power. However, programs, such as the low income home energy assistance program in Pennsylvania, are available to assist low-income families in paying for increased electrical costs.

*Waste Management*: SMALL to MODERATE

New and continued operations of existing nuclear and natural gas-fired plants and wind energy projects would not have noticeable impacts. However, new and continued generation of coal-fired plants would have noticeable impacts because of the accumulation of ash and scrubber sludge.

The impacts presented in Table 8–6 represent the potential range of impacts from relying on purchased power to replace LGS. Impacts from operation of other generators would likely occur elsewhere in PJM. The overall impacts would range from SMALL to MODERATE.

**Table 8–6. Summary of Environmental Impacts of Purchased Power Compared to Continued Operation of the Existing LGS**

| | Purchased Power Alternative | Continued Operation of LGS |
|---|---|---|
| Air Quality | SMALL to MODERATE | SMALL |
| Groundwater Resources | SMALL | SMALL |
| Surface Water Resources | SMALL | SMALL |
| Aguatic & Terrestrial Resources | SMALL to MODERATE | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | SMALL to LARGE | SMALL |
| Socioeconomics (including transportation and aesthetics) | SMALL to LARGE | SMALL |
| Historic and Archaeological | SMALL to LARGE | SMALL |
| Waste Management | SMALL to MODERATE | SMALL[a] |

[a] As described in Chapter 6, the issue, “offsite radiological impacts (spent fuel and high level waste disposal),” is not evaluated in this EIS.

## 8.6. Alternatives Considered but Dismissed

Alternatives to LGS license renewal that were considered and eliminated from detailed study are presented in this section. These alternatives were eliminated because of technical, resource availability, or current commercial limitations. Many of these limitations would continue to exist when the current LGS licenses expire.

### 8.6.1. Solar Power

Solar technologies, including photovoltaic (PV) and solar thermal (also known as concentrated solar power (CSP)), use the sun’s energy to produce electricity at a utility scale. In PV systems, special PV materials convert the energy contained in photons of sunlight incident to direct current (DC) electricity that can be aggregated, converted to alternating current (AC), and connected to the high-voltage transmission grid. Some PV installations, especially those located on existing buildings, provide power directly to consumers without first going onto the grid. CSP technologies produce electricity by capturing the sun’s heat energy. CSP facilities are typically grid connected, and owing to their size and operational characteristics, are not located atop existing structures. Although some aspects of solar generation result in few environmental impacts, solar technology requires substantial land areas, and CSP technologies require roughly the same amount of water for cooling of the steam cycle as most other thermoelectric technologies.

The potential for solar technologies to serve as reliable baseload power alternative to LGS depends on the value, constancy, and accessibility of the solar resource. Both PV and CSP are enjoying explosive growth worldwide, especially for various off-grid applications or to augment grid-provided power at the point of consumption; however, discrete baseload applications still have technological limitations. As Exelon indicates in the ER, solar power generation typically requires backup generation or other means of balancing its variable output. Further, PV installations have no ability to provide power at night, and they provide reduced levels of power on overcast days, during fog events, and when snow accumulates. While their generation during summer months is high when electricity consumption is high, their capacity to generate electricity in winter declines before the evening electricity demand peaks.

EIA reports the total solar generating capacity (CSP and solar PV) in the United States in 2009 was 619 MW, 0.005 percent of the total nationwide generating capacity. Solar power produced 891,000 MWh of power in 2009, 0.02 percent of the nationwide production (EIA 2011a). The staff is not aware of any CSP facilities in the United States that are not located in the southwest, while many PV installations occur throughout the country. As a result, the staff determined that a solar-powered alternative in PJM would rely on solar PV technology rather than CSP technology.

Because PV does not produce electricity at night and produces diminished amounts of power during particular weather conditions, the staff does not consider solar PV to provide a viable, standalone alternative to license renewal. The staff considers a standalone PV alternative here, however, because Exelon includes solar PV in its range of alternatives to LGS license renewal in the ER, and because solar PV comprises a portion of the combination alternative in Section 8.6.2.

This section addresses only the solar PV impacts, and does not address impacts from load balancing or firming methods, which would be necessary for solar to serve as a standalone alternative to LGS. Technology to achieve load balancing or firming methods is not yet feasible or commercially available, which is part of the reason why the staff's determined that this alternative is not reasonable. As a result, this analysis likely understates potential impacts from a solar PV alternative because technology to achieve load balancing or firming methods would also result in environmental impacts. As discussed in the wind power section, pumped hydroelectric storage, compressed air energy storage, and backup generating capacity could all conceivably offset the variable power output of solar PV facilities. Unlike wind power, however, interconnected solar installations cannot span a sufficient area to provide consistent output at night.

Within PJM, solar PV installations receive a 38 percent capacity credit (PJM 2010). On this basis, approximately 6,160 MW(e) of solar capacity would be necessary to replace LGS. Exelon indicates that a utility-scale solar PV facility located in PJM receives 2.8 to 3.9 kWh of solar radiation per square meter per day (2011). (These estimates take into account average weather conditions, and they also account for solar unavailability at night. The estimate thus also accounts for solar capacity factors.) As a result, Exelon estimated that a solar PV facility would require approximately 6.5 ha (16 ac) per MW(e) of capacity (Exelon 2011). The total area necessary for solar PV installations, then, is approximately 40,000 ha (98,900 ac).

The staff notes that much of the solar capacity installed in PJM is likely to be in the form of rooftop installations. This type of installation minimizes land disturbance, can provide electricity directly to end-users, and minimizes the modifications necessary to the transmission system. Some land-based installations are also likely to occur. They are likely to be larger than rooftop installations, and they will require some degree of land disturbance for installation purposes.

Environmental impacts from the solar PV alternative are summarized in Table 8–7.

#### *8.6.1.1. Air Quality*

As discussed in Section 2.2.2.1, the LGS site is located in Montgomery and Chester Counties, Pennsylvania, and is part of the Metropolitan Philadelphia Interstate Air Quality Control Region AQCR (40 CFR 81.15). With regard to the National Ambient Air Quality Standards (NAAQS), EPA has designated Montgomery and Chester Counties as unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$; and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339).

Beyond maintenance activities (e.g. serving equipment or repairs), there would be no routine air emissions associated with operations from solar PV. Activities associated with the construction and installation would cause some temporary air pollutant emissions. However, emissions from workers' vehicles and construction equipment exhaust would be temporary. The staff concludes that the air quality impact from construction would be SMALL.

*Greenhouse Gas Emissions*

Solar PV installations release no GHGs during operation, although some GHG emissions occur during component manufacturing, transportation, and installation, as well as during site preparation. Greenhouse gas emissions during construction of this alternative would result primarily from the consumption of fossil fuels in the engines of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. However, all such impacts would be temporary. In general, solar PV installations are among the least carbon-intensive electric generation options available. For a comparison to other means of electric generation, see the discussion in Chapter 6.

Given the expected small workforces and GHGs emitted during construction, site preparation and installation, the overall impact from the release of GHGs of the solar PV alternative would be SMALL.

*Conclusion*

Based on the above analysis, the impact would be SMALL.

*8.6.1.2. Groundwater Resources*

For construction of solar PV installations, the need for groundwater dewatering likely would be minimal because of the small footprint and shallow depth of excavation for PV installations. For all construction activities, appropriate BMPs, including spill prevention practices, would be used during construction to prevent or minimize impacts on groundwater quality. Operation of PV units would not be expected to have any appreciable effect on groundwater resources. Based on the foregoing, the impacts on groundwater use and quality associated with the solar PV alternative would be SMALL.

*8.6.1.3. Surface Water Resources*

Siting and construction of solar PV installations would require relatively small amounts of water for dust suppression and soil compaction during site clearing and for concrete production. The NRC assumes that required water would be procured from offsite sources and trucked to the point of use on an as needed basis. Use of ready-mix concrete also would reduce the need for onsite use of nearby water sources. To support operations, water additionally would be required to clean PV panels. The staff expects that water would be trucked to the point of use and procured from nearby sources or could be supplied from a municipal water source. Adherence to appropriate waste management and minimization plans, spill prevention practices, and pollution prevention plans during servicing of PV installations would minimize the risks to soils and surface water resources from spills of petroleum, oil, and lubricant products and runoff. As a result, the impacts on surface water use and quality under this alternative would be SMALL.

*8.6.1.4. Aquatic Resources*

Construction activities for the solar PV alternative (such as construction of heavy-haul roads and the solar panels) could affect drainage areas or other onsite aquatic features. Minimal impacts on aquatic ecology resources are expected because BMPs would likely be used to minimize erosion and sedimentation at large facilities. Stormwater control measures, which would be required if an NPDES permit was necessary, would minimize the flow of disturbed soils into aquatic features. Many of the solar panels would be installed on rooftops. Because construction would occur within an existing structure, impacts to aquatic resources would be minimal. During operations, the solar PV alternative would not require consumptive water use.

For installations that do not occur on top of existing buildings, operators of the solar PV alternative would need to assess the occurrence and potential impacts to protected aquatic species within surface waters potentially affected during construction. In compliance with the ESA, FWCA, and the Magnuson-Stevens Act, the solar PV operators would need to consult with state officials, NMFS, and FWS to determine whether any avoidance or mitigation measures would be required and to ensure that construction and operation do not adversely affect any Federally listed species or adversely modify or destroy designated critical habitat.

The impacts on aquatic ecology would be minor because construction activities would likely require BMPs and stormwater management permits. During operations, the solar PV alternative would not require consumptive water use. Therefore, impacts on aquatic ecology from the solar PV alternative would be SMALL.

*8.6.1.5. Terrestrial Resources*

Up to 155 $mi^2$ (420 $km^2$) of land would be needed to support a solar PV alternative to replace LGS if all installations were located at standalone solar sites (see Section 8.6.1.7). Because the solar PV alternative would include many relatively small installations on building roofs or existing residential, commercial, or industrial sites, impacts to terrestrial species and habitats would be minimal. Some installations may be built on standalone solar sites, and impacts to terrestrial species and habitats on these sites would vary greatly depending on site selection and the allocation of installations on buildings versus standalone sites. Because many of the installations would likely be installed in developed areas that are already connected to the regional electric grid, construction of additional transmission lines or access roads to solar PV installation sites would likely be unnecessary. The impacts of construction to terrestrial habitats and species could range from SMALL to MODERATE, and the impacts of operation to terrestrial habitats and species would be SMALL.

Impacts to protected species and habitats would only occur in locations where solar PV installations are constructed on standalone solar sites. However, as with the previously discussed alternatives, consultation with FWS under the ESA would avoid any potential adverse impacts to Federally listed species or adverse modification or destruction of designated critical habitat. Coordination with state natural resource agencies would further ensure that Exelon would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of the solar PV alternative on protected species and habitats would be SMALL.

*8.6.1.6. Human Health*

The manufacture of solar cells involves the use of many hazardous chemicals, including toxic gases (e.g., arsine, phosphine, silane, sulfur hexafluoride, molybdenum hexafluoride, tungsten hexafluoride, hydrogen selenide, hydrochloric, and hydrofluoric acids), toxic metals (e.g., arsenic, cadmium, selenium, and various other heavy metals), and numerous flammable, corrosive, or highly reactive chemicals. In addition, the photocells contain cadmium, selenium, and other heavy metals. However, worker exposure to these hazards often are minimized. For example, a 2003 study conducted jointly by the Electric Power Research Institute (EPRI) and the California Energy Commission (CEC) concluded that the manufacture and use of photocells presented no significant health or environmental risk (EPRI and CEC 2003). In the study, EPRI and CEC (2003) state that the greatest possibility of human health risks comes from the manufacturing of the solar PV cells. The study states that, because of these health risks, extensive work has been done to reduce those hazards to plant workers. It also states that OSHA and similar state agencies set standards for allowable exposure limits to the various toxic chemicals used in the manufacturing process.

Impacts on human health from construction of the solar PV alternative would be similar to impacts associated with the construction of any major industrial facility. Compliance with worker protection rules would control those impacts on workers at acceptable levels. Impacts from construction on the general public would be minimal since limiting active construction area access to authorized individuals is expected. Impacts on human health from the construction of the solar PV alternative would be SMALL.

Solar PV panels are encased in heavy-duty glass or plastic. As a result, there is little risk that the small amounts of hazardous semiconductor material they contain will be released into the environment.

In the event of a fire, hazardous particulate matter could be released to the atmosphere. Given the short duration of fires and the high melting points of the materials found in the solar photovoltaic panels, the impacts from inhalation are minimal. Also, the risk of fire at ground-mounted solar installations is minimal because of precautions taken during site preparation, such as the removal of fuels and the lack of burnable materials contained in the solar photovoltaic panels. Another potential risk associated with photovoltaic systems and fire is the potential for shock or electrocution if a person would come in contact with a high-voltage conductor. Proper procedures and clear marking of system components should be used to provide emergency responders with appropriate warnings to diminish risk of shock or electrocution (OIPP 2010).

Photovoltaic solar panels do not produce electromagnetic fields at levels considered harmful to human health established by the International Commission on Non-Ionizing Radiation Protection. These small electromagnetic fields diminish significantly with distance and are indistinguishable from normal background levels within several yards (OIPP 2010).

Overall, given proper health-based regulation through procedures and access limitations, the staff expects human health impacts from operation of the Solar PV alternative at an alternate site to be SMALL.

#### *8.6.1.7. Land Use*

As discussed in Section 8.1.7, the GEIS generically evaluates the impact of constructing and operating various replacement power plant alternatives on land use, both on and off each power plant site. The analysis of land-use impacts focuses on the amount of land area that would be affected by the installation and operation of solar PV technologies. PV technologies would generally be installed on building roofs at existing residential, commercial, or industrial sites. Some solar installations may also be built at standalone solar sites. Land use impacts may vary depending on the amount of additional land required and the actual allocation of solar installations.

The footprint of a utility scale standalone PV solar installation would be quite large. Based on Exelon's local PJM territory estimates, approximately 98,900 ac (40,000 ha or 155 $mi^2$ [400 $km^2$]) of land would be needed to support a solar PV alternative to replace the LGS (Exelon 2011). Land required for a standalone PV solar installation would alter the existing land to energy production, and would preclude most other land uses from coexisting. Land would also be needed for transmission lines to connect PV solar installations to the electrical power grid and site access roads for maintenance purposes. Installing PV solar technologies on building rooftops would reduce the amount of land required for standalone solar.

The elimination of uranium fuel for the LGS would partially offset some, but not all, of the land requirements for standalone PV solar sites. Scaling from GEIS estimates, approximately 1,640 ac (660 ha) (NRC 1996) would no longer be needed for mining and processing uranium during the operating life of the plant. Based on this information, overall land-use impacts from the construction and operation of a PV solar alternative could range from SMALL to LARGE, depending in part on the extent to which PV installations occur on existing buildings rather than standalone sites.

*8.6.1.8. Socioeconomics*

As previously explained in Section 8.1.8, two types of jobs would be created by this alternative: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements for the construction and operation of the PV alternative were evaluated in order to measure their possible effects on current socioeconomic conditions.

Exelon estimated 200 construction and 50 operations workers would be required for this alternative (Exelon 2011). These estimates appear reasonable and in line with current construction and operational trends. Because of the relatively small number of construction workers and the potentially large area covered by the PV solar installations at standalone sites and other locations, the relative economic impact of this many workers on local communities and the tax base would be SMALL. Given the small number of operations workers, socioeconomic impacts associated with operation of the PV solar installations would also be SMALL.

The reduction in employment at LGS could affect property tax revenue and income in local communities and businesses. In addition, the permanent housing market could also experience increased vacancies and decreased prices if operations workers and their families move out of the LGS region. However, the amount of property taxes paid for a utility-scale standalone PV solar installation may offset lost tax revenues in the socioeconomic region around local jurisdictions if more land is required for solar installations. Based on this information, socioeconomic impacts during PV solar power generating operations could range from SMALL to MODERATE.

*8.6.1.9. Transportation*

Transportation impacts during the construction and operation of the PV alternative would be similar to the wind alternative, discussed in Section 8.4.10, as a smaller construction workforce and smaller volume of materials and equipment would be needed to be transported to the construction site.

During periods of peak construction activity, up to 200 workers could be commuting daily to the sites (Exelon 2011). Workers commuting to the construction sites would arrive by site access roads and the volume of traffic on nearby roads could increase during shift changes. In addition to commuting workers, trucks would be transporting construction materials and equipment to the worksites, thus increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary levels of service impacts and delays at intersections. Delays may not be noticeable because the solar alternative may be spread across multiple sites. Some components and materials could also be delivered by train or barge, depending on the locations. Train deliveries could cause additional traffic delays at railroad crossings. Based on this information, traffic related transportation impacts during construction could range from SMALL to MODERATE depending on the location of the standalone site, road capacities, and traffic volumes.

During plant operations transportation impacts would not be noticeable because of the small estimated operational workforce spread across multiple sites. Exelon estimated an operational workforce of 50 workers (Exelon 2011), which appears reasonable. Given the small numbers of operations workers, the traffic impacts on local roads from PV solar installation operations would be SMALL.

*8.6.1.10. Aesthetics*

The analysis of aesthetic impacts focuses on the degree of contrast between PV solar installations and the surrounding landscape and the visibility of PV installed technologies. In general, aesthetic changes would be limited to the immediate vicinity of PV solar installations.

As previously discussed, the footprint of a utility scale standalone PV solar installation would be quite large, and could create a noticeable visual impact. Spread across a large site, the utility scale standalone PV solar installation could dominate the view and would likely become the major focus of attention. The introduction of a utility scale standalone PV solar installation would be in sharp contrast to the visual appearance of the surrounding environment. Installing PV solar technologies on building rooftops, although noticeable to a lesser degree in urban settings, would reduce the amount of land required for standalone solar sites. Any noise at utility scale standalone PV solar installation would be limited to industrial processes and communications. Based on this information, aesthetic impacts from the construction and operation of a PV alternative could range from MODERATE to LARGE depending on the type of solar technology installed and its location and surroundings.

*8.6.1.11. Historic and Archaeological Resources*

Any areas potentially affected by the construction of the solar alternative would need to be surveyed to identify and record historic and archaeological resources. Resources found in these surveys would need to be evaluated for eligibility on the NRHP and mitigation of adverse effects would need to be addressed if eligible resources were encountered. Plant operators would need to survey all areas associated with operation of the alternative (e.g., roads, transmission corridors, other ROWs). Visual impacts on significant cultural resources—such as the viewsheds of historic properties near the sites—should also be assessed.

The impacts of the construction of a new solar PV alternative on historic and archaeological resources will vary depending on the form of the solar capacity installed in PJM. Rooftop installations minimize land disturbance and the modifications necessary to the transmission system, thereby minimizing impacts to historic and archaeological resources. Land-based installations are larger than rooftop installations and will require some degree of land disturbance for installation purposes, potentially causing greater impacts to historic and archaeological resources. Aesthetic changes caused by the installation of both forms could have a noticeable effect on the viewshed of nearby historic properties. Using previously disturbed sites for land-based installations and collocating any new transmission lines with existing right-of-ways could minimize impacts to historic and archaeological resources. Areas with the greatest sensitivity could be avoided or effectively managed under current laws and regulations. Therefore, depending on the resource richness of the sites chosen and the type of solar technology installed, the impacts could range from SMALL to LARGE.

*8.6.1.13. Environmental Justice*

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health, environmental, and socioeconomic effects on minority and low-income populations that could result from the construction and operation of PV solar installations. As previously discussed in Section 8.1.12, such effects may include human health, biological, cultural, economic, or social impacts.

Potential impacts to minority and low-income populations would mostly consist of environmental and socioeconomic effects during construction (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be affected by increased commuter vehicle and truck traffic. However, because of the temporary nature of construction, these effects would only occur during certain hours of the day and not likely to be high and adverse and would be contained to a limited time period during certain hours of the day. Increased demand for rental housing during construction could affect low-income populations. However, given the small number of construction workers and the possibility that workers could commute to the construction site, the need for rental housing would not be significant.

Minority and low-income populations living in close proximity to the PV solar installations could be disproportionately affected by operations. However, operational impacts would mostly be limited to aesthetic effects. The general public living near the PV solar installation would also be exposed to the same effects.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the construction and operation of PV solar installations would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

#### *8.6.1.14. Waste Management*

During the construction stage of a solar PV facility, land clearing and other construction activities would produce minor quantities of waste. During operation, very small quantities of waste might be produced when operators perform maintenance activities. Based on this information, waste impacts would be SMALL for the solar PV alternative.

**Table 8–7. Summary of Environmental Impacts of the Solar PV Alternative Compared to Continued Operation of the Existing LGS**

| | Solar PV Alternative | Continued LGS Operation |
|---|---|---|
| Air Quality | SMALL | SMALL |
| Groundwater Resources | SMALL | SMALL |
| Surface Water Resources | SMALL | SMALL |
| Aquatic Ecology | SMALL | SMALL |
| Terrestrial Ecology | SMALL to MODERATE | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | SMALL to LARGE | SMALL |
| Socioeconomics | SMALL to MODERATE | SMALL |
| Transportation | SMALL to MODERATE | SMALL |
| Aesthetics | MODERATE to LARGE | SMALL |
| Historic and Archaeological | SMALL to LARGE | SMALL |
| Waste Management | SMALL | SMALL[a] |

[a] As described in Chapter 6, the issue, “offsite radiological impacts (spent fuel and high level waste disposal),” is not evaluated in this EIS

### 8.6.2. Combination Alternative: Wind, Solar, and NGCC

The combination alternative consists of 2,300 MW(e) of installed wind capacity, 3,000 MW(e) of solar PV capacity, and 400 MW(e) of NGCC capacity to provide the balance needed to replace LGS. The impacts of this alternative are similar to the combined and scaled impacts of the NGCC, wind, and solar PV alternatives considered in Sections 8.1, 8.4, and 8.6.1, respectively. The staff assumes that sufficient rooftop space exists throughout PJM to support installation of the solar-PV portion of this alternative solely on existing structures, thus minimizing potential for land-use and terrestrial ecology impacts from solar PV installations. The staff applied a capacity-factor-based approach to determining the relative amount of wind power (much as it did in Section 8.4), and applied a capacity-credit approach to solar-PV capacity (using PJM's 38 percent capacity credit) in this alternative. The NGCC capacity considered here provides backup and firming capacity to the variable wind and solar PV resources, though it may not be adequate to provide full firming capacity at all times (e.g., on nights with little wind across PJM). At the same time, this alternative may produce markedly more power than LGS on days that are both sunny and windy.

Because this alternative many not be able to generate 2,340 MW(e) because of the variable wind and solar PV resources, the staff does not consider the wind, solar, and NGCC combination alternative to provide a viable, standalone alternative to license renewal. The staff considers a standalone alternative here, however, because Exelon includes a wind, solar, and NGCC combination alternative in its range of alternatives to LGS license renewal in the ER.

Table 8–8 summarizes the environmental impacts of the combination alternative compared to the continued operation of LGS.

#### *8.6.2.1. Air Quality*

As discussed in Section 2.2.2.1, the LGS site is located in Montgomery and Chester Counties, Pennsylvania, and is part of the Metropolitan Philadelphia Interstate Air Quality Control Region AQCR (40 CFR 81.15). With regard to the National Ambient Air Quality Standards (NAAQS), EPA has designated Montgomery and Chester Counties as unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$; and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339).

This alternative includes a combination of generation from wind, solar, and NGCC capacity. Operational air emissions would only be associated with the NGCC portion (400 MW[e]) of this alternative. The NGCC component would qualify as a new major-emitting industrial facility and would be subject to PSD under CAA requirements (EPA 2012a). The Pennsylvania Department of Environmental Protection (PADEP) has adopted 25 Pa. Code Chapter 127, which implements the EPA's PSD review. The NGCC plant would need to comply with the standards of performance for stationary combustion turbines set forth in 40 CFR Part 60 Subpart KKKK.

Subpart P of 40 CFR Part 51.307 contains the visibility protection regulatory requirements, including the review of the new sources that may affect visibility in any Federal Class I area. If the NGCC component of this combination alternative were located close to a mandatory Class I area, additional air pollution control requirements would be required. As noted in Section 2.2.2.1, there are no Mandatory Class I Federal areas within 50 miles (80 km) of the LGS site. There are a total of 13 designated Class 1 Federal areas (40 CFR 81) located in the following PJM states: Kentucky, Michigan, New Jersey, North Carolina, Tennessee, Virginia, and West Virginia.

A new NGCC plant would have to comply with Title IV of the CAA (42 USC §7651) reduction requirements for $SO_2$ and NOx, which are the main precursors of acid rain and the major cause of reduced visibility. Title IV establishes maximum $SO_2$ and NOx emission rates from the existing plants and a system of $SO_2$ emission allowances that can be used, sold, or saved for future use by the new plants.

More recently, EPA has promulgated additional rules and requirements that apply to certain fossil-fueled power plants, such as NGCC generation. The Cross-State Air Pollution Rule (CSAPR) and the Prevention of Significant Deterioration and Title V Greenhouse Gas (GHG) Tailoring Rule impose several additional standards to limit ozone, particulate, and GHG emissions from fossil-fuel based power plants (EPA 2012c). A new NGCC plant would be subject to these additional rules and regulations.

The EPA has developed standard emission factors that relate the quantity of released air pollutants to a variety of regulated activities (EPA 2012b). Using these emission factors, the staff projects the following air emissions for the NGCC portion of this alternative:

- sulfur oxides ($SO_x$) – 31.4 tons (28.5 MT) per year,
- nitrogen oxides ($NO_x$) – 91.5 tons (83.0 MT) per year,
- carbon monoxide (CO) – 138.7 tons (125.8 MT) per year,
- $PM_{10}$ and $PM_{2.5}$ – 61.0 tons (55.4 MT) per year, and
- carbon dioxide ($CO_2$) – 1,016,100 tons (922,622 MT) per year.

Activities associated with the construction of the combination alternative, which includes wind, solar, and NGCC, would cause some additional, temporary air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material-handling equipment. Emissions from workers' vehicles and motorized construction equipment exhaust would be temporary. Construction crews would use dust-control practices to control and reduce fugitive dust. The staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of the earth-moving and material-handling equipment would be SMALL.

*Greenhouse Gas Emissions*

As discussed in Sections 8.1.1 and 8.2.1, combustion of fossil fuels, including natural gas, is the greatest anthropogenic source of GHG emissions in the United States. As noted in Sections 8.4.1 and 8.6.1.1—and discussed in Section 6.2—wind power and solar PV generation are among the least GHG-intensive generation options available.

Greenhouse gas emissions during construction of this alternative would result primarily from the consumption of fossil fuels in the engines of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. However, all such impacts would be temporary.

Only the NGCC portion of this alternative would emit GHGs during operations, and it would emit approximately 25 percent of the emissions of the full NGCC alternative that the staff evaluated in Section 8.1.1. As discussed in Section 8.1.1, NETL estimates that CCS will capture and remove as much as 90 percent of the $CO_2$ from the exhausts of combustion turbines but will result in a power production capacity decrease of approximately 14 percent, a reduction in net overall thermal efficiency of the CTs studied from 50.8 percent to 43.7 percent, and a potential increase in the levelized cost of electricity produced in NGCC units so equipped by as much as 30 percent (NETL 2007). Further, permanent sequestering of the $CO_2$ would involve removing impurities (including water) and pressurizing it to meet pipeline specifications and transferring the gas by pipeline to acceptable geologic formations. Even when opportunities exist to utilize the $CO_2$ for enhanced oil recovery (rather than simply dispose of the $CO_2$ in geologic formations), permanent disposal costs could be substantial, especially if the NGCC unit is far removed from acceptable geologic formations. With CCS in place, the NGCC portion of this alternative would release 92,262 MT per year (0.102 million tons) of $CO_2$. Without CCS in place, the staff's projected $CO_2$ emissions for the NGCC portion would be 922,622 MT (1,016,100 tons) per year.

Given the expected relatively small workforces, relatively short construction period for constructing the alternatives' components, and GHG emissions resulting from operations of the NGCC portion, the overall from the releases of GHGs of the combination alternative would be SMALL to MODERATE.

*Conclusion*

There would be no routine air emissions associated with the wind and solar component of this alternative. However, the NGCC component of this alternative would result in routine air emissions. Therefore, the overall air-quality impact from this combination alternative would be SMALL to MODERATE.

*8.6.2.2. Groundwater Resources*

Impacts on groundwater resources from constructing and operating a new NGCC plant under this alternative would be a fraction of those described in Section 8.1.2. For construction of wind turbine and solar PV installations, the need for groundwater dewatering likely would be minimal. For all construction activities, appropriate BMPs, including spill prevention practices, would be used during wind turbine construction to prevent or minimize impacts on groundwater quality. Operation of the wind turbine and PV components of this alternative would not be expected to have any appreciable effect on groundwater resources. Based on the above, the impacts on groundwater use and quality under this alternative would be SMALL.

*8.6.2.3. Surface Water Resources*

Impacts on surface water resources from constructing and operating a new NGCC plant under this alternative would be a fraction of those described in Section 8.1.3 because the NGCC component has been scaled back to 400 MW(e). Construction of the wind turbine and solar PV installations would each require relatively small amounts of water for dust suppression and soil compaction during site clearing and for concrete production. The NRC assumes that required water would be procured from offsite sources and trucked to the point of use on an as needed basis. Use of ready-mix concrete would also reduce the need for onsite use of nearby water sources.

To support operation of individual wind turbine installations, only very small amounts of water would be needed to periodically clean turbine blades and motors as part of routine servicing. Water also would be required to clean PV panels. The staff expects that water would be trucked to the point of use and procured from nearby sources. Adherence to appropriate waste management and minimization plans, spill prevention practices, and pollution prevention plans during servicing of turbine and PV installations would minimize the risks to soils and surface water resources from spills of petroleum, oil, and lubricant products and runoff. As a result, the impacts on surface water use and quality under the combination alternative would be SMALL.

*8.6.2.4. Aquatic Resources*

Construction activities for the wind, solar, and NGCC combination alternative (such as construction of heavy-haul roads, the NGCC power block, wind turbines, and solar panels) could affect drainage areas or other onsite aquatic features. Minimal impacts on aquatic ecology resources are expected because BMPs would likely be used to minimize erosion and sedimentation. Stormwater control measures, which would be required to comply with Pennsylvania NPDES permitting, would minimize the flow of disturbed soils into aquatic features. Depending on the available infrastructure at the selected site, the NGCC plant may require modification or expansion of the existing intake or discharge structures. Because of the relatively low withdrawal rates compared to the NGCC, SCPC, or new nuclear alternatives, it is unlikely that the operators would need to construct new intake and discharge structures for the combination alternative. Dredging activities that result from infrastructure construction would require BMPs for in-water work to minimize sedimentation and erosion. Because of the short-term nature of the dredging activities, the hydrological alterations to aquatic habitats would likely be localized and temporary.

Similar to the NGCC alternative described in Section 8.1.4, during operations, the NGCC component of the combination alternative would require cooling water to be withdrawn from the Schuylkill River or other similar water body, would have chemical discharges, and would emit some pollutants that could settle onto the river surface. However, these impacts would be less than that described in Section 8.1.4 because NGCC would be a smaller portion of this alternative. During operations, the solar PV and wind components of the combination alternative would not require consumptive water use.

The impacts on aquatic ecology would be minor because construction activities would require BMPs and stormwater management permits, and because the surface water withdrawal and discharge for this alternative would be less than for LGS Units 1 and 2. Therefore, the staff concluded that impacts on aquatic ecology would be SMALL.

Consultation with NMFS and FWS under ESA would ensure that the construction and operation of wind, solar, NGCC plants would not adversely affect any Federally listed species or adversely modify or destroy designated critical habitat. If new infrastructure were located near EFH, consultation with NMFS under the Magnuson-Stevens Act would require NRC to evaluate impacts to EFH and NMFS would provide conservation recommendations if there would be adverse impacts to EFH. Coordination with state natural resource agencies would further ensure that the plant and wind farm operators would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation on protected species and habitats would be SMALL.

*8.6.2.5. Terrestrial Resources*

Impacts to terrestrial species and habitats from construction and operation of this combined alternative would be similar to those described under each individual alternative in Sections 8.1.5, 8.4.5, and 8.6.1.5. The same is true of mitigation measures. The primary difference in this alternative is that each portion of this alternative is smaller than the full-replacement alternatives considered in Sections 8.1, 8.4, and 8.8.1. Also, solar PV capacity would be installed almost entirely at already-developed sites on building rooftops. The wind-power portion of this alternative would require approximately half of the area required for the standalone wind alternative in Section 8.4. The development of the solar component on land already in use for other purposes, combined with the reduced size of the wind-power component, would likely result in minimal additional impacts to terrestrial species and habitats during construction and operation. The NGCC component of this alternative would be smaller and require less land than the NGCC plant described in Section 8.1.5. This alternative still assumes that the NGCC plant would be sited on an already existing power station other than LGS, and predominantly previously developed or pre-disturbed land would be affected. The impacts of construction and operation of this alternative on terrestrial species and habitats would be SMALL because of this alternative’s extensive use of developed or previously disturbed land.

Because the solar PV installations would be sited on buildings and other already-developed sites, impacts to protected species and habitats would be most likely to occur as a result of the wind or NGCC component of this alternative. As with the previously discussed alternatives, consultation with FWS under the ESA would avoid potential adverse impacts to Federally listed species or adverse modification or destruction of designated critical habitat. Coordination with state natural resource agencies would further ensure that Exelon would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of this alternative on protected species and habitats would be SMALL.

#### *8.6.2.6. Human Health*

Impacts on human health from construction of the wind alternative, the NGCC alternative, and the solar PV portion of this alternative would be similar to impacts associated with the construction of any major industrial facility. Compliance with worker protection rules would control those impacts on workers at acceptable levels. Impacts from construction on the general public would be minimal since limiting active construction area access to authorized individuals is expected. Impacts on human health from the construction of the wind alternative would be SMALL.

Given proper health-based regulation through procedures and access limitations, the staff expects human health impacts from operation of the solar PV and the wind portions of this alternative at an alternate site to be SMALL.

The staff notes that human health effects of gas-fired generation are generally low, although in Table 8–2 of the GEIS (NRC 1996), the staff identified cancer and emphysema as potential health risks from gas-fired plants. $NO_x$ emissions contribute to ozone formation, which in turn contributes to human health risks. Emission controls on the NGCC alternative can be expected to maintain $NO_x$ emissions well below air quality standards established for the purposes of protecting human health, and emissions trading or offset requirements mean that overall $NO_x$ releases in the region will not increase. Health risks for workers may also result from handling spent catalysts used for $NO_x$ control that may contain heavy metals. Impacts on human health from the operation of the NGCC alternative would be SMALL.

#### *8.6.2.7. Land Use*

As discussed in Section 8.1.7, the GEIS (NRC 1996) generically discusses the impact of constructing and operating various replacement power plant alternatives on land use, both on and off each power plant site. The analysis of land-use impacts here focuses on the amount of land area that would be affected by the construction and operation of a combination of wind turbines, PV solar installations, and a NGCC power plant in the PJM territory.

Land-use impacts from this alternative would be similar those described for each of the alternatives described in Sections 8.1.7, 8.4.7, and 8.6.1.7. Because each component of this alternative would individually be generating less electricity, the magnitude of the impacts from each individual component would be less than those previously described. For example, under this combination alternative, solar PV technology would be installed on existing building rooftops, and approximately half the number of wind turbines would be installed as would be installed in the standalone wind alternative (Section 8.4). In addition, the NGCC component would be constructed at an existing power plant site.

The elimination of uranium fuel for the LGS would partially offset some, but not all, new land requirements. Scaling from GEIS estimates, approximately 1,640 ac (660 ha) would no longer be needed for mining and processing uranium during the operating life of the plant. Based on this information, overall land-use impacts from the construction and operation of a combination of wind, solar, and NGCC alternatives would range from SMALL to MODERATE.

*8.6.2.8. Socioeconomics*

As previously explained in Section 8.1.8, two types of jobs would be created by this alternative: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements for the construction and operation of a combination of wind turbines, PV solar installations, and a NGCC power plant were evaluated in order to measure their possible effects on current socioeconomic conditions.

Approximately 200 construction and 50 operations workers would be required for the utility scale wind alternative and 200 construction and 50 operations workers would be required for the solar alternative (see Sections 8.4.8, and 8.6.1.8) (Exelon 2011). These estimates appear reasonable and in line with current construction and operational trends. The construction and operation workforce requirements for these two components of this combination alternative would be much less. The NGCC component scaled down to 400 MW(e) would require 150 (Exelon 2011) to 500 (NRC 1996) construction workers during peak construction and 8 to 60 operations workers. Socioeconomic impacts would be similar to those described for NGCC, wind, and solar alternatives discussed in Sections 8.1.8, 8.4.8, and 8.6.1.8, but on a smaller scale than each of the full alternatives. Because of the relatively small number of construction workers scattered over a large area at various locations, the relative economic impact of this many workers on local communities and the tax base would be SMALL. Given the small number of operations workers, socioeconomic impacts associated with operation of the NGCC, wind, and solar components of this combination alternative would also be SMALL.

The net reduction in employment at LGS could affect property tax revenue and income in local communities and businesses. In addition, the permanent housing market could also experience increased vacancies and decreased prices if operations workers and their families move out of the region. Nevertheless, the amount of property taxes paid under the combination alternative may offset lost tax revenues in the socioeconomic region around LGS. Based on this information, socioeconomic impacts during operations could range from SMALL to MODERATE.

*8.6.2.9. Transportation*

Transportation impacts during the construction and operation of the NGCC, wind, and solar components of this combination alternative would be less than the impacts for the NGCC, wind, and PV solar alternatives, discussed in Sections 8.1.7, 8.4.7, and 8.6.1.7. This is because the construction workforce for each component and the volume of materials and equipment needing to be transported to each respective construction site would be smaller than each of the individual alternatives. In other words, the transportation impacts would not be as concentrated as in the other alternatives, but spread out over a wider area.

As previously described for each alternative, workers commuting to the construction site would arrive by site access roads and the volume of traffic on nearby roads could increase during shift changes. In addition to commuting workers, trucks would be transporting construction materials and equipment to the worksite, thus increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary levels of service impacts and delays at intersections. Transporting heavy and oversized wind turbine components on local roads could have a noticeable impact over a large area. Some components and materials could also be delivered by train or barge, depending on location. Train deliveries could cause additional traffic delays at railroad crossings. Based on this information, traffic-related transportation impacts during construction could range from SMALL to MODERATE depending on the location of the NGCC power plant, wind farm, and PV solar installation; road capacities; and traffic volumes.

During operations, transportation impacts would be less noticeable during shift changes and maintenance activities. Given the small number of operations workers, the levels of service traffic impacts on local roads from NGCC power plant, wind farm, and PV solar installation operations would be SMALL.

*8.6.2.10. Aesthetics*

The analysis of aesthetic impacts focuses on the degree of contrast between the wind, solar, and NGCC alternative and surrounding landscapes and the visibility of new wind turbines at existing wind farms, PV solar technologies on existing buildings, and the new NGCC plant at an existing power plant site. In general, aesthetic changes would be limited to the immediate vicinity of the wind farms, PV solar installations, and NGCC power plant.

Wind turbines would have the greatest potential visual impact. At 400 ft (122 m) tall (Exelon 2011) and spread across multiple sites, wind turbines often dominate the view and become the major focus of attention. However, adding additional wind turbines to existing wind farms at multiple sites is not likely to increase the visible impact of the wind farm unless it significantly increases the number of wind turbines at the wind farm. PV solar technologies located on building rooftops, depending on the angle of the roof, may or may not be seen offsite, and would be less noticeable in urban settings.

Located near an existing power plant site, the NGCC power plant could be approximately 100 ft (30 m) tall, with an exhaust stack up to 150 ft (46 m) tall and have two cooling towers over 500 ft (152 m) high (Exelon 2011). The facility would be visible off site during daylight hours, and some structures may require aircraft warning lights. The power block of the new NGCC power plant unit could look very similar to the existing power plant at the site where it would be constructed. The addition of mechanical draft cooling towers and associated condensate plumes could add to the NGCC power plant visual impact. Mechanical draft cooling towers also generate noise. Most other noises during power NGCC plant operations would be limited to industrial processes and communications. Pipelines delivering natural gas fuel could be audible off site near gas compressor stations.

Based on this information, aesthetic changes caused by this combination alternative would be limited to the immediate vicinity of the existing facilities and would therefore be SMALL to MODERATE depending on location and surroundings.

*8.6.2.11. Historic and Archaeological Resources*

Areas potentially affected by the construction of the NGCC, wind, and solar PV alternative would need to be surveyed to identify and record historic and archaeological resources. Any resources found in these surveys would need to be evaluated for eligibility on the NRHP and mitigation of adverse effects would need to be addressed if eligible resources were encountered. An inventory of a previously disturbed former plant (brownfield) site may still be necessary if the site has not been previously surveyed or to verify the level of disturbance and evaluate the potential for intact subsurface resources. Plant operators would need to survey all areas associated with operation of the alternative (e.g., roads, transmission corridors, other ROWs). Areas with the greatest sensitivity should be avoided. Visual impacts on significant cultural resources—such as the viewsheds of historic properties near the sites—should also be assessed.

The impacts of this alternative are similar to the combined and scaled impacts of the NGCC, wind, and solar PV alternatives considered in Sections 8.1, 8.4, and 8.6.1, respectively. The potential for impacts would vary greatly depending on the location of the proposed sites. Use of a previously disturbed site for the NGCC alternative and rooftop PV technology could minimize affects to historic and archaeological resources. Wind turbines could be installed in pre-established wind farms. Areas with the greatest sensitivity could be avoided or effectively managed under current laws and regulations. However, construction of wind farms sites and their support infrastructure on developed sites, agricultural areas, or previously undisturbed have the potential to notably impact historic and archaeological resources because of earthmoving activities (e.g., grading and digging). Aesthetic changes from wind farms and solar technology may also impact the viewshed of historic properties located nearby. Therefore, depending on the resource richness of the site chosen for the NGCC, wind, and solar PV alternative, the impacts could range from SMALL to MODERATE.

#### *8.6.2.12. Environmental Justice*

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health, environmental, and socioeconomic effects on minority and low-income populations that could result from the construction and operation of a combination of wind turbines, PV solar installations, and a NGCC power plant. As previously discussed in Section 8.1.12, such effects may include human health, biological, cultural, economic, or social impacts.

Potential impacts to minority and low-income populations would mostly consist of environmental and socioeconomic effects during construction (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be affected by increased commuter vehicle and truck traffic. However, because of the temporary nature of construction, these effects are not likely to be high and adverse and would be contained to a limited time period during certain hours of the day. During construction, increased demand for rental housing in the vicinity of the site could affect low-income populations living near the plant site. However, given the small number of construction workers and the possibility that workers could commute to the construction site, the need for rental housing would not be significant.

Minority and low-income populations living in close proximity to the power generating facilities could be disproportionately affected by wind farm, PV solar, and NGCC power plant operations. However, all would be exposed to the same potential effects from operations, and any effects would depend on the magnitude of the change in ambient conditions. Operational impacts from the wind turbines and PV solar installations would mostly be limited to noise and aesthetic effects. The general public living near the wind farms and PV solar installations would be exposed to the same effects.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the construction and operation of new wind turbines, PV solar installations, and a NGCC power plant would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

#### *8.6.2.13. Waste Management*

During the construction stage of this combination of alternatives (wind, solar, and NGCC), land clearing and other construction activities would generate wastes that could be recycled, disposed of on site, or shipped to the offsite waste disposal facility. During the operational stage, spent SCR catalysts, which control $NO_x$ emissions from the NGCC plant, would make up the majority of the waste generated by this alternative, along with some wastes generated during maintenance for the wind and solar operations.

The staff concludes that overall waste impacts from the combination of the NGCC unit constructed on an existing site, and renewable energy components such as wind and solar, would be SMALL.

**Table 8–8. Summary of Environmental Impacts of the Combination Alternative Compared to Continued Operation of the Existing LGS**

| | Combination Alternative | Continued Operation of LGS |
|---|---|---|
| Air Quality | SMALL to MODERATE | SMALL |
| Groundwater Resources | SMALL | SMALL |
| Surface Water Resources | SMALL | SMALL |
| Aquatic Ecology | SMALL | SMALL |
| Terrestrial Ecology | SMALL | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | SMALL to MODERATE | SMALL |
| Socioeconomics | SMALL to MODERATE | SMALL |
| Transportation | SMALL to MODERATE | SMALL |
| Aesthetics | SMALL to MODERATE | SMALL |
| Historic and Archaeological | SMALL to MODERATE | SMALL |
| Waste Management | SMALL | SMALL[a] |

[a] As described in Chapter 6, the issue, “offsite radiological impacts (spent fuel and high level waste disposal),” is not evaluated in this EIS.

### 8.6.3. Combination Alternative: Wind and Compressed Air Energy Storage

In compressed air energy storage (CAES), an electric motor uses electricity to pump air into an underground, pressurized cavity, and when electricity is needed, the operator releases the compressed air through a gas turbine generator. The compressed air provides some power to the generator (essentially, reducing the need for compression by the turbine), and burning natural gas provides heat to increase pressure and to power the turbine. Thus, CAES is not solely an energy storage technology, but also relies on additional fossil fuel (future, as-yet-undeveloped CAES technologies promise no reliance on natural gas).

CAES is a commercially viable technology for energy storage, though it is seldom-used on a utility scale. It is in use at one site in the United States and one site in Germany (with capacities of 110 MW[e] and 290 MW[e], respectively).

Currently, no state or utility in the United States is operating wind power in combination with compressed air energy storage, let alone doing so to offset baseload power supplies. A group of utilities had proposed a 270-MW(e) project of that type in Iowa but have since terminated the project because of geologic unsuitability of the proposed site (ISEPA 2011). The McIntosh facility in Alabama is the only existing U.S. compressed air energy storage installation; it provides peaking capacity to existing non-wind generation, and it is relatively small. It provides 110 MW(e) of power for up to 26 hours. The McIntosh facility and Germany’s Huntorf facility are both based in salt domes.

Currently, no compressed air energy storage facilities exist in PJM. In Ohio, First Energy has acquired the Norton Energy Storage project, a proposed CAES facility that could be constructed in a retired limestone mine. The First Energy Nuclear Operating Company (FENOC) indicates that the Norton Energy Storage facility could have a maximum of 536 MW(e) of capacity available by 2017 (though it has not committed to install this capacity in that time period) and that it has an air permit for up to 804 MW(e) of capacity that the site (FENOC 2011). FENOC indicates that the maximum potential storage capacity at the Norton Energy Storage project is 2,700 MW(e) (FENOC 2011). However, the NRC is not aware of a CAES project coupled with wind generation that is providing baseload power. Therefore, the NRC concludes that the use of CAES in combination with wind turbines to generate 2,340 MW(e) in PMJ is unlikely.

Because the use of CAES in combination with wind turbines to generate 2,340 MW(e) in PMJ is unlikely, the staff does not consider CAES in combination with wind to provide a viable, standalone alternative to license renewal. The staff considers a standalone alternative here, however, because Exelon includes a CAES and wind combination alternative in its range of alternatives to LGS license renewal in the ER.

This section analyzes the potential impacts from a CAES and wind combination alternative. NREL (2006) suggests that 2,000 MW(e) of wind power together with 900 MW(e) of CAES can provide a near-constant 900 MW(e) of output. Using the high capacity factors the staff applied to the windpower alternative in Section 8.4 (which exceeds current wind capacity factors), this alternative relies on 2,000 MW(e) of CAES capacity from a facility similar in operation to the Norton project and 4,500 MW(e) of onshore wind capacity. While the approach in NREL (2006) suggests that 2,340 MW(e) of CAES may be necessary to provide firming capacity that would provide similar baseload potential as that provided by LGS, this alternative underestimates the amount of CAES capacity necessary to provide for technological advances and avoid overstating the potential impacts from relying on a combination of wind and CAES. In general, the staff relies on information from the Norton project to describe the potential impacts of a CAES project, though the staff notes that projects at different sites may incur varying levels of environmental impacts. Where appropriate, the staff scales impacts from the Norton project to account for the size of the CAES project considered here.

Table 8–9 summarizes the environmental impacts of the wind and CAES alternative compared to the continued operation of LGS.

*8.6.3.1. Air Quality*

As discussed in Section 2.2.2.1, the LGS site is located in Montgomery and Chester Counties, Pennsylvania, and is part of the Metropolitan Philadelphia Interstate Air Quality Control Region AQCR (40 CFR 81.15). With regard to the NAAQS, EPA has designated Montgomery and Chester Counties as unclassified or in attainment with respect to carbon monoxide, lead, sulfur dioxide, and $PM_{10}$; and nonattainment with respect to ozone and $PM_{2.5}$ (40 CFR 81.339).

This alternative relies on CAES to store electricity produced by wind turbines, which is then released during periods of low wind production. CAES facilities burn natural gas to heat the compressed air; therefore, they produce air emissions. The CAES facility would qualify as a new major-emitting industrial facility and would be subject to PSD under CAA requirements (EPA 2012). The PADEP has adopted 25 Pa. Code Chapter 127, which implements the EPA's PSD review. The CAES plant would need to comply with the standards of performance for stationary combustion turbines set forth in 40 CFR Part 60 Subpart KKKK.

Subpart P of 40 CFR Part 51.307 contains visibility protection regulatory requirements, including the review of the new sources that may affect visibility in any Federal Class I area. If the CAES component of this combination alternative were located close to a mandatory Class I area, additional air pollution control requirements would be required. As noted in Section 2.2.2.1, there are no Mandatory Class I Federal areas within 50 miles of the LGS site. There are a total of 13 designated Class 1 Federal areas (40 CFR 81) located in the following PJM states: Kentucky, Michigan, New Jersey, North Carolina, Tennessee, Virginia, and West Virginia.

A new CAES facility would have to comply with Title IV of the CAA (42 USC §7651) reduction requirements for $SO_2$ and $NO_x$, which are the main precursors of acid rain and the major cause of reduced visibility. Title IV establishes maximum $SO_2$ and $NO_x$ emission rates from the existing plants and a system of $SO_2$ emission allowances that can be used, sold, or saved for future use by the new plants.

More recently, the EPA has promulgated additional rules and requirements that apply to certain fossil-fuel based power plants, such as the CAES portion of this alternative. The CSAPR and the Prevention of Significant Deterioration and Title V GHG Tailoring Rule impose several additional standards to limit ozone, particulate, and GHG emissions from fossil-fuel based power plants (EPA 2012c). A new CAES plant would be subject to these additional rules and regulations.

Air emission permits from the Norton CAES Project in Norton, Ohio, were used as a basis for estimating emissions for this alternative. The current Norton air emissions permit allows 804 MW(e), so the staff scales the values from the Norton CAES project to 2,000 MW(e) to determine air quality impacts associated with this alternative. The staff projects the following air emissions for the CAES alternative:

- sulfur oxides ($SO_x$) – 105.5 tons (96.2 MT) per year,
- nitrogen oxides ($NO_x$) – 233.0 tons (212.4 MT) per year,
- carbon monoxide (CO) – 224.8 tons (204.9 MT) per year,
- $PM_{10}$ and $PM_{2.5}$ – 116.0 tons (105.8 MT) per year, and
- carbon dioxide ($CO_2$) – 1,694,279 tons (1,544,735 MT) per year.

Activities associated with the construction of the CAES alternative would cause some additional, temporary air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material-handling equipment. Emissions from workers' vehicles and motorized construction equipment exhaust would be temporary. Construction crews could use dust-control practices to control and reduce fugitive dust. The staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of the earth-moving and material-handling equipment would be SMALL.

*Greenhouse Gas Emissions*

Greenhouse gas emissions during construction of this alternative would result primarily from the consumption of fossil fuels in the engines of construction vehicles and equipment, workforce vehicles used in commuting to and from the work site, and delivery vehicles. However, all such impacts would be temporary.

Greenhouse gas emissions during operation would primarily be from natural gas combustion in the combustion turbines (at both the NGCC facility and the CAES facility). However, other miscellaneous ancillary sources such as truck and rail deliveries of materials to the site and commuting of the workforce would make minor contributions.

NETL estimates that CCS will capture and remove as much as 90 percent of the $CO_2$ from the exhausts of combustion turbines, but will result in a power production capacity decrease of approximately 14 percent, a reduction in net overall thermal efficiency of the CTs studied from 50.8 percent to 43.7 percent, and a potential increase in the levelized cost of electricity produced in NGCC units so equipped by as much as 30 percent (NETL 2007). Further, permanent sequestering of the $CO_2$ would involve removing impurities (including water) and pressurizing it to meet pipeline specifications and transferring the gas by pipeline to acceptable geologic formations. Even when opportunities exist to utilize the $CO_2$ for enhanced oil recovery (rather than simply dispose of the $CO_2$ in geologic formations), permanent disposal costs could be substantial, especially if the combustion turbines are far removed from acceptable geologic formations. With CCS in place, the CAES alternative would release 0.154 million MT per year (0.169 million tons) of $CO_2$. Without CCS in place, the CAES alternative would release 1.54 million MT (1.69 million tons) of $CO_2$ per year

Given the temporary impacts during the construction period and GHG emissions resulting from operations, the overall from the releases of GHGs of the CAES alternative would be SMALL to MODERATE.

*Conclusion*

The overall air quality impacts from CAES alternative would be similar to those of an NGCC facility and would be designated as SMALL to MODERATE.

*8.6.3.2. Groundwater Resources*

Impacts on groundwater resources of constructing and operating wind turbine installations under this alternative would be similar to those described in Section 8.4.2. Similarly, for construction and operation of the CAES facility, it is expected that overall impacts would be similar to and would be bounded by those described for the NGCC alternative (see Section 8.1.2) because construction and operations of the two facilities would be relatively similar, although the NGCC plant would be larger than the CAES facility. As an additional impact, pressurization of an underground cavity associated with CAES operations could affect groundwater flow on a localized basis. However, overall impacts on groundwater use and quality under this alternative would be SMALL.

*8.6.3.3. Surface Water Resources*

Impacts on surface water resources of constructing and operating wind turbine installations under this alternative would be similar to those described in Section 8.4.3. For construction and operation of the CAES facility, it is expected that overall impacts on surface water would be similar to and would be bounded by those described for the NGCC alternative (see Section 8.1.3). The nature of potential surface water impacts of CAES would depend on the type of CAES reservoir. For CAES using hard rock caverns, makeup water would be required because of evaporation from the surface reservoir and some potential for leakage. With these systems, as well as with porous rock reservoirs, there is generally a provision for pumping of water into the caprock or zones above the caprock to ensure hydraulic overpressure that would counter the potential for air leakage. In general, however, the potential for effects from caprock overpressure requirements would be smaller than the makeup water required for cooling. As a result, the projected cooling water demands would be smaller than the requirement presented in Section 8.1.3 for the NGCC alternative; the demands would relate primarily to removing waste heat from compression of the stored air. In conclusion, the overall impacts on surface water use and quality under this alternative would be SMALL.

*8.6.3.4. Aquatic Resources*

Construction activities for the wind and CAES alternative (such as construction of heavy-haul roads, the wind turbines, and CAES facility) could affect drainage areas and other onsite aquatic features. Minimal impacts on aquatic ecology resources are expected as the plant operator would likely implement BMPs to minimize erosion and sedimentation elsewhere on the site. Stormwater control measures, which would be required to comply with Pennsylvania NPDES permitting, would minimize the flow of disturbed soils into aquatic features. Depending on the available infrastructure at the selected site, the CAES facility may require modification or expansion of the existing intake or discharge structures. Because of the relatively low withdrawal rates compared to the NGCC, SCPC, or new nuclear alternatives, it is unlikely that the operators would need to construct new intake and discharge structures. Dredging activities that result from infrastructure construction would require BMPs for in-water work to minimize sedimentation and erosion. Because of the short-term nature of the dredging activities, the hydrological alterations to aquatic habitats would likely be localized and temporary.

During operations, the CAES alternative would require less cooling water to be withdrawn from the Schuylkill River, or other similar water body, than required for LGS Units 1 and 2. In addition, the cooling system for a CAES plant would have similar chemical discharges as LGS. The flow of the Schuylkill River, or other similar waterbody, would likely dissipate and dilute the concentration of pollutants resulting in minimal exposure to aquatic biota.

The impacts on aquatic ecology would be minor because construction activities would require BMPs and stormwater management permits, and because the surface water withdrawal and discharge for this alternative would be less than for LGS Units 1 and 2. Therefore, the staff concluded that impacts on aquatic ecology would be SMALL.

Consultation with NMFS and FWS under ESA would ensure that the construction and operation of wind farms and CAES facility would not adversely affect any Federally listed species or adversely modify or destroy designated critical habitat. If new infrastructure were located near EFH, consultation with NMFS under the Magnuson-Stevens Act would require NRC to evaluate impacts to EFH and NMFS would provide conservation recommendations if there would be adverse impacts to EFH. Coordination with state natural resource agencies would further ensure that the CAES and wind farm operators would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation on protected species and habitats would be SMALL.

#### *8.6.3.5. Terrestrial Resources*

Impacts to terrestrial species and habitats from construction and operation of this combined alternative would be similar in type, magnitude, and intensity as those described in Section 8.4.5 for the wind alternative. The primary difference in impact would result from the additional 92 ac (37 ha) required for the CAES facility. Impacts resulting from the CAES facility would vary depending on the site of the facility, but would generally not contribute considerably more impacts than the wind component because of the wind component's large land area requirements. Consequently, the impacts of construction and operation of this alternative to terrestrial habitats and species could range from SMALL to MODERATE.

As with the previously discussed alternatives, consultation with FWS under the ESA would avoid potential adverse impacts to Federally listed species or adverse modification or destruction of designated critical habitat. Coordination with state natural resource agencies would further ensure that Exelon would take appropriate steps to avoid or mitigate impacts to state-listed species, habitats of conservation concern, and other protected species and habitats. Consequently, the impacts of construction and operation of a wind and CAES alternative on protected species and habitats would be SMALL.

#### *8.6.3.6. Human Health*

CAES is a process by which air is compressed and forced into a holding area (like a large underground cavern) for later use in powering a gas turbine. Construction impacts of a CAES facility would be similar to impacts associated with the construction of any major industrial facility. Although constructing an energy facility with and near a suitable holding area (like a large underground cavern) would pose some unique challenges, proper regulation through state and Federal agencies would ensure that human health impacts are minimized.

Impacts on human health from construction of the wind alternative would be similar to impacts associated with the construction of any major industrial facility. Compliance with worker protection rules would control those impacts on workers at acceptable levels. Impacts from construction on the general public would be minimal since limiting active construction area access to authorized individuals is expected. Impacts on human health from the construction of the wind alternative would be SMALL.

Given proper health-based regulation through procedures and access limitations, the staff expects human health impacts from operation of the CAES and the wind alternative at an alternate site to be SMALL.

##### *8.6.3.7. Land Use*

As discussed in Section 8.1.7, the GEIS generically discusses the impact of constructing and operating various replacement power plant alternatives on land use, both on and off each power plant site. The analysis of land-use impacts focuses on the amount of land area that would be affected by the construction and operation of new wind turbines and CAES.

Land-use impacts from the wind turbines would be similar to the impacts described for the wind alternative (see Section 8.4.7). Most of the wind farms would be located on open agricultural cropland, which would remain largely unaffected by the presence of the wind turbines. Since wind turbines require ample spacing between one another to avoid air turbulence, the footprint of a utility scale wind farm could be quite large. Exelon estimates 3,200 ac (1,300 ha) of land would be directly affected by the placement of the wind turbines (Exelon 2011). These estimates appear reasonable based upon the size of current and proposed wind farms. Nevertheless, wind turbines would be located on multiple wind farms spread across approximately 130,000 ac (53,000 ha or 200 $mi^2$ [520 $km^2$]) of land. Most of this land would be temporarily affected during the installation of the turbines and the construction of support facilities, and about one-third of the land would be permanently impacted. Based on Exelon's estimates, approximately 3,200 ac (1,300 ha) of land would be needed to support the wind portion of the alternative to replace the LGS. This amount of land use would include the area directly affected by the placement of turbines. Turbines would be spread across about 200 $mi^2$ (520 $km^2$). Additional land would be needed for any new transmission lines to connect wind farms to the grid and for any needed access roads.

Delivering heavy and oversized wind turbine components would also require the construction of temporary site access roads, some of which may require a circuitous route to their destination. However, once construction is completed, many temporary access roads can be reclaimed and replaced with more direct access to the wind turbines for maintenance purposes. Likewise, land used for equipment and material lay down areas, turbine assembly, and installation could be returned to its original state. During operations, only 5–10 percent of the total acreage within the wind farm is actually occupied by turbines, access roads, support buildings, and associated infrastructure while the remaining land area can be returned to its original condition or some other compatible use, such as farming or grazing.

Land-use impacts from the gas-fired portion of the energy recovery process associated with the CAES portion of this alternative would be similar to the impacts described for a NGCC power plant (see Section 8.1.7). Only a minor amount of land would be needed above the geologic storage formation. As a whole, construction and operation of a wind generation facility combined with the construction and operation of a CAES facility would have relatively greater impacts than the wind generation facilities alone.

The elimination of uranium fuel for LGS would partially offset some, but not all, of the land requirements for the wind farms. Scaling from GEIS estimates, approximately 1,640 ac

(660 ha) would no longer be needed during the operating life of the wind farms and the CAES facility. Overall land-use impacts from the construction and operation of new wind farms and a CAES facility would range from MODERATE to LARGE.

*8.6.3.8. Socioeconomics*

As previously explained in Section 8.1.8, two types of jobs would be created by this alternative: (1) construction jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operations jobs, which have the greater potential for permanent, long-term socioeconomic impacts. Workforce requirements for the construction and operation of a combination of wind turbines and a CAES facility were evaluated in order to measure their possible effects on current socioeconomic conditions.

Socioeconomic impacts from the wind turbine component would be similar to the impacts described for the wind alternative (see Section 8.4.8). Exelon estimated the wind alternative would require 200 construction and 50 operations workers (Exelon 2011). These estimates appear reasonable and in line with current construction and operational trends. Impacts from the construction and operation of the gas-fired portion of the energy recovery process associated with the CAES component would be similar to the impacts described for a NGCC power plant (see Section 8.1.8). Because of the relatively small number of construction workers at wind farms scattered over a large area at various locations, the relative economic impact of this many workers on local communities and the tax base would be SMALL. Given the small number of operations workers, socioeconomic impacts associated with operation of the wind and CAES components of this combination alternative would also be SMALL.

The reduction in employment at LGS could affect property tax revenue and income in local communities and businesses. In addition, the permanent housing market could also experience increased vacancies and decreased prices if operations workers and their families move out of the LGS region. However, the amount of property taxes paid by wind farms and CAES may offset lost tax revenues in the socioeconomic region around local jurisdictions if additional land is required to support this alternative. Based on this information, socioeconomic impacts during wind farm operations and CAES could range from SMALL to MODERATE.

*8.6.3.9. Transportation*

Transportation impacts during the construction and operation of the wind and CAES components of this combination alternative would be similar to the impacts for the NGCC and wind alternatives, discussed in Sections 8.1.7 and 8.4.7. This is because the construction workforce for each component and the volume of materials and equipment needing to be transported to each respective construction site would be the same.

As previously described for the NGCC and wind alternatives, workers commuting to the construction site would arrive by site access roads and the volume of traffic on nearby roads could increase during shift changes. In addition to commuting workers, trucks would be transporting construction materials and equipment to the worksite, thus increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary traffic volume impacts and delays at intersections. Transporting heavy and oversized wind turbine components on local roads could have a noticeable impact over a large area. Some components and materials could also be delivered by train or barge, depending on location. Train deliveries could cause additional traffic delays at railroad crossings. Based on this information, traffic-related transportation impacts during construction could range from SMALL to MODERATE depending on the location of the wind farm and CAES facility; road capacities; and traffic volumes.

During operations, transportation impacts would be less noticeable during shift changes and maintenance activities. Given the small numbers of operations workers, traffic impacts on local roads from wind turbine and CAES facility operations would be SMALL.

*8.6.3.10. Aesthetics*

The analysis of aesthetic impacts focuses on the degree of contrast between the wind and CAES alternative and surrounding landscapes and the visibility of new wind turbines at existing wind farms and the new CAES facility. In general, aesthetic changes would be limited to the immediate vicinity of the wind farms and CAES facility.

Aesthetic impacts during the construction and operation of the wind and CAES components of this combination alternative would be similar to the impacts for the NGCC and wind alternatives, discussed in Sections 8.1.10 and 8.4.10. Wind turbines would have the greatest potential visual impact. At 400 ft (122 m) tall (Exelon 2011) and spread across multiple sites, wind turbines often dominate the view and become the major focus of attention. Because wind farms are generally located in rural or remote areas, the introduction of wind turbines will be in sharp contrast to the visual appearance of the surrounding environment. Placing turbines along ridgelines would maximize their visibility. Wind turbines also generate noise.

The new CAES facility could be sited at a previously undisturbed location. The mechanical draft cooling towers and associated condensate plumes along with the CAES facility surface structures would be the only significant visual for this part of the alternative. Mechanical draft cooling towers also generate noise. Most other noises during facility operations would be limited to industrial processes and communications. Based on this information, aesthetic impacts from the construction and operation of new wind farms and CAES facility would range from MODERATE to LARGE depending on location and surroundings.

*8.6.3.11. Historic and Archaeological Resources*

Any areas potentially affected by the construction of a wind and CAES alternative should be surveyed to identify and record historic and archaeological resources. Resources found in these surveys would need to be evaluated for eligibility on the NRHP and mitigation of adverse effects would need to be addressed if eligible resources were encountered. Plant operators would need to survey all areas associated with operation of the alternative (e.g., roads, transmission corridors, other ROWs). Visual impacts on significant cultural resources—such as the viewsheds of historic properties near the sites—should also be assessed.

The potential for impacts on historic and archaeological resources from the wind and CAES alternative would vary greatly depending on the location of the proposed sites. Areas with the greatest sensitivity could be avoided or effectively managed under current laws and regulations. However, construction of wind farms and CAES could have the potential to notably impact historic and archaeological resources because of ground disturbing-activities (e.g., grading, digging an underground geologic repository). Aesthetic changes caused by the installation of wind turbines could also have a noticeable effect on the viewshed of nearby historic properties. Therefore, depending on the resource richness of the site chosen for the wind farm and CAES alternative, the impacts could range from SMALL to LARGE.

*8.6.3.12. Environmental Justice*

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health, environmental, and socioeconomic effects on minority and low-income populations that could result from the installation and operation of wind turbines and a CAES facility. As previously discussed in Section 8.1.12, such effects may include human health, biological, cultural, economic, or social impacts. Some of these potential effects have been identified in resource areas discussed in this SEIS.

Potential impacts to minority and low-income populations would mostly consist of environmental and socioeconomic effects during construction (e.g., noise, dust, traffic, employment, and housing impacts). Noise and dust impacts during construction would be short term and primarily limited to onsite activities. Minority and low-income populations residing along site access roads would be affected by increased commuter vehicle and truck traffic. However, because of the temporary nature of construction, these effects would only occur during certain hours of the day and are not likely to be high and adverse and would be contained to a limited time period during certain hours of the day. During construction, increased demand for rental housing in the vicinity of the site could affect low-income populations living near the alternatives. However, given the small number of construction workers and the possibility that workers could commute to the construction site, the need for rental housing would not be significant.

Minority and low-income populations living in close proximity to the wind farms and CAES facility could be disproportionately affected by operations. However, operational impacts would mostly be limited to noise and aesthetic effects. The general public living near the wind farms and CAES facility would also be exposed to the same effects.

Based on this information and the analysis of human health and environmental impacts presented in this SEIS, the construction and operation of new wind turbines and a CAES facility would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

##### *8.6.3.13. Waste Management*

During the construction stage of the combination of wind and CAES alternative, land clearing and excavation, and other construction activities would generate wastes that could be recycled, disposed of on site, or shipped to the offsite waste disposal facility. During the operational stage, the wind and CAES alternative might generate minor amounts of waste.

The staff concludes that overall waste impacts from the combination of the wind and CAES alternative would be SMALL.

**Table 8–9. Summary of Environmental Impacts of the Wind and CAES Alternative Compared to Continued Operation of the Existing LGS**

| | Wind and CAES Alternative | Continued Operation of LGS |
|---|---|---|
| Air Quality | SMALL to MODERATE | SMALL |
| Groundwater Resources | SMALL | SMALL |
| Surface Water Resources | SMALL | SMALL |
| Aquatic Ecology | SMALL | SMALL |
| Terrestrial Ecology | SMALL to MODERATE | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | MODERATE to LARGE | SMALL |
| Socioeconomics | SMALL to MODERATE | SMALL |
| Transportation | SMALL to MODERATE | SMALL |
| Aesthetics | MODERATE to LARGE | SMALL |
| Historic and Archaeological | SMALL TO LARGE | SMALL |
| Waste Management | SMALL | SMALL[a] |

[a] As described in Chapter 6, the issue, "offsite radiological impacts (spent fuel and high level waste disposal)," is not evaluated in this EIS.

### 8.6.4. Wood Waste

As noted in the GEIS (NRC 1996), the use of wood waste to generate utility-scale baseload power is limited to those locations where wood waste is plentiful. Wastes from pulp, paper, and paperboard industries and from forest management activities can be expected to provide sufficient, reliable supplies of wood waste as feedstocks to external combustion sources for energy generation. Beside the fuel source, the technological aspects of a wood-fired generation facility are virtually identical to those of a coal-fired alternative—combustion in an external combustion unit such as a boiler to produce steam to drive a conventional STG. Given constancy of the fuel source, wood waste facilities can be expected to operate at equivalent efficiencies and reliabilities. Costs of operation would depend significantly on processing and delivery costs. Wood waste combustors would be sources of criteria pollutants and GHGs, and pollution control requirements would be similar to those for coal plants. Unlike coal plants, there is no potential for the release of HAPs such as mercury. Co-firing of wood waste with coal is also technically feasible. Processing the wood waste into pellets can improve the overall efficiency of such co-fired units.

Although co-fired units can have capacity factors similar to baseload coal-fired units, such levels of performance are dependent on the continuous availability of the wood fuel. In the Commonwealth of Pennsylvania, 2010 electricity generating capacity from wood waste was 108 MW(e) and produced 675,000 MWh (EIA 2011c). Given the limited capacity and modest actual electricity production, the staff has determined that production of electricity from wood waste at levels equivalent to LGS would not be a feasible alternative to LGS license renewal.

### 8.6.5. Conventional Hydroelectric Power

Three technology variants of hydroelectric power exist—dam and release (also known as impoundment), run-of-the-river (also known as diversion), and pumped storage. In each variant, flowing water spins turbines of different designs to drive a generator to produce electricity. Dam and release facilities affect large amounts of land behind the dam to create reservoirs but can provide substantial amounts of power at capacity factors greater than 90 percent. Power generating capacities of run-of-the-river dams fluctuate with the flow of water in the river, and the operation of such dams is typically constrained (and stopped entirely during certain periods) so as not to create undue stress on the aquatic ecosystems present. Pumped storage facilities use electricity from other power sources to pump water from lower impoundments or flowing watercourses to higher elevations during off-peak load periods. Water is then released during peak load periods through turbines to generate electricity. Capacities of pumped storage facilities are dependent on the configuration and capacity of the elevated storage facility.

A comprehensive survey of hydropower resources in Pennsylvania was completed in 1997 by DOE's Idaho National Environmental Engineering Laboratory (now known as the Idaho National Laboratory). In the study, generating potential was defined by a model that considered the existing hydroelectric technology at developed sites or applied the most appropriate technology to undeveloped sites and introduced site-specific environmental considerations and limitations. Pennsylvania had modest hydroelectric potential, with a total generating potential of 703 MW(e) (INEEL 1997). This potential was spread across 104 sites, only one of which had the potential for more than 100 MW(e) of generation. Most other states in PJM have very limited potential (INEEL 1998b), with the exception of West Virginia, which has 1,149 MW(e) spread across 37 sites (INEEL 1998a)

More recently, EIA reported that, in 2010, conventional hydroelectric power (excluding pumped storage) was the principal electricity generation source among renewable sources in Pennsylvania (EIA 2011c). Nevertheless, only 747 MW(e) of hydroelectric capacity was installed in the Commonwealth. Those installations provided 2,332 gigawatt-hours of electricity (EIA 2011a). Although hydroelectric facilities can demonstrate relatively high capacity factors, the small potential capacities and actual recent power generation of hydroelectric facilities in Pennsylvania, combined with the diminishing public support for large hydroelectric facilities because of their potential for adverse environmental impacts, supports the staff's conclusion that hydroelectric is not a feasible alternative to LGS.

### 8.6.6. Ocean Wave and Current Energy

Ocean waves, currents, and tides represent kinetic and potential energies. The total annual average wave energy off the U.S. coastlines at a water depth of 60 m (197 ft) is estimated at 2,100 terawatt-hours (TWh) (MMS 2006). Waves, currents, and tides are often predictable and reliable; ocean currents flow consistently, while tides can be predicted months and years in advance with well-known behavior in most coastal areas. Four principal wave energy conversion (WEC) technologies have been developed to date to capture the potential or kinetic energy of waves—point absorbers, attenuators, overtopping devices, and terminators. All have similar approaches to electricity generation but differ in size, anchoring method, spacing, interconnection, array patterns, and water depth limitations. Point absorbers and attenuators both allow waves to interact with a floating buoy, subsequently converting its motion into mechanical energy to drive a generator. Overtopping devices and terminators are also similar in their function. Overtopping devices trap some portion of the incident wave at a higher elevation than the average height of the surrounding sea surface, thus giving it higher potential energy, which is then transferred to power generators. Terminators allow waves to enter a tube, compressing air trapped at the top of the tube, which is then used to drive a generator.

Capacities of point absorbers range from 80–250 kW, with capacity factors as high as 40 percent; attenuator facilities have capacities of as high as 750 kW. Overtopping devices have design capacities as high as 4 MW, while terminators have design capacities ranging from 500 kW–2 MW and capacity factors as high as 50 percent (MMS 2007).

The most advanced technology for capturing tidal and ocean current energy is the submerged turbine. Underwater turbines share many design features and functions with wind turbines, but because of the greater density of water compared to air, they have substantially greater power-generating potential than wind turbines with comparably sized blades. Only a small number of prototypes and demonstration units have been deployed to date, however. Underwater turbine "farms" are projected to have capacities of 2–3 MW, with capacity factors directly related to the constancy of the current with which they interact.

The staff is not currently aware of any plans to develop or deploy ocean wave and ocean current generation technologies on a scale similar to that of LGS. Consequently, the relatively modest power capacities, relatively high costs, and limited planned implementation support the staff's conclusion that water energy current technologies are not feasible substitutes for LGS.

### 8.6.7. Geothermal Power

Geothermal technologies extract the heat contained in geologic formations to produce steam to drive a conventional steam-turbine generator. The following variants of the heat exchanging mechanism have been developed:

- Hot geothermal fluids contained under pressure in a geological formation are brought to the surface where the release of pressure allows them to flash into steam (the most common of geothermal technologies applied to electricity production).
- Hot geothermal fluids are brought to the surface in a closed loop system and directed to a heat exchanger where they convert water in a secondary loop into steam.
- Hot dry rock technologies involve fracturing a rock formation and extracting heat through injection of a heat transfer fluid.

Facilities producing electricity from geothermal energy can routinely demonstrate capacity factors of 95 percent or greater, making geothermal energy clearly eligible as a source of baseload electric power. However, as with other renewable energy technologies, the ultimate feasibility of geothermal energy serving as a baseload power replacement for LGS depends on the quality and accessibility of geothermal resources within or proximate to the region of interest—in this case, Pennsylvania or PJM. As of April 2010, the United States had a total installed geothermal electricity production capacity of 3,087 MW(e) originating from geothermal facilities in nine states—Alaska, California, Hawaii, Idaho, Nevada, New Mexico, Oregon, Utah, and Wyoming. Additional geothermal facilities are being considered for Colorado, Florida, Louisiana, Mississippi, and Oregon. Neither Pennsylvania nor PJM has adequate geothermal resources to support utility-scale electricity production (GEA 2010). NRC concludes, therefore, that geothermal energy does not represent a feasible alternative to LGS.

### 8.6.8. Municipal Solid Waste

Municipal solid waste (MSW) combustors use three types of technologies—mass burn, modular, and refuse-derived fuel. Mass burning is currently the method used most frequently in the United States and involves no (or little) sorting, shredding, or separation. Consequently, toxic or hazardous components present in the waste stream are combusted, and toxic constituents are exhausted to the air or become part of the resulting solid wastes. Currently, approximately 86 waste-to-energy plants operate in 24 states, processing 97,000 tons (88,000 MT) of municipal solid waste per day. Approximately 26 million tons (24 million MT) of trash were processed in 2008 by waste-to-energy facilities. With a reliable supply of waste fuel, waste-to-energy plants have a nationwide aggregate capacity of 2,572 MW(e) (compared to 2,340 MW[e] capacity at LGS) and can operate at capacity factors greater than 90 percent (ERC 2010). The EPA estimates that, on average, air impacts from MSW-to-energy plants are as follows:

- carbon dioxide ($CO_2$) –3,685 lb (1,672 kg)/MWh,
- sulfur dioxide ($SO_X$) –1.2 lb (0.54 kg)/MWh, and
- nitrogen oxide ($NO_x$) – 6.7 lb (3.0 kg)/MWh.

Depending on the composition of the municipal waste stream, air emissions can vary greatly, and the ash produced may exhibit hazardous characteristics that require special treatment and handling (EPA 2010).

Estimates in the GEIS suggest that the overall level of construction impact from a waste-fired plant would be approximately the same as that for a coal-fired power plant. Additionally, waste-fired plants have the same or greater operational impacts as coal-fired technologies (including impacts on the aquatic environment, air, and waste disposal). The initial capital costs for municipal solid-waste plants are greater than those for comparable steam-turbine technology at coal-fired facilities or at wood-waste facilities because of the need for specialized waste separation and handling equipment (NRC 1996).

The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills, rather than energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term as energy prices increase (and especially since such landfills, of sufficient size and maturity, can be sources of easily recoverable methane fuel); however, it is possible that municipal waste combustion facilities may become attractive again.

Regulatory structures that once supported municipal solid waste incineration no longer exist. For example, the Tax Reform Act of 1986 made capital-intensive projects, such as municipal waste combustion facilities, more expensive relative to less capital-intensive waste disposal alternatives such as landfills. Additionally, the 1994 Supreme Court decision C&A Carbone, Inc. *v.* Town of Clarkstown, New York, struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that may have had lower fees. In addition, environmental regulations have increased the capital cost necessary to construct and maintain municipal waste combustion facilities.

Given the limited nationwide implementation of MSW-based generation to date (only 10 percent greater than the capacity of LGS), small average installed size of municipal solid waste plants, the likelihood that additional stable streams of MSW are not likely to be available to support numerous new facilities, and the increasingly unfavorable regulatory environment, the staff does not consider municipal solid waste combustion to be a reasonable alternative to LGS license renewal.

### 8.6.9. Biomass Fuels

When used here, “biomass fuels” include crop residues, switchgrass grown specifically for electricity production, forest residues, methane from landfills, methane from animal manure management, primary wood mill residues, secondary wood mill residues, urban wood wastes, and methane from domestic wastewater treatment. The feasibility of using biomass fuels for baseload power depends on its geographic distribution, available quantities, constancy of supply, and energy content. A variety of technical approaches has been developed for biomass-fired electric generators, including direct burning, conversion to liquid biofuels, and biomass gasification. In a study completed in December 2005, Milbrandt of NREL documented the geographic distribution of biomass fuels within the United States, reporting the results in metric tons available (dry basis) per year (NREL 2005). Most counties in Pennsylvania have limited potential biomass fuels, with the exception of Philadelphia and Bucks County. Use of biomass fuels in Pennsylvania is also limited. Beyond the wood and wood waste considered in Section 8.6.4, generators in the Commonwealth used biomass fuels to produce merely 3,000 MWh of electricity in 2010 (EIA 2011c).

In the GEIS, the NRC indicated that technologies relying on a variety of biomass fuels had not progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as LGS. After reevaluating current technologies, and after reviewing existing statewide capacities and the extent to which biomass is currently being used to produce electricity, the staff finds biomass-fueled alternatives are still unable to replace the LGS capacity and are not considered feasible alternatives to LGS license renewal.

### 8.6.10. Oil-Fired Power

Although oil has historically been used extensively in the Northeast for comfort heating, EIA projects that oil-fired plants will account for very little of the new generation capacity constructed in the United States during the 2008 to 2030 time period. In 2010, Pennsylvania generated 0.2 percent of its total electricity from oil (EIA 2012). Further, EIA does not project that oil-fired power will account for any significant additions to capacity (EIA 2011b).

The variable costs of oil-fired generation tend to be greater than those of nuclear or coal-fired operations, and oil-fired generation tends to have greater environmental impacts than natural gas-fired generation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly expensive (EIA 2011b). The high cost of oil has prompted a steady decline in its use for electricity generation. Thus, the staff does not consider oil-fired generation as a reasonable alternative to LGS license renewal.

### 8.6.11. Delayed Retirement

Exelon currently plans to retire three coal-fired units and one oil-fired unit (Exelon 2011). These units total 946 MW(e) of capacity, far less than the 2,340 MW(e) LGS currently provides. In PJM, however, Exelon indicates that generators have retired 5,945 MW(e) from 2003 to 2009 (Exelon 2011).

Most retired units are dirtier and less efficient than new units. Often, units are retired because operation is no longer economical. In some cases, the cost of environmental compliance or necessary repairs and upgrades are too high to justify continued operation. As a result, the staff does not consider delayed retirement a reasonable alternative to license renewal. It is possible, however, that a site where a unit has been retired could play host to a new generation facility, like the NGCC and SCPC alternatives considered in Sections 8.1 and 8.2, and the NGCC portion of the combination alternative considered in Section 8.6.2.

### 8.6.12. Fuel Cells

Fuel cells oxidize fuels without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air (or oxygen) over a cathode and separating the two by an electrolyte. The only byproducts (depending on fuel characteristics) are heat, water, and $CO_2$. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam reforming under pressure. Natural gas is typically used as the source of hydrogen.

Currently, fuel cells are not economically or technologically competitive with other alternatives for electricity generation. EIA projects that fuel cells may cost $5,478 per installed kW (total overnight costs, 2008 dollars) (EIA 2010c). This amount is substantially greater than coal ($2,223), advanced (natural gas) combustion turbines ($648), onshore wind ($1,966), or offshore wind ($3,937), but it is cost-competitive with solar PV ($6,171) or CSP solar ($5,132). Installed costs provided for PV and CSP solar are before application of Investment Tax Credits provided in Federal statutes. More importantly, fuel cell units are likely to be small in size (the EIA reference plant is 10 MWe). While it may be possible to use a distributed array of fuel cells to provide an alternative to LGS, it would be extremely costly to do so and would require many units and wholesale modifications to the existing transmission system. Accordingly, the staff does not consider fuel cell technology to be a reasonable alternative to LGS license renewal.

### 8.6.13. Coal-Fired Integrated Gasification Combined-Cycle

Integrated gasification combined-cycle (IGCC) is an emerging technology for generating electricity with coal that combines modern coal gasification technology with both gas turbine and steam turbine power generation. Gasifiers, similar to those used in oil refineries, use heat pressure and steam to pyrolyze (thermally reform complex organic molecules without oxidation) coal to produce synthesis gases (generically referred to as syngas) typically composed of carbon monoxide, hydrogen, and other flammable constituents. After processing to remove contaminants and produce various liquid chemicals, the syngas is combusted in a combustion turbine to produce electric power. Separating the $CO_2$ from the syngas before combustion is also possible. Latent heat is recovered both from the syngas as it exits the gasifier and from the combustion gases exiting the combustion turbine and directed to a heat recovery steam generator feeding a conventional Rankine cycle STG to produce additional amounts of electricity. Emissions of criteria pollutants would likely be slightly higher than those from an NGCC alternative but significantly lower than those from the supercritical coal-fired alternative. Depending on the gasification technology employed, IGCC would use less water than SCPC units but slightly more than NGCC (NETL 2007). Long-term maintenance costs of this relatively complex technology would likely be greater than those for a similarly sized SCPC or NGCC plant.

Only a few IGCC plants are operating at utility scale. Operating at higher thermal efficiencies than supercritical coal-fired boilers, IGCC plants can produce electrical power with fewer air pollutants and solid wastes than coal-fired boilers. To date, however, IGCC technologies have had limited application and have been plagued with operational problems such that its effective, long-term capacity factors are often not high enough for them to reliably serve as baseload units. Although IGCC technology may become more commonplace in the future, current operational problems that compromise reliability result in the dismissal of this technology as a viable alternative to LGS.

### 8.6.14. Demand-Side Management

In its ER, Exelon indicates that DSM does not fulfill the stated purpose of license renewal because it does not provide power generation capacity (Exelon 2011). Exelon also notes that the purpose of LGS license renewal is to “allow Exelon to sell wholesale power generated by LGS to meet future demand.” The ER continues to note that, because “Exelon engages solely in the sale of wholesale electric power, the Company has no business connection to end-users of its electricity and, therefore, no ability to implement DSM.” While the staff finds this position reasonable for purposes of this analysis, it notes that DSM is an option for energy planners and decisionmakers—and it may be a potential consequence of no action—and so will discuss it in brief in this section.

DSM measures—unlike the energy supply alternatives discussed in previous sections—address energy end uses. DSM can include measures that do the following:

- reduce energy consumption;
- shift energy consumption to different times of the day to reduce peak loads;
- interrupt certain large customers during periods of high demand;
- interrupt certain appliances during high demand periods; and
- encourage customers to switch from gas to electricity for water heating and other similar measures that utilities use to boost sales.

In terms of overall ability to offset or replace an existing baseload power plant, DSM measures that reduce energy consumption, typically referred to as energy conservation and energy efficiency, are the most useful. Though often used interchangeably, energy conservation and energy efficiency are different concepts. Energy efficiency typically means deriving a similar level of service by using less energy, while energy conservation simply indicates a reduction in energy consumption. The GEIS directly addressed energy conservation, and noted that it is not a discrete power-generating source; it represents an option that states and utilities may use to reduce their need for power generation capability (NRC 1996). Conservation measures may include incentives to reduce overall energy consumption, while efficiency measures may include incentives to replace older, less efficient appliances, lighting, or heating and cooling systems. A variety of conservation or energy efficiency measures would likely be necessary to replace the capacity currently provided by LGS.

Another DMS approach is called demand-response. PJM currently has a robust demand-response program, which, unlike energy efficiency and energy conservation measures, generally aims to reduce consumption during times of high demand. This program also reduces stresses on the PJM transmission system.

PJM’s demand-response program provides payments to participants who reduce demand (PJM 2012c, PJM undated). The payments increase as the price of electricity increases, so that participants are most likely to reduce consumption when electricity is most expensive, which usually (though not always) occurs during times of high demand (this may also occur during certain emergencies). This type of approach usually offsets intermediate and peaking generation rather than baseload generation. Exelon notes, in the ER, that it is unlikely that demand reductions in PJM could be sufficiently increased to replace the LGS baseload capacity (Exelon 2011). The NRC staff determined that this conclusion is reasonable because a considerable amount of demand reduction efforts are currently in place and it is unlikely that additional programs could reduce use by another 2,340 MW(e).

As Exelon noted in its ER, the impacts of DSM at most sites are generally SMALL. The staff has considered energy efficiency or energy conservation in several SEISs (see, e.g., NUREG-1437, Supplements 33, 37, and 38) and in each case has found the impacts to be SMALL, except when conservation or efficiency measures are unlikely to offset socioeconomic impacts of plant shutdown. For LGS, the conservation or efficiency measures may not offset the socioeconomic plant shutdown because the measures could occur across the entire PJM territory, which includes several states. The GEIS also indicates that impacts from energy conservation are likely to be SMALL. The staff notes, however, that some generation owners recently expressed concern that in cases where demand-response programs trigger increased reliance on backup diesel generators, air-quality impacts may occur, particularly in PJM (see, e.g., Beattie 2012). The EPA has provided clean-air waivers for the use of these generators for a limited number of hours throughout the year. Emergency use of these generators is likely to occur during the hottest days of the summer, when impaired air quality often also occurs (Beattie 2012). Some air quality effects from some DSM measures are possible, but they would depend on the specific DSM measures employed. Because it is unlikely that demand reductions in PJM could be sufficiently increased to replace the LGS baseload capacity, the NRC did not consider DSM to be a reasonable alternative.

## 8.7. No-Action Alternative

This section examines the environmental effects that occur if NRC takes no action. No action, in this case, means that NRC denies the renewed operating licenses for LGS and the licenses expire at the end of the current license terms, in 2024 and 2029. If the NRC denies the renewed operating licenses, the plant will shut down at or before the end of the current licenses. After shutdown, plant operators will initiate decommissioning in accordance with 10 CFR 50.82.

No action does not satisfy the purpose and need for this SEIS, as it neither provides power-generation capacity nor meets the needs currently met by LGS or that the alternatives evaluated in Sections 8.1–8.5 would satisfy. Assuming that a need currently exists for the power generated by LGS, the no-action alternative would require the appropriate energy planning decision-makers (not NRC) to rely on an alternative to replace the capacity of LGS, rely on energy conservation or power purchases to offset parts of the LGS capacity, or rely on some combination of measures to offset and replace the generation provided by the facility.

This section addresses only those impacts that arise directly as a result of plant shutdown. The environmental impacts from decommissioning and related activities have already been addressed in several other documents, including the “Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities,” NUREG-0586, Supplement 1 (NRC 2002); the license renewal GEIS, Chapter 7 (NRC 1996); and Chapter 7 of this SEIS. These analyses either directly address or bound the environmental impacts of decommissioning whenever Exelon ceases to operate LGS.

Even with a renewed operating license, LGS will eventually shut down, and the environmental effects we address in this section will occur at that time. Because these effects have not otherwise been addressed in this SEIS, the impacts are addressed in this section. As with decommissioning effects, shutdown effects are expected to be similar whether they occur at the end of the current license or at the end of a renewed license. Table 8–10 provides a summary of the environmental impacts of the no-action alternative.

### 8.7.1. Air Quality

When the plant stops operating, there will be a reduction in emissions from activities related to plant operation, such as use of diesel generators and employee vehicles. In Chapter 4, the staff determined that these emissions would have a SMALL impact on air quality during the renewal term; therefore, if emissions decrease, the impact on air quality would also decrease and would be SMALL.

### 8.7.2. Groundwater Resources

Impacts to groundwater resources would decrease, as the plant would withdraw less water than it does during operations. Therefore, shutdown would reduce the impacts to groundwater resources, which would remain SMALL.

### 8.7.3. Surface Water Resources

Impacts to surface water resources would decrease, as the plant would withdraw and discharge less water than it does during operations. Therefore, shutdown would reduce the impacts to surface water resources, which would remain SMALL.

### 8.7.4. Aquatic and Terrestrial Resources

Impacts to aquatic ecology would decrease, as the plant would withdraw and discharge less water than it does during operations. Therefore, fewer organisms would be subject to impingement, entrainment, and heat shock. Shutdown would reduce the impacts to aquatic ecology, which would remain SMALL.

Terrestrial ecology impacts would remain SMALL. No additional land disturbances on or offsite would occur.

### 8.7.5. Human Health

In Chapter 4 of this SEIS, the staff concluded that the impacts of continued plant operation on human health would be SMALL. After cessation of plant operations, the amounts of radioactive material released to the environment in gaseous and liquid forms, all of which are currently within respective regulatory limits, would be reduced or eliminated. Therefore, the staff concludes that the impact of plant shutdown on human health would also be SMALL. In addition, the potential for a variety of accidents would also be reduced to only those associated specifically with shutdown activities and fuel handling. In Chapter 5 of this SEIS, the staff concluded that impacts of accidents during operation would be SMALL. It follows, therefore, that impacts on human health from a reduced suite of potential accidents after reactor operation ceases would also be SMALL. Therefore, the staff concludes that impacts on human health from the no-action alternative would be SMALL.

### 8.7.6. Land Use

Plant shutdown would not affect onsite land use. Plant structures and other facilities would remain in place until decommissioning. Most transmission lines connected to the LGS would remain in service after the plant stops operating. Maintenance of most existing transmission lines would continue as before. Impacts on land use from plant shutdown would be SMALL.

### 8.7.7. Socioeconomics

Plant shutdown would have a noticeable impact on socioeconomic conditions in the communities located in the immediate vicinity of LGS. Should LGS shut down, there would be immediate socioeconomic impact from the loss of jobs (some, though not all, of the 820 employees would begin to leave), and tax payments may be reduced. As the majority of

LGS employees reside in Montgomery, Berks, and Chester Counties, socioeconomic impacts from plant shutdown would be concentrated in these counties, with a corresponding reduction in purchasing activity and tax contributions to the regional economy. Revenue losses from LGS operations would directly affect Montgomery County and other local taxing districts and communities closest to, and most reliant on, the nuclear plant's tax revenue. The impact of the job loss, however, may not be as noticeable given the amount of time required to decontaminate and decommission existing facilities and the proximity of LGS to the Philadelphia metropolitan area. The socioeconomic impacts of plant shutdown (which may not entirely cease until after decommissioning) could, depending on the jurisdiction, range from SMALL to MODERATE.

### 8.7.8. Transportation

Traffic volumes on the roads in the vicinity of LGS would be reduced after plant shutdown. Most of the reduction in traffic volume would be associated with the loss of jobs at the nuclear power plant. The number of deliveries to the power plant would be reduced until decommissioning. Transportation impacts would be SMALL as a result of plant shutdown.

### 8.7.9. Aesthetics

Plant structures and other facilities would remain in place until decommissioning. Most sources of operational noise would cease. Therefore, aesthetic impacts of plant closure would be SMALL.

### 8.7.10. Historic and Archaeological Resources

Impacts from the no-action alternative on historic and archaeological resources would be SMALL. A separate environmental review addressing the protection of historic and archaeological resources would be conducted for decommissioning.

### 8.7.11. Environmental Justice

Impacts to minority and low-income populations would depend on the number of jobs and the amount of tax revenues lost by communities in the immediate vicinity of the power plant after LGS ceases operations. Closure of LGS would reduce the overall number of jobs (there are currently 820 employed at the facility) and tax revenue for social services attributed to nuclear plant operations. Minority and low-income populations in the vicinity of LGS could experience some socioeconomic effects from plant shutdown, but these effects would not likely be high and adverse.

### 8.7.12. Waste Management

If the no-action alternative were implemented, the generation of high-level waste would stop, and generation of low-level and mixed waste would decrease. Impacts from implementation of the no-action alternative are expected to be SMALL.

**Table 8–10. Environmental Impacts of No-Action Alternative**

| | No-Action Alternative | Continued Operation of LGS |
|---|---|---|
| Air Quality | SMALL | SMALL |
| Groundwater Resources | SMALL | SMALL |
| Surface Water Resources | SMALL | SMALL |
| Aquatic Ecology | SMALL | SMALL |
| Terrestrial Ecology | SMALL | SMALL |
| Human Health | SMALL | SMALL |
| Land Use | SMALL | SMALL |
| Socioeconomics | SMALL to MODERATE | SMALL |
| Transportation | SMALL | SMALL |
| Aesthetics | SMALL | SMALL |
| Historic and Archaeological | SMALL | SMALL |
| Waste Management | SMALL[a] | SMALL[a] |

[a] As described in Chapter 6, the issue, "offsite radiological impacts (spent fuel and high level waste disposal)," is not evaluated in this EIS

## 8.8. Alternatives Summary

In this SEIS, the staff has considered alternative actions to license renewal of LGS, including in-depth evaluations of new generation alternatives (Sections 8.1–8.4), a purchased power alternative (Section 8.5), alternatives that the staff dismissed from detailed evaluation as infeasible or inappropriate (Section 8.6; including in-depth consideration of solar PV generation and two combination alternatives), and the no-action alternative in which the operating license is not renewed (Section 8.7). Impacts of all alternatives considered in detail are summarized in Table 8-11.

Based on the above evaluations, the staff concludes that the environmental impacts of renewal of the operating license for LGS would be smaller than those of feasible and commercially viable alternatives studied in this SEIS that satisfy the purpose and need of license renewal (providing 2,340 MWe of baseload power to the grid). Impacts on air quality are less from continued operation of LGS than from any of the alternatives involving fossil fuels, though they are likely to be greater than wind and solar PV alone. Finally, the staff concluded that under the no-action alternative, the act of shutting down LGS on or before its license expiration would have mostly SMALL impacts, although socioeconomic impacts would be SMALL to MODERATE. Depending on how the power lost to the region from reactor shutdown was replaced (decisions outside of the NRC's authority and made instead by Exelon, other power producers, PJM operators, and state or non-NRC Federal authorities), the net environmental impact of the no-action alternative could be greater than continued reactor operation, especially when fossil energy power plants provide replacement generation capacity.

**Table 8–11. Summary of Environmental Impacts of Proposed Action and Alternatives**

| Alternative | Impact Area: Air Quality | Groundwater and Surface Water Resources | Aquatic and Terrestrial Resources | Human Health | Land Use | Socioeconomics (including Transportation and Aesthetics) | Historic and Archaeological Resources | Waste Management |
|---|---|---|---|---|---|---|---|---|
| License Renewal | SMALL | SMALL | SMALL | SMALL | SMALL | SMALL | SMALL | SMALL[(a)] |
| NGCC at an Alternate Site | SMALL to MODERATE | SMALL | SMALL | SMALL | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL |
| SCPC at an Alternate Site | MODERATE | SMALL | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL to LARGE | SMALL | MODERATE |
| New Nuclear at an Alternate Site | SMALL | SMALL | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL to LARGE | SMALL | SMALL[(a)] |
| Wind Power | SMALL | SMALL | SMALL to MODERATE | SMALL | MODERATE to LARGE | SMALL to LARGE | SMALL to LARGE | SMALL |
| Purchased Power | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL | SMALL to LARGE | SMALL to LARGE | SMALL to LARGE | SMALL to MODERATE |
| Solar PV (dismissed in Section 8.6.1) | SMALL | SMALL | SMALL to MODERATE | SMALL | SMALL to LARGE | SMALL to LARGE | SMALL to LARGE | SMALL |
| Wind, Solar, and NGCC (dismissed in Section 8.6.2) | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL to MODERATE | SMALL to MODERATE | SMALL |
| Wind and CAES (dismissed in Section 8.6.3) | SMALL to MODERATE | SMALL | SMALL to MODERATE | SMALL | MODERATE to LARGE | SMALL to LARGE | SMALL to LARGE | SMALL |
| No-Action Alternative | SMALL | SMALL | SMALL | SMALL | SMALL | SMALL to MODERATE | SMALL | SMALL[(a)] |

[(a)] As described in Chapter 6, the issue, “offsite radiological impacts (spent fuel and high level waste disposal),” is not evaluated in this EIS.

## 8.9. References

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40 CFR Part 75. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 75, "Continuous emission monitoring."

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# 9.0 CONCLUSION

This draft supplemental environmental impact statement (SEIS) contains the environmental review of Exelon's application for renewed operating licenses for Limerick Generating Station, Units 1 and 2 (LGS), as required by the *Code of Federal Regulations* (CFR), Part 51 of Title 10 (10 CFR Part 51), the U.S. Nuclear Regulatory Commission's (NRC's) regulations that implement the National Environmental Policy Act (NEPA). This chapter presents conclusions and recommendations from the site-specific environmental review of LGS and summarizes site-specific environmental issues of license renewal that the NRC staff (staff) noted during the review. Section 9.1 summarizes the environmental impacts of license renewal; Section 9.2 presents a comparison of the environmental impacts of license renewal and energy alternatives; Section 9.3 discusses unavoidable impacts of license renewal, energy alternatives, and resource commitments; and Section 9.4 presents conclusions and staff recommendations.

## 9.1. Environmental Impacts of License Renewal

The staff's review of site-specific environmental issues in this SEIS leads to the conclusion that issuing renewed licenses at LGS would have SMALL impacts for the Category 2 issues applicable to license renewal at LGS, as well as environmental justice and chronic effects for electromagnetic fields.

The staff considered mitigation measures for each Category 2 issue, as applicable. For surface water use, current measures to mitigate the environmental impacts of plant operations were found to be adequate. The Delaware River Basin Commission (DRBC) requires LGS to shift to an alternative water source when the flow of the Schuylkill River falls to 560 (15.9 $m^3$/s) to ensure that LGS cooling water withdrawals and associated consumptive use will not reduce flow by more than 12 percent during low-flow periods.

The staff also considered cumulative impacts of past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes them. The staff concluded in Section 4.11 that cumulative impacts of LGS's license renewal would be SMALL for all areas except aquatic ecology and terrestrial ecology. For aquatic ecology, the staff concluded that the cumulative impact would be SMALL to MODERATE. For terrestrial ecology, the cumulative impacts would be MODERATE.

## 9.2. Comparison of Alternatives

In the conclusion to Chapter 8, the staff considered the following alternatives to LGS license renewal:

- natural-gas-fired combined-cycle (NGCC),
- supercritical pulverized coal,
- new nuclear,
- wind power,
- purchased power, and
- no-action.

The staff concluded that the environmental impacts of renewal of the operating license for LGS would be smaller than those of feasible and commercially viable alternatives. The no-action alternative, the act of shutting down LGS on or before its license expires, would have SMALL environmental impacts in most areas with the exception of socioeconomic impacts which would have SMALL to MODERATE environmental impact. Continued operations would have SMALL environmental impacts in all areas. The staff concluded that continued operation of the existing LGS is the environmentally preferred alternative.

## 9.3. Resource Commitments

### 9.3.1. Unavoidable Adverse Environmental Impacts

Unavoidable adverse environmental impacts are impacts that would occur after implementation of all workable mitigation measures. Carrying out any of the energy alternatives considered in this SEIS, including the proposed action, would result in some unavoidable adverse environmental impacts.

Minor unavoidable adverse impacts on air quality would occur due to emission and release of various chemical and radiological constituents from power plant operations. Nonradiological emissions resulting from power plant operations are expected to comply with U.S. Environmental Protection Agency (EPA) emissions standards, although the alternative of operating a fossil-fueled power plant in some areas may worsen existing attainment issues. Chemical and radiological emissions would not exceed the National Emission Standards for hazardous air pollutants.

During nuclear power plant operations, workers and members of the public would face unavoidable exposure to radiation and hazardous and toxic chemicals. Workers would be exposed to radiation and chemicals associated with routine plant operations and the handling of nuclear fuel and waste material. Workers would have higher levels of exposure than members of the public, but doses would be administratively controlled and would not exceed standards or administrative control limits. In comparison, the alternatives involving the construction and operation of a non-nuclear power generating facility would also result in unavoidable exposure to hazardous and toxic chemicals to workers and the public.

The generation of spent nuclear fuel and waste material, including low-level radioactive waste, hazardous waste, and nonhazardous waste would also be unavoidable. In comparison, hazardous and nonhazardous wastes would also be generated at non-nuclear power generating facilities. Wastes generated during plant operations would be collected, stored, and shipped for suitable treatment, recycling, or disposal in accordance with applicable Federal and State regulations. Due to the costs of handling these materials, power plant operators would be expected to carry out all activities and optimize all operations in a way that generates the smallest amount of waste possible.

### 9.3.2. Short-Term Versus Long-Term Productivity

The operation of power generating facilities would result in short-term uses of the environment, as described in Chapters 4, 5, 6, 7, and 8. “Short-term” is the period of time that continued power generating activities take place.

Power plant operations require short-term use of the environment and commitment of resources and commit certain resources (e.g., land and energy), indefinitely or permanently. Certain short-term resource commitments are substantially greater under most energy alternatives, including license renewal, than under the no-action alternative because of the continued generation of electrical power and the continued use of generating sites and associated infrastructure. During operations, all energy alternatives require similar relationships between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

Air emissions from power plant operations introduce small amounts of radiological and nonradiological constituents to the region around the plant site. Over time, these emissions would result in increased concentrations and exposure, but they are not expected to impact air quality or radiation exposure to the extent that public health and long-term productivity of the environment would be impaired.

Continued employment, expenditures, and tax revenues generated during power plant operations directly benefit local, regional, and State economies over the short term. Local governments investing project-generated tax revenues into infrastructure and other required services could enhance economic productivity over the long term.

The management and disposal of spent nuclear fuel, low-level radioactive waste, hazardous waste, and nonhazardous waste requires an increase in energy and consumes space at treatment, storage, or disposal facilities. Regardless of the location, the use of land to meet waste disposal needs would reduce the long-term productivity of the land.

Power plant facilities are committed to electricity production over the short term. After decommissioning these facilities and restoring the area, the land could be available for other future productive uses.

### 9.3.3. Irreversible and Irretrievable Commitments of Resources

This section describes the irreversible and irretrievable commitment of resources that have been noted in this SEIS. Resources are irreversible when primary or secondary impacts limit the future options for a resource. An irretrievable commitment refers to the use or consumption of resources that are neither renewable nor recoverable for future use. Irreversible and irretrievable commitment of resources for electrical power generation include the commitment of land, water, energy, raw materials, and other natural and man-made resources required for power plant operations. In general, the commitment of capital, energy, labor, and material resources are also irreversible.

The implementation of any of the energy alternatives considered in this SEIS would entail the irreversible and irretrievable commitment of energy, water, chemicals, and in some cases, fossil fuels. These resources would be committed during the license renewal term and over the entire life cycle of the power plant, and they would be unrecoverable.

Energy expended would be in the form of fuel for equipment, vehicles, and power plant operations and electricity for equipment and facility operations. Electricity and fuel would be purchased from offsite commercial sources. Water would be obtained from existing water supply systems. These resources are readily available, and the amounts required are not expected to deplete available supplies or exceed available system capacities.

## 9.4. Recommendations

The NRC's preliminary recommendation is that the adverse environmental impacts of license renewal for LGS are not great enough to deny the option of license renewal for energy-planning decisionmakers. This recommendation is based on the following:

- the analysis and findings in NUREG-1437, Volumes 1 and 2, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*,
- the environmental report submitted by Exelon,
- consultation with Federal, state, and local agencies,
- the NRC's environmental review, and
- consideration of public comments received during the scoping process.

# 10.0 LIST OF PREPARERS

Members of the U.S. Nuclear Regulatory Commission's (NRC's) Office of Nuclear Reactor Regulation (NRR) prepared this SEIS with assistance from other NRC organizations and contract support from Pacific Northwest National Laboratory (PNNL). Table 10–1 lists each contributor's name, affiliation, and function or expertise.

**Table 10–1. List of Preparers**

| Name | Affiliation | Function or Expertise |
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| Leslie Perkins | NRR | Project Manager |
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| Briana Balsam | NRR | Terrestrial Ecology |
| William Rautzen | NRR | Radiation Protection; Human Health |
| Kevin Folk | NRR | Hydrology |
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| Jeffrey Rikhoff | NRR | Socioeconomics; Environmental Justice; Land Use |
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| Allison Travers | NRR | Historic & Archaeological Resources |
| Jerry Dozier | NRR | Severe Accident Mitigation Alternatives |
| | **Contractor[(a)]** | |
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| David Anderson | PNNL | Land Use |

[(a)]PNNL is operated by Battelle for the U.S. Department of Energy

# 11.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THIS SEIS ARE SENT

**Table 11–1. List of Agencies, Organizations, and Persons to Whom Copies of this SEIS Are Sent**

| Name and Title | Company and Address |
|---|---|
| EIS Filing Section | U.S. Environmental Protection Agency<br>1200 Pennsylvania Avenue, NW<br>Washington, DC 20004 |
| Tom McColloch<br>Office of Federal Programs | Advisory Council on Historic Preservation<br>Old Post Office Building, Suite 803<br>1100 Pennsylvania Avenue, NW<br>Washington, DC 20004 |
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| Clint Halftown<br>Heron Clan Representative | Cayuga Nation<br>P.O. Box 11<br>Versailles, NY  14168 |
| Chief Roger Hill | Tonawanda Seneca Nation<br>7027 Meadville Road<br>Basom, NY  14013 |
| Neil Patterson, Jr.<br>Director, Tuscarora Environmental Program | Tuscarora Nation<br>2045 Upper Mountain Road<br>Sanborn, NY  14132 |
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| Paul Barton<br>Historic Preservation Officer | Seneca–Cayuga Tribe of Oklahoma<br>23701 South 655 Road<br>Grove, OK  74344 |
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| Jesse Bergevin<br>Historian | Oneida Indian Nation<br>1256 Union Street<br>P.O. Box 662<br>Oneida, NY  13421-0662 |
| Michael P. Gallagher<br>Vice President, License Renewal Projects | Exelon Generation Company, LLC<br>200 Exelon Way<br>Kennett Square, PA  19348 |
| Nancy L. Ranek<br>Environmental Lead | Exelon Generation Company, LLC<br>200 Exelon Way, KSA-2-E<br>Kennett Square, PA  19348 |
| Chris Wilson<br>Licensing Lead | Exelon Generation Company, LLC<br>200 Exelon Way, KSA-2-E<br>Kennett Square, PA  19348 |
| Environmental Review Section | U.S. Environmental Protection Agency<br>Region 3<br>1650 Arch Street<br>Philadelphia, PA  19103-2029 |
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| Ken Stoller<br>Project Review Section Chief | Delaware River Basin Commission<br>P.O. Box 7360<br>25 State Police Drive<br>West Trenton, NJ  08628-0360 |
| Steve Walsh | Delaware River Basin Commission<br>P.O. Box 7360<br>25 State Police Drive<br>West Trenton, NJ  08628-0360 |
| Regional Administrator | U.S. Nuclear Regulatory Commission<br>Region 1<br>2100 Renaissance Boulevard<br>Renaissance Park<br>King of Prussia, PA  19406 |

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| Professor Paul Friesseman | Northwestern University<br>304 Scott Hall<br>Evanston, IL  60208 |
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| Thomas Sullivan | Montgomery County Department of Public Safety<br>Operation Center<br>50 Eagleville Road<br>Eagleville, PA  19403 |
| Natural Resources Defense Counsel | Natural Resource Defense Counsel<br>1152 15th Street NW, Suite 300<br>Washington, DC  20005 |
| Representative Tom Quigley | Pennsylvania State Representative |
| Lorraine Ruppe | Resident |
| Dr. Fred Winter | Resident |
| Dr. Anita Baly | Resident |
| Camilla Lange | Resident |
| Eric Hamell | Resident |
| Steven Furber | Resident |
| Charlene Padworny | Resident |
| Sylvia Polluck | Resident |
| Joe Roberto | Resident |
| Richard Kolsch | Resident |
| Charles Shank | Resident |
| Elizabeth Shank | Resident |
| Nancy Leaming | Resident |
| Cynthia Gale | Resident |
| Jude Shwegel | Resident |
| Michael Gale | Resident |
| Melissa Atrium | Resident |
| Michael Atrium | Resident |
| Joan McGone | Resident |
| Mary Lou Smith | Resident |
| Harold Smith | Resident |
| Lisa Moyer | Resident |
| Ken Sekellick | Resident |
| Debby Penrod | Resident |
| Charlie Koeing | Resident |

| Name and Title | Company and Address |
|---|---|
| Joyce Webber | Resident |
| Charlotte Derr | Resident |
| Dr. Lewis Cuthbert | Alliance for Clean Environment |
| Sharon Yohn | Resident |
| Michael Smokowicz | Resident |
| Barbara Miller | Resident |
| Bill Maguire | Exelon Generation Company, LLC |

# 12.0 INDEX

# APPENDIX A
# COMMENTS RECEIVED ON THE LIMERICK GENERATING STATION, UNITS 1 AND 2, ENVIRONMENTAL REVIEW

# COMMENTS RECEIVED ON THE LIMERICK GENERATING STATION, UNITS 1 AND 2, ENVIRONMENTAL REVIEW

## A.1. Comments Received during Scoping

The scoping process began on August 26, 2011, with the publication of the U.S. Nuclear Regulatory Commission's (NRC's) notice of intent to conduct scoping in the *Federal Register* (FR) (75 FR 53498). As part of the scoping process, the NRC held two public meetings at the Sunnybrook Ballroom in Pottstown, PA, September 22, 2011. Approximately 100 members of the public attended the meetings. After the NRC staff presented prepared statements pertaining to the license renewal and the scoping processes, the meetings were opened to members of the public for their comments. Attendees provided oral statements that were recorded and transcribed by a certified court reporter. Transcripts of the entire meeting are available using the NRC's Agencywide Documents Access and Management System (ADAMS). ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams.html. Transcripts for the afternoon and evening meetings are available in ADAMS under Accession Nos. ML11287A207 and ML11287A211, respectively (NRC 2011a, NRC 2011b). In addition to the comments received during the public meetings, comments were received through the mail and e-mail.

Each commenter was given a unique identifier so that every comment could be traced back to its author. Table A-1 identifies the individuals who provided comments applicable to the environmental review and the commenter ID associated with each person's set of comments. The individuals are listed in the order in which they spoke at the public meeting and in random order for the comments received by letter or e--mail. To maintain consistency with the scoping summary report, the unique identifier used in that report for each set of comments is retained in this appendix.

Specific comments were categorized and consolidated by topic. Comments with similar specific objectives were combined to capture the common essential issues raised by participants. Comments fall into one of the following general groups:

- Specific comments that address environmental issues within the purview of the NRC environmental regulations related to license renewal. These comments address the Category 1 (generic) or Category 2 (site-specific) issues identified in NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), or issues not addressed in the GEIS. The comments also address alternatives to license renewal and related Federal actions. There are also comments that do not identify new information for the NRC to analyze as part of its environmental review.

- There are comments that address issues that do not to fall within or are specifically excluded from the purview of NRC environmental regulations related to license renewal. These comments typically address issues such as the need for power, emergency preparedness, security, current operational safety issues, and safety issues related to operation during the renewal period.

**Table A–1. Individuals Providing Comments during the Scoping Comment Period**
*Commenters are identified below, along with their affiliations and how their comments were submitted.*

| Commenter | Affiliation (if stated) | ID | Comment source | ADAMS Accession Number |
|---|---|---|---|---|
| Dr. Lewis Cuthbert | Alliance for a Clean Environment | 1 | Afternoon scoping meeting | ML11287A207 |
| | | | Evening scoping meeting | ML11287A211 |
| | | | Letters | ML11354A392<br>ML11036A244<br>ML11036A245 |
| Bill Maguire | Limerick Site Vice President, Exelon | 2 | Afternoon scoping meeting | Ml11287A207 |
| | | | Evening scoping meeting | ML11287A211 |
| Representative Tom Quigley | State Representative | 3 | Afternoon scoping meeting | ML11287A207 |
| Lorraine Ruppe | Resident | 4 | Afternoon scoping meeting | ML11287A207 |
| | | | Evening scoping meeting | ML11287A211 |
| | | | Letter | ML11308B354 |
| Mike Gallagher | Vice President for License Renewal, Exelon | 5 | Afternoon scoping meeting | ML11287A207 |
| | | | Evening scoping meeting | ML11287A211 |
| Dr. Fred Winter | Resident | 6 | Afternoon scoping meeting | ML11287A207 |
| | | | Evening scoping meeting | ML11287A211 |
| | | | Letter | ML11305A016 |
| Thomas Neafcy | Resident | 7 | Afternoon scoping meeting | ML11287A207 |
| Dr. Anita Baly | Resident | 8 | Afternoon scoping meeting | ML11287A207 |
| | | | Letter | ML11035A010 |
| Tim Fenchel | Schuylkill River Heritage Area | 9 | Afternoon scoping meeting | ML11287A207 |
| Bill Vogel | Resident | 10 | Afternoon scoping meeting | ML11287A207 |

| Commenter | Affiliation (if stated) | ID | Comment source | ADAMS Accession Number |
|---|---|---|---|---|
| Eileen Dautrich | Tri-County Area Chamber of Commerce | 11 | Afternoon scoping meeting | ML11287A207 |
| Billy Albany | Resident | 12 | Afternoon scoping meeting | ML11287A207 |
| John McGowen | Jaeco/Gas Breaker/UMAC, Inc. | 13 | Afternoon scoping meeting | ML11287A207 |
| Ted Del Gaizo | Resident | 14 | Afternoon scoping meeting | ML11287A207 |
| Tim Phelps | Resident | 15 | Afternoon scoping meeting | ML11287A207 |
| Thomas Saporito | Saporito-Associates | 16 | Evening scoping meeting | ML11287A207 |
| Jeff Chomnuk | Resident | 17 | Evening scoping meeting | ML11287A207 |
| Daniel Ludwig | Resident | 18 | Evening scoping meeting | ML11287A207 |
| Catherine Allison | | 19 | Evening scoping meeting | ML11287A207 |
| Jeffrey Norton | Pennsylvania Energy Alliance | 20 | Evening scoping meeting | ML11287A207 |
| Dan Ely | Resident | 21 | Evening scoping meeting | ML11287A207 |
| Jay Beckermen | Resident | 22 | Evening scoping meeting | ML11287A207 |
| Jim Der | Pottstown Energy Advisory Committee | 23 | Evening scoping meeting | ML11287A207 |
| Traci Confer | Energy Justice Network | 24 | Evening scoping meeting | ML11287A207 |
| Camilla Lange | | 25 | E-mail | ML11279A107 |
| Eric Hamell | | 26 | E-mail | ML11279A108 |
| Steven Furber | | 27 | E-mail | ML11279A109 |
| Charlene Padworny | | 28 | Letter | ML11279A110 |
| Sylvia Polluck | | 29 | Letter | ML11279A111 |
| Joe Roberto | | 30 | E-mail | ML11290A106 |
| | | | E-mail | ML11279A112 |
| Brice Obermeyer | Delaware Tribe Historic Preservation Office | 31 | Letter | ML11279A113 |
| Sherry White | Stockbridge-Munsee Tribal Historic Preservation Office | 32 | Letter | ML11279A114 |

| Commenter | Affiliation (if stated) | ID | Comment source | ADAMS Accession Number |
|---|---|---|---|---|
| Unknown | | 33 | Letter | ML11286A298 |
| Richard Kolsch | Resident | 34 | E-mail | ML11286A299 |
| Charles and Elizabeth Shank | Resident | 35 | Letter | ML11286A300 |
| Nancy Leaming | Resident | 36 | E-mail | ML11290A102 |
| Cynthia Gale | Resident | 37 | E-mail | ML11290A103 |
| Jude Schwegel | | 38 | E-mail | ML11290A104 |
| Michael Gale | Resident | 39 | E-mail | ML11290A105 |
| Melissa Antrim | Resident | 40 | E-mail | ML11291A155 |
| Michael Antrim | Resident | 41 | E-mail | ML11291A156 |
| Joan McGone | | 42 | E-mail | ML11292A011 |
| Mary Lou and Harold Smith | Resident | 43 | Letter | ML11294A208 |
| Lisa Smoyer | | 44 | E-mail | ML11300A011 |
| Unknown | | 45 | Letter | ML11300A012 |
| Lori Molinari | Resident | 46 | Letter | ML11305A072 |
| Doris Meyers | Resident | 47 | E-mail | ML11305A014 |
| Ken Sekellick | Resident | 48 | E-mail | ML11305A015 |
| Anthony Gonyea | Onondaga Nation | 49 | Letter | ML11305A006 |
| Debby Penrod | Resident | 50 | E-mail | ML11305A007 |
| Charlie Koeing | Resident | 51 | E-mail | ML11305A008 |
| Joyce Webber | Resident | 52 | E-mail | ML11305A009 |
| Charlotte Derr | Resident | 53 | Letter | ML11307A388 |
| Michael Stokes | Montgomery County Planning Commission | 54 | Letter | ML11307A387 |
| Thomas Sullivan | Montgomery County Department of Public Safety | 55 | Letter | ML11307A386 |
| Natural Resources Defense Council | | 56 | Letter | ML11307A456 |
| Sharon Yohn | | 57 | E-mail | ML11307A455 |
| Michael Smokowicz | | 58 | E-mail | ML11307A454 |
| Barbara Miller | Resident | 59 | Letter | ML11311A063 |
| Debra Schneider | Resident | 60 | Letter | ML11313A013 |

To evaluate the comments, the NRC staff gave each comment a unique identification code that categorizes the comment by technical issue and allows each comment or set of comments to be traced back to the commenter and original source (transcript, letter, or e-mail) from which the comments were submitted.

Comments were placed into one of the technical issue categories, which are based on the topics that will be contained within the staff's supplemental environmental impact statement (SEIS) for Limerick Generating Station (LGS), as outlined by the GEIS. These technical issue categories and their abbreviation codes are presented in Table A-2.

**Table A–2. Technical Issue Categories**

*Comments were divided into 1 of the 16 categories below, each of which has a unique abbreviation code.*

| Code | Technical issue |
|---|---|
| AL | Alternatives Energy Sources |
| AM | Air & Meteorology |
| DC | Decommissioning |
| GE | Geology |
| GW | Ground water |
| HA | Historical and Archeological |
| HH | Human Health |
| LU | Land Use |
| LR | License Renewal and its Process |
| OL | Opposition to License Renewal |
| OS | Outside of Scope[a] |
| PA | Postulated Accidents and Severe Accident Mitigation Analyses (SAMA) |
| RW | Radioactive & Non-Radioactive Waste |
| SE | Socioeconomics |
| SR | Support of License Renewal |
| SW | Surface Water |

[a] Outside of scope are those comments that pertain to issues that are not evaluated during the environmental review of license renewal and include, but are not limited to, issues such as need for power, emergency preparedness, safety, security, terrorism, and spent nuclear fuel storage and disposal.

Comments received during scoping applicable to this environmental review are presented in this section, along with the NRC response. They are presented in the order shown in Table A-3. The comments that are outside the scope of the environmental review for LGS are not included here but can be found in the scoping summary report, which can be accessed through ADAMS, Accession No. ML12131A499.

**Table A–3. Comment Response Location in Order of Resource Area**

| Comment category | Page |
|---|---|
| Alternative Energy Sources (AL) | A-7 |
| Air & Meteorology (AM) | A-10 |
| Decommissioning (DC) | A-10 |
| Geology (GE) | A-11 |
| Groundwater (GW) | A-12 |
| Historical and Archeological (HA) | A-13 |
| Human Health (HH) | A-14 |
| Land Use (LU) | A-20 |
| License Renewal and its Process (LR) | A-20 |
| Opposition to License Renewal (OR) | A-24 |
| Postulated Accidents and SAMA (PA) | A-27 |
| Radioactive & Non-Radioactive Waste (RW) | A-33 |
| Socioeconomics (SE) | A-34 |
| Support of License Renewal (SR) | A-35 |
| Surface Water (SW) | A-39 |

### A.1.1. Alternative Energy Sources (AL)

**Comment: 1-44-AL;** We have had 26 years of insults to our environment, and I choose that word purposely, insults to our environment and costly nuclear power. We can replace it with safe, clean, renewable energy before 2029. That is a matter of scientific fact.

**Comment: 4-8-AL;** Solar wind, geothermal, ocean thermal, energy conservation and efficiency are now cheaper than nuclear power, along with being truly clean and safe. The Department of Energy 2006 report stated solar alone could provide 55 times our entire nation's energy needs which leads me to a point, there have been numerous studies proving the many dangerous and deadly consequences of nuclear power.

**Comment: 5-3-AL;** We also reviewed the alternatives if Limerick would not have its license renewed and another source of electric generation would need to be installed either here on site or someplace else to generate the replacement electricity. We concluded that any other means of generating the replacement electricity would have more of an impact on the environment than continued operation of Limerick. For instance, if Limerick could be replaced by a wind generation facility, the wind from [it] would have to occupy between 10 and 40 percent of all the land in the state of Delaware and that would have a huge impact on the land. If a solar facility could replace Limerick, it would need to cover 32 to 50 percent the entire land area of Montgomery County.

**Comment: 6-10-AL;** Please listen to this advice after years of doing my best for America. Rely on more and truly safe and renewable sources like solar, wind, and geothermal power.
A patriotic duty to protect our kids.

**Comment: 16-7-AL;** The NRC is required under the law in this review, the environmental review to consider renewable energy sources, alternatives. And that means need. Is there really a need for these two nuclear plants to operate and the answer is no. Simply stated if all the customers who receive power from these nuclear plants were to simply remove their hot water heaters and replace them with on-demand electric water heaters you would reduce the electric base load demand by 50 to 70 percent. You wouldn't need either one of those nuclear power plants to operate. If you take that further and introduce other energy conservation you would actually have the licensee shut down more of their other power plants because of you would need a demand. If you take wind energy which is plentiful up there in Pennsylvania and even the new solar panel which can operate when the sun isn't shining on a cloudy day you could replace even more operating power plants. So these renewable energy sources even with respect to wind energy since you have a common grid throughout the United States you can have wind farms generate power to a common grid point and supplying the power that these nuclear plants are now providing. The NRC's required under the law to consider these alternatives to extending this license. And I would hope that the NRC's final evaluation and review shows a complete and thorough analysis of all these renewable energy sources including installing on demand hot water electric heater and doing an analysis of how many megawatts you're going to take off the grid and based on those evaluations make a licensing determination whether or not this license should be extended. Because 20 years from now all these renewable resources are going to be all that much more advanced and capable of supplying all that much more power than they're currently supplying.

**Comment: 25-5-AL;** Other forms of energy can and must be utilized to meet consumption demands.

**Comment: 27-1-AL;** I am under the belief that the natural disaster in Japan is enough for Pennsylvania to make a move toward clean energy.

**Comment: 28-2-AL;** I support more healthy and efficient sources of energy such as Solar and Wind Power. Please stop ignoring the detrimental effects that this power plant is having on our environment, health, and children's health…it's time to move on to betters things for all involved.

**Comment: 29-1-AL;** I hope Exelon Energy does not get Renewed. I am sure we could find alternative energy that would not be contaminating the whole area.

**Comment: 35-6-AL;** The nuclear process is not an enlightened way to generate electrical energy. This plant needs to transition itself into a more intelligent way of generating energy by actually phasing out and safely shutting down the nuclear plant. By retraining its workers and adopting the safer green technologies, it could truly partner with the local community without putting its workers out of jobs.

**Comment: 37-15-A, 39-16-AL;** Dangerous, Dirty, Harmful, and Costly Nuclear Power Is Not Needed. It Can And Should Be Replaced With Safe, Clean, Renewable Energy

**Comment: 44-5-AL;** We as a society need to wake up and start paying attention to the massive harm power plants can cause to the people, animals, water, air, etc. Why does everyone want to pay attention when it is way too late?? There are safer alternative forms of energy available to our country/communities. We should be working on them and training employees, who currently work for the nuclear power plants, how to work with safer forms of energy to help our country move forward in today's society.

**Comment: 44-10-AL;** We deserve to live in a community where our air and water isn't being contaminated constantly with hazardous chemicals, radiation, etc., when there are other energy alternatives out there that are being used that are safer for the community.

**Comment: 44-12-AL;** Do your job knowing that you are doing what is morally right and safe for humanity and for my children and for the future of generations to come. Please help women have a chance to carry a baby full term without complications due to any possible air and water pollution that may have been caused by allowing more radiation into the environment when there are safer alternatives for energy.

**Comment: 53-2-AL;** We need cleaner air and water. We need to decrease radiation. We need clean, safe, renewable energy.

**Comment: 60-3-AL;** Do not extend—Plenty of safe alternatives—water—solar—wind—geothermal.

**Comment: 60-19-AL;** Can replace with clean renewable energy before current license expires.

**Response:** *In evaluating alternatives to license renewal, the NRC staff first selects energy technologies or options currently in commercial operation, as well as some technologies not currently in commercial operation but likely to be commercially available by the time the current LGS's operating licenses expire, in 2024 and 2029.*

*Second, the NRC staff screens the alternatives to remove those that cannot meet future system needs. Then, the remaining options are screened to remove those whose costs or benefits don't justify inclusion in the range of reasonable alternatives. Any alternatives remaining, then, constitute alternatives to the proposed action that the NRC staff evaluates in depth throughout Chapter 8.*

*The staff will evaluate all reasonable alternatives in Chapter 8 of the SEIS. In this chapter, the NRC staff examines the potential environmental impacts of alternatives to license renewal for LGS, as well as alternatives that may reduce or avoid adverse environmental impacts from license renewal, when and where these alternatives are applicable.*

*In addition to evaluating alternatives to the proposed action, the NRC staff also—when appropriate—examines alternatives that may reduce or avoid environmental impacts of the proposed action; the NRC staff does so to illustrate how such alternatives may mitigate potential impacts of license renewal.*

*The NRC staff considered 18 alternatives to the proposed action and then narrowed to the five alternatives considered. In addition to the five alternative, the staff considered the no-action alternative (not renewing the operating license).*

*The alternatives evaluated in depth included the following;*

- *natural-gas-fired combined-cycle (NGCC)*
- *supercritical pulverized coal*
- *new nuclear*
- *wind power*
- *purchased power*
- *no action*

*Other alternatives considered, but dismissed, are listed below:*

- *solar power*
- *combination alternative of wind, solar, and NGCC*
- *combination alternative of wind and compressed-air energy storage*
- *wood waste*
- *conventional hydroelectric power*
- *ocean wave and current energy*

- *municipal solid waste*
- *biofuels*
- *oiled-fired power*
- *delayed retirement*
- *coal-fired integrated gasification combined-cycle*
- *demand-side management*

### A.1.2. Air & Meteorology (AM)

**Comment: 1 -16-AM;** Major air pollution issues under health-based standards of the Clean Air Act, 32 individual sources listed. Drastic, harmful increases permitted in particulate matter known also as PM-10 from the cooling towers, other air pollution increases also permitted.

**Comment: 1-22-AM;** They are a major air polluter under the Clean Air Act and to say they're not doing it anymore, they just asked for the conditions that would allow an eightfold increase in dangerous air pollution that actually is claimed to kill people, thousands of deaths per year. And they asked for an eightfold increase. As a matter of fact, these are all the air pollution sources and the pollutants they list in their own permit. If you add that to all the radiation emissions there's a broad range of radionuclides.

**Comment: 1-32-AM;** [M]ajor air pollution under health-based standards of the Clean Air Act. A Title 5 permit being issued to this facility means by definition that they are a major air polluter under the federal Clean Air Act.

**Comment: 37-2-AM, 39-3-AM;** Major Air Pollution Under Health Based Standards of the Clean Air Act

**Comment: 60-8-AM;** They want increase emissions—Pollutants

**Response:** *Air pollutant emissions associated with LGS operations are presented in Sections 2.2.2.1 of the SEIS. The NRC's evaluation of LGS's air emissions is presented in Section 4.2 of this SEIS.*

**Comment: 35-3-AM;** Limerick Nuclear's request for re-licensing is ludicrous, considering its aging and inadequate equipment, its increased air pollution by particulate matter, its horrific destruction of Schuylkill river

***Response:*** *Aging management of plant systems is evaluated as part of the LRA safety review. The results of the staff's safety review of the LRA for LGS will be documented in the staff's safety evaluation report (SER).*

*Air pollutant emissions associated with LGS operations are presented in Sections 2.2.2.1 of the SEIS. The NRC's evaluation of LGS's air emissions is presented in Section 4.2 of this SEIS.*

*Surface water resources at LGS, including the Schuylkill River, and the effects of plant operations on surface water hydrology and quality are presented in Sections 2.2.4 and 4.3 of the SEIS. In addition, Section 2.1.6 of the SEIS details the surface water sources relied upon by LGS and including the sources of water used to augment low flows in the Schuylkill River.*

### A.1.3. Decommissioning (DC)

**Comment: 34-2-DC;** A firm closure plan should be approved before license renewal is accepted. This must include what is to be done with the site, where the nuclear waste will be disposed of etc.

**Response:** *Decommissioning would occur whether LGS were shut down at the end of its current operating license or at the end of the period of extended operation. Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the GEIS (NUREG-1437) and in NUREG-0586 Generic Environmental Impact Statement for Decommissioning Nuclear Facilities, Supplement 1, "Regarding the Decommissioning of Nuclear Power Reactors," published in 2002. The findings from these two documents are used to support the findings in the SEIS by the use of tiering. Tiering is a process by which agencies eliminate repetitive discussions. The effects of license renewal on the impacts of decommissioning are stated in Chapter 7 of this SEIS.*

### A.1.4. Geology (GE)

**Comment: 1-12- GE;** Limerick, in addition, is now third on the earthquake risk list for nuclear plants in the United States.

**Comment: 4-2-GE;** [F]our months have passed since the NRC failed to get back to me when I asked how close the Remapo fault line is to the Limerick nuclear reactors?

**Comment: 4-14-GE;** It took five months for the Nuclear Regulatory Commission to answer my question concerning how close the nearest fault line is to Limerick Nuclear Plant. No wonder! Two faults are dangerously close. Chalfont Fault is only 9 miles East. Ramapo Fault is 17 miles Northwest. This is alarming!

**Comment: 30-2-GE;** Limerick should NOT be approved for an extension with their permit for the following reasons:

- Limerick is designated as one of the TOP THREE nuclear plants in the country based on it's construction (which is similar to the ones in Japan—and we see how they failed) and the fact that it sits on an earthquake fault line.
- The NRC JUST a few weeks ago stated that "more information needs to be done and studied" regarding further fortifying nuclear plants regarding earthquakes. Thus, until you folks know exactly what needs to be done, etc.THERE IS NOTHING TO APPROVE as long as Limerick sits in it's current position.
- Do NOT think that earthquakes only happen on the West Coast—as we JUST had a 6+ earthquake less than a month ago. BY ONLY luck was there no damage to the plant, environment or community.

**Comment: 51-4-GE;** Limerick is built on a fault

**Comment: 52-5-GE;** It is one of the six most dangerous plants in the country because [of] its proximity to an earthquake fault.

**Comment: 60-2-GE;** Earthquake Fault

**Response:** *Geologic and seismic conditions were considered in the original design of nuclear power plants and are part of the license bases for operating plants. Seismic conditions are attributes of the geologic environment that are not affected by continued plant operations and refurbishment and are not expected to change appreciably during the license renewal term for all nuclear power plants. Nevertheless, as part of characterizing the environmental baseline (affected environment) and associated resource conditions of LGS and the vicinity, Section 2.2.3 of the SEIS includes a discussion of the current geologic environment, including its seismic setting. Specifically, the section includes a discussion of the Ramapo fault system.*

*This fault system encompasses the Chalfont fault and other named geologic faults. In addition, the NRC and Exelon considered in Chapter 5 of this SEIS whether increased seismic risk could provide a seriously different picture of severe accidents mitigation at Limerick.*

*As noted in the section, the nearest mapped faults to LGS have not been geologically active for more than 140 million years.*

*To the extent that the comments express concern for the seismic design of LGS, the seismic design of structures are beyond the scope of the environmental review. NRC's assessment of seismic hazards for existing nuclear power plants is a separate and distinct process from license renewal reviews. Seismic hazard issues are being addressed by the NRC on an ongoing basis at all licensed nuclear facilities. The NRC requires all licensees to take seismic activity into account to maintain safe operating conditions at all nuclear power plants. When new seismic hazard information becomes available, the NRC evaluates the new data and models to determine if any changes are needed at existing plants, regardless of whether or not a plant has renewed its license or is applying for license renewal. This reactor oversight process, which includes seismic safety, remains separate from license renewal.*

*Unrelated to license renewal, the NRC completed the Generic Issues Program Safety/Risk Assessment Stage for Generic Issue (GI) 199 in August 2010, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern United States on Existing Plants," which evaluated recent updates to estimates of the seismic hazard in the central and eastern United States. The results of the GI-199 Safety/Risk Assessment indicated that the currently operating nuclear power plants have adequate safety margin for seismic issues. The NRC's assessment indicated that overall seismic risk estimates remain SMALL, and adequate protection is maintained. NRC Information Notice 2010–18 (ADAMS Accession No. ML101970221) was then issued to nuclear power plants and independent spent fuel storage installations (ISFSI). It provided notice of the NRC's intent to follow the appropriate regulatory process to request that operating plants and ISFSIs provide specific information relating to their facilities to enable the NRC staff to complete the Regulatory Assessment, in which candidate backfits would be identified and evaluated. The NRC then developed a draft Generic Letter to request needed data from power reactor licensees.*

*However, following the accident at the Fukushima Dai-ichi nuclear power plant resulting from the March 11, 2011, Great Tohoku Earthquake and subsequent tsunami, the NRC established the Near-Term Task Force, as directed by the Commission. The Japan Near-Term Task Force assessment resulted in the issuance of letters requesting information per Title 10 of the* Code of Federal Regulations *(10 CFR) 50.54(f) letter on March 12, 2012. These letters were issued to all power reactor licensees and holders of construction permits and address GI-199 in its entirety in recommendation 2.1 regarding seismic reevaluations, (ADAMS Accession No ML12056A046). The NRC staff will use this information, as well as information requested in the 10 CFR 50.54(f) letter, to determine if further regulatory action is needed, including issuing orders to modify, suspend, or revoke a license.*

### A.1.5. Groundwater (GW)

**Comment: 1-34-GW, 37-5-GW, 39-6-GW;** Radioactive Groundwater Contamination.

**Comment: 37-4-GW, 39-5-GW;** Schuylkill River Depletion and Major Drink Water Contamination

**Comment: 45-10-GW;** Limerick contaminated groundwater. Radioactive leaks and spills over the years were never cleaned up. More radioactive leaks can be expected in the future through earthquakes, deterioration, and corrosion. Many residential well are very close to Limerick.

**Response:** *This comment deals with groundwater quality issues related to the operation of LGS. Groundwater resources at LGS, and the effects of plant operations on groundwater hydrology and quality, are presented in Sections 2.2.5 and 4.4 of the SEIS. Specifically, Section 2.2.5.1 discusses groundwater users at and in the vicinity of the plant, and Section 2.2.5.2 summarizes the results of the NRC's review of Exelon's Radiological Groundwater Protection Program for LGS, including the placement of site groundwater monitoring wells. As part of this evaluation, the NRC staff specifically reviewed the hydrogeologic investigation prepared for LGS in 2006 and the results of ongoing groundwater quality monitoring. Chapter 2 of this SEIS cites all studies reviewed by the NRC staff.*

*Based on the staff's review, and as presented in Section 4.4.3 of this SEIS, no strontium-90 or gamma-emitting radionuclides have been detected in groundwater or surface water associated with LGS operations or at levels above natural background. While inadvertent releases of liquids containing tritium (a radioactive isotope of hydrogen) have occurred to the ground and subsurface at LGS, levels in groundwater have been less than one-tenth of the EPA established drinking water standard of 20,000 picoCuries per liter. No upward trend in tritium levels has been observed, and Exelon's ongoing Radiological Groundwater Protection Program functions to detect and address potential new sources of groundwater contamination. Further, there are no offsite drinking water wells downgradient of LGS that could be affected by inadvertent releases of radionuclides to groundwater.*

### A.1.6. Historical and Archaeological (HA)

**Comment: 31-1-HA;** Thank you for informing the Delaware Tribe on the proposed construction associated with the above referenced project. Our review indicates that there are no religious or culturally significant sites in the project area. As such, we defer comment to your office as well as to the State Historic Preservation Office and/or the State Archaeologist.

We wish to continue as a consulting party on this project and look forward to receiving a copy of the cultural resources survey report if one is performed. We also ask that if any human remains are accidentally unearthed during the course of the survey and/or the construction project that you cease development immediately and inform the Delaware Tribe of Indians of the inadvertent discovery.

**Comment: 49-1-HA;** Thank you for providing the Onondaga Nation with information about this project. If any changes are made, I would like to be consulted. I realize that Unit 1 and Unit 2 have licenses that may be renewed in 2024 and 2029 respectively, therefore you may send updates and information until then.

In the event that during project construction, any archeological resources or remains, including, without limitation, human remains, funerary objects, sacred objects, or objects of cultural patrimony are uncovered, please immediately stop construction and contact me at (315) 952-3109, or the Onondaga Nation's General Counsel Mr. Joseph Heath at (315) 475-2559.

***Response:*** *In accordance with 36 CFR 800.8(c), the NRC has elected to coordinate compliance with section 106 of the National Historical Preservation Act with steps it has taken to meet its requirements under the National Environmental Policy Act (NEPA). An overview of consultation activities that occurred during the preparation of this SEIS is given in Section 4.10.6. All consultation parties will receive a copy of the draft SEIS to review and provide comments to the NRC.*

## A.1.7. Human Health (HH)

**Comment: 1-15-HH;** Research has confirmed radiation in our children's baby teeth in this community.

**Comment: 1-18-HH;** Alarming cancer increases that have been well documented in this community repeatedly far higher than national and state averages after Limerick started operating until the late 1990s.

**Comment: 1-25-HH;** The sooner this place closes the better off we'll all be. Even if you look at infant mortality rates we have higher infant mortality rates and neonatal mortality rates far above state averages and even above Philadelphia and Reading, and we've had these for quite awhile. The fact is when babies are the most vulnerable in the womb what else would we expect? And by the way, for those of you who have been saying that ACE data is anecdotal today I have news for you. This infant mortality report for example is state data reported by EPA in 2003. Every cancer statistic that you see back there is based on Pennsylvania Cancer Registry statistics or CDC statistics. So it is not anecdotal, those are the cancer increases, those are the cancer above the national average that have happened here since Limerick started operating.

**Comment: 1-26-HH;** We have so many cancers above the national average. Childhood cancer, 92.5 percent higher than the national average. Think about that. We track the cost of one child with cancer diagnosed at six months to two years and up until that time it was $2.2 million. How many more kids have that above the national average? Cost that out and how many other cancers are above the national average?

**Comment: 1-36-H;** [D]ocumented alarming cancer increases especially in our children since Limerick started operating

**Comment: 4-6-HH;** There has been increased particulate matter in the air and other toxics from Limerick causing increased asthma, heart attacks, and strokes. And to add insult to injury, Limerick was granted a permit to allow an eight-fold increase in air pollution since 2009. Cancer rates in our area have skyrocketed since Limerick has been up and running in the '80s and rates have steadily increased.

**Comment: 4-7-HH;** The Toothfairy Project showed high levels of strontium 90, a radionuclide in baby teeth of children nearest to nuke plants. Baby teeth near Limerick plant had the highest levels in the whole United States. This stuff and God knows what else is in our bodies now thanks to a Nuclear Regulatory Commission that to put it nicely is less than enthusiastic about protecting us.

**Comment: 6-1-HH;** As a physician practicing radiology for over 50 years, I still have strong concern about cancer sensitivities from harmful radiation exposures, naturally. My medical colleagues share the same concerns because we have seen our cancer rates increase since the Limerick power plant started, especially thyroid cancer. It jumped to 78 percent higher here than the national average. And some of the people I talked to, this is because people are aging more now, getting older, so there are more cancers. But that's not true because in other areas similar to our area in Pottstown, they're not nearly getting the thyroid cancers that we are. This has been well established by the state.

**Comment: 6-2-HH;** Having attended a Hiroshima, Japan atom bomb clinic right after World War II, naturally I had a chance to see the worst results of harmful radiation. All those little kids I saw who only lived for a few days, it left me with a very sad memory. Of course, what is happening here will be taking much longer, but it sure is not good. I don't know whether you've heard that some scientists are already predicting that -- I'm sorry to tell you this, but nuclear energy has the capacity of destroying mankind. It may take about 100 years, but our whole world is exposed to the harmful effects, maybe not so much here in the United States, but the whole world can be affected.

**Comment: 6-6-HH;** According to the National Center of Disease Control, Pennsylvania ranks No. 1 for the highest incidence of Thyroid cancer. This occurred after installation of nuclear power plants in our area as well as in the rest of the State. Medical journals are reporting high rates of cancer near nuclear plants.

**Comment: 6-8-HH;** Incidentally, baby teeth studies have revealed Strontium 90 radioactive particles which can affect the child's immune system for more illness.

**Comment: 19-6-HH;** but I hate to tell you I have so many friends and coworkers and people that are only 35, 40, 50 years old, cancer. And why? We have to stop and think. Go home, don't just always, you know, just go watch TV and get on your computer. Stop and think what we're doing to ourselves, our bodies, our children, our grandchildren.

This is again, this licensing renewal is coming down to human lives, the quality of our lives. Again, why all this cancer? Microwaves and electricity. So I won't go on and on, but I just think us as a group can't just all be just complaining about the power companies, we are the ones using the electricity. That's all I'm saying. Maybe we should cut back and we won't need power plants.

**Comment: 21-2-HH;** Some people don't understand about radiation and I read when the Japanese thing occurred and I heard on the news a radiologist talking about oh, the radiation is such a low amount. It really isn't the low amount of radiation exposure that we get incidentally in standing next to a nuclear power plant. It's three ten-thousandths of a gram of plutonium that is death for you if you breathe that dust particle. It's almost certain death. And the problem becomes you can't have -- and it's not going to be a nuclear bomb. It's going to catch on fire if the fuel pool girders were to fail and you'll have a cloud of a material that in and of itself you might not have radiation exposure to it but that particle when it deposits itself can be an issue much the same as fluoride is what causes thyroid cancer when it's a radioactive fluoride. That's why we're very careful in building a plant with no Teflon and no fluoride components

**Comment: 36-1-HH;** I am concerned about the effects of our surrounding air and water supply of my children and grandchildren, some of whom are already inflicted with cancer and other diseases.

**Comment: 37-1-HH, 39-2-HH;** Radiation into Air and Water From Routine and Accidental Emissions

**Comment: 37-7-HH, 39-8-HH;** Alarming cancer increases, especially in children, since Limerick started operating

**Comment: 37-14-HH, 39-15-HH;** Increased Costs to the Public—More cancers and other costly illnesses, more emergency room visits and hospitalization from massive increases in PM-10 and TDS, treatment of public drinking water, environmental clean-up

**Comment: 25-2-HH;** The scientific statistics citing dramatic increase in cancer rates, infant mortality, and Schuylkill River water pollution is disturbing.

**Comment: 36-3-HH;** I am more concerned about the effects of surrounding air and water supply and the future of my children and grandchildren, some of whom are already inflicted with cancer and other diseases.

**Comment: 40-4-HH;** it doesn't take an accident or disaster for Limerick to poison the region's residents with radiation. Radiation from Limerick's routine and accidental emissions alone for the past 26 years is reason enough to deny Exelon's request. It's not credible for NRC to claim continuous radiation levels are safe for me and my family when there is no safe level of exposure according to the National Academy of Sciences and Physicians for Social Responsibility.

NRC never did any radiation monitoring or testing at Limerick. Evidence shows testing done by Exelon and DEP cannot be trusted. Exposure to radiation [is] known to cause cancer. It should be obvious to NRC that Limerick played a major role in our tragic, well documented cancer crisis after Limerick started operating in the mid 1980s to late 1990s. Four cancer studies based on PA Cancer Registry and CDC data showed skyrocketing rates for several cancers far higher than national and state averages, especially in children. Our children had the highest levels of Strontium-90 radiation in their baby teeth of any group near any nuclear plant studied. Limerick Nuclear Plant released SR-90 into our air and water that got into the milk, vegetation, and food since Limerick started operating.

**Comment: 40-5-HH;** Thyroid cancer increased by 128% from 1985 to 1997—was as side note, with no family history or other obvious risk factors in my life, I was recently treated for thyroid cancer. Since my diagnosis, I have learned of many other locals like me. It's scary to think the choice of where we lived could kill us.

**Comment: 41-3-HH;** Exposure to radiation is known to cause cancer. NRC has not done any radiation monitoring or testing at Limerick. Evidence shows testing done by Exelon and DEP cannot be trusted—it's ridiculous to think they could monitor themselves. It should be obvious to NRC that Limerick played a major role in our cancer crisis after Limerick started operating mid 1980s to 2000. Four cancer studies based on Pennsylvania Cancer Registry and the CDC showed skyrocketing rates for several cancers much higher than national and state averages, especially children—innocent children. Thyroid cancer increased 128% from 1985 to 1997. I have local friends and family with thyroid cancer and brain cancer—not one, but several. Sadly it is uncommon in other areas of the country. It used to be uncommon here too—prior to Limerick. Would you want to live here? Would you approve a license renewal so close to home? Your job is to safely review the facts.

**Comment: 42-2-HH;** The increased risk of cancer is well founded in the literature also.

**Comment: 44-8-HH;** The most alarming and compelling thing to me as a taxpayer, homeowner, and mother is the overwhelming and alarming cancer increases to the public after Limerick had started operating. The CDC website showed 92.5% higher than the national average for childhood cancer in six communities close to the Limerick Nuclear Plant which included, Pottstown, West Pottsgrove, Lower Pottsgrove, North Conventry, and Douglas Berks Township from cancers diagnosed from 1995-1999. The Pennsylvannia State Cancer Registry For Montgomery County from 1985-86 to 1996-97 also shows cancer rates skyrocketed in Montgomery County where the Limerick Nuclear Plant is located during the Mid 80's and 90's after they opened. Prostate Cancer increased 132%, Thyroid Cancer increased 128%, Kidney cancer increased 96%, Multiple Myeloma increased 91%, Hodgkin's Disease increase 67%, Non-Hogdin's Lymphoma increased 61%, Breast cancer increased 61%, Pancreas cancer increased 54%, and Leukemia increased 48%.

Radiation exposure can cause cancer and other serious disease and disability, at any level of exposure according the National Academy of Sciences and Physicians Responsibility. Permissible radiation levels does not mean that they are safe levels for everyone in the community. Most permissible levels based on the average healthy adult. They are not levels that were based or researched for fetuses, infants, toddlers, and children or pets. Fetuses, infants, children, pets, and the elderly and immuned compromised individuals are at most risk of health problems. There is a broad range of dangerous randionulcides routinely released into air and water from the Limerick Nuclear Plant as well as any accidental releases. Permissible radiation levels does not mean that they are safe radiation levels, it only means that they are allowed.

**Comment: 44-9-HH;** I have children as well as other loved ones that have or have had allergies, asthma, learning disabilities, speech disabilities, behavioral disabilities, thyroid conditions, cancers, skin disorders and irritation, etc. I know neighbors and other community members that have suffered from the same and more.

**Comment: 45-6-HH;** But, it doesn't take an accident or disaster for Limerick to poison the region's residents with radiation. Radiation from Limerick routine and accidental emissions alone for the past 26 years is reason enough to deny Exelon's request. It's not credible for NRC to claim continuous radiation levels are safe for me and my family when there is no safe level of exposure according to the National Academy of Sciences and Physicians for Social Responsibility.

**Comment: 45-7-HH;** NRC is failing to acknowledge obvious health harms from Limerick's continuous additive, cumulative, and synergistic radiation releases which get into water, food, soil, vegetation, milk, and our bodies. NRC has no idea what health harms some of the region's residents experienced from Limerick Nuclear Plant. NRC never did any radiation monitoring or testing at Limerick. Evidence shows testing done by Exelon and DEP cannot by trusted.

**Comment: 45-8-HH;** Exposure to radiation is known to cause cancer. It should be obvious to the NRC that Limerick played a major role in our tragic, well documented cancer crisis after Limerick started operating in the mid 1980s to the late 1990s. Four cancer studies based on PA Cancer Registry and CDC data showed skyrocketing rate for several cancers for higher than the national and state averages, especially children. Our children had the highest levels of Strontium-90 radiation in their baby teeth of any group near any nuclear plant studied. Limerick Nuclear Plant release SR-90 into our air and water that got into the milk, vegetation, and food since Limerick started operating. Thyroid cancer increased by 128% from 1985 to 1997. Other cancers rose dramatically as well.

**Comment: 46-6-HH;** Finally, my concerns regarding the impact of this nuclear power plant on my community are not limited to catastrophic scenarios that might potentially occur. There have been studies published in health journals that show a higher incidence of certain illness—particular among children—in communities surrounding nuclear plants. While these studies were conducted in a variety of locations, they seem to be consistent with some of the data that Pottstown's local Alliance for a Clean Environment presents on its website regarding increased cancer and leukemia rates–also especially among children–in the greater Pottstown area.

**Comment: 47-2-HH;** I am fully aware of the amount of cancer that is prevalent in this area.

**Comment: 48-2-HH;** I moved to Pottstown, Pa., some time ago in perfect health. In 2006, I was diagnosed with prostate cancer. Although, I cannot prove it was a direct cause of the nuclear power plant, I feel that much further, unbiased studies and tests need to be done prior to the relicensing of the Limerick plant by reputable sources not by corporate interests groups that can manipulate the statistics in Exelon's favor.

Wouldn't it be in the best interest of our community and surrounding communities if the higher cancer rate was due the Limerick power plant? This question is a "no brainer." There is plenty of time for testing to be done prior to relicensing.

**Comment: 51-3-HH;** Cancer rates are higher than the national average and NRC is going with the status quo.

**Comment: 52-6-HH;** The surrounding area has abnormally high cancer rates among adults and children.

**Comment: 57-3-HH;** I also feel its presence has led to [an] increase of cancer in our area.

**Comment: 58-1-HH;** I feel that there is a lot of people that had not known to report anything because of not knowing who to go to. I don't understand why the hospitals don't give statistical information based on areas?

Anyway my daughter Tracey had Leukemia at the age of 2 1/2. Was a patient at Children's Hospital until she was 5. With several years of chemotherapy she is now 18 and in remission. We had lived on Limerick Center Road for most of our young lives and now with our kids. I don't know what other information you would need but I would be happy to get you whatever you might need.

**Comment: 60-10-HH;** High infant mortality rates and neo natal, cancer increase, thyroid cancer rates 70% higher

**Comment: 60-14-HH;** cancer increases, especially children

**Response:** *The NRC's mission is to protect the public health and safety and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities. The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects (i.e., cancer and other biological impacts) of radiation on humans. Radiation standards reflect extensive scientific study by national and international organizations. The NRC actively participates and monitors the work of these organizations to keep current on the latest trends in radiation protection.*

*Recently, the NRC asked the National Academy of Sciences (NAS) to perform a state-of-the-art study on cancer risk for populations surrounding nuclear power facilities. The NAS study will update the 1990 U.S. National Institutes of Health—NCI report, "Cancer in Populations Living near Nuclear Facilities."*

*The study will be carried out in two consecutive phases. A Phase 1 scoping study will identify scientifically sound approaches for carrying out an epidemiological study of cancer risks. This scoping study began on September 1, 2010, and will last for 15 months. The result of this Phase 1 study will be used to inform the design of the cancer risk assessment, which will be carried out in a future Phase 2 study.*

*Although radiation can cause cancers at high doses, currently there are no data to unequivocally establish the occurrence of cancer following exposures to low doses, below about 10 rem (0.1 Sv). Radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for larger radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and detriments such as cancer induction. Simply stated, any increase in dose, no matter how small, is assumed to result in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably over-estimates those risks. Based on this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public. While the public dose limit is 100 mrem (1 mSv) for all facilities licensed by the NRC (10 CFR Part 20, "Standards for Protection Against Radiation"), the NRC has imposed additional constraints on nuclear power reactors. Each nuclear power reactor, including LGS, has license conditions that limit the total annual whole body dose to a member of the public outside the facility to 25 mrem (0.25 mSv). In addition, there are license conditions to limit the* *dose to a member of the public from radioactive material in gaseous effluents to an annual dose of 15 mrem (0.15 mSv) to any organ; for radioactive liquid effluents, a dose limit of 3 mrem (0.03 mSv) to the whole body, and 10 mrem (0.1 mSv) to any organ.*

*Chapter 4 of this SEIS discusses the Radiological Environmental Monitoring Program (REMP) that LGS uses for environmental monitoring. The purpose of the LGS Radiological REMP is to evaluate the radiological impact that operation may have on the environment. The program is designed to highlight and look at specific consumption pathways for local inhabitants and special interest groups. The LGS radiological environmental monitoring program is made up of three categories based on the exposure pathways to the public. They are as follows: atmospheric, aquatic, and ambient gamma radiation. The atmospheric samples taken around LGS are airborne particulate, airborne iodine, milk, and broad leaf vegetation. Sampling for the LGS REMP program is performed as specified in Appendix I to 10 CFR Part 50, "Domestic licensing of production and utilization facilities," as well as agreements made with the State of Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection.*

*The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are so low (i.e., less than a few millirem) that resulting cancers attributed to the radiation have not been observed and would not be expected. To put this in perspective, each person in this country receives a total annual dose of about 300 mrems (3 mSv) from natural sources of radiation (i.e., radon, 200 mrem; cosmic rays, 2 mrem; terrestrial (soil and rocks), 28 mrem; and radiation within our body, 39 mrem) and about 63 mrem (0.63 mSv) from man-made sources (i.e., medical x-rays, 39 mrem; nuclear medicine, 14 mrem; consumer products, 10 mrem; occupational, 0.9 mrem; nuclear fuel cycle, <1 mrem; and fallout, <1 mrem).*

*A number of studies have been performed to examine the health effects around nuclear power facilities. The following is a list of some of the studies that have been conducted:*

- *In 1990, at the request of Congress, the National Cancer Institute (NCI) conducted a study of cancer mortality rates around 52 nuclear power plants and 10 other nuclear facilities. The study covered the period from 1950–1984 and evaluated the change in mortality rates before and during facility operations. The study concluded there was no evidence that nuclear facilities may be casually linked to excess deaths from leukemia or from other cancers in populations living nearby.*

- *Investigators from the University of Pittsburgh found no link between radiation released during the 1979 accident at the Three Mile Island Nuclear Station and cancer deaths among nearby residents. This study followed more than 32,000 people who lived within 5 miles (mi) (8 kilometers (km)) of the facility at the time of the accident.*

- *In January 2001, the Connecticut Academy of Sciences and Engineering issued a report on a study around the Haddam Neck Nuclear Power Plant, in Connecticut, and concluded that exposures to radionuclides were so low as to be negligible and found no meaningful associations to the cancers studied.*

- *In 2001, the American Cancer Society concluded that, although reports about cancer clusters in some communities have raised public concern, studies show that clusters do not occur more often near nuclear plants than they do by chance elsewhere in the population. Likewise, there is no evidence linking* *the isotope strontium-90 with increases in breast cancer, prostate cancer, or childhood cancer rates.*

- *In 2001, the Florida Bureau of Environmental Epidemiology reviewed claims that there are striking increases in cancer rates in southeastern Florida counties caused by increased radiation exposures from nuclear power plants. However, using the same data to reconstruct the calculations on which the claims were based, Florida officials did not identify unusually high rates of cancers in these counties compared with the rest of the state of Florida and the nation.*
- *In 2000, the Illinois Public Health Department compared childhood cancer statistics for counties with nuclear power plants to similar counties without nuclear plants and found no statistically significant difference.*

*In summary, there are no studies to date that are accepted by the nation's leading scientific authorities that indicate a causative relationship between radiation dose from nuclear power facilities and cancer in the general public. The amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small.*

*The staff addresses human health impacts of renewing the LGS operating licenses in Chapters 2 and 4 of the draft SEIS.*

### A.1.8. Land Use (LU)

**Comment: 54-5-LU;** The county has been working hard to develop an interconnected system of open space and trails along the Schuylkill River and within other natural resource areas of the county. In doing this, the county has provided funding to local municipalities and nonprofit conservation organizations to purchase open space and park land; acquired county land and agriculture easements; and developed trails. The Limerick Generating Station site contains significant land along the Schuylkill River that has been identified as part of the Schuylkill River Greenway in the county plan. The use and management of these lands relative to the county open space and natural areas inventory plans should be evaluated in the relicensing process.

**Response:** *Current onsite and offsite land use conditions in the vicinity of LGS are described in Sections 2.2.1 and 2.2.9.3 of this SEIS. The NRC's evaluation of LGS's impacts on onsite and offsite land use during the license renewal term is presented Section 4.1 of this SEIS. While license renewal is not expected to affect the use and management of LGS lands identified as part of the Schuylkill River Greenway, this information will be evaluated with other potential cumulative effects in Section 4.12.6.*

### A.1.9. License Renewal and its Process (LR)

**Comment: 1-4-LR;** Current 40-year operating licenses expire in 2024 and 2029. Why the rush to renew these licenses now?

**Comment: 1-19-LR;** While NRC is required to prepare a supplement to the Limerick Environmental Impact Statement for license renewal, we have little confidence in the process based on NRC's regulatory history. It would be difficult to enumerate a short list, so I'm going to rely on written documents.

**Comment: 4-9-LR;** But my big question of the day is why is Exelon applying for an extension 18 years ahead of time?

**Comment: 4-13-LR;** Exelon is rushing the timeline to reissue a license (18 years ahead of time) to run Limerick Nuclear Plant into the unknown, yet it took more than 5 months for the NRC to get back me concerning an already known survey of fault lines.

**Comment: 8-1-LR;** I'm a retired Lutheran pastor and my concern today is with the speed at which this application process is going. I mean it seems to me that to predict what environmental factors will be in place 13 years hence and 18 years hence, posits a kind of omniscience and prescience that we should attribute to Almighty God, but certainly not to any of us human beings. I would favor a slower process.

**Comment: 8-5-LR;** As I stated then, I continue to be concerned and puzzled about the very early and pre-mature application of Exelon to extend the licenses of the towers. One [of] those does not come up for renewal until 2024 and the other 2029. I ask the NRC not work on the relicensing for this facility for at least ten years. The wait could only ensure better information. The public can not possibly benefit from a decision to renew the licenses at this time. The best decision will be made based on the best possible information. The NRC does not have the best information this early. Much will happen in the next ten years. I urge NRC to wait and see how any of it affects the prospect of continuing these plants at that later date.

What can happen in the next ten years that we can all learn from the relevantly could be anything. It may be better information about how natural disasters are affecting nuclear facilities; we may know more about weather patterns that could cause damage. We will certainly know more about the world situation in terms of advances in terrorist technological capabilities and goals. We will know more about how well nuclear plants in general and the Limerick facility are faring as they continue age. If someone steps forward to fund studies, we will know yet more about cancer rates in the nuclear zones

**Comment: 16-4-LR;** This particular nuclear plant, these plants, you know, their license is already good till 2024. Why are we here now 12 years ahead of time trying to extend this license? And the only reason is because it's a foot race the NRC's in with Congress and nothing more. This has nothing to do with protecting public health and safety, it's the NRC's zeal to continue to rubber-stamp these license extensions without allowing citizens due process like I already talked about and without doing a cost intense and thorough review.

**Comment: 19-4-LR;** He was stating the fact why are we re-licensing them, what, 12 years ahead of time. To me that is absurd. Like maybe a year before or they have to do some studies, two years before. Why do they want us, and I love Thomas's words, rubber-stamp something? Twelve years beforehand to go into what, 2024 for Unit 1 was it and 2029 for Unit 2? Why do they need to push this licensing renewal? You've got to stop and think.

**Comment: 25-1-LR;** First of all, considering the impact of the outcome to many area residents, this forum was not widely publicized for local citizens to be aware of this important matter and offer feedback. Secondly, it does not make sense that Exelon is pursuing renewal for a license that does not expire until 2024.

**Comment: 30-1-LR;** It is NOT due to expire until 2024—thus, Exelon has nothing to [lose] but getting an extension sooner than later so they can sit back and relax operating for the next 20+ years.

**Comment: 30-13-LR;** Since the reactor has until 2024—why the rush, and only one public meeting. I if you have not heard it, you will. There is a major public outrage over this one meeting and not know about it until too late. People want public meetings so that people hear that many are against this plant rather than just submitting comments to the NRC which appears to be rubber stamping license requests—which is not comforting to me and many.

**Comment: 3-1-LR;** Why is the request so early—The NRC should get a request closer to [the] expiration date. Also, the inspection should [be] done closer to the expiration date. In 2023, not 2013.

**Comment: 34-1-LR;** Why is there rush to renew the license? It is not due until 2024, approval at the earliest should be 2019. This would allow 5 years for the business plan of PECO to either continue or close the plant and make arrangements for additional power to replace the closed plant.

**Comment: 41-1-OR;** The possible renewal of Limerick Nuclear Plant's license for 20 years past its current 2024 and 2029 expiration dates more than 12 years ahead of time, worries me a great deal. It's hard to understand why something this major would be done so far in advance. It's IMPOSSIBLE to know the condition of Limerick 12-19 years ahead of time. Why on earth would this be renewed early? It's lengthy process that could begin earlier, but in no way should something this important be rushed through now. Why not wait until closer to the expiration dates, and then seek approval? I understand this how the original guidelines were set up—but those are long outdated. Approving Limerick Nuclear Plant to be relicensed until 2049 would be jeopardizing the health of millions. Renewing this license could be catastrophic to millions.

**Comment: 48-3-LR;** Also, why the hurry? Common sense would indicate that Exelon knows something which we are not aware. Why must the license be renewed at this time when they are licensed through 2024 and 2029?

Again, Why The Hurry? To relicense now is not the best interest of everyone in our area.

**Comment: 56-2-LR;** Finally, we have grave misgivings regarding the future time-dependence, accuracy, and relevance of the licensee's current ER, as presumptively incorporated in the NRC's planned SEIS for LGS license extension, given that such license extension will not become effective until the current unit operating licenses expire in 2024 (for Unit 1) and 2029 for Unit 2. We submit that any decision to relicense these units must be supported by the most timely NEPA and SAMA analysis obtainable within a reasonable interval (e.g. five years) prior to actual expiration of the existing licenses.

Intervals of 12 and 17 years are not required for corporate planning purposes and are far too long to credibly sustain the accuracy and relevance of NEPA analyses, or for the NRC to accurately project both the future condition of the plant, the future state of nuclear safety knowledge, trends in local resource use, population, and the affected environment, and the future range of reasonable electricity supply alternatives to LGS license extension. By comparison, major government owned nuclear installations, such as nuclear laboratories and weapon production sites, are required to conduct site-wide NEPA reviews of their operations and facility plans every\five years. Using this federal standard for timeliness, the NRC's NEPA analysis for LGS relicensing should not commence before 2019, for Unit 1, and before 2024 for Unit 2, or should be subjected to mandatory reassessment and supplementation after those dates.

**Comment: 60-5-LR;** 12 years ahead of time—no way to guarantee safety

**Comment 60-13-LR;** NRC should not be considering this so far in advance—no way to assure safety—shut it down

***Response:*** *According to NRC regulations, 10 CFR* Part 54, "Requirements for renewal of operating licenses for nuclear power plants," *a nuclear power plant licensee may apply to the NRC to renew a license as early as 20 years before expiration of the current license. The NRC determined that 20 years of operating experience is sufficient to assess aging and environmental issues at the site. Additionally, 20 years is a reasonable lead period because if* *the NRC denies the license renewal application, it takes about 10 years to design and construct major new generating facilities, and long lead time times are required by energy-planning decisionmakers.*

**Comment: 54-7-LR;** As part of the environmental assessment process and the evaluation of the plant safety and long term operational capacity, we think that it is important for the NRC to maintain close communication with the community surrounding the plant. Overall education about the plant and the associated risks presented by its operation should be provided in a variety of ways so that the public is better informed about the plant and the overall evaluation taking place as part of the relicensing.

***Response:*** *The NRC's Office of Public Affairs (OPA) is available to address the public concerns and questions regarding nuclear safety and information regarding about LGS. The office follows news coverage of the agency and responds to media and public inquiries. If members of the public have questions or comments about the NRC, nuclear safety, or related topics, they can contact OPA at* OPA.Resource@nrc.gov. *For specific questions and concerns regarding Limerick, the public can contact the Region I OPA at* OPA1.Resource.@nrc.gov. *Additional contact information for OPA can be accessed at http://www.nrc.gov/about-nrc/organization/opafuncdesc.html*

**Comment: 1-6-LR;** The public was led to believe that Limerick's generators, fuel pools, and miles of underground pipes and cables could operate safely for 40 years and then the facility would close. Is Exelon fearful that the longer they wait the more serious problems may arise?

***Response:*** *The original licenses for commercial nuclear power plants were granted for 40 year period, which was set by the Atomic Energy Act 1954 and the NRC's regulations. It was imposed for economic and antitrust reasons rather than technical limitations of the plant. According NRC regulations, 10 CFR Part 54, a nuclear power plant licensee may apply to the NRC to renew a license as early as 20 years before expiration of the current license. Part 54 requires the applicant to demonstrate that it can successfully manage aging at the facility during the period of extended operation.*

**Comment: 22-1-LR;** I'm a resident of Phoenixville. I found out about this meeting because I scan a lot of newspaper websites. I found the notice of the meeting on the West Chester Daily Local website. Didn't find it in the Phoenixville paper, didn't see it in the Philadelphia newspaper, didn't hear about it on any of the local radio stations, didn't hear about it on cable, didn't hear about it on any of the television.

**Comment: 60-20-LR;** Should have been more public notice for hearing—Mail notices so people have an opportunity to attend.

***Response:*** *The NRC provides notice of the environmental public meetings through the* Federal Register, *press releases, and local advertisements. The public also can get information about all NRC public meetings at the NRC public Web site, http://www.nrc.gov/public-involve/public-meetings/index.cfm. The public also can receive public meeting notices and press releases by subscribing to e-mail notices for reactor correspondence for Limerick at http://www.nrc.gov/public-involve/listserver/plants-by-region.html.*

**Comment: 22-3-LR:** The slide behind me documents exactly two libraries that the documents are going to go in. Why not in my library in Phoenixville? Why not in Montgomery County and Norristown and all of the other public libraries that are in areas that can be affected by the plume should something happen here? Why are the documents in such a restricted area?

***Response:*** *The NRC contacts the local libraries in the communities surrounding the plant to ask if the agency could send them copies of license renewal applications and other documents* *related to the license renewal review so that they could be accessed by members of the public. However, some libraries have limited shelf space and may not be able to accommodate the NRC. Members of the public also can access the license renewal application and SEIS on the Limerick license renewal Web page on the NRC public Web site. The public can access the site at http://www.nrc.gov/reactors/operating/licensing/renewal/applications/limerick.html.*

*Additionally, the NRC will have hard copies and CDs of the draft SEIS available for the public during the public meeting on the draft SEIS. Members of the public also can contact the NRC to request a hard copy or CD of the SEIS.*

**Comment: 16-2-LR;** And I'd like to correct that statement. He stated that the NRC is extending the original operating license which was granted by the NRC for a 40-year period of time that that initial 40- year license was not based on safety considerations or technical considerations. But that's absolutely not true and there was recently a year-long investigative report done by the Associated Press who interviewed expert nuclear personnel, engineers, safety engineers in the nuclear industry who told them that the 40-year licenses issued by the NRC for 104 nuclear plants in the United States was based on safety and technical—safety technical analysis. So these proceedings, these license extension proceedings like the one we're currently at are a rubber-stamping of these 20-year license extensions.

**Comment: 16-3-LR;** This is in fact a foot race between the Nuclear Regulatory Commission and the United States Congress where Congress wants to stop this process, put a moratorium on the re-licensing until the Fukushima disasters can be fully understood and the enhancement enacted in August for our power plants here.

***Reponses:*** *As a result of Fukushima, the NRC issued three orders requiring safety enhancements of operating reactors, construction permit holders, and combined license holders. These orders require nuclear power plants to implement safety enhancements related to (1) mitigation strategies to respond to extreme natural events resulting in the loss of power at plants, (2) ways to ensure reliable hardened containment vents, and (3) ways to enhance spent fuel pool instrumentation. The plants are required to promptly begin implementation of the safety enhancements and complete implementation within two refueling outages or by December 31, 2016, whichever comes first. In addition, the NRC issued a request for information asking each licensee to reevaluate the seismic and flooding hazards at the site using present-day methods and information, conduct walkdowns of its facilities to ensure protection against the hazards in its current design basis, and reevaluate emergency communications systems and staffing levels. LGS is required to comply with the NRC orders or revised regulations whether or not the operating licenses are renewed.*

### A.1.10. Opposition to License Renewal (OR)

**Comment: 1-5-OR;** We urge the NRC to say no to Exelon's requested license renewals.

**Comment: 1-20-LR;** It's long past time for the NRC to summon the courage to do the right thing in our judgment and actually protect the environment and the public, rather than the industry.

**Comment: 1-21-OR;** Based on the compelling body of evidence of environmental harms to date and the enormous increased population in proximity to this facility, Limerick Nuclear Plant must be closed by 2029. There is no amount of energy production that is worth risking the lives of so many people.

**Comment: 1-29-OR;** Nuclear Regulatory Commission today and that is very simply that Limerick nuclear power plant must be closed by the NRC, not re-licensed until 2049.

**Comment: 6-5-OR;** So please, ask your politicians, reliable politicians to close the Limerick power plant. Let's save America for our kids and descendants

**Comment: 6-9-OR;** We can't control the use of nuclear in the rest of the world, but we can keep the U.S. safer by eliminating nuclear energies. Fortunately, many European allies including Australia have decided to phase out reactors. We should join them [to] reduce human suffering. Also this can reduce our increasing costs of health care.

**Comment: 6-11-OR;** Limerick Power Plant is ranked in the top 3 riskiest nuclear power plants in the U.S.A. Limerick Power Plant must be closed not relicensed.

**Comment: 10-1-OR;** If Limerick Unit 1 or 2 fails, all hell breaks loose, no disrespect. That's what a nuclear failure is, hell. It affects everybody in this room, everybody in the community, everybody in the tri-state area, not for a week, but for decades. It's very, very last thing we want to happen.

And I think we're putting ourselves in harm's way by taking something that had a lifespan of 40 years and adding another 20 to it. It doesn't make sense. The only way to rationalize it is through our personal fear of being inconvenienced because we lose a very, very good source of power. It's done a great job for us. But like me, you get to a point where your ability to provide a great job is at an end and things start deteriorating. Let's not put ourselves in that position. Let's make an intelligent decision now and allow these two units to expire at their nameplate time.

**Comment: 19-3-OR;** So from day one I think power plants never should have been built but now that they are here why would we ever want to re-license.

**Comment: 25-4-OR;** I attend to agree with the fourteen reasons provided by the Alliance For A Clean Environment why Exelon should be denied the renewal license. In my opinion, the long-term negative consequences caused by the Limerick Generating Station far outweigh any possible benefits it may contribute.

**Comment: 26-1-OR;** Please do NOT extend the Limerick licenses!

**Comment: 27-2-OR;** Renewing Limerick's license just as controversies are arising with pushes to move from dependence on Nuclear energy is a bold business strategy by them. I don't think this the right move to make. A long term contract will limit any sort of wiggle room to address future issues that may arise.

I ask that you please consider the future of our great state. I don't think oil or nuclear energy is the way. I truly believe in heart, that in order to protect the health of our population for the future, we must change our ways today.

**Comment: 28-1-OR;** I object being continuously poisoned by the Limerick Nuclear Plant's radiation and other dangerous toxins. Please do not allow for an extension of the Limerick Nuclear Power Plant's operation license.

**Comment: 29-2-OR;** The Reactor time has served its years and should not be renewed.

**Comment: 30-10-OR;** I feel firmly and many in the community feel the exact same way, that there is no reason to approve NOW (especially so far in advance, with no answer on usage on rods nor what needs to be done to prevent a meltdown due to an earthquake, etc.) or Ever since the population will only increase and the facility age further. It is the wrong timing, wrong plant, wrong place, etc. for Limerick. Maybe Exelon can put in as much effort and "energy" to develop solar fields, etc… They would rather beat the hell out of a high efficiency plan at any and all cost to the environment and community. This where the NRC does the right thing and says NO until a year before it expires.

**Comment: 35-1-OR;** Limerick Nuclear's influence is vast and horrific. This industry is a behemoth that has not been honest with the public about its true impact, forming its own "environmental" partnerships that are pure pronuclear propaganda tools. It's economic contributions are miniscule when compared to its enormous profits, while destroying our quality of life. The nuclear process's devastating environmental effect on our community cannot be understated.

**Comment: 35-7-OR;** Ordinary daily nuclear generation has had devastating community-wide consequences that need to be addressed. Re-licensing should not even be a consideration! The NRC must fully investigate the environmental concerns presented Dr. Lewis and Donna Cuthbert (ACE), Dr. Winter, and each resident who so civilly represented this community's concerns at the September 22, 2011 hearings. The Limerick Nuclear Power Plant should NOT be re-licensed and should, instead, begin to address the pollution issues it has already created as it seriously and carefully shuts down its reactors.

**Comment: 38-1-OR;** I'm writing to you to state my opposition to the relicensing of Limerick Generating Station in Limerick Township, Pennsylvania.

**Comment: 40-1-OR;** I attended the recent meeting on the possible renewal of Limerick Nuclear Plant's license for 20 years past its current 2024 and 2029 expiration dates. I strongly believe, as do many of my local friends and family that the Limerick Nuclear Plant must be closed, not relicensed. Approving Limerick Nuclear Plant to be relicensed until 2049 would be jeopardizing the health of thousands and thousands of people in neighboring communities. There is substantial evidence readily available which justifies closing Limerick. Renewing this license could lead to a catastrophic meltdown.

**Comment: 40-6-OR;** It would be careless, unethical and immoral for NRC to approve Exelon's requested license extensions Limerick Nuclear Power Plant. Limerick Nuclear Power Plant must be closed by 2029.

**Comment: 41-4-OR;** Just remember, it would be careless, unethical and immoral for NRC to approve Exelon's requested license extensions for Limerick Nuclear Power Plant. Limerick Nuclear Plant must be closed by 2029.

**Comment: 42-3-OR;** Why does the NRC think they can play God with people lives? It is no longer debatable, shut it down before our very lives are jeopardized.

So-called quality life issues addressed as part of public debate, e.g. "the power is always on" seems irrelevant to us when our families are required to evacuate during disaster. Limerick must be closed and NOT relicensed at any cost, specifically the cost of life itself!

**Comment: 43-1-OR;** Do NOT renew Limerick licenses. It's too dangerous and too old. Please listen to their neighbors like us.

**Comment: 44-1-OR;** There are so many reasons why you as a group should already know that it would be in the best interest of the men, women, children, babies, fetuses, animals, fish, wildlife in general and the environment for you to refuse/oppose Limerick Power Plant from re-licensing. The problem that always seems to come up at some of the public hearings and sessions where businesses/corporations want to expand and become bigger and run their businesses long past the time that they should truly be allowed in order keep safe, always comes back to the issue of money, offerings, bribes, donations, etc. in the end. When these things occur, people and businesses turn a "blind eye" so to speak to the dangers of allowing a business like the Limerick Power Plant to renew its license again. That is unacceptable. I expect and demand better service from you to help protect myself and my family from harm!

**Comment: 44-4-OR;** It is disgusting and heart wrenching to know that officials and organizations are not paying attention to what can happen to the public if Limerick Power Plant continues to operate longer than expected. Ignoring the obvious problems our community is facing and hoping that after they serve their term, it will be someone else problem to deal with is unacceptable. Now is the time. Step up and [do] what is morally right for humanity

**Comment: 44-11-OR;** I expect you to what is morally right now for me, my family, my neighbors, my community, and the pets, wildlife, air, water, and environmental in whole by rejecting, refusing, and opposing Limerick Power Plant from relicensing to run their business longer than originally planned for 2029.

**Comment: 45-1-OR;** I urge NRC to deny Exelon's request to renew Limerick Nuclear Plant's license for 20 years past its current 2024 and 2029 expiration dates. Limerick Nuclear Plant must be closed, not relicensed, for many valid reasons. Approval of Limerick Nuclear Plant to be relicensed until 2049 would be reckless and would show blatant disregard for the health and safety of the public. There is more than sufficient evidence of harms and threats to justify closing Limerick. There are too many things beyond NRC's control that could lead to a catastrophic meltdown.

**Comment: 45-11-OR;** It would be both unethical and immoral for NRC to approve Exelon's requested license extensions for Limerick Nuclear Power Plant. All of the unprecedented harms, threats, risks from Limerick Nuclear Plant will increase if NRC approves and additional 20 year Limerick license extension, until 2049. Limerick Nuclear Plant must be closed by 2029.

**Comment: 46-1-OR;** I am writing to express my opposition to the re-licensing of Limerick nuclear power generating station, which is located about 20 miles from my home. There are several reasons why this relicensing in not in the best interests of people living in the surrounding community

**Comment: 48-1-OR;** Just a quick note requesting the NRC to NOT allow the relicensing of the Limerick, PA, nuclear plant at this time.

**Comment: 51-1-OR;** Please protect our citizens from possible disaster and do not relicense Limerick

**Comment: 52-1-OR;** As a resident of New Hanover Twp., Montgomery County, PA (less than 5 miles from Exelon's Limerick Nuclear Power Plant), I urge you to vote AGAINST the premature relicensing of that facility.

**Comment: 53-1-OR;** I implore you to not relicense the Nuclear Power Plant of Limerick when its licenses expires in 2029. If I had my wish, the power plant would be closed years before 2029.

**Comment: 57-1-OR;** Just wanted to voice my opinion for a no vote to renew the license for the Limerick power plant.

**Response:** *These comments are general in nature and express opposition to Exelon, nuclear power, and license renewal of LGS. Portions of these comments that express general opposition to renewing the licenses for LGS provide no new and significant information and have not resulted in any changes to this SEIS. Portions of these comments that address particular technical issues are addressed in the respective technical sections of this appendix.*

### A.1.11. Postulated Accidents & SAMA (PA)

**Comment: 1-1-PA;** Whether a natural disaster or terrorist attack occurs, by relicensing Limerick, NRC would in effect be playing Russian roulette with the lives of more than eight million people. NRC must close Limerick Nuclear Plant by 2029.

**Comment: 1-13-PA;** With loss of cooling water, Limerick's fuel rods could heat up, self ignite, and burn in an unstoppable fire with catastrophic results. Exelon has not been required to spend the money to guard limerick against terrorists, missiles, or air strike despite repeated requests to do so.

**Comment: 1-24-PA;** It's not safe, it's a ticking time bomb. And nuclear power, they say it's always on. That's not true either as evidence by shutdowns, some for long periods caused by earthquakes, tornadoes, hurricanes, fires, heat, and drought and more.

**Comment: 4-1-PA;** Increasing floods, droughts, earthquakes, tornados have made us all feel insecure, making nuclear power increasingly risky, especially with the Limerick plant basically in our backyards. Any earthquake that comes through this area could be a possible Fukushima, Chernobyl or Three Mile Island…

**Comment: 4-15-PA;** The 9-21-11 Mercury article said "whether or not earthquake risk is a factor in the current relicensing request for Limerick remains to be seen". It would be grossly unacceptable for the NRC to ignore Limerick's extreme vulnerability to earthquake damage.

Earthquake risk should be on the top of NRC's relicensing concerns for Limerick. Earthquake risks are far greater for Limerick than previously realized—increased by 141%. We now know Limerick is 3rd on nation's earthquake risk list Plus evidence shows earthquakes in the East can be far stronger than Limerick's "design basis" can withstand.

There's a good chance that an earthquake can exceed Limerick's design basis, causing a severe nuclear accident, jeopardizing the health, safety and financial well being of our entire region.

The Virginia 8-24-11 earthquake caused shaking in PA at Limerick Nuclear Plant. Since January there have been 2 small earthquakes in Philadelphia, only 21 miles from Limerick.

Shaking and breaking in miles of Limerick's buried underground pipes and cables can lead to nuclear disaster. It's disquieting that NRC uses a "visual inspection" to determine damage on buried pipes. Problems may not be identified until it's too late.

For years the NRC allowed Exelon to do its own studies, to stall and avoid responsible action on fires and earthquakes. To save money, Exelon typically concludes Limerick is "safe enough". This is unacceptable!

10-5-11, the Mercury reported a flaw was found in the mechanism to shut down the nuclear plant. The warning was tied to renewed focus on earthquake risk. It's difficult to see how Limerick's design flaws can be fixed, even if Exelon WOULD spend the money.

There is no proof whatsoever Limerick's design can withstand other threats ranging from hurricanes, tornadoes, floods, or terrorist attacks to an impact from a jet airliner.

We need precaution before there is a catastrophe. NRC should close Limerick as soon as possible.

**Comment: 6-3-PA;** Of course, what is happening here will be taking much longer, but it is sure not good news. Besides harmful power plant exposures, we have environmental disasters and a concern about our nearby earthquake fault and others in the eastern U.S., especially one near

New York City. And then there are the radioactive spent fuel deadly waste material sitting around, supposedly protected.

**Comment: 6-7-A;** An earthquake in our area is not too far fetched. And of course, threat of terrorism with vulnerable spent fuel are always a concern.

**Comment: 8-6-PA;** One big concern—because of Japan's recent experience and the fact that we had an earthquake in the Limerick plant's territory—is refurbishing the plants so they can withstand earthquakes. It has been widely reported by MSNBC and the AP, using NRC data—that the Limerick plant has the nation's third highest risk of being damage by an earthquake. When the plant was built, no one thought this area would get earthquakes. Now we do. I understand Congress is now or soon will be considering increasing earthquake preparedness capabilities at the plants. I fear that if you grant Exelon carte blanche now, the NRC would encourage them to do less than they should to make the plant safer.

**Comment: 19-1-A;** Now lately with the -- unfortunately it's a reality now that we have hurricanes, more tornadoes, tsunamis throughout the world. And I hate to say it but it is a reality now that we have terrorist attacks and Limerick is definitely one. I don't want to be blowing this out of proportion but it's just something that I know that we've all been concerned about, not wanting to say yes, Limerick, and all the people that built the power plant and the company say oh, there's no impact to the air and the water pollution and so forth. So we've kind of just blinded our, you know, selves to that and let's believe then, okay, let's take a minute. Let's really believe that there is no impact in our clean air, clean water and those type of things and cancer, et cetera. Let's just go into the new reality which is terrorist attacks which would happen. Let's just say for example there was human error there with the spent fuel rods and something happened, or a radiation leak.

**Comment: 30-10-PA;** Let's also mention a fact that Category I Hurricane Irene, which could have been Category 3, just zipped less than 100 miles away from the site a few weeks ago and then Hurricane Lee which decided to travel further east case close to also causing chaos. Limerick is still TOO close to the disaster of Hurricanes as well.

**Comment: 37-11-PA, 39-12-PA;** Increased Risked of Meltdown From More Frequent and Stronger Earthquakes and Other Natural Disasters

**Comment: 45-2-PA;** Limerick is 3rd on the earthquake risk list. It is too dangerous to keep Limerick operating. Earthquakes and other natural disasters are more frequent and stronger. Underground pipes and cables can shake and break, then lead to loss of power, loss of cooling water, and meltdown. Limerick's substandard containment flaw means more radiation would be released.

**Comment: 47-1-PA;** Limerick Generating Station is old and I don't think it is strong enough to with stand plane impacts, earthquakes, or tornadoes that occur here.

**Response:** *The comments express concern for the potential adverse environmental impacts associated with postulated accidents. The impacts of design basis accidents were evaluated in the GEIS and determined to be small for all plants; therefore, it is a Category 1 issue. The GEIS evaluated severe accidents for all plants including LGS, and it concluded that the impact was small under Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions." In accordance with 10 CFR 51.53(c)(3)(ii)(L), the license renewal Environmental Reports must provide consideration of alternatives to mitigate severe accidents if the staff has not previous evaluated SAMAs for the applicant's plants in an environmental impact statement or related supplement or in an environmental assessment. The staff has previously performed a site-specific analysis of severe accidents mitigation in the NEPA* *document for LGS. For the license renewal review, the staff must consider whether new and significant information affects the environmental determination in the NRC regulations.*

*A detailed discussion of postulated accidents, and the staff's considerations of new and significant information related to SAMA, including seismic risk, can be found in Chapter 5 of this SEIS.*

**Comment: 56-1-PA;** The original SAMA analysis for the Limerick Generating Station (LGS) is a 1989 report that was issued as the result of a ruling by the U.S. Court of Appeals for the Third Circuit, which concluded that the NRC had failed to consider a "reasonable set" of Severe Accident Mitigation Design Alternatives ("SAMDAs"). In 1989, the NRC subsequently adopted this SAMDA analysis and agency staff concluded they had "discovered no substantial changes in the proposed action as previously evaluated in the FES [Final Environmental Statement] that are relevant to environmental concerns nor significant new circumstances or information relevant to environmental concerns and bearing on the licensing of [LGS]".

As the original LGS SAMDA effort in 1989 was the first mandated effort to focus on SAMAs, the notion that an updated SAMA analysis need not be completed at the license renewal stage (for the exact reactor site that gave birth to the regulatory requirement) we find highly objectionable, particularly in light of the catastrophic nuclear accident that befell similar Boiling Water Reactor (BWR) units in Japan in March, 2011. It has become clear in the 770 years of combined U.S. BWR operational experience since 1989 that domestic and international events provide numerous examples of "new information" and make a strong case for the need to reconsider all that has been learned about newly discovered risks and vulnerabilities of nuclear power plants.

It has been noted that global core damage events happen at a rate that exceeds NRC's presumptions of what should be considered safe at plants within the U.S., which implies that either the NRC estimates for domestic plants are wrong or that international nuclear plants have a core damage frequency much higher than what the NRC deems safe. Either scenario is troubling and deserves the industry's full attention and effort. Exelon's 1989 effort in response to the Court was, respectfully, less than one would have hoped for in light of the seriousness of the issue. The LGS 1989 SAMDA can in no way claim necessary conservatism with regard to public safety over the total timeframe of a possible sixty year reactor lifetime.

In contrast to the 1989 SAMDA, relatively recent SAMA analyses conducted in other license renewal applications, such as those for sites at Nine Mile Point, Three Mile Island, and the Joseph M. Farley Nuclear Plant, to name a few, were considerably more thorough and addressed a range of detailed alternatives. Pursuant to regulatory analysis techniques supplied by NRC and aided by an industry-supplied guidance document most modern-day SAMA analyses are designed using a fairly prescriptive set of initial assumptions, baseline calculations, and cost benefit arithmetic recipes that employ the use of sophisticated codes in their evaluation of potential risk and the benefit of removing this risk.

The most common code used is the MELCOR accident consequence code system (MACCS2), which provides a modeling framework for calculating the off-site consequences of a severe accident. This code accepts an advanced set of input parameters, including population density distributions within 50 miles, detailed regional economic data obtained from multiple sources, nuclide release scenarios accounting for reactor core inventory, emergency response and exposure variables, and meteorological data for plume migration pathways. The current state of knowledge regarding the assumptions and understanding of severe accident events has expanded and improved in the intervening twenty-two years since the initial SAMDA analysis for LGS.

While we acknowledge that this analysis was limited by the knowledge available at the time, the limitations and shortcomings of a previous era in no way disqualify the claim that, in light of numerous advances in modeling capabilities, a library of discovered cost-beneficial SAMAs, and the saliency of severe accident risks following the disaster at Fukushima Daiichi, not only is there new and significant information, there are significant volumes of this information acquired since 1989.

In the licensee's current environmental report, the identification and treatment of new and significant information (four items in total) were developed only in the narrow context of how they may affect the dated SAMDA analysis. It should go without saying that this approach does not comprise all of the applicable new and noteworthy severe accident mitigation strategies bearing on the site in question, or serve to remedy gaps and omissions in the original SAMDA analysis.

The entire set of first-stage envisioned alternatives in the initial SAMDA analysis was no more than fifteen options. The "analysis" in the current environmental report consists of perfunctory, "back-of-the-envelope" calculations in lieu of a proper SAMA analysis. The current operator Exelon referred to these considerations as representing an "abundance of caution." We disagree.

One of the largest problems with the calculations offered, aside from only focusing on an arbitrarily limited number of alternatives, is that licensee evaluated each item of new information in isolation of the other factors that would also change the cost-benefit conclusion for a particular alternative. The effects of each changed parameter (e.g., population, offsite economic risk, cost per person-rem averted, and seismic hazards) should be evaluated in a comprehensive model that shows the aggregate benefit, as performed in all current day SAMA analyses. Unfortunately, their analysis barely scraped the surface of how this new information should actually be considered in the context of environmental impacts.

In comparison, a "reasonable set" of alternatives for another recently relicensed plant included an initial consideration of 128 SAMA candidates developed from previous lists at other plants, NRC documents, and documents related to advanced power reactor designs. After screening this initial set for non-applicable or previously implemented designs as well as combining/dropping common-benefit options, the applicant was still left with a set of forty unique SAMA candidates, for which it was required to enter preliminary cost estimates in a so-called "Phase I Analysis." A total of fifteen SAMA candidates survived this screening to enter more detailed cost consideration in the Phase II analysis, of which none were deemed cost-beneficial. However, in another renewal application, the SAMA analysis found eleven potentially cost-beneficial options from an initial set of thirty-three.

In an NRC report discussing insights on SAMAs in connection with plant license renewals, the agency authors list numerous potentially cost-beneficial SAMAs relating to station blackouts, protection and support systems, procedures and training, and external events such as flood, fire, and seismic hazards. The authors note that "averted onsite costs (AOSC) is a critical factor in cost-benefit analyses and tends to make preventative SAMAs more attractive than mitigative SAMAs." This AOSC factor was not considered in either the original SAMDA or the recently submitted environmental report.

Finally, NRDC believes that in addition to a comprehensively updated SAMA analysis, the licensee or agency must conduct a study that, as part of the supplemental environmental impact statement, presents postulated accident scenarios showing the full range and weight of environmental, economic, and health risks posed by these accidents. This type of study should model site-specific severe accidents and illustrate the full consequences of a range of severe accident scenarios so that the public and their policy makers can make informed decisions whether to continue plant operations after the existing licenses expire, thereby continuing to run the risk of a severe nuclear accident, invest in additional accident mitigation capabilities, or alternatively, avoid these risks altogether by relying on a portfolio of low carbon electricity generation alternatives that could meet future electricity service needs over the license extension period.

The SAMA analyses are inadequate in this regard because they only address isolated issues in a cost-benefit analysis that discounts the cumulative impacts on displaced populations, regional economic losses, and environmental cleanup. These types of calculations do not present a clear picture of the potential hazards or costs experienced in the event of a severe accident. Instead they tend to mask the full range of accident consequences that policy makers may wish to avoid. Recently, NRDC produced an analysis, of the type we believe should be included in the Limerick NEPA analysis, to inform ongoing relicensing efforts at the Indian Point nuclear plant site.

In order to illustrate the full extent of a major accident, the NRDC study used the U.S. Department of Defense computer model HPAC (Hazard Prediction and Assessment Capability) to calculate site-specific release radiological source-terms, resulting fallout plumes, and data on the effects on nearby populations. The results were compared to similar modeling of the Fukushima disaster to provide a sense of scale, and to estimate the rough magnitude of financial and economic damages that would be incurred if a severe accident were to occur at Indian Point. This is not a hypothetical issue. Policy makers in several countries, including Germany and Switzerland, have made decisions not to grant nuclear plant license extensions to avoid having to endure the continuing risk of severe nuclear plant accidents.

Regardless of Exelon's own corporate understanding of its legal obligations, NEPA is clear in its well-established mandates and what it requires of the NRC. NEPA requires that federal agencies characterize environmental impacts broadly to include not only ecological effects, such as physical, chemical, radiological and biological effects, but also aesthetic, historic, cultural, economic, and social effects. NEPA requires an agency to consider both the direct effects caused by an action and any indirect effects that are reasonably foreseeable. Effects include direct effects caused by the action and occurring at the same time and place and indirect effects caused by the action, but later in time or farther removed in distance, but still reasonably foreseeable.

Most specifically, NEPA directs that NRC take a "hard look" at the environmental impacts of its proposed action, in this instance the relicensing of two BWR Mark 2 units for an additional 20 years, and compare them to a full range of reasonable alternatives. "What constitutes a 'hard look' cannot be outlined with rule-like precision, but it at least encompasses a thorough investigation into the environmental impacts of an agency's action and a *candid acknowledgement of the risks that those impacts entail." Nat'l Audubon Soc. v. Dept of the Navy, 422 F.3d 174, 185* (4th Cir. 2005) (emphasis added). As a stalking horse for the NRC's draft EIS, the applicant's ER does not meet this standard. In taking the "hard look" required by law, the NRC must therefore address the potential environmental impacts of a range of severe accidents—and accident mitigation strategies—especially in light of the new information provided by the Fukushima nuclear disaster on the performance of BWR radiological containment in a prolonged loss-of-coolant, core-damage scenario.

For the reasons stated above, NRDC urges that NRC direct that a thorough and lawful SAMA analysis be conducted as part of (or supplement to) the required supplemental environmental impact statement, the draft of which is currently scheduled for August 2012 and the final SEIS currently scheduled for February 2013. Additionally, the full cumulative effect of severe accidents must be studied and presented as part of these documents. These analyses must make every effort to meet the current expectations of what these studies should encompass and use the necessary guidance and tools commonly utilized by the industry and NRC. The NRC's legal obligation to consider new information and determine its nuclear safety significance exists independently of whether a SAMA has or has not been prepared previously: in the event a SAMA has not been prepared, then new and potentially significant nuclear safety information must be included in the initial SAMA; if a previous SAMA exists, then it must be updated to reflect this new information, and the resulting costs and benefits of the full spectrum of reasonable accident mitigation alternatives must be considered as part of the Draft Supplemental Environmental Impact Statement, and issued for public comment.

**Response:** *For license renewal, the NRC discharges its NEPA obligation to consider severe accidents mitigation through 10 CFR 51.539(c)(3)(ii)(L) and Table B–1. In accordance with 10 CFR 51.53(c)(3)(ii)(L), the license renewal ERs must provide consideration of alternatives to mitigate severe accidents if the staff has not previous evaluated SAMAs for the applicants plants in an environmental impact statement or related supplement or in an environmental assessment. LGS is a plant that had a previous SAMA documented in a NEPA document.*

*Under NEPA, the NRC must consider whether new and significant information affects environmental determination in the NRC's regulations, including the determination in 10 CFR 51353(c)(3)(ii)(L) and Table B–1, that the agency need not reconsider SAMAs at license renewal if it has already done so in a NEPA document for the plant. New information is significant if it provides a seriously different picture of the impacts of the Federal action under consideration. For SAMAs, new information may be significant if it indicated a given cost-beneficial SAMA would substantially reduce the risk of a severe accident, by reducing the probability, or the consequences of a severe accident.*

*The staff's evaluation of new and significant information for SAMAs is addressed in Section 5.3 of this SEIS.*

### A.1.12. Radioactive & Non-Radioactive Waste (RW)

**Comment: 1-10-RW;** This aging plant is an accident waiting to happen. Large volumes, more than 6,000 assemblies weighing more than a thousand tons of highly radioactive waste in the form of spent fuel rods are stored in densely-packed pools, elevated five stories above and outside the reinforced containment structure.

**Comment: 1-11-RW;** This plant will produce about two more tons of dangerous spent fuel rods every year that it operates.

**Comment: 1-14-RW;** Dry cask storage and transport are also very dangerous alternatives. It's time to close Limerick and stop producing such deadly waste for which there is no safe solution. As long as Limerick operates harms to us and our environment will increase.

**Comment: 1-30-RW;** [R]adiation into air and water from routine and accidental emissions

**Comment 1-36-RW;** [D]eadly high-level radioactive wastes that are packed in vulnerable fuel pools on this site and they are in fact unprotected. They are above ground and unprotected

**Comment: 6-4-RW;** [T]he radioactive spent fuel deadly waste material sitting around, supposedly protected

**Comment: 18-1-RW;** One would be what are we going to do with the 20 years of spent rods and how are you going to take care of those.

**Comment: 23-3-RW;** And then to—I'm sure that the generic plan includes a pretty good discussion of fuel storage long-term and short-term onsite but certainly the site-specific fuel storage considerations.

**Comment: 30-7-RW;** The NRC and USA Government still have not decided where to store spent nuclear rods and as we speak each spent rod is sitting in baths on the Limerick site, stacking up—expanding even a greater hazard to the community, environment, etc. So put simply, there absolutely no reason to approve this request for years until the US Government decides how they will handle such rod and such rods and properly stored.

**Comment: 34-3-RW;** The disposal area must be in operation not some theoretical site like the now defunct Yucca site. The public and our future generation deserves to know what is expected to be done at the site. Radioactive material must not be allowed to remain on the site.

**Comment: 35-5-RW;** Limerick Nuclear's request for re-licensing is ludicrous, considering its aging and inadequate equipment, its increased air pollution by particular matter, its horrific destruction of the Schuylkill River and dangerous above-ground spent fuel rod storage.

**Comment: 37-8-RW, 39-9-RW;** Deadly high level radioactive wastes packed in vulnerable fuel pools on site

**Comment: 52-5-RW;** The plant can no longer store its used fuel rods and has asked permission to begin transporting them to another facility.

**Comment: 60-4-RW;** Spent fuel—Storage—Uranium mining—Dirty

**Comment: 60-11-RW;** Nuclear waste—nothing clean

**Comment: 60-14-RW;** Radiation in air and water—Radioactive ground water

**Response:** *Radioactive and non-radioactive waste management is discussed in Section 2.1.2 in this SEIS. The NRC's evaluation of impacts of the uranium fuel cycle and waste management are addressed in Chapter 6 of this SEIS.*

### A.1.13. Socioeconomics (SE)

**Comment: 1-28-SE;** Then you take the property taxes. They tried to get zero for their property taxed by the end of the 90s and didn't pay any property taxes until the early 2000s at which time they paid $3 million instead of $17 million they were suppose to pay. So when you think about that no wonder Exelon's willing throw around a couple million in the community. They owe this community a lot more than what they're giving.

**Comment: 52-3-SE;** The area around the facility has exploded with homes and businesses

***Response:*** *The property taxes paid by Exelon are presented Section 2.2.9.2 in this SEIS. Section 2.2.9.1 discusses the total number of vacant and occupied housing units in Berks, Chester, and Montgomery counties. Section 2.2.9.6 presents information on the number of businesses in the area. Section 4.9 presents the NRC's evaluation of socioeconomic impacts of continued operation of LGS. In addition, the socioeconomic impacts of not renewing the operating license are discussed in Chapter 8.*

### A.1.14. Support of License Renewal (SR)

**Comment: 2-1-SR;** Operating Limerick Generating Station safely and reliably is a responsibility that everyone at the power station takes very seriously. We understand our obligation to the community, to the environment, and to each other to operate the plant safely.

A key component of a thriving community like ours is the availability of safe, clean, and reliable electricity. And as we look into the future for the power needs of Pennsylvania and the United States as a whole, we can see the increasing demand for this very important resource.

At the same time, there's a growing concern about greenhouse gases and climate change that is a result of burning fossil fuels. To help meet that growing power demand and to help keep our environment clean, Exelon has applied to the U.S. Nuclear Regulatory Commission for a 20-year extension to the plant's operating license. Limerick's current license for Unit 1 will expire in 2024 and Unit 2 in 2029. With license renewal, Limerick can provide our region with clean power through 2049.

We understand our special obligation to operate the plant safely and reliably and to maintain a close relationship with our neighbors. We pledge to continue that special trust as we operate the plant well into the future.

**Comment: 3-1-SR;** I'm here today to voice my strong support for the relicensing of the Limerick Generating Station. I wanted to touch on a couple points of why I feel it is important for this facility to be relicensed.

First is the amount of electricity that is produced by this facility. One of the things that myself and my colleagues in Harrisburg hear consistently from businesses and the Commonwealth and our citizens is the demand for energy and electricity now and more importantly what that demand is going to be in the future.

Right now this facility generates enough electricity for two millions homes and without producing some of the greenhouse gases that we hear so much about that could be produced by coal, natural gas, or oil. And I'm going to put a caveat in there for my good friends out in the western part of the state where coal is a big part of the Pennsylvania economy and I'm suggesting that this be done to the exclusion of coal and nevertheless, some of the technologies that they're developing out there are also important for that industry and important for the Commonwealth of Pennsylvania.

Again, one of the concerns we hear consistently from businesses is how can we come here into Pennsylvania with the infrastructure being what it is which needs to be improved for the transmission of the electricity, but more importantly the generation of that electricity?

Number two, I think is important is the jobs and overall economy. Again, in these tough economic times that we're facing here in the Commonwealth of Pennsylvania and also in this nation, one of the top issues that we hear consistently about is jobs.

And as was mentioned by the site vice president, over 860 people are employed here with an annual payroll of $75 million. The direct impact that is to the Commonwealth of Pennsylvania, of course, is realized through the state income tax and also all of these local municipalities most of them enact an earned income tax which again sustains their townships as well as their respective school districts. To have that taken away I think would have an even more dramatic impact on our local economy.

As was mentioned the impact for the local area here, the temporary workers who show up here during the outages and the refueling, there's already been two hotels that have sprung up along the 422 corridor with another one planned right up here at the Sanatoga area. Again, more jobs and more economic growth here for our communities.

Thirdly, I want to talk about the communication that I've experienced in the seven years that I've been in office with Exelon and with their Government Affairs people as well as with their site people. I've been on the site three times, twice for a tour and one to make a presentation during an anniversary of the facility. And I have to say that it is a very secure area. I know a lot of people are concerned about terrorism attacks or people being on the property. But unless you've actually gone over there and gone through a tour, seeing how things are set up, seeing the armed guards there, seeing the security measures that are in place, I think you come away much more relieved with that. And I'm able to speak to my constituents more affirmatively about the safety and security of the facility.

Any time that there's been the slightest occurrence there, whether it will be a couple times a hunter has wandered onto the property where the authorities were called, the Government Affairs people at Exelon are on the phone to me or with an email right away to let me know what's happening before the word gets out to the media or to the press. So they're always very well prepared in their explanations, not only of things that happen at the plant itself, but also incidents and issues that occur around the country and around the world.

Obviously, what took place in Japan with the incident over there, they were on the phone with me and met with me a few times to explain what took place over there and how the safeguards are being put in place here so that doesn't happen at this facility.

**Comment: 5-1-SR;** Because the license Generating Station can be operated safely and reliably, Exelon decided to pursue license renewal for Limerick. Limerick is a very clean energy source which produces no greenhouse gas emissions. Limerick is also good for the economy in that it lowers market prices on electricity for the citizens of Pennsylvania to the tune of $880 million per year.

**Comment: 5-4-SR;** [W]e operate Limerick safely and we can continue to operate it safely for an additional 20 years. Limerick will provide approximately 2340 megawatts of base-load generation that's not only safe, but it's clean, reliable and economical.

Continued operation of Limerick will benefit this community, the Commonwealth of Pennsylvania and our nation.

**Comment: 7-1-SR;** As the largest private employer in the region, the Board is thankful for the 860 jobs that Exelon provides, the positive impact of their operation, the vitality of our local community. The community and local economy are enhanced by the needed services provided by the township, which includes the roadway network maintained by our Limerick Township Public Works, public safety provided by the Limerick and Linfield Fire Companies, and our local emergency medical response, our public parks, our recreation facilities and also the police protection that's provided by Limerick's 21 sworn officers.

Because of Limerick Generating Station's location within our borders, the Limerick Township Police Department is the only municipal police department in Pennsylvania with the primary jurisdiction over Tier 1 critical infrastructure. This Board prides itself on the services provided directly both to the residents and the businesses of this community and the township's ability to maintain those current levels of service during these difficult economic downturns. We are thankful for the generosity of the Limerick generating plant and Exelon for being good corporate neighbors and the assistance they provide to the community. Without their financial assistance that impact to provide those services to the community would fall squarely on the backs of the taxpayers. They assist in our fire companies. They have been corporate sponsors of our Limerick Community Days. And we are confident that Limerick generating facility and Exelon will continue that support in the future and be our good corporate neighbor. We also are in support of the relicensing of the Limerick nuclear plant.

**Comment: 11-1-SR;** I'm president of the Tri-County Area Chamber of Commerce. I'm happy to be here today to provide examples of how Limerick Generating Station is a valued community and business partner and echo the statements already shared by several others. They're one of the tri-county area's largest employer, providing professional employment opportunities for local residents. Those local residents employed by Limerick Generating Station are supporting the entire tri-county business community. They're purchasing personal goods and services from local small businesses. The annual outage is a tremendous benefit to the local economy and our local businesses. Limerick encourages their outage employees to visit and purchase from tri-county area, local businesses, and small businesses.

In addition to the jobs they provide local residents, they're making a significant investment in our local communities. Municipalities and residents benefit from assistance received from Limerick to start, maintain, expand parks, recreation, and quality of life opportunities.

Their corporate culture of giving back to the community is practiced by their hundreds of employees. Nonprofit organizations are supported by Limerick Generating Station and the efforts of their employees. Financial donations, as well as volunteer hours and time are donated, enabling our local nonprofits to provide the much needed services that impact those in need throughout the tri-county area.

The Limerick Generating Station is confident in the clean and safe environment they maintain in our community. The community has been invited to experience the generating station firsthand. The chamber hosted a membership breakfast and the site vice president, Bill Maguire provided the keynote presentation. He summarized safety measures and advancements at Limerick and answered questions pertaining to the Limerick plant and its safety in the wake of the tsunami in Japan.

**Comment: 12-1-SR;** I don't believe that continued operations of the power plant would have any detrimental effect on public safety in the southeast region.

**Comment: 13-1-SR;** Today, I would like to say that in all of the years that I've lived in this area, I've never worried at all about the safety of the nuclear power plant. I see it every day. And it bothers me not in the least. I have never seen any credible evidence to suggest that there are safety problems with this plant. In terms of reliability, it is the same. It is running 24/7, 365 days a year and it has been doing so for a quarter of a century and I hope it continues to do so for many more years to come.

As far as its environmental impact, I think it's pretty widely known that nuclear power is one of the cleanest environmental energies that we possess today throughout the world and to dismiss it is I think a foolish notion.

The impact of the Limerick plant in our region has been extraordinarily positive. It provides, as we all know and have heard today, lots of jobs, lots of good jobs, tax revenues for schools, local governments and for those who live in the area to enjoy the fruits of public services and it also provides a lot of charitable donations to the community which is very important.

I think that to not keep this plant running and not consider a renewal of its license for an extended period would be a tragic mistake for all of us and I would like to end this by saying that the only meltdown that would concern me is the economic one that certainly would happen to this area should this plant not continue to operate.

**Comment: 14-1-SR;** But I'm here today as a private citizen, as a resident of the area and as a member of the Pennsylvania Energy Alliance to go on record and say I strongly favor license renewal for the Limerick Generating Station. I say that because in my personal experience I know in spite of some of the things you've probably heard here today, nuclear power is safe, reliable, secure and clean. But in addition to that, I would like to go on record, I would like my neighbors to know we are lucky to have the Limerick Generating Station in this area. In the industry, it has a top reputation. It is one of the finest nuclear power plants in America. And Exelon, if not the best, is certainly one of the finest nuclear operators in the world.

I have nothing but confidence that Exelon will work together with the NRC, will run through the process and we will come up with the right conclusion here which is license renewal should be granted to the Limerick Generating Station. I think we need to keep Limerick operating as long as we can.

**Comment: 14-2-SR;** And so from my perspective as a citizen, as a business person who worked in this community, I understand the value this is to the region. And for me, I applaud the NRC for what they're doing here. I applaud Exelon for the great work that they're doing there and I encourage the renewal process to take place.

**Comment: 17-1-SR;** And my comments tonight are more I guess from my perspective as a newly elected official with the generating station. About a year ago I had the opportunity to go down to the generating station and meet with Joe Saffron and the first part of my meeting had to do with looking for some support for the Pottstown Soapbox Derby. Through some conversation while we were standing outside you know Joe [told] me a little bit on what Exelon and the generating station do for the surrounding communities, whether it's supporting our firefighters, police departments and other civic organizations. You know, from a Pottstown perspective they help us with our yearly borough cleanup, our Salvation Army and now the Soapbox Derby. Thank you.

And we were standing outside that day, it was pretty nice out, and our conversation led to the power plant itself. We were standing there looking around it's a pretty impressive sight. So I asked him about, you know, possibly having a tour for municipal officials. He said he would look into it and see what he could do. A couple of months later he got a group of about 20 of us and gave us a tour of the plant one evening. And I have to say that from the time we walked through the front gates and past the security as our tour progressed, you know, throughout the plant safety was paramount. Whether you were having explained what the different colors are on the different panels and what they mean to different fail safes, why you walk certain areas certain ways and what lines you had to stand behind, you know, safety was paramount with them. You know, from the environment, I'm looking around and this place is spotless. And I asked why and it's because they can't afford to have dirt or lint or fuzz balls around because of static electricity because it could create issues. So from that aspect I thought it was a good tour and it made me feel good about the safety aspects there.

To finish our tour we ended up in the control room upstairs. And I'd say maybe a dozen or so individuals up there monitoring you know everything going on within the plant and around the plant. And again, explaining the failsafes and why they're double-, triple-checked to eliminate human error. It was just very impressive and as an elected official to go down and take a tour of the plant and understand how it operates. I know when I left I personally know how to issue a concern with the generating station. I know I felt a lot better and a lot safer going home that night. And it was also good to realize, you know, as one of our region's largest employers now that they are willing to give back to the community and keep safety first. So thank you, I just wanted to make those comments.

**Comment: 20-1-SR;** I'm going to be making essentially five points in support of license renewal for Limerick Generating Stations and they are that, number one, nuclear energy lowers electricity prices, it protects our environment against greenhouse gases, it strengthens our local economies and it is safe.

With regard to my first point in lowering electricity prices the Limerick Generating Station has reduced wholesale energy costs in Pennsylvania by $880 million in 2010 thus lowering electricity prices for all consumers. It operates around the clock thereby stabilizing the nation's electricity distribution system and the electricity marketplace. The average electricity production costs at nuclear plants have actually declined more than 30 percent in the past 10 years due to various efficiencies. Nuclear power is cheaper to produce than other forms of electricity generation such as coal and natural gas, and helps moderate the price of electricity for consumers.

My next point is that Limerick Generating Station and nuclear plants strengthen our local economies and it is a valuable economic driver for the Commonwealth of Pennsylvania. Limerick Generating Station contributes $113 million annually in direct economic contributions to the Pennsylvania economy through various employee wages and salaries, purchase of goods and services from other Pennsylvania businesses and in property tax payments to the local governments. Limerick Generating Station also contributes generously as we've also heard and in fact in 2010 contributed $600,000 to various community organizations. Limerick has over 800 full-time employees and employs more than 1,000 skilled temporary contract employees during annual refueling outages. A significant percentage of the current nuclear plant workforce will reach retirement age in the next 10 years creating a demand for high-paying jobs in the nuclear industry. Yes, Limerick Generating Station is one of Pennsylvania's most valuable economic and energy assets and the commonwealth should embrace it.

My third point is that nuclear energy protects our environment from greenhouse gases and reduces the need to generate electricity from fossil fuels. If Limerick Generating Station were retired from service replacing the electricity would require increased natural gas-fired or coal-fired generation. Nuclear energy is the nation’s largest source of carbon-free electricity and is critical to our nation's environmental, security and energy goals.

My next point is that nuclear energy is safe. It's always on, it’s stable, it’s a reliable source of electricity and the station here at Limerick has been built with multiple redundant safety layers.

And the workforce is committed to best practices and continuous improvement. It is also important for our nation's quest to be energy-independent. According to the Bureau of Labor Statistics it’s safer to work at a nuclear plant than in industries such as manufacturing, real estate and finance. And according to the Department of Energy a person receives more radiation exposure flying from Baltimore to Los Angeles than by standing near a nuclear plant 24 hours for a year.

On a personal note I've been inside Limerick Generating Station several times. I’ve also lived within 30 miles with my four boys and wife next to the Limerick Generating Station and also Three Mile Island. I feel safe, secure and comfortable. That is why I'm in support of the re-licensing of the Limerick Generating Station.

**Comment: 50-1-SR;** I wanted to let you know that I am complete and full supporter of the Limerick Nuclear plant. I am also supportive of the scientific [judgment] and expertise of those such as yourself who have the job of making the decisions.

**Response:** *These comments express support for nuclear power or the license renewal of LGS or both. The comments provide no new and significant information and will not be evaluated further.*

### A.1.15. Surface Water (SW)

**Comment: 1-17-SW;** Dangerous depletion of the Schuylkill River, in and by itself, a singular reason to deny this permit. The Schuylkill is a vital drinking water source for nearly two million people from Pottstown to Philadelphia. It is being depleted and contaminated every day that this plant operates.

**Comment: 1-23-SW;** They are destroying the Schuylkill River. There was enough water in the Schuylkill River to sustain this nuclear plant from the very beginning and now we’re seeing the consequences of that and they more and more pollution in it. They want to pump mine water in to supplement the flow for Limerick. It’s contaminated and they don’t filter it. And they’re actually asking for huge, four times Safe Drinking Water standard increase in total dissolved solids which carry a lot of toxic pollutants. So they put radiation into the river 24 hours a day, 365 days a year, and now they’re asking for these huge increases and people have the nerve to get up here and say that they have no environmental impacts.

**Comment: 1-32 SW;** Schuylkill River depletion and major drinking water contamination. Keep in this is vital drinking water source for nearly 2 million people from here to Philadelphia.

Comment: 4-5-SW; Our drinking and bathing water here is being continuously polluted by Limerick every day, 24/7 for years with radiation and unfiltered toxic contaminated mine water, thanks to the NRC and Exelon. This is disgusting. Most of us have to depend on the water, especially for bathing. Some of us pay extra for water filtration or drink bottled water because we are afraid to drink from the Schuylkill and because it tastes really bad now. Imagine how toxic it would be 18 plus years from now if there was even any wate left.

**Comment: 4-10-SW;** So then there’s the cost for the pollution they’re putting in the river. They're asking for increases in pollution. They want to put more mine water in. They want to increase the total dissolved salts. That's going to cost water treatment systems a lot of money to try to—for extra treatment for that. It can even break down their equipment, some of the stuff that’s coming out of the mines. And when you think about it who actually ultimately pays that cost? We do. We pay for increased costs for our water because they're having to do that at the water treatment systems. And it seems to me that if you really take a good look at things Limerick has got to be the major cause for the radiation in Philadelphia's water.

**Comment: 23-1-SW;** Mine water issue, better defining that quality and flow particularly in light of the likely pending changes in stormwater concerns and regulations in the area. Adding that flow to the Schuylkill is going to affect all the municipalities around here who have to deal with stormwater.

**Comment: 44-3-SW;** There is concern that should be faced regarding the Schuylkill River and the affects it is going to have on the public if it becomes depleted, and/or toxic due to the contaminates going in it.

**Comment: 36-2-SW;** I am more concerned about the effects of surrounding air and water supply and the future of my children and grandchildren, some of whom are already inflicted with cancer and other diseases.

**Comment: 45-9-SW;** Limerick Nuclear Plant is slowly destroying the vital public drinking water source for almost two million people from Pottstown to Philadelphia. Radioactive and heated wastewater is discharged by Limerick Nuclear Plant into the Schuylkill River 24/7. Limerick’s cooling towers are causing significant depletion. To supplement the flow to operate Limerick, Exelon wants to pump more contaminated mine water into the river. No one can credibly assure if drinking water will remain safe even until 2029 when Limerick’s original license expires.

**Comment: 54-4-SW;** Since the last impact statement was prepared in 1973, the Schuylkill River has been designated as a state scenic river and as a heritage area for both the state and federal government. Due to these designations and the efforts of non-profit organizations and local government, access to the river has been expanded so that the river has become a recreation and heritage tourism destination. Use of the river in the vicinity of the plant will continue to grow. With the return of American Shad made possible through down stream fish ladders, interest in the river could even grow further in the future.

The Limerick Plant withdraws sizeable portions of river water. During low flow periods, additional quantities of water are released into the river from the Wadesville Mine, and Still Creek Reservoir in Schuylkill County to compensate for the water withdrawn at the plant. This process was initially approved by the Delaware River Basin Commission (DRBC), in 2003 and kept active through a series of docket amendments. Future river water use is, dependent upon the ability of this water make up system to operate within various water quality and flow parameters set by DRBC. It is important to evaluate the viability of the use of the river water and water make up system to provide needed water through the expanded plant lifetime. Analysis of this aspect of plant operation needs to account for the water quality impact from the total dissolved solids in the Wadesville water among other parameters. If resumed use of the Delaware water diversion is anticipated, an evaluation of that system is required to ensure that the capacity is available in the conveyance system and that water quality objectives can be met for discharge into the East Branch of the Perkiomen Creek.

**Comment: 60-9-SW;** Dirty polluted mine water

**Response:** *These comments express concern in part over the health of the Schuylkill River, including river flow and water quality. Surface water resources at LGS, including the Schuylkill River, and the effects of plant operations on surface water hydrology and quality are presented in Sections 2.2.4 and 4.3 of the SEIS. In addition, Section 2.1.6 of the SEIS details the surface water sources relied upon by LGS and include the sources of water used to augment low flows in the Schuylkill River. Section 2.1.7 further describes the surface water and groundwater sources used to support plant operations, the volumes of water used, and the regulatory conditions and associated regulatory agencies that govern the plant's water uses. With respect to the comments regarding depletion of the Schuylkill River, the NRC's evaluation of LGS's consumptive use of surface water is presented in Section 4.3.2.1 of the SEIS. As described in Section 2.1.7.1 and 4.3.2.1, the Delaware River Basin Commission (DRBC) has imposed consumptive use limits on LGS's surface water withdrawals. During low river flows, the DRBC limits the plant's consumptive withdrawals to no more than 12 percent of river flow to be protective of aquatic life and downstream water users. Under average flow conditions, consumptive water use by LGS amounts to about 3 percent of river flow.*

*With respect to concerns about pollution attributable to operation of LGS, effluent discharges to the Schuylkill River through its discharge structure are regulated by, and subject to, water quality standards set by, the Pennsylvania Department of Environmental Protection (DEP), in conjunction with the DRBC docket issued to Exelon. More precisely, these discharges are regulated through the National Pollutant Discharge Elimination System (NPDES) permitting process as discussed in Section 2.2.4.1. Although the Schuylkill River has historically been affected by a range of activities as described in Section 2.2.4.1 and further in Section 4.11.3 (Cumulative Impacts), the main stem of the Schuylkill River in the vicinity of the LGS currently meets designated water quality standards and uses, including use as a source for public water supply.*

*As required by its operating license, Exelon Generation conducts a Radiological Environmental Monitoring Program (REMP) at LGS to assess the radiological impact, if any, to its employees, the public, and the environment around the plant site. The REMP measures the aquatic, terrestrial, and atmospheric environment for radioactivity, as well as the ambient radiation. The NRC's staff's evaluation of the radiological impacts of LGS operation and its REMP are discussed in Section 4.8 of this SEIS. As part of its evaluation, the NRC staff reviewed Exelon's annual radiological environmental operating reports for 2006–2010 to look for any significant impacts to the environment or any unusual trends in the data. A 5-year period provides a representative data set that covers a broad range of activities that occur at a nuclear power plant. Based on the review of the radiological environmental monitoring data, the staff found* *that there were no unusual and adverse trends, and there was no measurable impact to the offsite environment from LGS operations. Further, the NRC's ongoing Inspection Program periodically inspects Exelon's Radioactive Effluent Monitoring and REMP programs for compliance with the NRC's radiation protection standards in 10 CFR. The NRC's Inspection Program evaluates the data for compliance with radiation protection standards. If the data were to show a noncompliance with requirements, the NRC would take appropriate enforcement action. Additional information for LGS can be found at http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-specific-reports/lim1-2.html.*

*Comments 1-23-SW, 4-5-SW, 4-10-SW, 45-9-SW, 54-4-SW, and 60-9-SW specifically raise the issue of the diversion of water from the Wadesville Mine Pool to augment the flow of the Schuylkill River. The use of mine pool water and other diversion sources to augment surface water flows to support LGS operations are described in Sections 2.1.6 and 2.1.7 of the SEIS. These sections also summarize the background and current status surrounding the ongoing water diversion demonstration project that is regulated by the DRBC. The NRC staff's evaluation of the projected impacts on surface water resources of the continued operations of LGS during the license renewal term are presented in Section 4.3 of this SEIS. Regarding use of the Wadesville Mine Pool and other low flow augmentation sources, the DRBC, and not the NRC, is responsible for regulating such activities. Likewise, and as mentioned above, the Pennsylvania DEP through the NPDES permitting process, along with DRBC's docket approval process, are responsible for regulating effluent discharges from LGS and will ultimately decide if revised effluent limits on chemical and thermal discharges are appropriate.*

**Comment: 55-6-SW;** A note should be added regarding the diversion of Delaware River water to the East Bank of the Perkiomen. Due to the residential build-up along the Perkiomen Creek area, additional consideration should be presented and discussed with the Army Corps of Engineers and the National Weather Service regarding potential flooding impact this may have on the area.

**Comment: 35-4-SW;** Limerick Nuclear's request for re-licensing is ludicrous, considering its aging and inadequate equipment, its increased air pollution by particular matter, its horrific destruction of the Schuylkill River and dangerous above-ground spent fuel rod storage.

**Response:** *Aging management of plant systems is evaluated as part of the LRA safety review. The results of the staff's safety review of the LRA for LGS will be documented in the staff's SER.*

*Air pollutant emissions associated with LGS operations are presented in Section 2.2.2.1 of the SEIS. The NRC's evaluation of LGS's air emissions is presented in Section 4.2 of this SEIS.*

*Surface water resources at LGS, including the Schuylkill River, and the effects of plant operations on surface water hydrology and quality are presented in Sections 2.2.4 and 4.3 of the SEIS. In addition, Section 2.1.6 of the SEIS details the surface water sources relied on by LGS and include the sources of water used to augment low flows in the Schuylkill River.*

**Comment: 24-1-SW;** …I want to add that I want the NRC to look into potential water depletion issues from shale gas fracking upriver in both rivers.

**Comment: 60-21-SW;** Depleted water due to fracking up river

**Response:** *The contributions of past, present, and reasonably foreseeable future actions or activities in the Delaware River Basin, including hydraulic fracturing (fracking), have been considered in the cumulative impacts analyses of this SEIS as presented in Section 4.11 of the SEIS. With respect to surface water, these impacts are presented in Section 4.11.3. In addition, the environmental impacts of alternatives to the proposed action (i.e., whether to grant a renewed operating license to LGS) are evaluated in depth in Chapter 8 of the SEIS. This* *includes comparative analysis of a natural gas-fired combined-cycle facility as a replacement power source for LGS and considers related effects of hydraulic fracturing to supply natural gas.*

## A.2. References


10 CFR 2. *Code of Federal Regulations*, Title 10, *Energy*, Part 2, "Rules of practice for domestic licensing proceedings and issuance of orders."

10 CFR 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic licensing of production and utilization facilities."

10 CFR 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental protection regulations for domestic licensing and related regulatory functions."

10 CFR 54. *Code of Federal Regulations*, Title 10, *Energy*, Part 54, "Requirements for renewal of operating licenses for nuclear power plants."

[Exelon] Exelon Generation Company, LLC. 2011. *License Renewal Application, Limerick Generating Station, Units 1 and 2, Appendix E, Applicant's Environmental Report, Operating License Renewal Stage.* Agencywide Documents Access and Management System (ADAMS) Accession No. ML11179A104.

National Environmental Policy Act of 1969. 42 U.S.C. 4321, et seq.

[NRC] U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG-1437, Volumes 1 and 2, Washington, DC, ADAMS Accession Nos. ML040690705 and ML040690738.

[NRC] U.S. Nuclear Regulatory Commission. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report,* "Section 6.3 – Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report," NUREG-1437, Volume 1, Addendum 1, Washington, DC, ADAMS Accession No. ML040690720.

[NRC] U.S. Nuclear Regulatory Commission. 2011a. Official Transcript of Proceeding, "Limerick Generating Station License Renewal Public Meeting: Afternoon Session." Adams Accession No ML11287A207

[NRC] U.S. Nuclear Regulatory Commission. 2011b. Official Transcript of Proceeding, "Limerick Generating Station License Renewal Public Meeting: Afternoon Session." Adams Accession No ML11287A211

## Comment Letters and Meeting Transcripts

The following pages contain the comments, identified by commenter designation and comment number, from letters and public scoping meeting transcripts.

unthinkable proportions. Whether a natural disaster or terrorist attack occurs, by relicensing Limerick, NRC would in effect be placing Russian roulette with the lives of more than eight million people. NRC must close Limerick Nuclear Plant by 2029. 1-1-PA

There is no way for either NRC or Exelon to ensure the safety of the environment or the residents impacted by this plant. It cannot be made fail safe. 1-2-OS No other facility has the potential to render the entire region uninhabitable, possibly for centuries as the result of an accident or terrorist attack. This is the highest-risk facility that could exist in any community in this country. 1-3-OS

Current 40-year operating licenses expire in 2024 and 2029. Why the rush to renew these licenses now? 1-4-LR

We urge the NRC to say no to Exelon's requested license renewals. 1-5-OR The public was led to believe that Limerick's generators, fuel pools, and miles of underground pipes and cables could operate safely for 40 years and then the facility would close. 1-6-LR Is Exelon fearful that the longer they wait the more serious problems may arise?

After only 26 of 40 years, numerous signs of aging and risk have been identified. Corrosion, 1-7-OS deterioration, fatigue, cracking, thinning with loss of material, loss of fracture toughness are all documented in Exelon's own renewal application in the aging management section. Instances of equipment fatigue and cracking of vital equipment include the reactor vessel and coolant system. 1-7-OS Cont'd

Aging equipment, after only 26 years suggests that NRC should not just close the plant by 2029, but also ramp up their oversight vigilance during the remaining 18 years of the current license. 1-8-OS

In the past few years, Limerick has had numerous unplanned shutdowns suggesting there are already significant problems. Three occurred in one week in June 2011. Loss of coolant leaks and accidents at Limerick have already been documented. Serious radioactive contamination could go undetected and unreported for years from the corroding infrastructure, much of it underground. 1-9-OS

There have already been two near misses at Limerick from 1996 to 2001.

This aging plant is an accident waiting to happen. Large volumes, more than 6,000 assemblies weighing more than a thousand tons of highly radioactive waste in the form of spent fuel rods are stored in densely-packed pools, elevated five stories 1-10-RW above and outside the reinforced containment structure. This plant will produce about two more tons of dangerous spent fuel rods every year that it operates. Limerick, in addition, is now third on the earthquake risk list for nuclear plants in the United States.

1-10-RW Cont'd

1-11-RW

1-12-OS

With loss of cooling water, Limerick's fuel rods could heat up, self ignite, and burn in an unstoppable fire with catastrophic results. Exelon has not been required to spend the money to guard Limerick against terrorists, missiles, or air strikes despite repeated requests to do so.

1-13-PA

Dry cask storage and transport are also very dangerous alternatives. It's time to close Limerick and stop producing such deadly waste for which there is no safe solution. As long as Limerick operates harms to us and our environment will increase.

1-14-RW

Their harmful environmental impacts are unprecedented. At the conclusion of our 11-year investigation of routine radiation releases and review of permits for major air pollution and a variety of dangerous water contamination issues, it's clear that this energy is not just dirty, it is in fact filthy. Evidence that we've compiled has addressed a wide range of topics: routine radiation releases into the air, radioactive wastewater discharges into the Schuylkill River, radioactive groundwater contamination, radioactive nuclides associated with the plant detected in our soil, our sediment, our vegetation, our fish, our water, and milk.

Research has confirmed radiation in our children's baby teeth in this community. Major air pollution issues under health-based standards of the Clean Air Act, 32 individual sources listed. Drastic, harmful increases permitted in particulate matter known also as PM-10 from the cooling towers, other air pollution increases also permitted.

1-15-HH

1-16-AM

Dangerous depletion of the Schuylkill River, in and by itself, a singular reason to deny this permit. The Schuylkill is a vital drinking water source for nearly two million people from Pottstown to Philadelphia. It is being depleted and contaminated every day that this plant operates.

1-17-SW

Alarming cancer increases that have been well documented in this community repeatedly far higher than national and state averages after Limerick started operating until the late 1990s. The findings of our investigation lead us to conclude that this plant is in common language a recipe for

1-18-HH

disaster.

While NRC is required to prepare a supplement to the Limerick Environmental Impact Statement for license renewal, we have little confidence in the process based on NRC's regulatory history. It would be difficult to enumerate a short list, so I'm going to rely on written documents. 1-19-LR

There are critics of the NRC out there who have done a much better job than we have of generating such a list, most notably a scathing indictment by the Associated Press. I'm not going to re-enumerate that information.

It's long past time for the NRC to summon the courage to do the right thing in our judgment and actually protect the environment and the public, rather than the industry. 1-20-OR

Today, I am going to be submitting on the record summary packets of our research on Limerick's major air pollution, harms to the Schuylkill River, radioactive groundwater contamination, links between Limerick's radiation and our elevated cancers in this community and how Limerick's nuclear power can, in fact, be replaced with safer sources today.

Based on the compelling body of evidence of environmental harms to date and the enormous 1-21-OR increased population in proximity to this facility, Limerick Nuclear Plant must be closed by 2029.

1-21-OR Cont'd

There is no amount of energy production that is worth risking the lives of so many people. Thank you very much.

(Applause.)

FACILITATOR BARKLEY: Thank you, sir.

MR. MAGUIRE: Good afternoon. My name is Bill Maguire and I am the site vice president at Limerick Generating Station. And I have overall responsibility for the safe and reliable operation of the facility.

I have been working in the nuclear power industry for 25 years and my career began at the Limerick Generating Station as an engineer. I continued with a license to be a licensed senior reactor operator supervisor in the operations organization and was the on-shift senior manager of that facility for many years.

I have also worked at a few other nuclear stations across the country and before rejoining Limerick as the site vice president in May of 2010, I was the site vice president at the Peach Bottom Atomic Power Station in southeastern Pennsylvania in York County.

Operating Limerick Generating Station safely and reliably is a responsibility that everyone at the power station takes very seriously. We understand our obligation to the community, to the environment, and to each other to operate the plant safely.

A key component of a thriving community like ours is the availability of safe, clean, and reliable electricity. And as we look into the future for the power needs of Pennsylvania and the United States as a whole, we can see the increasing demand for this very important resource.

2-1-SR

At the same time, there's a growing concern about greenhouse gases and climate change that is a result of burning fossil fuels. To help meet that growing power demand and to help keep our environment clean, Exelon has applied to the U.S. Nuclear Regulatory Commission for a 20-year extension to the plant's operating license. Limerick's current license for Unit 1 will expire in 2024 and Unit 2 in 2029. With license renewal, Limerick can provide our region with clean power through 2049.

We understand our special obligation to operate the plant safely and reliably and to maintain a close relationship with our neighbors. We pledge to continue that special trust as we operate the plant well into the future. 2-1-SR Cont'd

The 104 nuclear reactors in the United States provide roughly 20 percent of our nation's electricity. More than 70 reactors nationwide have already received approval from the Nuclear Regulatory Commission for a 20-year license extension including the Peach Bottom Atomic Power Station in York County.

Limerick Generating Station operates in a manner that preserves the environment. The plant produces almost no greenhouse gases. The plant conducts approximately 1700 tests annually on air, water, fish, soil, cow's milk, and other food products to measure for environmental impact. We also maintain a chain of radiation monitors surrounding the plant.

In 2005, the environmental management systems at Limerick Generating Station achieved certification under the strict criterion of the International Organization for Standardization, ISO. This certification is known as ISO 14001, a common industry reference for the environmental certification. The ISO 14001 certification requires a commitment to excellence to prevent pollution and to ensure continuous improvement in environmental areas.

In 2010, the Wildlife Habitat Council

recognized Limerick Generating Station's commitment to environmental stewardship by awarding us the Wildlife at Work Certification. This distinction was awarded to Limerick Generating Station for our commitment towards establishing long-term wildlife habitat enhancements that provided undisturbed habitats with food, water, cover, and space for animal species living on the plant station's landscape.

To ensure Limerick continues to operate safely for years to come, Exelon is investing in upgrades to plant equipment. Since 2010, Exelon has invested more than $200 million into the plant including installation of new safety equipment, new electrical cables, new valves, and refurbishing the cooling towers. In addition, Limerick has made more than $40 million in physical security upgrades since 2001.

Our investment in the future does not stop with equipment. We have hired and trained over 100 new employees over the last three years, mostly coming from our native region here. We maintain a steady workforce of approximately 850 people and during our annual maintenance and refueling outages, we bring in between 1500 and 2000 temporary workers that provide a boost to our local economy. Hiring and retaining top talent is a key priority for Limerick Generating Station.

Over the past 25 years, Limerick has been one of the best performing and most reliable generating stations in the nuclear power industry. During that time, the plant has set several records for continuous days of operation and has been recognized by the industry for our reliable operation. In March 2010, Limerick completed a successful run of 727 continuous days for our Unit 1 plant. This represented the second longest continuous run for a boiling water reactor in the United States.

While we do not set out to break records, continuous operations are on indicator of the excellent human performance and equipment reliability that Limerick strikes for every day.

We also take pride in our investments in the community. In 2010, Limerick donated more than $600,000 to the community in contributions to the United Way, fire and ambulance companies, educational health and youth organizations. And many of our employees serve as volunteers in the local communities around the plant.

In conclusion, Limerick Generating Station looks forward to working with the Nuclear Regulatory

Commission as you review our license renewal. I appreciate the opportunity to speak with you this afternoon. Thank you.

FACILITATOR BARKLEY: Thanks, Bill.

(Applause.)

FACILITATOR BARKLEY: Representative Quigley.

REP. QUIGLEY: Good afternoon, my name is State Representative Tom Quigley. I represent the 146th District here of which lower Pottsville is a party of that district, so I want to welcome the NRC here today to the beautiful Sunnybrook Ballroom for this meeting and thank them for coming out to listen to the public and take commentary.

I'm here today to voice my strong support for the relicensing of the Limerick Generating Station. I wanted to touch on a couple points of why I feel it is important for this facility to be relicensed.

3-1-SR

First is the amount of electricity that is produced by this facility. One of the things that myself and my colleagues in Harrisburg hear consistently from businesses and the Commonwealth and our citizens is the demand for energy and electricity now and more importantly what that demand is going to be in the future.

Right now this facility generates enough electricity for two millions homes and without producing some of the greenhouse gases that we hear so much about that could be produced by coal, natural gas, or oil. And I'm going to put a caveat in there for my good friends out in the western part of the state where coal is a big part of the Pennsylvania economy and I'm suggesting that this be done to the exclusion of coal and nevertheless, some of the technologies that they're developing out there are also important for that industry and important for the Commonwealth of Pennsylvania.

3-1-SR Cont'd

Again, one of the concerns we hear consistently from businesses is how can we come here into Pennsylvania with the infrastructure being what it is which needs to be improved for the transmission of the electricity, but more importantly the generation of that electricity?

Number two, I think is important is the jobs and overall economy. Again, in these tough economic times that we're facing here in the Commonwealth of Pennsylvania and also in this nation, one of the top issues that we hear consistently about is jobs.

And as was mentioned by the site vice president, over 860 people are employed here with an annual payroll of $75 million. The direct impact that is to the Commonwealth of Pennsylvania, of course, is realized through the state income tax and also all of these local municipalities most of them enact an earned income tax which again sustains their townships as well as their respective school districts. To have that taken away I think would have an even more dramatic impact on our local economy.

3-1-SR
Cont'd

As was mentioned the impact for the local area here, the temporary workers who show up here during the outages and the refueling, there's already been two hotels that have sprung up along the 422 corridor with another one planned right up here at the Sanatoga area. Again, more jobs and more economic growth here for our communities.

Thirdly, I want to talk about the communication that I've experienced in the seven years that I've been in office with Exelon and with their Government Affairs people as well as with their site people. I've been on the site three times, twice for a tour and one to make a presentation during an anniversary of the facility. And I have to say that it is a very secure area. I know a lot of people are concerned about terrorism attacks or people being on the property. But unless you've actually gone over there and gone through a tour, seeing how things are set up, seeing the armed guards there, seeing the security measures that are in place, I think you come away much more relieved with that. And I'm able to speak to my constituents more affirmatively about the safety and security of the facility. 3-1-SR Cont'd

Any time that there's been the slightest occurrence there, whether it will be a couple times a hunter has wandered onto the property where the authorities were called, the Government Affairs people at Exelon are on the phone to me or with an email right away to let me know what's happening before the word gets out to the media or to the press. So they're always very well prepared in their explanations, not only of things that happen at the plant itself, but also incidents and issues that occur around the country and around the world.

Obviously, what took place in Japan with the incident over there, they were on the phone with me and met with me a few times to explain what took place over there and how the safeguards are being put in place here so that doesn't happen at this facility.

It was mentioned earlier the dry cask

storage where the spent fuel rods are now stored outside in a dry cask storage facility. When that was proposed back in 2005-2006, the Generating Station held two open houses that were very well attended. I went to both of them where they had people on there to explain to the people what exactly was taking place with this dry cask storage, why it was necessary. A lot of questions and answers back and forth and I think a lot of the people came away better informed about that process.

Just recently at an open house, the site VP who just spoke, Bill Maguire, came out to give some initial comments and wound up spending the full hour in an impromptu question and answer session and not again just planted questions, a lot of tough questions. And I think again the people came away feeling confident in the openness and the transparency that was displayed in that question and answer session.

Another point of that is for relicensing for the overall environment here is the good corporate citizenship that the Generating Station has exhibited. As was mentioned by Bill, some of the charitable contributions that have gone on, not only for the host community of Limerick, but also for the surrounding areas. I attended a few dedication services where they provided money to the Upper Providence Elementary School and the Limerick Elementary School for an outside environmental classroom.

One of the things we talk about as political leaders, and I'm on the House Education Committee, is the need for our children to be educated particularly in the sciences and given these budget constraints that we're operating under, both the school districts and the Commonwealth, it's good to see a corporate citizen stepping up to the plate and providing that financial support, particularly in the area of science. They've also partnered with the Montgomery County Community College to provide assistance in support for an associate degree in nuclear engineering technology.

Again, we hear so much about our students here not being well versed in technology and engineering and things of that nature. So again, stepping up to the plate to provide that assistance when, in fact, perhaps in these tough budget times where the government might not be able to do that.

Last, I want to talk about overall public opinion and safety issues. One of the things that I looked at when I talk about safety and the feeling of comfort that people have here is how many of the people who work at that plant live within the ten-mile radius of the facility? And I asked that question when I first was elected in 2004 and I just asked it again in preparation for this hearing and 563 employees live within the ten-mile radius.

The population growth in my District in the past ten years, we're getting ready to redraw our lines based on the 2010 Census, so I broke it down by township as to how much the population has increased in those areas: Limerick Township, increasing by 33.5 percent; Upper Pottsgrove by 29.5; Royersford Borough, where I live, 11.9; Lower Pottsgrove, 7; Pottstown, 2; now this is a little bit skewed, but I have a small piece of New Hanover Township which actually increased by 54 percent.

When you look at the public opinion, and again, we get calls on a lot of different issues and as I mentioned that dry cask storage issue. Back then, at the same time that that issue was being rolled out to the public, Boyd Gaming had purchased a property next to our plant was getting ready to apply -- had applied for a license, casino license. At that time, my office had received 2 calls in regard to the dry cask storage project, over 200 calls regarding the casino application. So at the time, it appeared people were more concerned about the prospect of a casino being in their neighborhood than they were a dry cask storage facility.

And lastly, as some of you heard, there is a proposal right now to put a hold on Route 422. And again, in the past six months with the incidents in Japan, with the current earthquake we had here, with the AP story telling you how these plants are all falling apart, I received two calls regarding that one where they could get the KI pills, one where they could -- what was the evacuation plan for that, and more calls and emails regarding the proposed 422. So again, it appears that the constituents and the 146th, they're more concerned about the prospect of paying a toll to ride of 422 than they are about the nuclear power plant issues.

So again, I strongly support the relicensing of this for the reasons I mentioned. Thank you.

(Applause.)

FACILITATOR BARKLEY: Thank you, Representative Quigley.

The next three people I'd like to call, first is Lorraine Ruppe, private citizen; and the next, Michael Gallagher of Exelon; and finally, I'd like to call Dr. Fred Winter after that.

MS. RUPPE: Hi, my name is Lorraine Ruppe. I am speaking here today to represent the children and future generations, especially in our community. Residents are fearful about the possibility of disasters here in light of Fukushima in March 2011 and since the earthquake and Hurricane Irene in August 2011 affecting our area. Climate changes, etcetera, are causing disasters everywhere and continuing to get worse.

Increasing floods, droughts, earthquakes, tornados have made us all feel insecure, making nuclear power increasingly risky, especially with the Limerick plant basically in our backyards. Any earthquake that comes through this area could be a possible Fukushima, Chernobyl or Three Mile Island

4-1-PA

which reminds me, four months have passed since the NRC failed to get back to me when I asked how close the Remapo fault line is to the Limerick nuclear reactors? Maybe I can get an answer today.

4-2-GE

Indian Point nuke plant was sketched as a possible terrorist target in reference to 9/11 attacks. A suspected terrorist worked at Limerick for years without the industry knowing it. How scary is

4-3-OS

that?

4-4-OS

The Pacific Ocean is now severely irradiated by Fukushima. Radiation impacts of Fukushima equalled over 20 Hiroshima bombs when I last researched. Our drinking and bathing water here is being continuously polluted by Limerick every day, 24/7 for years with radiation and unfiltered toxic contaminated mine water, thanks to the NRC and Exelon. This is disgusting.

4-5-SW

Most of us have to depend on the water, especially for bathing. Some of us pay extra for water filtration or drink bottled water because we are afraid to drink from the Schuylkill and because it tastes really bad now. Imagine how toxic it would be 18 plus years from now if there was even any water left.

4-6-HH

There has been increased particulate matter in the air and other toxics from Limerick causing increased asthma, heart attacks, and strokes. And to add insult to injury, Limerick was granted a permit to allow an eight-fold increase in air pollution since 2009. Cancer rates in our area have skyrocketed since Limerick has been up and running in the '80s and rates have steadily increased.

4-7-HH

The Toothfairy Project showed high levels of strontium 90, a radionuclide in baby teeth of children nearest to nuke plants. Baby teeth near Limerick plant had the highest levels in the whole United States. This stuff and God knows what else is in our bodies now thanks to a Nuclear Regulatory Commission that to put it nicely is less than enthusiastic about protecting us.

4-7-HH Cont'd

Solar wind, geothermal, ocean thermal, energy conservation and efficiency are now cheaper than nuclear power, along with being truly clean and safe. The Department of Energy 2006 report stated solar alone could provide 55 times our entire nation's energy needs which leads me to a point, there have been numerous studies proving the many dangerous and deadly consequences of nuclear power. There's no denying the massive devastation it has already caused and will continue to cause indefinitely, but the industry still goes on in their trance-like, indifferent fashion as if everything is safe and wonderful and will continue to be 18 plus years from now or until 2049 for our community. This is what really scares us the most.

4-8-AL

The NRC has turned into a culture of secrecy, hiding the dangers and sweeping the problems under the rug. The industry's addiction to money and power has blinded them to moral life and death issues and facts set right in front of their faces. But my big question of the day is why is Exelon applying for an extension 18 years ahead of time? Thank you. 4-9-LR

(Applause.)

FACILITATOR BARKLEY: Thank you, Lorraine. Mike?

MR. GALLAGHER: Good afternoon. My name is Mike Gallagher and I'm the Vice President of License Renewal for Exelon. I have overall responsibility for the Limerick Generating Station license renewal application.

Exelon has a great deal of experience with license renewal, as we have already obtained the renewed licenses for our Peach Bottom and our TMI plants in Pennsylvania, our Oyster Creek plant in New Jersey, and our Dresden and Quad Cities plants in Illinois.

Just briefly about myself. I've been working in the nuclear power industry for 30 years. I was a licensed senior operator and plant manager at Limerick and I worked at two other nuclear plants and our corporate offices.

Mr. Maguire, the site vice president for Limerick spoke about reasons for renewing the license for Limerick. I'd like to speak briefly about the process for preparing this license renewal application and the amount of work and engineering analysis that was put into preparing the application.

Because the license Generating Station can be operated safely and reliably, Exelon decided to pursue license renewal for Limerick. Limerick is a very clean energy source which produces no greenhouse gas emissions. Limerick is also good for the economy in that it lowers market prices on electricity for the citizens of Pennsylvania to the tune of $880 million per year. 5-1-SR

So in 2009, we announced our intention to seek license renewal for Limerick. Later that year, we started the work necessary to prepare the application. After over two years of work, we submitted the application to the Nuclear Regulatory Commission on June 22, 2011. The application, as Lisa had mentioned, when you print it out it's about 2100 pages. And when you put it in the binders it's three large binders. It's a huge amount of information. But that only represents a small part of the work that was done for the engineering analysis to prepare this application.

The total amount of engineering analysis, if we printed it all out would be about 290 binders of information. We invested over 60,000 manhours of engineering work. Once we completed our engineering work to prepare the application, we brought in experts from outside Exelon to review the application to ensure that it was complete, thorough and accurate. Our total cost to prepare the application and get this application reviewed by the NRC will be about $30 million.

There are two different parts of our application, the safety review and the environmental review. For the safety review, we took an in-depth look at the history and the condition of the safety equipment in the plant. We did that to determine whether the necessary maintenance was being performed on that equipment and to make sure that the equipment will be able to operate when it's needed, not only for today, but also for an additional 20 years of operation. 5-2-OS

When you look back at Limerick, when it was built, all the equipment was new. It was thoroughly tested to make sure it would perform properly, but like anything else equipment does age. That doesn't mean it won't work, but it does age and certain activities need to be done to the equipment.

So we perform preventive maintenance. Sometimes we refurbish the equipment. Some equipment is replaced. There may be modifications done to upgrade the equipment in the plant and in fact, as Bill Maguire has stated, Limerick had spent over $200 million in the last couple years alone to improve and modernize the equipment and enhance plant operations and safety.

We also then reviewed calculations that were performed as part of the original design of the plant that were done to ensure that the plant could operate safely for 40 years. We analyzed those calculations and were able to confirm that the plant would be able to operate safely for 60 years. Overall, our conclusion from our engineering review was that Limerick could operate safely for up to 60 years.

5-2-OS Cont'd

We also took a look at the environmental impacts of continuing to operate Limerick. We looked at all the impacts of continued impact of the plant on the environment. Our conclusion is that impacts on the environment are small and I use the term small in the sense that is in the regulation. The regulation defines small as environmental effects are not detectable or are minor.

We also reviewed the alternatives if

5-3-AL

Limerick would not have its license renewed and another source of electric generation would need to be installed either here on site or someplace else to generate the replacement electricity. We concluded that any other means of generating the replacement electricity would have more of an impact on the environment than continued operation of Limerick. For instance, if Limerick could be replaced by a wind generation facility, the wind form would have to occupy between 10 and 40 percent of all the land in the state of Delaware and that would have a huge impact on the land. If a solar facility could replace Limerick, it would need to cover 32 to 50 percent of the entire land area of Montgomery County.

5-3-AL Cont'd

In conclusion, we operate Limerick safely and we can continue to operate it safely for an additional 20 years. Limerick will provide approximately 2340 megawatts of base-load generation that's not only safe, but it's clean, reliable and economical.

5-4-SR

Continued operation of Limerick will benefit this community, the Commonwealth of Pennsylvania and our nation. Thanks for giving me the time for this. Thank you.

(Applause.)

FACILITATOR BARKLEY: Thank you, Mike. Dr. Winter?

DR. WINTER: Good afternoon. Thanks for letting me speak. We have heard a lot of pros and cons, haven't we? And it's hard to make a decision that's for sure. But let me get going here.

As a physician practicing radiology for over 50 years, I still have strong concern about cancer sensitivities from harmful radiation exposures, naturally. My medical colleagues share the same concerns because we have seen our cancer rates increase since the Limerick power plant started, especially thyroid cancer. It jumped to 78 percent higher here than the national average. And some of the people I talked to, this is because people are aging more now, getting older, so there are more cancers. But that's not true because in other areas similar to our area in Pottstown, they're not nearly getting the thyroid cancers that we are. This has been well established by the state. 6-1-HH

You wonder why some of our medical and cancer fundraisers haven't reacted with more responsibility in order to stop this. They're making a lot of money, but not taking much effort to prevent environmental damage.

Yes, we are creating our own form of terrorism. Now that sounds kind of funny, doesn't it? But allowing any harmful environmental events to occur, we are allowing our own form of terrorism, just like foreign people would come in here.

Having attended a Hiroshima, Japan atom bomb clinic right after World War II, naturally I had a chance to see the worst results of harmful radiation. All those little kids I saw who only lived for a few days, it left me with a very sad memory. Of course, what is happening here will be taking much longer, but it sure is not good. 6-2-HH

I don't know whether you've heard that some scientists are already predicting that -- I'm sorry to tell you this, but nuclear energy has the capacity of destroying mankind. It may take about 100 years, but our whole world is exposed to the harmful effects, maybe not so much here in the United States, but the whole world can be affected.

Of course, what is happening here will be taking much longer, but it is sure not good news. Besides harmful power plant exposures, we have environmental disasters and a concern about our nearby earthquake fault and others in the eastern U.S., especially one near New York City. And then there are 6-3-PA

6-4-OS

the radioactive spent fuel deadly waste material sitting around, supposedly protected. We can't control the use of nuclear power in the rest of the world, but can keep America safer and cleaner here.

6-5-OR

So please, ask your politicians, reliable politicians to close the Limerick power plant. Let's save America for our kids and descendants. I hope you will take my concerns seriously. And thank you for listening.

(Applause.)

FACILITATOR BARKLEY: Okay, thank you, Dr. Winter. The next three people I'd like to call is Tom Neafcy of Limerick Township, followed by Dr. Anita Baly, and then Tim Fenchel of the Schuylkill River Heritage Foundation.

MR. NEAFCY: Good afternoon, thank you. My name is Tom Neafcy. I'm the Chairman of Limerick Township Board of Supervisors and I want to thank you for this opportunity to speak at this forum today.

7-1-SR

As the largest private employer in the region, the Board is thankful for the 860 jobs that Exelon provides, the positive impact of their operation, the vitality of our local community. The community and local economy are enhanced by the needed services provided by the township, which includes the roadway network maintained by our Limerick Township Public Works, public safety provided by the Limerick and Linfield Fire Companies, and our local emergency medical response, our public parks, our recreation facilities and also the police protection that's provided by Limerick's 21 sworn officers.

Because of Limerick Generating Station's location within our borders,the Limerick Township Police Department is the only municipal police department in Pennsylvania with the primary jurisdiction over Tier 1 critical infrastructure. 7-1-SR Cont'sd
This Board prides itself on the services provided directly both to the residents and the businesses of this community and the township's ability to maintain those current levels of service during these difficult economic downturns. We are thankful for the generosity of the Limerick generating plant and Exelon for being good corporate neighbors and the assistance they provide to the community. Without their financial assistance that impact to provide those services to the community would fall squarely on the backs of the taxpayers. They assist in our fire companies. They have been corporate sponsors of our Limerick Community Days. And we are confident that Limerick generating facility and Exelon will continue

that support in the future and be our good corporate neighbor.

7-1-SR Cont'd

We also are in support of the relicensing of the Limerick nuclear plant. Thank you.

(Applause.)

FACILITATOR BARKLEY: Dr. Baly?

DR. BALY: Good afternoon. I'm Anita Baly. I'm a retired Lutheran pastor and my concern today is with the speed at which this application process is going. I mean it seems to me that to predict what environmental factors will be in place 13 years hence and 18 years hence, posits a kind of omniscience and prescience that we should attribute to Almighty God, but certainly not to any of us human beings.

8-1-LR

I would favor a slower process. As we look around, we see that the population in this area is getting denser all the time. The roads are not being improved. And that leaves me with concerns about how we would effect an evacuation were one needed. I suspect strongly that we couldn't perform a good evacuation today. And I also suspect that the population will be increasing and the roads deteriorating. In fact, just this morning in the Pottstown Mercury, they were reporting on the hearing

8-2-OS

that was held on Route 422 which is our main road around here. And Barry Seymour is quoted, he's the Executive Director of the Delaware River Valley Regional Planning Commission, and he told last week's forum audience that population projections anticipate a 50 percent increase in the region and if we don't increase capacity on 422, we will have virtual gridlock all the way to the Berks County line.

8-2-OS Cont'd

Maybe we'll improve that situation, but it's way too early to know if that will happen. And so my plea and my concern is can we slow this down so that we know, in fact, what the environmental impacts are going to be closer to a time that the decision is made. Thank you.

(Applause.)

FACILITATOR BARKLEY: Thank you. Tim?

MR. FENCHEL: Good afternoon. My name is Tim Fenchel and I'm on the staff of the Schuylkill River National and State Heritage Area. We are one of 49 congressionally-designated Heritage Areas in the country and our mission is to use recreation, conservation, education, cultural and historic preservation and tourism as tools for community revitalization and economic development with the Schuylkill River Valley.

The Heritage Area has had the opportunity for almost seven years now to partner with Exelon Nuclear and the Limerick Generating Station on several local and regional projects and programs. These programs have proven to have a positive impact on our local communities, residents, and natural resources. And I would like to take a few moments to highlight those now.

In 2005, Exelon Nuclear approached us about the possibility of partnering together on a grant program that would work to restore our area's critical natural resource, the Schuylkill River. The river has been detrimentally impacted by hundreds of years of abuse and neglect, primarily as a result of our nation's history related to the Industrial Revolution. But even more recently, due to deforestation, farming practices, and continued open space development.

Beginning in 2006, after the creation of grant program guidelines, an advisory committee and a necessary accounting and reporting structures, Exelon began making annual contributions to the Schuylkill River Restoration Fund. The Schuylkill River Heritage Area acts as the administrator and the manager of this grant program, redistributing Exelon's contributions to local and regional watershed groups, conservation organizations, and local government agencies for projects addressing the quality and quantity of Schuylkill River water. Projects focusing on agricultural remediation, abandoned mine drainage, and stormwater runoff are supported through this program.

To date, Exelon has contributed over $1.2 million to the restoration fund for watershed-wide projects. Twenty-two grants have been awarded and 11 projects have been completed. These projects have made an impact on the water quality and quantity of the Schuylkill River which is a source of drinking water for over 1.75 million people in southeastern Pennsylvania.

Exelon's establishment and contribution to the restoration fund has been a model program and is now a uniquely valued public/private partnership as several new partners have joined efforts and made their own contributions to the fund. Both the Philadelphia Water Department and the Partnership for the Delaware Estuary have brought funding to the program and supported regional watershed projects. The contributions made by Exelon have been the catalyst to leverage additional funds well over $600,000 for area restoration.

The goal of the Restoration Fund Advisory Committee is to be able to support a sustainable level of half a million dollars annually for the fund and in turn, conservation projects that will continue to ensure the future health of the Schuylkill River.

In addition to our work on the restoration fund, we have assisted Exelon Nuclear, East Coventry Township, and Chester County in a planning effort to begin the process of restoration and preservation of the historic Fricks Locks Village. Earlier this year, Exelon Nuclear, the current owners of the village, signed an agreement with East Coventry Township to stabilize, rehabilitate, and protect several of Chester County's oldest buildings. Exelon has agreed to spend $2.5 million to restore the exterior of several buildings as stabilized ruins. A fence will be built around the grounds and the corporation is donating four houses to the township worth an estimated $1 million.

In addition, the corporation has agreed to continue to do routine maintenance on the village and work with the local historical society to host guided, historic and educational tours for the public.

From our perspective, much of the success of this partnership can be assigned to the hard work, dedication and personal commitment of Exelon staff and management. Based on the very positive community programs and involvement we have experienced and 9-1-SR witnessed first hand as a regional organization, we would like to communicate our support for the relicensing and continued operation of Limerick Generating Station. Thank you.

(Applause.)

FACILITATOR BARKLEY: Okay, thank you. The next three people I would like to call, Bill Vogel, followed by Eileen Dautrich, is that how you say that?

MS. DAUTRICH: Dautrich.

FACILITATOR BARKLEY: Dautrich. Okay. And then Bill Albany.

MR. VOGEL: Hi, my name is Bill Vogel. I live in Phoenixville. Units 1 and 2 had an initial life expectancy of 40 years. They are now asking to increase that 20 years, a full one third increase. Everything has a life expectancy, machinery, as well as people. Demographically, my life expectancy is 74. 10-1-LR If I was to get a one third extension, like the Limerick plant wants, that would take me to 111. What do you think is going to happen to me between age 74, my life span, my nameplate capacity, and the year when

I reach 111? It's going to go down hill. That's lifecycle. Machinery has them. You don't need an engineer to tell you that. Just like human beings have them. We become less effective, less efficient, less competent.

The significant difference is my failure will be containable. Limerick's most likely will not. If I drive over you with my car because I no longer see as well or have the reflexes I once had, that's a tragedy for you, your family, for me and my family. The sphere of the tragedy is containable. If Limerick Unit 1 or 2 fails, all hell breaks loose, no disrespect. That's what a nuclear failure is, hell. It affects everybody in this room, everybody in the community, everybody in the tri-state area, not for a week, but for decades. It's very, very last thing we want to happen.

10-1-LR Cont'd

And I think we're putting ourselves in harm's way by taking something that had a lifespan of 40 years and adding another 20 to it. It doesn't make sense. The only way to rationalize it is through our personal fear of being inconvenienced because we lose a very, very good source of power. It's done a great job for us. But like me, you get to a point where your ability to provide a great job is at an end and

10-2-OR

things start deteriorating. Let's not put ourselves in that position. Let's make an intelligent decision now and allow these two units to expire at their nameplate time. Thank you.

10-2-OR Cont'd

(Applause.)

FACILITATOR BARKLEY: Thank you, Bill. Eileen.

MS. DAUTRICH: Good afternoon. My name is Eileen Dautrich. I'm president of the Tri-County Area Chamber of Commerce. I'm happy to be here today to provide examples of how Limerick Generating Station is a valued community and business partner and echo the statements already shared by several others.

11-1-SR

They're one of the tri-county area's largest employer, providing professional employment opportunities for local residents. Those local residents employed by Limerick Generating Station are supporting the entire tri-county business community. They're purchasing personal goods and services from local small businesses. The annual outage is a tremendous benefit to the local economy and our local businesses. Limerick encourages their outage employees to visit and purchase from tri-county area, local businesses, and small businesses.

In addition to the jobs they provide local residents, they're making a significant investment in our local communities. Municipalities and residents benefit from assistance received from Limerick to start, maintain, expand parks, recreation, and quality of life opportunities.

11-1-SR Cont'd

Their corporate culture of giving back to the community is practiced by their hundreds of employees. Nonprofit organizations are supported by Limerick Generating Station and the efforts of their employees. Financial donations, as well as volunteer hours and time are donated, enabling our local nonprofits to provide the much needed services that impact those in need throughout the tri-county area.

The Limerick Generating Station is confident in the clean and safe environment they maintain in our community. The community has been invited to experience the generating station firsthand. The chamber hosted a membership breakfast and the site vice president, Bill Maguire provided the keynote presentation. He summarized safety measures and advancements at Limerick and answered questions pertaining to the Limerick plant and its safety in the wake of the tsunami in Japan.

In addition, after our breakfast, Chamber members were encouraged to attend the informational see policies and procedures that people talk about and they're put up on a shelf and they're followed at best haphazardly with a wink and a nod and deviation from the policy is not addressed.

One of the things that I'm continuously impressed at LGS when I visit is their sound adherence to policy and procedure. They don't deviate from it. I've been to numerous drills at the plant, numerous exercises at the plant, some of which were run by the NRC and I've never seen them fail. They always come out on top. In fact, in 2009, Limerick was selected as a site for the first comprehensive pilot exercise involving federal, state, and local law enforcement SWAT teams to actually go into the power block and conduct tactical operations in there, and that drill was used as a boiler plate to develop policies and procedures for implementation in power plants throughout the country.

One of the -- I'm sorry, I don't believe that continued operations of the power plant would have any detrimental effect on public safety in the southeast region. Thank you. 12-1-SR

(Applause.)

FACILITATOR BARKLEY: Okay, thank you. I'd like to call the final three speakers who have signed up, John McGowan, Ted Del Gaizo, and Timothy Phillips. John?

MR. McGOWAN: Thank you very much. My name is John McGowan and I am a life-long resident of the Delaware Valley. I have lived half of my -- or I should say the Limerick Nuclear Power Station has been operating for half of my life. I own three manufacturing companies in the Malvern area and employ a number of people in those facilities who rely tremendously on the Limerick Power Generating Station to supply safe, reliable electrical power to keep us operating.

Today, I would like to say that in all of the years that I've lived in this area, I've never worried at all about the safety of the nuclear power plant. I see it every day. And it bothers me not in the least. I have never seen any credible evidence to suggest that there are safety problems with this plant. In terms of reliability, it is the same. It is running 24/7, 365 days a year and it has been doing so for a quarter of a century and I hope it continues to do so for many more years to come. 13-1-SR

As far as its environmental impact, I think it's pretty widely known that nuclear power is one of the cleanest environmental energies that we possess today throughout the world and to dismiss it is I think a foolish notion.

The impact of the Limerick plant in our region has been extraordinarily positive. It provides, as we all know and have heard today, lots of jobs, lots of good jobs, tax revenues for schools, local governments and for those who live in the area to enjoy the fruits of public services and it also provides a lot of charitable donations to the community which is very important. 13-1-SE Cont'd

I think that to not keep this plant running and not consider a renewal of its license for an extended period would be a tragic mistake for all of us and I would like to end this by saying that the only meltdown that would concern me is the economic one that certainly would happen to this area should this plant not continue to operate.

(Applause.)

FACILITATOR BARKLEY: Ted, go ahead.

MR. DEL GAIZO: Hi, my name is Ted Del Gaizo. I'm a registered professional engineer in the Commonwealth of Pennsylvania. I'm also president and CEO of a small business engineering firm in nearby Exton, Pennsylvania.

My experience in nuclear power goes back to the 1960s where I spent 14 years in Navy submarines and I personally operated, maintained, and refueled nuclear power plants during that period.

But I'm here today as a private citizen, as a resident of the area and as a member of the Pennsylvania Energy Alliance to go on record and say I strongly favor license renewal for the Limerick Generating Station. I say that because in my personal experience I know in spite of some of the things you've probably heard here today, nuclear power is safe, reliable, secure and clean. But in addition to that, I would like to go on record, I would like my neighbors to know we are lucky to have the Limerick Generating Station in this area. In the industry, it has a top reputation. It is one of the finest nuclear power plants in America. And Exelon, if not the best, is certainly one of the finest nuclear operators in the world. 14-1-SR

I have nothing but confidence that Exelon will work together with the NRC, will run through the process and we will come up with the right conclusion here which is license renewal should be granted to the Limerick Generating Station. I think we need to keep Limerick operating as long as we can.

In addition, in spite of some other things openness in the thinking process that goes into place for renewal of any nuclear power plant.

And so from my perspective as a citizen, as a business person who has worked in this community, I understand the value this is to the region. And for me, I applaud the NRC for what they're doing here. I applaud Exelon for the great work that they're doing there and I encourage the renewal process to take place. Thank you. 14-2-SR

(Applause.)

FACILITATOR BARKLEY: Thank you. With that, I have all 15 people who had signed up for this meeting, have been called. Is there anyone else who would like to make a short follow-up remark or would like to still speak at this point?

Okay, if not, I'd like to make two points before we wrap up. One, the NRC does have public meeting feedback forms which give us feedback on how you think this meeting was conducted, so I would greatly appreciate you filling out one of those forms for us so that we can learn how to improve. There is another session of this meeting at 7 o'clock tonight. You're welcome to speak again tonight.

And secondly, what I'd like to say is I facilitate a lot of meetings throughout the Northeast meeting via conference bridge. And due to the arrangements of the audio in this room it wasn't possible to do it any other way than a cell phone. So we're going to go to him and ask him to make a statement for the period and move from there. So our first speaker will be Mr. Thomas Saporito who is a senior consulting associate and he actually lives in Florida. So as soon as we can work having him on the microphone we will have him make his statement. Are we free to give it a try?

MS. REGNER: Go ahead. Yes. Go ahead, Mr. Saporito.

MR. SAPORITO: Is it my turn to speak?

MS. REGNER: Yes.

MR. SAPORITO: Okay. Can you hear me okay?

FACILITATOR BARKLEY: As best we can, yes.

MS. REGNER: Yes, go ahead.

MR. SAPORITO: All right. My name is Thomas Saporito. I'm the senior consultant with Saprodani Associates and I'm located in Jupiter, Florida. I would like to comment on the NRC's environmental review but before I do that I want to state that, you know, I'm very upset at the NRC's refusal to honor my enforcement petition filed under

16-1-OS

10 CFR 2.206 with respect to the Limerick nuclear plant. The NRC denied that petition on the basis that I would have an opportunity to intervene on this proceeding through the NRC's judicial process. However, that's not available to me. I made that quite clear in the 2206 petition. Now, I don't have standing as a United States citizen because of my physical location in Jupiter to intervene in a proceeding in Pennsylvania where this plant is located. The NRC staff is incorrect in their opinion and they have a legal obligation to honor that enforcement petition and to provide an opportunity for me to address the Petition Review Board. So I want to put that on the record and I'm asking the NRC to look into that issue.

16-1-OS Cont'd

With respect to this environmental petition the fellow who spoke earlier from the NRC, I don't recall his name. It was very hard for me to hear through this communication his name. But anyway, one of his comments was exceptionally incorrect and he misinformed the public. And I'd like to correct that statement. He stated that the NRC is extending the original operating license which was granted by the NRC for a 40-year period of time that that initial 40-year license was not based on safety considerations or

16-2-LR

technical considerations. But that's absolutely not true and there was recently a year-long investigative report done by the Associated Press who interviewed expert nuclear personnel, engineers, safety engineers in the nuclear industry who told them that the 40-year licenses issued by the NRC for 104 nuclear plants in the United States was based on safety and technical -- safety technical analysis. So these proceedings, these license extension proceedings like the one we're currently at are a rubber-stamping of these 20-year license extensions. This is in fact a foot race between the Nuclear Regulatory Commission and the United States Congress where Congress wants to stop this process, put a moratorium on the re-licensing until the Fukushima disasters can be fully understood and the enhancement enacted in August for our power plants here. This particular nuclear plant, these plants, you know, their license is already good till 2024. Why are we here now 12 years ahead of time trying to extend this license? And the only reason is because it's a foot race the NRC's in with Congress and nothing more. This has nothing to do with protecting public health and safety, it's the NRC's zeal to continue to rubber-stamp these license extensions without allowing citizens due process like

16-2-LR Cont'd

16-3-LR

16-4-LR

I already talked about and without doing a cost-intense and thorough environmental review.

16-4-LR Cont'd

And with respect to the NRC's environmental review the NRC in my view failed to properly consider the embrittlement of this nuclear reactor vessel. When these nuclear reactors are operating the neutrons cause the metal in the reactor vessel to become brittle over time. And after numerous years of operation these reactor vessels could crack because they're so brittle. But the NRC doesn't properly evaluate that and the NRC doesn't require the licensee to do destructive testing and analysis of the reactor's metal vessel prior to rubber-stamping a 20-year extension to these licenses. Twenty years from now, oh actually 20 years from 2024 which will be 2044 this reactor is going to be even more critically brittle and the NRC's not going to understand the dynamics of that and the reactor could crack and it's going to melt down because you can't recover from a loss of coolant accident of that magnitude. So that's one point.

16-5-OS

The other point is the NRC's Commission over there in Rockville, in the White Flint Building, they recently adopted a new policy with respect to evacuations. They want these licensees to update

16-6-OS

their evacuation plans. Now, I would hope that the NRC staff has made that requirement to the Limerick licensee so that the people near and around within 15 miles of the nuclear plant can properly and timely evacuate the area. Again, the Associated Press's investigation, year-long investigation shows that the populations around these nuclear plants increased tenfold over the years and that the roads and the congestion, you can't timely evacuate these areas. And the NRC keeps pushing these evacuation plans onto the licensee but the NRC doesn't enforce its regulation or properly review if these plans are even effective. 16-6-OS Cont'd

The NRC is required under the law in this review, the environmental review to consider renewable energy sources, alternatives. And that means need. Is there really a need for these two nuclear plants to operate and the answer is no. Simply stated if all the customers who receive power from these nuclear plants were to simply remove their hot water heaters and replace them with on-demand electric water heaters you would reduce the electric base load demand by 50 to 70 percent. You wouldn't need either one of those nuclear power plants to operate. If you take that further and introduce other energy conservation you 16-7-AL would actually have the licensee shut down more of their other power plants because of you would need a demand. If you take wind energy which is plentiful up there in Pennsylvania and even the new solar panel which can operate when the sun isn't shining on a cloudy day you could replace even more operating power plants. So these renewable energy sources even with respect to wind energy since you have a common grid throughout the United States you can have wind farms generate power to a common grid point and supplying the power that these nuclear plants are now providing. The NRC's required under the law to consider these alternatives to extending this license. And I would hope that the NRC's final evaluation and review shows a complete and thorough analysis of all these renewable energy sources including installing on-demand hot water electric heater and doing an analysis of how many megawatts you're going to take off the grid and based on those evaluations make a licensing determination whether or not this license should be extended. Because 20 years from now all these renewable resources are going to be all that much more advanced and capable of supplying all that much more power than they're currently supplying. So those are my comments and I would hope that the NRC takes them 16-7-AL Cont'd seriously and applies them to this license renewal. And I hope everybody heard me.

(Applause)

MS. REGNER: Can you hear that? They're clapping.

FACILITATOR BARKLEY: Okay, at this point I'll call back Mr. Saporito later and thank him for his remarks and for being succinct in his remarks. It's awfully awkward to provide comments via this avenue.

The first three people I would like to call are actually individuals who did not speak this afternoon so I'd like to start with them. Firstly, Jeff Chumnuk, then Daniel Ludewig, and then finally Catherine Allison. So Jeff, if you could lead off.

MR. CHUMNUK: Hi, my name is Jeff Chumnuk and I'm a member of Borough Council with Pottstown Borough. And my comments tonight are more I guess from my perspective as a newly elected official with the generating station. About a year ago I had the opportunity to go down to the generating station and meet with Joe Saffron and the first part of my meeting had to do with looking for some support for the Pottstown Soapbox Derby. Through some conversation while we were standing outside you know Joe

17-1-SR

enlightened me a little bit on what Exelon and the generating station do for the surrounding communities, whether it's supporting our firefighters, police departments and other civic organizations. You know, from a Pottstown perspective they help us with our yearly borough cleanup, our Salvation Army and now the Soapbox Derby. Thank you.

And we were standing outside that day, it was pretty nice out, and our conversation led to the power plant itself. We were standing there looking around, it's a pretty impressive sight. So I asked him about, you know, possibly having a tour for municipal officials. He said he would look into it and see what he could do. A couple of months later he got a group of about 20 of us and gave us a tour of the plant one evening. And I have to say that from the time we walked through the front gates and past the security as our tour progressed, you know, throughout the plant safety was paramount. Whether you were having explained what the different colors are on the different panels and what they mean to different failsafes, why you walk certain areas certain ways and what lines you had to stand behind, you know, safety was paramount with them. You know, from the environment, I'm looking around and this

17-1-SR Cont'd

place is spotless. And I asked why and it's because they can't afford to have dirt or lint or fuzz balls around because of static electricity because it could create issues. So from that aspect I thought it was a good tour and it made me feel good about the safety aspects there.

To finish our tour we ended up in the control room upstairs. And I'd say maybe a dozen or so individuals up there monitoring you know everything going on within the plant and around the plant. And again, explaining the failsafes and why they're double-, triple-checked to eliminate human error. It was just very impressive and as an elected official to go down and take a tour of the plant and understand how it operates. I know when I left I personally know how to issue a concern with the generating station. I know I felt a lot better and a lot safer going home that night. And it was also good to realize, you know, as one of our region's largest employers now that they are willing to give back to the community and keep safety first. So thank you, I just wanted to make those comments.

17-1-SR Cont'd

(Applause)

FACILITATOR BARKLEY: Thank you, Jeff. Daniel?

MR. LUDEWIG: I'm Dan Ludewig. Just two questions. One would be what are we going to do with the 20 years of spent rods and how are you going to take care of those. And secondly, if we don't get the license which I doubt but what would -- how would we get electric if the license were canceled? I don't know who answers this.

18-1-RW

18-2-OS

FACILITATOR BARKLEY: I'll ask Lisa to speak.

MS. REGNER: Yes, the spent fuel rods. Limerick is licensed for an individual spent fuel pool facility. They offload the spent fuel. Once they've cooled to a certain level they will put those into dry cask storage and store those onsite. In the environmental review that's looked at generically. Limerick does have storage for the spent fuel rods. That's an ongoing, it's onsite and part of their reactor oversight process as well. So the residents that work at the plant monitor the safe operation of those facilities.

The second question, where would the power come from if Limerick were shut down? There are alternate power facilities in the area. Dave, you want to give that a try?

MR. WRONA: I'm David Wrona, a branch

Can everyone hear me in the back row? I am Catherine Allison and I was born and raised in this area so as far as the NRC wanting to know how this impacts the area I know it very well. I've also traveled the world so, Europe, et cetera. So did anyone not be able to hear me, just raise your hand. You're good? Okay.

One thing I wanted to say is the NRC tonight is doing a scoping basically for environmental purposes for the re-licensing. What I wanted to say is for years everyone, I'm being general here, but most people have been talking about the effects of like, you know, cancer, you know, the impact on the clean air, clean water which things we are all concerned about and a lot of us just didn't do anything about it even though we were very concerned.

Now lately with the -- unfortunately it's a reality now that we have hurricanes, more tornadoes, tsunamis throughout the world. And I hate to say it but it is a reality now that we have terrorist attacks and Limerick is definitely one. I don't want to be blowing this out of proportion but it's just something that I know that we've all been concerned about, not wanting to say yes, Limerick, and all the people that built the power plant and the company say oh, there's 19-1-PA no impact to the air and the water pollution and so forth. So we've kind of just blinded our, you know, selves to that and let's believe then, okay, let's take a minute. Let's really believe that there is no impact in our clean air, clean water and those type of things and cancer, et cetera. Let's just go into the new reality which is terrorist attacks which would happen. Let's just say for example there was human error there with the spent fuel rods and something happened, or a radiation leak. I just drove tonight

19-1-PA Cont'd

from King of Prussia. Talk about evacuation when these natural disasters and realities hit us. One accident, two hour backup, almost no exaggeration, one thousand cars. There will be no evacuation. I don't want to be like scare tactics here but like I said, the weather and so forth, natural disasters has really been hitting the whole United States and the world lately so it's a reality.

There was flooding after the hurricane that we just had. Five days later there was roads closed in Pottstown, in North Coventry, East Coventry. There were, when I tried to get home from work right on Route 724, no exaggeration again from all the back roads about 500 cars. There will be no evacuation and I certainly hope that people understand I'm not trying

19-2-OS

to be scare tactics. I see this. I'm sure a lot of you have seen this and been in these situations. All with a little bit of flooding. What this does to the roads. Again, there will be no evacuation.

19-2-OS Cont'd

So from day one I think power plants never should have been built but now that they are here why would we ever want to re-license. And as our gentleman caller just said, I believe his name was Thomas, he was very eloquent. He was stating the fact why are we re-licensing them, what, 12 years ahead of time. To me that is absurd. Like maybe a year before or they have to do some studies, two years before. Why do they want us, and I love Thomas's words, rubber-stamp something? Twelve years beforehand to go into what, 2024 for Unit 1 was it and 2029 for Unit 2? Why do they need to push this licensing renewal? You've got to stop and think. People, go home, think about that. I'm not an expert like evidently our caller Thomas was but again, I'm concerned about human life. This is what I have at the top here. We are talking about human life. What's more important, not all this electricity that we need for all our cell phones and everything. In a way we are responsible for the fact that PECO and all these other Exelon companies are building power plants. I myself you

19-3-OR

19-4-LR

19-5-OS

know am guilty of a lot of this but let's just maybe for a solution besides the wind and solar power and everything stop using all this new technology. Yes, you need it for some jobs and businesses, it's good for certain things, but let's not overindulge where we need so much electricity that we are willing to risk our lives. Cancer, polluted water. There's no drinking water anymore. People have to pay to buy water that comes from natural springs. But you're using plastic bottles, you can't even trust that.

But this whole world has kind of just changed from you know nature. Let's get back to nature, let the -- instead of having all the young teenagers on their cell phones texting, using more electricity, that again it's going to cause cancer for them. Everybody has to stop and think why do we need the power plants? We really don't and again, Thomas, our wonderful caller mentioned some alternatives like the solar power, wind, but I'm just saying we are using so much electricity and stupid little video games on the computers. People get on the computers for hours at a time doing nonsense. That's taking up electricity where again why do you need all this electricity? It could be causing cancer in your children. I am not that old but I'm not that young,

19-5-OS Cont'd

19-6-HH

but I hate to tell you I have so many friends and coworkers and people that are only 35, 40, 50 years old, cancer. And why? We have to stop and think. Go home, don't just always, you know, just go watch TV and get on your computer. Stop and think what we're doing to ourselves, our bodies, our children, our grandchildren.

19-6-HH Cont'd

This is again, this licensing renewal is coming down to human lives, the quality of our lives. Again, why all this cancer? Microwaves and electricity. So I won't go on and on, but I just think us as a group can't just all be just complaining about the power companies, we are the ones using the electricity. That's all I'm saying. Maybe we should cut back and we won't need power plants. Thank you.

(Applause)

FACILITATOR BARKLEY: Thank you, Catherine. The next three people I'd like to call would be Jeffrey Norton of the P. Energy Alliance, then Bill Maguire and then finally Lorraine Ruppe. Mr. Norton?

MR. NORTON: Good evening. My name is Jeffrey Norton and I'm here to represent the Pennsylvania Energy Alliance which is an independent grassroots diverse organization made up of community leaders and organizations who promote nuclear power as a clean, safe, reliable and affordable source of power. I'm going to be making essentially five points in support of license renewal for Limerick Generating Stations and they are that, number one, nuclear energy lowers electricity prices, it protects our environment against greenhouse gases, it strengthens our local economies and it is safe.

With regard to my first point in lowering electricity prices the Limerick Generating Station has reduced wholesale energy costs in Pennsylvania by $880 million in 2010 thus lowering electricity prices for all consumers. It operates around the clock thereby stabilizing the nation's electricity distribution system and the electricity marketplace. The average electricity production costs at nuclear plants have actually declined more than 30 percent in the past 10 years due to various efficiencies. Nuclear power is cheaper to produce than other forms of electricity generation such as coal and natural gas, and helps moderate the price of electricity for consumers. 20-1-SR

My next point is that Limerick Generating Station and nuclear plants strengthen our local economies and it is a valuable economic driver for the Commonwealth of Pennsylvania. Limerick Generating

Station contributes $113 million annually in direct economic contributions to the Pennsylvania economy through various employee wages and salaries, purchase of goods and services from other Pennsylvania businesses and in property tax payments to the local governments. Limerick Generating Station also contributes generously as we've also heard and in fact in 2010 contributed $600,000 to various community organizations. Limerick has over 800 full-time employees and employs more than 1,000 skilled temporary contract employees during annual refueling outages. A significant percentage of the current nuclear plant workforce will reach retirement age in the next 10 years creating a demand for high-paying jobs in the nuclear industry. Yes, Limerick Generating Station is one of Pennsylvania's most valuable economic and energy assets and the commonwealth should embrace it. 20-1-SR Cont'd

My third point is that nuclear energy protects our environment from greenhouse gases and reduces the need to generate electricity from fossil fuels. If Limerick Generating Station were retired from service replacing the electricity would require increased natural gas-fired or coal-fired generation. Nuclear energy is the nation's largest source of carbon-free electricity and is critical to our nation's environmental, security and energy goals.

My next point is that nuclear energy is safe. It's always on, it's stable, it's a reliable source of electricity and the station here at Limerick has been built with multiple redundant safety layers. And the workforce is committed to best practices and continuous improvement. It is also important for our nation's quest to be energy-independent. According to the Bureau of Labor Statistics it's safer to work at a nuclear plant than in industries such as manufacturing, real estate and finance. And according to the Department of Energy a person receives more radiation exposure flying from Baltimore to Los Angeles than by standing near a nuclear plant 24 hours for a year.

20-1-SR Cont;'d

On a personal note I've been inside Limerick Generating Station several times. I've also lived within 30 miles with my four boys and wife next to the Limerick Generating Station and also Three Mile Island. I feel safe, secure and comfortable. That is why I'm in support of the re-licensing of the Limerick Generating Station. Thank you very much.

(Applause)

FACILITATOR BARKLEY: Thank you. Mr.

three people I'll call are Donna Cuthbert, followed by Mike Gallagher and then followed by Dr. Fred Winter. Okay, Donna.

MS. CUTHBERT: You know, after hearing some of these gentlemen speak tonight I feel like I'm living in fantasy land. For somebody to get up here and actually say that there's no adverse impacts from Limerick nuclear power plant is insanity. It is unbelievable. I have spent the last 11 years reviewing permits from Limerick nuclear power plant. They are a major air polluter under the Clean Air Act and to say they're not doing it anymore, they just asked for the conditions that would allow an eightfold increase in dangerous air pollution that actually is claimed to kill people, thousands of deaths per year. And they asked for an eightfold increase.

1-22-AM

As a matter of fact, these are all the air pollution sources and the pollutants they list in their own permit. If you add that to all the radiation emissions there's a broad range of radionuclides. For somebody to just claim that it's only tritium going into the water is insanity. It's unbelievable what they expect people to believe. I encourage everybody to go back to the table we have and take a good look at that Schuylkill River board.

They are destroying the Schuylkill River. There was never enough water in the Schuylkill River to sustain this nuclear plant from the very beginning and now we're seeing the consequences of that and they put more and more pollution in it. They want to pump mine water in to supplement the flow for Limerick. It's contaminated and they don't filter it. And they're actually asking for a huge, four times Safe Drinking Water standard increase in total dissolved solids which carry a lot of toxic pollutants. So they put radiation into the river 24 hours a day, 365 days a year, and now they're asking for these huge increases and people have the nerve to get up here and say that they have no environmental impacts. Frankly I've had enough of this deception at the expense of public health. I am sick of it.

1-23-SW

The facts show, when we looked at Exelon's thing for environmental harms they say they were clean energy. The facts show Limerick isn't clean, it is filthy. It's not safe, it's a ticking time bomb. And nuclear power, they say it's always on. That's not true either as evidenced by shutdowns, some for long periods caused by earthquakes, tornadoes, hurricanes, fires, heat and drought and more. It clearly isn't always on in Japan. So when you take all of this

1-24-PA

together and you look at all the ways that they pollute our environment with radiation and all the other toxics, every day Limerick operates our children face more risk. And that's what it's all about. It's about the health of our region.

The sooner this place closes the better off we'll all be. Even if you look at infant mortality rates we have higher infant mortality rates and neonatal mortality rates far above state averages and even above Philadelphia and Reading, and we've had these for quite awhile. The fact is when babies are the most vulnerable in the womb what else would we expect? And by the way, for those of you who have been saying that ACE data is anecdotal today I have news for you. This infant mortality report for example is state data reported by EPA in 2003. Every cancer statistic that you see back there is based on Pennsylvania Cancer Registry statistics or CDC statistics. So it is not anecdotal, those are the cancer increases, those are the cancer above the national average that have happened here since Limerick started operating. That is a fact. 1-25-HH

So it's not anecdotal and the fact of the matter is I thought this was about the environment but apparently it's about money. So I decided that between the sessions I was going to change things around a little bit. I could talk about the environmental impacts of this place for a whole week it's so bad. And I've got all the documents in our office to prove it. Let's talk about, let's take a minute now though and we're going to talk about the cost. What is this place actually costing us? Let's just think about cancer for example. We have so many cancers above the national average. Childhood cancer, 92.5 percent higher than the national average. Think about that. We track the cost of one child with cancer diagnosed at six months to two years and up until that time it was $2.2 million. How many more kids have that above the national average? Cost that out and how many other cancers are above the national average? You do the math. Figure that out.

1-26-HH

How about the customers that paid -- I hear them talk about how great the costs are for Limerick. We paid for Limerick from 1985 to 2010 in our electric bills. And in fact the electric that was supposed to be too cheap to meter turned out to be 55 percent above the national average by 1997. So that's how cheap Limerick electric is.

1-27-OS

Then you take the property taxes. They tried to get zero for their property taxes by the end

1-28-SE

of the '90s and didn't pay any property taxes until the early 2000s at which time they paid $3 million instead of the $17 million they were supposed to pay. So when you think about that no wonder Exelon's willing to throw around a couple million in the community. They owe this community a lot more than what they're giving out.

1-28-SE Con'td

(Applause)

MS. RUPPE: So then there's the cost for the pollution they're putting in the river. They're asking for increases in pollution. They want to put more mine water in. They want to increase the total dissolved salts. That's going to cost water treatment systems a lot of money to try to -- for extra treatment for that. It can even break down their equipment, some of the stuff that's coming out of the mines. And when you think about it who actually ultimately pays that cost? We do. We pay for increased costs for our water because they're having to do that at the water treatment systems. And it seems to me that if you really take a good look at things Limerick has got to be the major cause for the radiation in Philadelphia's water.

4-10-SW

So all in all taken as a whole this place has unprecedented environmental harms. There is no question about that. Anybody that doesn't believe it come look at the permits with me and I'll show you exactly what's going on. I invite anybody to do that.

And the one thing that's really important is that NRC and the nuclear industry are claiming that age is no issue while at the same time they admit that some parts are too big and too expensive to replace. I frankly am really concerned about NRC accommodating the nuclear industry with weakened regulations, lax enforcement, negligence and unsubstantiated denials. It's happened right here even with their fire safety regulations that are -- we're on weakened fire safety regulations even though we know that that can eventually lead to a meltdown. I know my time's up. Thank you.

4-11-OS

4-12-OS

(Applause)

FACILITATOR BARKLEY: Thank you, Donna. Mike?

MR. GALLAGHER: Okay, good evening. My name's Mike Gallagher and I'm vice president of license renewal for Exelon. I have the overall responsibility for the Limerick license renewal application. Exelon has a great deal of experience in license renewal. We've obtained renewed licenses for the Peach Bottom and TMI plants in Pennsylvania, also

FACILITATOR BARKLEY: We have an inspection ongoing at that point right now regarding the North Anna facility. So yes, it did experience an earthquake beyond its original design. So far the inspections have revealed no -- minimal damage. I've only heard of one piece of equipment that experienced even visible signs of problems. But the overall analysis, this is continuing and the licensee has to have permission from us to restart after an extensive inspection.

MR. ELY: My concern is that this hastened license renewal process is inappropriate for engineering reasons. I worked in a variety of different areas in the construction of that power plant and there were continual deviations that were provided, whether it was in-storage maintenance monitoring of the condition of the components that were used to the actual construction of that plant. I could cite you several examples.

21-1-OS

What I would like to ask of the public is that the people that had worked at that nuclear power plant take a look at this licensing renewal and understand that they need to review those failures and those deviations that were provided to go ahead with the construction of that plant with non-conformances that were reviewed, but not reviewed in light of what we understand and know today about earthquakes or other anomalies. We need to have enough time to make the evaluation on those deviations. The cooling pools. The fuel pool girders that are placed there. There are rebar concrete reinforced supports where a quality engineer, he was supposed to be accepting the very highest grade of concrete to be placed in a 36-hour pour there and he didn't pay attention. And the cofferdam was being built down in the river and up comes this sand mix with a very low strength and gets pumped up into those fuel pool girders in a layer and the engineer said well, boy, that was a terrible mistake, but it'll be okay. We need to go back and take a look at all of those mistakes and make sure that they're not written off because a layer in a structure under load caused by an earthquake, that's an issue. It might not be an issue for the strength of the fuel pool girders to support those fuel pools that when we see them in Japan and they catch fire because they're extremely hot and you need to address that. I was on that pour but I wasn't the engineer that made that error, but there's a number of errors that were made. And I don't see or understand that the NRC or the review or the licensing application is 21-1-OS Cont'd taking a look at those failures and those errors and addressing them in light of the knowledge that we have today.

21-1-OS Cont'd

Some people don't understand about radiation and I read when the Japanese thing occurred and I heard on the news a radiologist talking about oh, the radiation is such a low amount. It really isn't the low amount of radiation exposure that we get incidentally in standing next to a nuclear power plant. It's three ten-thousandths of a gram of plutonium that is death for you if you breathe that dust particle. It's almost certain death. And the problem becomes you can't have -- and it's not going to be a nuclear bomb. It's going to catch on fire if the fuel pool girders were to fail and you'll have a cloud of a material that in and of itself you might not have radiation exposure to it but that particle when it deposits itself can be an issue much the same as fluoride is what causes thyroid cancer when it's a radioactive fluoride. That's why we're very careful in building a plant with no Teflon and no fluoride components.

21-2-HH

So we need to pay attention to some of that engineering and I'm not certain that that's being done. I'd like to see an agency or for somebody to contact me if they know about a variety of different flaws that they saw during the construction. And my email address is asqchair@yahoo.com. Yes, I will be the chair of the Philadelphia section of the American Society for Quality coming up and I've been past chair in the past so yes, I'm very quality-oriented and I'd appreciate any feedback from people that have issues with that construction. Thank you.

(Applause)

FACILITATOR BARKLEY: Okay. Thank you, Dan. Jim Beckerman?

MR. BECKERMAN: Good evening. My name is Jay Beckerman. I'm a resident of Phoenixville. I found out about this meeting because I scan a lot of newspaper websites. I found the notice of the meeting on the West Chester Daily Local website. Didn't find it in the Phoenixville paper, didn't see it in the Philadelphia newspaper, didn't hear about it on any of the local radio stations, didn't hear about it on cable, didn't hear about it on any of the television. 22-1-LR

Once a month, what is it the first Tuesday about 2:00 I hear the siren that we all hear. What should happen in terms of people getting notice is everybody who's within the plume area should something happen at Limerick should find out about this meeting and I seriously doubt that that actually happened. I think it was pure accident that I found it. Something as serious as license renewal should get the same kind of outreach that occurs when Limerick does what it should which is to mail out every year or two to all of the possibly affected homes the maps and the notifications of how do you evacuate. If you're going to renew a plant which happens once every 20 years I don't understand why the NRC doesn't require the same kind of outreach public notification so people get a chance to come to one-time meetings like this. I think that is a basic flaw in the NRC's licensing and re-licensing procedure and I think it should address that. 22-2-LR

The slide behind me documents exactly two libraries that the documents are going to go in. Why not in my library in Phoenixville? Why not in Montgomery County and Norristown and all of the other public libraries that are in areas that can be affected by the plume should something happen here? Why are the documents in such a restricted area? 22-3-LR

I'd like to switch a little bit. I've been researching, I didn't even know about this ACE organization. Glad to find it. I've been researching on my own information about nuclear power plants and their risks for quite awhile. An organization I ran across published this book titled Insurmountable Risks. The organization is called the Institute for Energy and Environmental Research. It's an amazingly well-researched book. I doubt very many people have read it but you should. This organization is at least as interested in alternative energy sources as it is in having put the effort in to document what are the problems with nuclear power engineering-wise. The man who's head of this organization is a nuclear scientist, a guy named Arjun Makhijani. He's a PhD nuclear scientist. These are first-class researchers, this is PhD-level stuff written for popular consumption. So I'll be glad to make more detail about the book available to anybody who wants to know.

A few questions I have, one that I've been thinking about for a long time. I wonder how many people here are aware of something called the Price Anderson Nuclear Industries Indemnity Act. Who knows about that? The title alone should give you some pause. Why do we need a nuclear industries indemnity act? What does it do? What it does is it puts a ceiling of a few hundred million dollars on the liability that nuclear power plant owners have for the damage their plants would cause. It's basically a

22-4-OS

scheme, they pay into a pool. The problem is that ceiling was set a very long time ago. It's totally unrealistic in terms of the risk in just the value of houses in areas that are covered by a plant like this. When this plant was planned the population in the area that its plume would cover probably wasn't 20 percent of what the population is now. That is I think a valid environmental concern. The environment

22-4-OS Cont'd

in which this plant operates has changed because of in-migration, population increase for all sorts of reasons. Part of that's been discussed tonight in terms of evacuation routes, would you be able to get people out were there an accident. The roads haven't changed very much, the population has. That I think is a valid environmental concern that surely ought to be addressed.

22-5-OS

The question I ask about the money liability is -- let's just go back to the Price Anderson Act. The fact is that the nuclear industry does not pay market rates for insurance to cover it for the liabilities. This congressional act from way back in the 1960s eliminates that need. Back then the insurance industry didn't have the research to put a price on what should the Limericks of the world have to pay for a liability policy. I think there's plenty

22-6-OS

of insurance industry experience now. So my question would be if nuclear plants are so safe why do we need the Price Anderson Act?

22-6-OS Cont'd

(Applause)

MR. BECKERMAN: I listened, I'm going to switch subjects again. I listened to Mr. Gallagher and I heard something I really didn't expect to hear. He said that their studies said that this plant is now safe to run for 60 years. That sounds to me like advanced notice to the public that this isn't the first renewal they're going to ask for on this plant. Mr. Gallagher, are you going to ask for another one 20 years from now?

FACILITATOR BARKLEY: We haven't had any licensee at this point in time ask for something beyond that.

MR. BECKERMAN: You didn't make the statement. Mr. Gallagher did.

FACILITATOR BARKLEY: I know and I'm not going to have him address this from the audience. This is a meeting with us.

MR. BECKERMAN: And I would like to finally address an issue that the speaker on the cell phone brought up. He talked about embrittlement of concrete over the lifetime so far of the nuclear

22-7-OS

reactor containment vessel. That's an internal environmental matter. I don't know if it's quite in the scope of what the NRC plans to talk about or plans to look at, but something that I have not read about at all is an NRC requirement for destructive testing.

22-7-OS Con'td

For instance, if you want to know what a tree looks like on the inside you put a borehole in it and you pull a core sample out and you find out what that tree looks like on the inside. If an engineer wants to know what is the quality of the concrete that was poured for a road -- I used to work for Florida Department of Transportation -- they bore out a sample and then you take a look at it. What I haven't heard anything about except generalizations is has anybody done any destructive even borehole testing of these containment vessels and their support pourings to find out has there been in fact any deterioration of the concrete, the rebar and anything else that went in there. The stuff that's buried in the concrete, the wire, all of those things that are buried in the concrete. If you haven't bothered to open that stuff up since the plant was built how on earth do you know what condition it's in? Shouldn't that be a requirement to do some destructive, open the bottom testing, go all the way through and make sure what you

22-8-OS

think is there is what's there and in the condition that it should be in to last for another 20 or 40 years? So these are questions that I'd like the NRC to go into. I thank you very much for listening. Overall it's been a very informative presentation by both the proponents and people who have questions and I thank you for the opportunity. I would like to see a meeting like this occur at a bigger venue with more notice. An example would be, as I've discussed with Ms. Regner is it?

22-8-OS Cont'd

FACILITATOR BARKLEY: Regner, yes.

MR. BECKERMAN: I didn't have her name correct. The Philadelphia Expo Center would be more central to where the plume area for this plant is. It's right off 422. This is not hard to get to, that's not hard to get to. It's much more in the center of the population. Thank you very much.

(Applause)

FACILITATOR BARKLEY: Okay, thank you. Mr. Cuthbert? Again, following Mr. Cuthbert's remarks it'll be Jim Derr to wrap up the evening.

DR. CUTHBERT: Good evening. My name is Dr. Lewis Cuthbert. I'm the president of ACE, the Alliance for a Clean Environment. And my comments this evening are going to differ from this afternoon because they're going to be focusing on as a general topic documented evidence. We've heard a lot of assertions, assumptions and claims throughout the day many of which would be very difficult to substantiate in our experience. Based on an 11-year investigation conducted by the Alliance for a Clean Environment we have formed a conclusion that we are presenting to the Nuclear Regulatory Commission today and that is very simply that Limerick nuclear power plant must be closed by the NRC, not re-licensed until 2049. And that's based on a substantial body of evidence in terms of documented environmental harms, threats and risks that have in fact gotten into our air, our water, our soil, our food, our milk and our children. The evidence is not refutable.

1-29-OR

So I'll be presenting as part of my remarks tonight what I'm calling a short list of 14 reasons why the NRC may feel free to with more than adequate justification deny this permit. And I'm going to categorize each of them very briefly without any further description or analysis. The evidence comes from a variety of permits, official records and reports, and Exelon's own renewal application which is sizable by their own admission and in our experience in taking a look at it.

The 14 items any of which in our judgment should be adequate and sufficient to deny this permit renewal include, number 1, radiation into air and water from routine and accidental emissions. 1-30-RW Number 2, major air pollution under health-based standards of the Clean Air Act. 1-31-AM A Title 5 permit being issued to this facility means by definition that they are a major air polluter under the federal Clean Air Act. Number 3, Schuylkill River depletion and major drinking water contamination. 1-32-SW Keep in mind this is a vital drinking water source for nearly 2 million people from here to Philadelphia. Number 4, radioactive groundwater contamination. 1-33-GW Number 5, radiation reporting levels increased dramatically after the Fukushima Japan disaster. 1-34-RW Number 6, documented alarming cancer increases especially in our children since Limerick started operating. 1-35-HH Number 7, deadly high-level radioactive wastes that are packed in vulnerable fuel pools on this site and they are in fact unprotected. 1-36-RW They are above ground and unprotected. Number 8, lax fire safety regulations and multiple violations. 1-37-OS Number 9, accidents and leaks from corroding, deteriorating equipment plus miles of buried pipes and cables. 1-38-OS Many problems and shutdowns have already occurred at this facility in its first 26 years of operation. They are a matter of 1-38-OS Cont'd

record. Number 10, increased risk of meltdowns from more frequent and stronger earthquakes and other natural disasters such as tornadoes and floods, not to mention mechanical failures. 1-39-OS

Number 11, threats from unguarded terrorist attacks with planes and missiles and a new threat, cyber attacks. Fuel pool are vulnerable to attack. 1-40-OS

Number 12, one that I think probably should jump to the head of the list for the NRC based on a lot of comments from a lot of other analysts and elected officials, the need for an updated evacuation plan and increased EPZ, a 10-mile radius. This plan is seriously outdated. It is by many expert's observations fatally flawed. There will be no evacuation in the event of a worst case scenario. Several people spoke to that this evening. The population in this area has increased more than 180 percent since 1980 to 2010, U.S. Census data. Updates are obviously needed and they should be reasonable, comprehensive, detailed and accommodate all of the demographics from 1985 to today and from today until as far out as the NRC is willing to license this facility. 1-41-OS

Number 13, increased cost to the public. 1-42-OS

We've heard a little bit about this this evening, more cancers, more illnesses, more emergency room visits, more hospitalization from increased PM-10. Massive research on what particulate matter in terms of PM-10 does to human beings. And there are a few other things that contribute to those visits. The costs are astronomical. One case that Donna mentioned, $2.2 million for a childhood cancer case. You do the math.

1-42-OS Cont'd

And number 14, the last item on my list. We have had 26 years of insults to our environment, and I choose that word purposely, insults to our environment and costly nuclear power. We can replace it with safe, clean, renewable energy before 2029. That is a matter of scientific fact.

1-43-AL

It is a scientific certainty that harms, threats and risks to our environment and to our community will increase continuously daily until Limerick's current operating licenses expire in 2029. It would be both unethical and irresponsible for the NRC to cavalierly approve a license renewal without the most rigorous review and justification in the history of this agency. NRC, you have a rare opportunity before you that most people and agencies never are afforded. It's called a do-over, a chance to correct a litany of mistakes and errors associated with this facility and with your agency since 1985. Twentieth century technology and infrastructure are no longer sufficiently reliable for any of you to assure us that there is nothing to fear and nothing about which to be concerned. Denial of documented evidence is no longer an option. We'll be submitting additional packets of research documentation and evidence tonight along with my comments which will compliment what I did earlier today. The major categories that you'll be getting for additional reading and review, meltdown threats, evacuation plans, Exelon's inaccurate and unsubstantiated claims and a criticism of the NRC's oversight track record in this community. Thank you very much and please accept this for review.

(Applause)

FACILITATOR BARKLEY: Okay, thank you, I will. Thank you. Mr. Derr?

MR. DERR: Good evening. I thought I would add some comments just to make sure my understanding is that this is essentially the NRC's opportunity of listening for things specifically to be included in the environmental site review of the re-licensing. And just a few things which are question marks that lots of folks in the community I think will be interested in. Most of these have been touched on.

Mine water issue, better defining that quality and flow particularly in light of the likely pending changes in stormwater concerns and regulations in the area. Adding that flow to the Schuylkill is going to affect all the municipalities around here who have to deal with stormwater. 23-1-SW

The emergency planning is an area which needs to be seriously looked at. Hard and soft infrastructure on that. Hopefully that's something which is part of the ongoing operational requirements for periodic review and update since obviously this is not a static environment we live in. That has to be changed on an ongoing basis. 23-2-OS

And then to -- I'm sure that the generic plan includes a pretty good discussion of fuel storage long-term and short-term onsite but certainly the site-specific fuel storage considerations. 23-3-OS

And I want to second the comments by Mr. Ely of review of records of non-conformances and anything that was done is part of the initial construction record. 23-4-OS

And basically that's -- those are the things that we're going to be looking for a better understanding of. Thank you.

(Applause)

FACILITATOR BARKLEY: I did have one last request for an individual to speak. She promises she'll only be two minutes so we'll have her up and then we'll wrap up the meeting. Thank you.

MS. CONFER: Hi, my name is Traci Confer. I'm with Energy Justice Network. We support clean energy which we do not believe nuclear is. I would like to put our name behind all of Buzz Cuthbert's comments and I want to add that I want the NRC to look into potential water depletion issues from shale gas fracking upriver in both rivers. 24-1-SW I also think that it would be very prudent to put a lot of attention on terrorist attacks on the fuel pools. 24-2-OS And those are my primary comments. Thank you for your time.

(Applause)

FACILITATOR BARKLEY: Okay, thank you. With that I'd like to have Lisa Regner come up for a minute and give closing remarks.

MS. REGNER: I just wanted to real quickly thank our senior resident inspector who came out tonight out of the goodness of her heart. She does not get paid for this. Jo, would you mind standing up?

(Applause)

MS. REGNER: Thank you. This is one of the NRC inspectors who works at the plant day in and

**Mendiola, Doris**

**From:** Camilla Lange [camillange@verizon.net]
**Sent:** Monday, September 26, 2011 2:20 AM
**To:** Regner, Lisa
**Subject:** NRC Public Meeting Feedback

8/26/2011
76FR53498

(1)

Dear Ms. Regner:

I attended the NRC Limerick Generating Station License Renewal public meeting at Sunnybrook Ballroom on 9/22/11. I listened attentively to comments from all 15 speakers at the evening session and took into account all the pro and con arguments presented. Despite all the reassurances from Exelon representatives about the safety and efficacy of the generating station's nuclear power, I have serious reservations and concerns about these issues.

First of all, considering the impact of the outcome to the many area residents, this forum was not widely publicized for local citizens to be aware of this important matter and offer feedback. Secondly, it does not make sense that Exelon is pursuing renewal for a license that does not expire until 2024. This action seems very premature. 25-1-LR

I will briefly summarize my chief concerns. The scientific statistics citing the dramatic increase in cancer rate infant mortality, and Schuylkill River water pollution are disturbing. 25-3-OS Also, it seems to me that the situation of unprotected above ground casks holding radioactive waste, as well as past safety failures and deviations in operations must be reviewed and addressed. 25-2-HH I tend to agree with the fourteen reasons offered by the Alliance For A Clean Environment why Exelon should be denied the renewal license. In my opinion, the long-term negative consequences caused by the Limerick Generating Station far outweigh any possible benefits it may contribute. 25-4-OR Other forms of energy can and must be utilized to meet energy consumption demands. 25-5-AI

Thank you for arranging the public meetings to discuss this serious matter. I trust you will take my comments into consideration and urge Exelon to provide other such forums with widespread notification beforehand so that more interested citizens can participate.

Sincerely,
Camilla Lange
616 W. Schuylkill Road Apt. 164
Pottstown, PA 19465
camillange@verizon.net

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SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = L. Regner (LMR2)

1

**Mendiola, Doris**

**From:** Eric Hamell [stripey7@yahoo.com]
**Sent:** Wednesday, September 21, 2011 7:38 AM
**To:** Regner, Lisa
**Subject:** Limerick

**Follow Up Flag:** Follow up
**Flag Status:** Flagged

Please do NOT extend the Limerick licenses! 26-1-OR

Eric Hamell
Philadelphia, PA

8/26/2011
76FR53498
2

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**Mendiola, Doris**

**From:** steve furber [ctevewrx@yahoo.com]
**Sent:** Tuesday, September 20, 2011 4:17 PM
**To:** Regner, Lisa
**Subject:** Limerack Renewal

**Follow Up Flag:** Follow up
**Flag Status:** Flagged

8/26/2011
76FR 53498
3

I am under the belief that the natural disaster in Japan is enough for Pennsylvania to make a move toward clean energy. It is a matter of thinking ahead to the future generations and protecting quality of life for those who follow. 27-1-AL

Renewing Limerick's license just as controversies are arising with pushes to move from dependence on Nuclear energy is a bold business strategy by them. I don't think this is the right move to make. A long term contract will limit any sort of wiggle room to address future issues that may arise. 27-2-OR

I ask that you please consider the future of our great state. I don't think oil or nuclear energy is the way. I truly believe in heart, that in order to protect the health of our population for the future, we must change our ways today.

Sincerely,

Steven Furber

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|---|
| **As of:** September 27, 2011 |
| **Received:** September 22, 2011 |
| **Status:** Pending_Post |
| **Tracking No.** 80f27eee |
| **Comments Due:** October 28, 2011 |
| **Submission Type:** Web |

# PUBLIC SUBMISSION

2011 SEP 27 AM 8: 47

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**Docket:** NRC-2011-0166
Notice of Receipt and Availability of Application for Renewal of Limerick Generating Station, Units 1 and 2 Facility Operating License

**Comment On:** NRC-2011-0166-0003
Exelon Generation Company, LLC; Notice of Intent to Prepare an Environmental Impact Statement and Conduct the Scoping Process for Limerick Generating Station, Units 1 and 2

**Document:** NRC-2011-0166-DRAFT-0002
Comment on FR Doc # 2011-21921

8/26/2011
76FR53498
(4)

## Submitter Information

**Name:** Charlene Padworny
**Address:**
1117 Oakdale Dr
Pottstown, pennsyvania, 19464-2782

## General Comment

I object to being continuously poisoned by the Limerick Nuclear Plant's radiation and other dangerous toxins. Please do not allow for an extension of the Limerick Nuclear Plant's operating license. 28-1-OR I support more healthy and efficient sources of energy such as Solar and Wind Power. Please stop ignoring the detrimental effects that this power plant is having on our environment, health and children's health...it's time to move on to better things for all involved! 28-2-AL

Thanks so much,

Charlene Padworny

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Add = L. Perkins (LMR2)

https://fdms.erulemaking.net/fdms-web-agency/component/contentstreamer?objectId=0900006480f27ee... 09/27/2011

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

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8/26/2011
76 FR 53498
5

**LIMERICK GENERATING STATION**
**Environmental Scoping Comments**
**Division of License Renewal**
**NRC-2011-0166**

## Written Comment Form

*Must be received on or before October 28, 2011. Please print clearly.*

Name: Sylvia Pollick

Title: Resident of East Coventry

Organization:

Address: 23 Earl Dr.

City: Pottstown State: PA Zip Code: 19465

**Comment:**
I hope Exelon Energy does not get Renewed. I am sure we could find alternative energy that would not be Contaiminating the whole area. 29-1-AL

The Reactor time has served its years and should not be renewed. 29-2-OR

*Use other side if more space is needed.*

Comment Forms may be mailed to:
Chief, Rules, Announcements, and Directives Branch
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

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Template = ADM-013

E-RIDS = ADM-03
Add = L. Regner (LMR2)

**Gallagher, Carol**

**From:** Joe Roberto [joe@robertoandassociates.com]
**Sent:** Wednesday, September 21, 2011 7:20 PM
**To:** Regner, Lisa
**Cc:** Joe Roberto
**Subject:** LIMERICK

8/26/2011
76FR 53498
6

RECEIVED
2011 SEP 30 PM 1:31
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Dear NRC:

First of all, let me ask why the lack of public notice regarding the public hearing to be held for Limerick Licensing Extension when in fact the current permit is through 2024 and Exelon is asking for another 20 year extension? Your first priority is NOT for the publically traded, for profit company to rush to get this public notice "done" as a requirement to extend the permit another 20 years out which is not due to expire for another 10+ years but to rather really solicit input from the community and folks impacted. The NRC did not do so. There was one article in the local newspapers stating that there would a public session and only saw the actual notice, by virtue of an article in the North Penn Reporter yesterday. This is not proper notice in general and not sure NRC did what is required. What is required and what have you done? And if proper notice was not done, I want another one(s) scheduled please. I, respectfully, am very interested in this answer.

FEEL FREE TO READ THE FOLLOWING AT THE PUBLIC HEARING:

Now, let's get to the big issue at hand. Limerick should NOT be approved for an extension with their permit for the following reasons:

- It is NOT due to expire until 2024 – thus, Exelon has nothing to loss but get an extension sooner than later so they can sit back and relax operating for the next 20+ years. 30-1-LR
- Limerick is designated as one of the TOP THREE nuclear plants in the country based on it's construction (which is similar to the ones in Japan – and we see how they failed) and the fact that it sits on an earthquake fault line.
- The NRC JUST a few weeks ago stated that "more information needs to be done and studied" regarding further fortifying nuclear plants regarding earthquakes. Thus, until you folks know exactly what needs to be done, etc. THERE IS NOTHING TO APPROVE as long as Limerick sits in it's current position. 30-2-GE
- Do NOT think that earthquakes only happen on the West Coast – as we JUST had a 6+ earthquake less than a month ago. BY ONLY luck was there no damage to the plant, environment or community.
- The NRC had NO business allowing this plant to ever be built a) so close to such populated areas like Philadelphia (now, what the 3 largest city in the country?) within less than an hour, and exactly due SE from the site. 30-3-OS
- When Limerick was built, there was no idea that the area would grow in population like it has. For safety reasons, just look on any given day the traffic on Route 422 – stacked and stuck for miles on end. Route 422 is the #1 route for evacuations and does not handle regular commuter traffic let alone entire communities. 30-4-OS
- The NRC and USA Government STILL have not decided on where to store spent nuclear rods and as we speak each spent rod is sitting in baths on the Limerick sit, stacking up – expanding even a greater hazard to the community, environment, etc. SO put simply, there is ABOSLUTELY NO REASON to approve this request for YEARS until the US Government decides how they will handle such rods and such rods and properly stored. 30-5-RW
- There are many other environmental friendly sources of energy and Limerick as anything but that. As a matter of fact, Limerick is a TIME BOMB, placed at the wrong location, on the wrong land, too close to major populations, run by a for profit company who can not even handle the basic maintenance issues of power lines, in an aged building without the newest technology nor able to stand a real earthquake, and on and on. 30-6-OS
- The cooling towers are within basic walking distance from shopping malls and all right aside of it – please explain that – with minimal security from what many of us can see. 30-7-OS

SUNSI Review Complete
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E-RIDS = ADM-03
Add = L. Regner (LMR2)

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- Let's also mention a fact that Category I Hurricane Irene, which could have been a Category 3, just zipped less than 100 miles away from the site a few weeks ago and then Hurricane Lee which decided to travel further Eas came close to also causing chaos. Limerick is still TOO close to the disaster of Hurricanes as well. 30-8-AM
- Lastly, some who have a vested interest in working at the plant, etc. are quick to state that it is safe, etc. – no now, nor has it ever been fool proof against disasters, technical glitches, etc. 30-9-OS

Thus, I feel firmly and many in the community feel the exact same way, that there is NO REASON to approve NOW (especially so far in advance, with no answer on usage rods nor what needs to be done to prevent a meltdown due to an earthquake, etc.) or EVER since the population will only increase and the facility age further. It is the wrong timing, wrong plant, wrong place, etc. for Limerick. Maybe Exelon can put in as much effort and "energy" to develop solar fields, wind, etc... They would rather beat the hell out of a high efficiency plant at any and all cost to the environment and community. This is where the NRC does the right thing and says NO until a year before it expires. NRC needs to take a stand as you have the data and know what I have stated above is more than fair and true. 30-10-OR

Thank you for your time and attention.

Regards,

Joe Roberto

8/26/2011
76FR53498

⑦

**Delaware Tribe Historic Preservation Office**
1420 C of E Drive, Suite 190
Emporia, KS 66801
(620) 340-0111
bobermeyer@delawaretribe.org

September 23, 2011

Chief, Rules, Announcements, and Directives Branch
Division of Administration Services
Office of Administration
Mailstop TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: Request for scoping comments concerning the Limerick Generating Station, Units 1 and 2, License Renewal Application Review

Dear Lisa Regner:

Thank you for informing the Delaware Tribe on the proposed construction associated with the above referenced project. Our review indicates that there are no religious or culturally significant sites in the project area. As such, we defer comment to your office as well as to the State Historic Preservation Office and/or the State Archaeologist.

31-1-HA

We wish to continue as a consulting party on this project and look forward to receiving a copy of the cultural resources survey report if one is performed. We also ask that if any human remains are accidentally unearthed during the course of the survey and/or the construction project that you cease development immediately and inform the Delaware Tribe of Indians of the inadvertent discovery.

If you have any questions, please feel free to contact this office by phone at (62) 340-0111 or by e-mail at bobermeyer@delawaretribe.org

Sincerely,

Brice Obermeyer

Brice Obermeyer
Delaware Tribe Historic Preservation Office
1420 C of E Drive, Suite 190
Emporia, KS 66801

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Add = L. Regner (LMR2)

# Stockbridge-Munsee Tribal Historic Preservation Office

Sherry White - Tribal Historic Preservation Officer
W13447 Camp 14 Road
P.O. Box 70
Bowler, WI 54416


8/26/2011
76FR53498
8

Date Sept 28-11
Project Number Limerick Generating Station
TCNS Number
Company Name United States Nuclear Reg.

We have received you letter for the above listed project. Before we can process the request we need more information. The additional items needed are checked below.

**Additional Information Required:**

_____Site visit by Tribal Historic Preservation Officer
_____Archeological survey, Phase 1
_____Literature/record search including colored maps
_____Pictures of the site
_____Any reports the State Historic Preservation Office may have
_____Has the site been previously disturbed
_____ Review fee must be included with letter

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2011 OCT -4 AM 8:47
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If site has been previously disturbed please explain what the use was and when it was disturbed.

Other comments or information needed_______________________________

**After reviewing your letter we find that:**

_X_ "No Properties" the Tribe concurs with a Federal agency's finding that there are no National Register eligible or listed properties within the Federal undertaking's area of potential effect or APE 36CFR 800.4 (d) (1)

32-1-HA

______"No Effect" historic or prehistoric properties are present but the Federal undertaking will have no effect on the National Register eligible or listed properties as defined in Sec. 800.16(i)

______"No Adverse Effect" refers to written opinions provided to a Federal agency as to whether or not the Tribe agrees with (or believes that there should be) a Federal agency finding that its Federal undertaking would have "No Adverse Effect" 36 CFR 800.5(b)

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Template = ADM-013

E-RIDS = ADM-03
Add = L. Perkins (LNR2)

NRC FORM 659
(4-2010)

U.S. NUCLEAR REGULATORY COMMISSION

Category
3

## NRC PUBLIC MEETING FEEDBACK

Meeting Date: 09/22/2011

Meeting Title: Limerick Generating Station License Renewal Overview and Environmental Scoping Comments Public Meeting

In order to better serve the public, we need to hear from the meeting participants. Please take a few minutes to fill out this feedback form and return it to NRC.

1. How did you hear about this meeting?
   - [ ] NRC Web Page
   - [ ] NRC Mailing List
   - [x] Newspaper Pottstown Mercury
   - [ ] Radio/TV
   - [ ] Other

| | | Yes | No | Somewhat (Please explain below) | |
|---|---|---|---|---|---|
| 2. | Were you able to find supporting information prior to the meeting? | [ ] | [ ] | [ ] | Didn't Check |
| 3. | Did the meeting achieve its stated purpose? | [x] | [ ] | [ ] | |
| 4. | Has this meeting helped you with your understanding of the topic? | [x] | [ ] | [ ] | |
| 5. | Were the meeting starting time, duration, and location reasonably convenient? | [x] | [ ] | [ ] | |
| 6. | Were you given sufficient opportunity to ask questions or express your views? | [x] | [ ] | [ ] | |
| 7. | Are you satisfied overall with the NRC staff who participated in the meeting? | [x] | [ ] | [ ] | |

**COMMENTS OR SUGGESTIONS:** Thank you for answering these questions.

Why is the request ~~so~~ early - the NRC should get a Request Closer to expiration date. Also, the Inspection should done Closer to the expiration date. In 2023, not 2013 33-1-LR

***Continue Comments on the reverse.***

***OPTIONAL***

Name

Organization Resident

Telephone No.

E-Mail

[ ] *Check here if you would like a member of NRC staff to contact you.*

OMB NO. 3150-0197

Expires: 08/31/2012



**Please fold on the dotted lines with Business Reply side out, tape the bottom, and mail back to the NRC.**

**Mendiola, Doris**

**Subject:** FW: Response from "Comment on NRC Documents"

8/26/2011
76 FR 53498

-----Original Message-----
From: Richard Kolsch [mailto:Rklsch@aol.com]
Sent: Thursday, September 22, 2011 5:44 PM
To: INFOCOLLECTS Resource
Subject: Response from "Comment on NRC Documents"

10

RECEIVED

2011 OCT 12 AM 9:42

RULES AND DIRECTIVES BRANCH USNRC

Below is the result of your feedback form. It was submitted by

Richard Kolsch (Rklsch@aol.com) on Thursday, September 22, 2011 at 17:44:25

---------------------------------------------------------------------------

Document_Title: License Renewal Limerick PA

Comments: Comments on Limerick Power Plant License Renewal Limerick, PA September 22, 2011

1. Why is there a rush to renew the license? It is not due until 2024, approval at the earliest should be 2019. This would allow 5 years for the business plan of PECO to either continue or close the plant and make arrangements for additional power to replace the closed plant. 34-1-LR

2. A firm closure plan should be approved before license renewal is accepted. This plan must include what is to be done with the site, where the nuclear waste will be disposed of etc. 34-2-DC The disposal area must be at site in operation not some theoretical site like the now defunct Yucca site. The public and our future generation deserves to know what is expected to be done at the site. Radioactive material must not be allowed to remain on the site. 34-3-RW

3. The government should conduct a survey of various illness in the vicinity of the nuclear plant prior to any renewal of a license. If this would indicate a danger living near the plant then the license should not be renewed. 34-4-HH

4. Developers are required to fund traffic improvements to an area to allow an area to be developed, this should apply to Limerick. The evacuation plan now will not work. When the plant was started there was no traffic out here, now it is grid lock. Limerick should fund new roads and bridge to alleviate traffic jams in order to have an orderly evacuation. 34-5-OS

5. The plant is vulnerable to terrorist attacks. An airport is located next to the facility. A plane could be flown into the reactor building or the emergency power supply for the water circulation system at the same time terrorist could cut all outside power to the plant this would cause a meltdown and render the entire area around and downwind of the area uninhabitable for hundreds of years. 34-6-PA

organization: None

address1: 1694 Kepler Rd.

address2:

E-RIDS = ADM-03
Add = L. Belgner (LMR2)

SUNSI Review Complete
Template = ADM-013

1

8/26/2011

76FR53498

11

September 24, 2011
2461 E. High St., Unit F-28
Pottstown PA 19464

USNRC
Mailstop: TWB-05-BO1 M
Washington DC 20555

USNRC Lisa Regner:

We wish to add our comments to the NRC record.

We attended one of the NRC hearings concerning Limerick's Environmental Impact (9/22/11 at 2:00 p.m.) and were appalled that local business and community leaders avoided voicing concerns about Limerick's environmental impact, mentioning its economic influence, instead. That doesn't mean that those speakers had no concerns. The NRC would be remiss to consider a "thank you for money and jobs" as part of its evaluation of community-wide nuclear safety issues connected with Limerick's re-licensing request. Nuclear energy production is not an earth-friendly or population-sustaining process. It has had terrible consequences!

Limerick Nuclear's influence is vast and horrific. This industry is a behemoth that has not been honest with the public about its true impact, forming its own "environmental" partnerships that are pure pronuclear propaganda tools. It's economic contributions are miniscule when compared to its enormous profits, while destroying our quality of life. The nuclear process's devastating environmental effect on our community cannot be understated. 35-1-OR

Limerick Nuclear's request for re-licensing is ludicrous, considering its aging and inadequate equipment, its increased air pollution by particulate matter, its horrific destruction of the Schuylkill River and dangerous above-ground spent fuel rod storage. The fact that its request has been made in the wake of Japan's recent triple meltdowns, is mind blowing! Representative Tom Quigley's comments were not at all an accurate assessment of local sentiment! 35-2-OS 35-3-AM 35-4-SW 35-5-RW

The nuclear process is not an enlightened way to generate electrical energy. This plant needs to transition itself into a more intelligent way of generating energy by actually phasing out and safely shuttin[g] down the nuclear plant. By retraining its workers and adopting the safer green technologies, it could truly partner with the local community without putting its workers out of jobs. 35-6-AL

Ordinary daily nuclear generation has had devastating community-wide consequences that need to be addressed. Re-licensing should not even be a consideration! The NRC must fully investigate the environmental concerns presented Dr. Lewis and Donna Cuthbert (ACE), Dr. Winter, and each resident who so civilly represented this community's concerns at the September 22, 2011 hearings. The Limerick Nuclear Power Plant should NOT be re-licensed and should, instead, begin to address the pollution issues it has already created as it seriously and carefully shuts down its reactors. 35-7-OR

Sincerely,

Charles and Elizabeth Shank

Charles and Elizabeth Shank
(610-323-6715)

RULES AND DIRECTIVES BRANCH
2011 OCT 12 AM 9: 21
RECEIVED

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = L. Regner (LMR2)

**Mendiola, Doris**

RECEIVED 2011 OCT 13 AM 9: 53 RULES AND DIRECTIVES BRANCH USNRC

**From:** naturalcat@comcast.net
**Sent:** Wednesday, October 12, 2011 5:26 PM
**To:** Regner, Lisa
**Subject:** NRC ID DOCKET 2011-0166

Dear Ms Regner
As a business owner in Pottstown and a long time resident of the area I am deeply concerne 36-1-AM about the Limerick plant. I do not know if this plant is internally "safe" and it may very wel 36-2-SW I am more concerned about the effects of our surrounding air and water supply and the future of my children and grandchildren, some of whom are already inflicted with cancer and other 36-3-HH diseases. I also am concerned about terrorist attacks, natural diseasters and the more common "human error." I plead with you to not renew this license. I am very fearful. 36-4-OS
Respectfully,
Nancy Leaming
p.s. I did attend the meeting and listen with open mind and ears but my fears were not eased.

8/26/2011
76FR53498
12

SUNSI Review Complete
Template = ADM-013

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E-RIDS = ADM-03
Add = L. Regner (LAR2)

8/26/2011
76 FR 53498

**Mendiola, Doris**

13

RECEIVED

2011 OCT 13 AM 9:53

RULES AND DIRECTIVES BRANCH USNRC

| | |
|---|---|
| **From:** | Cynthia Gale [cgale@barbergale.com] |
| **Sent:** | Wednesday, October 12, 2011 4:31 PM |
| **To:** | Regner, Lisa |
| **Cc:** | Michael Gale |
| **Subject:** | DO NOT RELICENSE LIMERICK NUCLEAR PLANT. PERIOD. |

Dear Ms. Regner,

**On behalf of my family, friends, and neighbors, please do not relicense the Limerick Nuclear Power Plant. We work in Pottstown, live in Elverson, and our young daughter goes to school in Kimberton. All these locations are in harm's way of Limerick. Every day when I drop our child off at school I have a view of the Limerick towers when I travel on Route 724. I pray everyday that nothing happens when our daughter is at school. We no longer feel safe or even drink our tap water, do you?**

Limerick Nuclear Plant's License Expires In 2029 - Exelon Wants To Run It Until 2049
Threats and Harms, Already Unacceptable After 26 Years, Are Increasing!

Since 1985, Unprecedented Environmental Harms, Threats, and Risks From Limerick Include:

1. Radiation Into Air and Water From Routine and Accidental Emissions 37-1-RW
2. Major Air Pollution Under Health Based Standards of the Clean Air Act 37-2-AM
3. Schuylkill River Depletion and Major Drinking Water Contamination 37-3-SW; 37-4-GW
4. Radioactive Groundwater Contamination 37-5-GW
5. Radiation Reporting Levels Increased Dramatically After Japan Disaster 37-6-OS
6. Alarming Cancer Increases, Especially In Children, Since Limerick Started Operating 37-7-HH
7. Deadly High Level Radioactive Wastes Packed In Vulnerable Fuel Pools On Site 37-8-RW
8. Lax Fire Safety Regulations 37-9-OS
9. Accidents and Leaks From Corroding, Deteriorating Equipment Plus Miles of Buried Pipes and Cables 37-10-OS
10. Increased Risk of Meltdown From More Frequent and Stronger Earthquakes and Other Natural Disaste 37-11-PA
11. Threats From Unguarded Terrorist Attacks With Planes and Missiles, Cyber Attacks 37-12-OS
12. Need for an Updated Evacuation Plan and Increased EPZ 37-13-OS
13. Increased Costs to the Public - More Cancers and Other Costly Illnesses, More Emergency Room Visits and Hospitalizations from Massive Increases in PM-10 and TDS, Treatment of Public Drinking Water, Environmental Clean-Up 37-14-HH
14. Dangerous, Dirty, Harmful, and Costly Nuclear Power Is Not Needed. It Can And Should Be Replaced With Safe, Clean, Renewable Energy. 37-15-AL

List Compiled By The Alliance For A Clean Environment - September 2011

SUNSI Review Complete
Template = ADM-013

1

E-RIDS = ADM-03
Add = L. Regner (LHR2)

(14) 8/26/2011
76FR53498

**Mendiola, Doris**

**From:** Schweg [schweg@gmail.com]
**Sent:** Thursday, October 13, 2011 10:21 AM
**To:** Regner, Lisa
**Subject:** Limerick License Renewal - NRC I.D. Docket 2011-0166

RECEIVED
2011 OCT 13 PM 4: 35
RULES AND DIRECTIVES BRANCH USNRC

Hello Ms. Regner,

I'm writing to you to state my opposition to the relicensing of the Limerick Generating Station in Limerick Township, Pennsylvania. 38-1-OR

I'm worried about Exelon Generation Co., LLC's safety record and I hope you will consider my opinion on this matter. 38-2-OS

Respectfully,
Jude Schwegel
79 South White Horse Road
Phoenixville, Pa 19460

--

If you want to be important—wonderful. If you want to be recognized—wonderful. If you want to be great—wonderful. But recognize that he who is greatest among you shall be your servant. That's a new definition of greatness.

Everybody can be great, because everybody can serve. You don't have to have a college degree to serve. You don't have to make your subject and your verb agree to serve. You don't have to know about Plato and Aristotle to serve. You don't have to know Einstein's theory of relativity to serve. You don't have to know the second theory of thermodynamics in physics to serve. You only need a heart full of grace, a soul generated by love. And you can be that servant.

Excerpted from The Drum Major Instinct sermon of the Rev. Dr. Martin Luther King, Jr.
Delivered at Ebenezer Baptist Church, Atlanta, Georgia, on 4 February 1968

SUNSI Review Complete
Template = ADM-013

1

E-RIDS= ADM-03
Add= L. Regner (LMR2)

8/26/2011
76FR53498

**Mendiola, Doris**

**From:** Michael Gale [mgale@barbergale.com]
**Sent:** Thursday, October 13, 2011 9:26 AM
**To:** Regner, Lisa
**Subject:** DO NOT RELICENSE LIMERICK NUCLEAR PLANT. PERIOD.

15

RECEIVED

2011 OCT 13 AM 4: 35

RULES AND DIRECTIVES BRANCH USNRC

And, get the US manufacturing again making wind turbines, solar panels, retrofitting older buildings to be energy efficient, not funding this an other budget-busting toxic time bombs. 39-1-AL

Limerick Nuclear Plant's License Expires In 2029 - Exelon Wants To Run It Until 2049
Threats and Harms, Already Unacceptable After 26 Years, Are Increasing!

Since 1985, Unprecedented Environmental Harms, Threats, and Risks From Limerick Include:

1. Radiation Into Air and Water From Routine and Accidental Emissions 39-2-RW
2. Major Air Pollution Under Health Based Standards of the Clean Air Act 39-3-AM
3. Schuylkill River Depletion and Major Drinking Water Contamination 39-4-SW; 39-5-GW
4. Radioactive Groundwater Contamination 39-6-GW
5. Radiation Reporting Levels Increased Dramatically After Japan Disaster 39-7-OS
6. Alarming Cancer Increases, Especially In Children, Since Limerick Started Operating 39-8-HH
7. Deadly High Level Radioactive Wastes Packed In Vulnerable Fuel Pools On Site 39-9-RW
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9. Accidents and Leaks From Corroding, Deteriorating Equipment Plus Miles of Buried Pipes and Cables 39-11-OS
10. Increased Risk of Meltdown From More Frequent and Stronger Earthquakes and Other Natural Disasters 39-12-PA
11. Threats From Unguarded Terrorist Attacks With Planes and Missiles, Cyber Attacks 39-13-OS
12. Need for an Updated Evacuation Plan and Increased EPZ 39-14-OS
13. Increased Costs to the Public - More Cancers and Other Costly Illnesses, More Emergency Room Visits and Hospitalizations from Massive Increases in PM-10 and TDS, Treatment of Public Drinking Water, Environmental Clean-Up 39-15-HH
14. Dangerous, Dirty, Harmful, and Costly Nuclear Power Is Not Needed. It Can And Should Be Replaced With Safe, Clean, Renewable Energy. 39-16-AL

List Compiled By The Alliance For A Clean Environment - September 2011

**We sincerely hope you will act with your fellow citizens' health, and indeed longevity in mind.**

Sincerely,

**Michael Gale**
172 north hanover street
pottstown, pa 19464
610-705-3606 *p*
mgale@barbergale.com
http://www.barbergale.com
*designing sustainable brands*

SUNSI Review Complete
Template = ADM-013

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E-RIDS = ADM-03
Add = L. Regner (LNR2)

8/26/2011
76FR53498

**Mendiola, Doris**

16

RECEIVED

2011 OCT 13 PM 4: 35

RULES AND DIRECTIVES BRANCH USNRC

**Subject:** FW: LIMERICK

**From:** Joe Roberto [mailto:joe@robertoandassociates.com]
**Sent:** Monday, September 26, 2011 2:46 PM
**To:** Regner, Lisa
**Subject:** RE: LIMERICK

Thanks and again, since this reactor has until 2024 – why the rush, and only one public meeting. If you have not heard it, you will. There is a major public outrage over this one meeting and not knowing about until too late. People want public meetings so that people hear that many are against this plant rather than just submitting comments to the NRC which appears to just rubber stamp license requests – which is not comforting to me and many. But I do thank you very much for the courtesy, response and review of points. 30-13-LR

There is also something that I did not comment on before – why was Limerick taken "offline" three times in as many months? Is NRC checking? 30-14-OS

Thanks,

*Joe Roberto*

SUNSI Review Complete
Template = ADM-013

1

E-RIDS = ADM-03
Add = L. Regner (LHR2)

**Mendiola, Doris**

**From:** Melissa Antrim [mantrim@boscovs.com]
**Sent:** Friday, October 14, 2011 2:18 PM
**To:** Regner, Lisa
**Cc:** Antrim, Melissa home)
**Subject:** Docket 2011-0166 - Limerick License Renewal

8/26/2011
76 FR 53498

RECEIVED

2011 OCT 14 PM 2: 56

RULES AND DIRECTIVES BRANCH USNRC

Via email: Lisa.Regner@NRC.gov
U.S. NRC
Ms. Lisa Regner
Mailstop TWB-05-BO1 M
Washington, D.C. 20555

17

Reference: **Request for Denial of Limerick License Renewal - NRC I.D. Docket 2011-0166**

Dear Ms. Regner:

I attended the recent meeting on the possible renewal of Limerick Nuclear Plant's license for 20 years past its current 2024 and 2029 expiration dates. I strongly believe, as do many of my local friends and family, that the **Limerick Nuclear Plant must** be closed, not relicensed. Approving Limerick Nuclear Plant to be relicensed until 2049 would be jeopardizing the health of thousands and thousands of people in neighboring communities. There is substantial evidence readily available which justifies closing Limerick. Renewing this license could lead to a catastrophic meltdown. 40-1-OR

Limerick was built to last 40 years. The older any facility gets, the more likely breakdowns and equipment failure will occur. When it's a nuclear power plant, meltdown could result from corroding, deteriorating, and aging pipes, cables, and equipment - honestly, a number of things. *Miles* of deteriorating underground buried pipes and cables are a major concern - how and how often are these inspected? **Signs of mechanical damage and breakdown already exist** - three unplanned shutdowns June 2011, preceded by many others since 2007, one with loss of cooling water. While some parts can be replaced, by the nuclear industry's own admission, some equipment is too big and expensive to replace. Limerick is showing signs of stress and no one knows just how bad this will be by the time the current license is up. To add 20 more years to that, without having a clue as to what the condition will be, would be beyond careless. 40-2-OS

Over eight million people live within 50 miles of Limerick Nuclear Plant. Safe evacuation is not possible, even within the seriously flawed and inadequate current 10-mile evacuation plan. Until Limerick closes, NRC should expand the evacuation plan (to 50 miles) and be sure there are enough shelters and supplies available to accommodate the over 8 million people within that radius. Exelon should pay for the supplies. 40-3-OS

It doesn't take an accident or disaster for Limerick to poison the region's residents with radiation. Radiation from Limerick's routine and accidental emissions alone for the past 26 years is reason enough to deny Exelon's request. ***It's not credible for NRC to claim continuous radiation levels are safe for me and my family when there is no safe level of exposure according to the National Academy of Sciences and Physicians for Social Responsibility***.

NRC never did any radiation monitoring or testing at Limerick. Evidence shows testing done by Exelon and DEP cannot be trusted. **Exposure to radiation is known to cause cancer.** It should be obvious to NRC that Limerick played a major role in our tragic, well documented cancer crisis after Limerick started operating in the mid 1980s to the late 1990s. Four cancer studies based on PA Cancer Registry and CDC data showed skyrocketing rates for several cancers far higher than national and state averages, especially in children. Our children had the highest levels of Strontium-90 radiation in their baby teeth of any group near any nuclear plant studied. Limerick Nuclear Plant released SR-90 into our air and water that got into the milk, vegetation, and food since Limerick started operating. 40-4-HH

SUNSI Review Complete
Template = ADM-013

1

E-RIDS = ADM-03
Add = L. Regner (LWRA)

Thyroid cancer increased by 128% from 1985 to 1997 - was a side note, with no family history or other obvious risk factors in my life, I was recently treated for thyroid cancer. Since my diagnosis, I have learned of many other locals like me. It's scary to think the choice of where we live could kill us. 40-5-HH

It would be careless, unethical and immoral for NRC to approve Exelon's requested license extensions for Limerick Nuclear Power Plant. **Limerick Nuclear Plant must be closed by 2029.** 40-6-OR

Sincerely,
Melissa Antrim
1008 Reading Ave
Boyertown, PA 19512

8/26/2011
76FR 53498

**Mendiola, Doris**

18

RECEIVED

2011 OCT 14 PM 2: 56

RULES AND DIRECTIVES BRANCH USNRC

**From:** Michael Antrim [antrim89@gmail.com]
**Sent:** Friday, October 14, 2011 2:35 PM
**To:** Regner, Lisa
**Subject:** Limerick - NRC I.D. Docket 2011-0166

Reference: **Request for Denial of Limerick License Renewal - NRC I.D. Docket 2011-0166**

Dear Ms. Regner:

The possible renewal of Limerick Nuclear Plant's license for 20 years past its current 2024 and 2029 expiration dates more than 12 years ahead of time, worries me a great deal. It's hard to understand why something this major would be done so far in advance. It's IMPOSSIBLE to know the condition of Limerick 12-19 years ahead of time. Why on earth would this be renewed so early? It's a lengthy process that could begin earlier, but in no way should something this important be rushed through now. Why not wait until closer to the expiration dates, and then seek approval? I understand this is how the original guidelines were set up - but those are long outdated. Approving Limerick Nuclear Plant to be relicensed until 2049 would be jeopardizing the health of millions. Renewing this license could be catastrophic to millions. Someone has to speak up; someone has to step up. 41-1-LR

Earthquakes and other natural disasters are more frequent and stronger than ever before. Limerick is 3rd on the earthquake risk list. Underground pipes and cables can shake and break, which would lead to loss of power, loss of cooling water, and ***meltdown***. Limerick's substandard containment flaw means more radiation would be released. It is simply too dangerous to keep Limerick operating. Would ***you*** want to live within miles of this potential catastrophic disaster? Add the enormous population growth that this area has seen over the past 10 years - with little to no road improvements - and attempting to evacuate the area during a disaster would be futile. It would be virtually impossible to get out of harms way. 41-2-OS

The older any facility gets, the more likely breakdowns and equipment failure will occur. Limerick was built to last 40 years. Limerick is showing signs of stress and no one knows just how bad this will be by the time the current license is up. To add 20 more years to that, without possibly knowing what the condition will be, would be careless. No one can predict what the condition of Limerick will be in 2024 or 2029. Over eight million people live within 50 miles of Limerick Nuclear Plant. Safe evacuation is not an option. Plain and simple. That's a scary thought for those of us who live here!!

Exposure to radiation is known to cause cancer. NRC has not done any radiation monitoring or testing at Limerick. Evidence shows testing done by Exelon and DEP cannot be trusted - it's ridiculous to think they could monitor themselves. It should be obvious to NRC that Limerick played a major role in our cancer crisis after Limerick started operating in the mid 1980s to 2000. Four cancer studies based on Pennsylvania Cancer Registry and the CDC showed skyrocketing rates for several cancers much higher than national and state averages, especially in children - innocent children. Thyroid cancer increased by 128% from 1985 to 1997. I have local friends and family with thyroid cancer and brain cancer - not one, but several. Sadly, it's no longer uncommon in this area to have a personal link to cancer. However, it IS uncommon in other areas of the country. It used to be uncommon here too - prior to Limerick. Would YOU want to live here? Would YOU approve a license renewal so close to home? Your job is to safely review the facts. Don't like the money of these corporations blur the facts. 41-3-HH

Thank you for your time today. Just remember, it would be careless, unethical and immoral for NRC to approve Exelon's requested license extensions for Limerick Nuclear Power Plant. Limerick Nuclear Plant must be closed by 2029. 41-4-OR

Sincerely,

SUNSI Review Complete
Template = ADM-013

1

E-RIDS= ADM-03
Add= L. Regner (LMR2)

8/24/2011

**Mendiola, Doris**

76FR53498

19

**From:** joanmcglone@comcast.net
**Sent:** Sunday, October 16, 2011 10:11 PM
**To:** Regner, Lisa
**Subject:** Limerick License Renewal

Dear Ms. Regner: re: Limerick License Renewal - NRC I.D. Docket 2011-0166

I am opposed to the license renewal of the Limerick nuclear plant which was designed to safely operate for 30 yrs. and should now be safely shut down. Statistics regarding nuclear accidents at similar aging structures are well documented. Those two towers are ticking timebombs and the NRC knows this and needs to shut them down. Following the Japanese nuclear disaster our Limerick nuclear plant hit the statistical at risk list again. The increased risk of cancer is well-founded in the literature also. Why does the NRC think they can play God with people's lives? It is no longer debatable, shut it down before our very lives are jeopardized!!! 42-1-OS 42-2-HH

So-called quality of life issues addressed as part of public debate, e.g. "the power is always on" seems irrelevant to us when our families are required to evacuate during a disaster. Limerick must be closed and NOT relicensed at any cost, specifically the cost of life itself! 42-3-OR

Sincerely,
Joan McGlone
Resident of Royersford borough

RULES AND DIRECTIVES BRANCH USNRC

2011 OCT 17 PM 4: 18

RECEIVED

SUNSI Review Complete
Template = ADM-013

E-RIDS=ADM-03
Add = L. Regner (LMR2)

1

Mary L Smith
1043 S Keim St
Pottstown PA 19465-7737

SOUTHEASTERN PA 193
14 OCT 2011 PM 1 L

USA FIRST-CLASS FOREVER

U.S. NRC, Lisa Regner, License Renewal
Mailstop TWB-05-B01M
Washington, DC 20555

To: Lisa Regner, License Renewal
NRC I.D. Docket 2011-0166
U.S. NRC

Do not renew Limerick License. It's too dangerous and too old

Please listen to their neighbors like us.

43-1-OR

Mary Lou, Harold Smith
and neighbors
1043 S. Keim St.
Pottstown, PA 19465

**Committed to Community Service**

**Mendiola, Doris**

**Subject:** FW: *Limerick License Renewal-NRC I.D. Docket 2011-0166
**Attachments:** Limerick.odt

-----Original Message-----
From: Angelbosley <angelbosley@aol.com>
To: Lisa.Regner <Lisa.Regner@NRC.gov>
Cc: AngelBosley <AngelBosley@aol.com>
Sent: Sun, Oct 23, 2011 12:48 pm
Subject: *Limerick License Renewal-NRC I.D. Docket 2011-0166

Lisa Regner:

Hello, I am attaching a letter to you regarding Limerick Power Plant trying to Re-license until 2049. Please read it. Thank you for your time and attention.

Sincerely,

8/26/2011
76 FR 53498

21

Lisa Smoyer
1027 Farmington Ave.
Pottstown PA 19464
484-945-0246

RECEIVED
2011 OCT 24 AM 9:58
RULES AND DIRECTIVES BRANCH USNRC

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = L. Regner (LMR2)

Sunday, October 23, 2011

Lisa Regner, License Renewal
Mailstop TWB-05-BO1 M
Washington DC 20555

Lisa.Regner@NRC.gov

*Limerick License Renewal-NRC I.D. Docket 2011-0166

Dear NRC/Lisa Regner:

I was unable to attend the public hearing at the time that is occurred. I would like to voice my concern to all of you through this letter. There are so many reasons why you as a group should already know that it would be in the best interest of the men, women, children, babies, fetuses, animals, fish, wildlife in general and the environment for you to refuse/oppose Limerick Power Plant from re-licensing. The problem that always seems to come up at some of these public hearings and sessions where businesses/corporations want to expand and become bigger and run their businesses long past the time that they should truly be allowed in order to keep people safe, always comes back to the issue of money, offerings, bribes, donations, etc. in the end. When these things occur, people and businesses turn a "blind eye" so to speak to the dangers of allowing a business like the Limerick Power Plant to renew its license again. That is unacceptable! I expect and demand better service from you to help protect myself and my family from harm! 44-1-OR

There is no "independent" testing being done at Limerick. The results of testing are provided by their own company, who has a vested interest in the outcome of those results, so how could you ever believe that they would be honest about the results? Seriously?? 44-2-OS

There is concern that should be faced regarding the Schuylkill River and the affects it is going to have on the public if it becomes depleted, and/or toxic due to the contaminates going in it. 44-3-SW It is disgusting and heart wrenching to know that officials and organizations are not paying attention to what can happen to the public if Limerick Power Plant continues to operate longer then expected. Ignoring the obvious problems our community is facing and hoping that after they serve their term, it will be someone else s problem to deal with is unacceptable. Now is the time. Step up and do what is morally right for humanity. 44-4-OR

We as a society need to wake up and start paying attention to the massive harm power plants can cause to the people, animals, water, air, etc. Why does everyone want to pay attention when it is way too late?? There are safer alternative forms of energy available to our country/communities. We should be working on them and training employees, who currently work for the nuclear power plants, how to work with safer forms of energy to help our country move forward in today's society. 44-5-AL

Haven't we already seen some of the damage that a terrorist attack can cause for our country and for others? Do you really need to risk more possible attacks on a power plant that is not fully equipped for that kind of attack or for some other natural disasters that can occur. This plant is not prepared for attacks with planes, missiles, and other threats such as a cyber attack. 44-6-PA There should also be a concern for accidents and leaks from corroding and deteriorating equipment at the site from over the years 44-7-OS

(Page 2 of 3)

which could cause parts of it to be shut down for periods of time, as well as the miles of buried pipes and cables. There are many concerns that should be fully looked at and considered, and just with minimal thought to them, it shouldn't take a "rocket scientists" so to speak to figure out that it is not in the best interest of the public or environment to allow them to re-license.

44-7-OS Cont'd

The most alarming and compelling thing to me as a taxpayer, homeowner, and mother is the overwhelming and alarming cancer increases to the public after Limerick had started operating. The CDC website showed a 92.5% higher than the national average for childhood cancer in six communities close to the Limerick Nuclear Plant which included, Pottstown, West Pottsgrove, Lower Pottsgrove, Upper Pottsgrove, North Coventry, and Douglass Berks Township from cancers diagnosed from 1995-1999. The Pennsylvania State Cancer Registry For Montgomery County- from 1985-86 to 1996-97 also shows cancer rates skyrocketed in Montgomery County where the Limerick Nuclear Plant is located during the Mid 80's to 90's after they opened. Prostate Cancer increased 132%, Thyroid Cancer increased 128%, Kidney cancer increased 96%, Multiple Myeloma increased 91%, Hodgkin's Disease increased 67%, Non-Hodgkin's Lymphoma increased 61%,Breast cancer increased 61%, Pancreas cancer increased 54%, and Leukemia increased 48%.

44-8-HH

Radiation exposure can cause cancer and other serious disease and disability, at any level of exposure according to the National Academy of Sciences and Physicians for Social Responsibility. Permissible radiation levels does not mean that they are safe levels for everyone in the community. Most permissible levels are based on the average healthy adult. They are not levels that were based or researched for fetuses, infants, toddlers and children or pets. Fetuses, infants, children, pets and the elderly and immuned compromised individuals are at most risk of health problems. There is a broad range of dangerous radionuclides routinely released into our air and water from the Limerick Nuclear Plant as well as any accidental releases. Permissible radiation levels does not mean that they are safe radiation levels, it only means that they are allowed.

44-9-HH

I have children as well as other loved ones that have or have had allergies, asthma, learning disabilities, speech disabilities, behavioral disabilities, thyroid conditions, cancers, skin disorders and irritation, etc. I know neighbors and other community members that have suffered from the same and more. We deserve to live in a community where our air and water isn't being contaminated constantly with hazardous chemicals, radiation, etc. when there are other energy alternatives out there that are being used that are safer for the community.

44-10-AL

I expect you to do what is morally right now for me, my family, my neighbors, my community, and the pets, wildlife, air, water, and environment in whole by rejecting, refusing and opposing Limerick Power Plant from re-licensing to run their business longer then originally planned for 2029. Don't turn a "blind eye" now. Do your job knowing that you are doing what is morally right and safe for humanity and for my children and for the future of generations to come. Please help women have a chance to carry a baby full term without complications due to any possible air and water pollution that may have been caused by allowing more radiation into the environment when there are safer alternatives for energy.

44-11-OR

44-12-AL

One person/individual can make a huge difference in the life of others whether or not you realize it. It can have a domino effect on others. Please step up and be that one person that we truly need right now to do what is right. Why does it have to take someone to be personally affected by a situation or to have a loved one suffer or die to step forward and do something? Please don't wait. Now is the time. Please be courageous enough to stand up and fight for what is right for this community and for humanity in a whole, no matter how hard or long the task may seem, it will be worth it in the end!!!

I appreciate your time and attention in this matter. Thank you.

Sincerely,

Lisa Smoyer- Upper Pottsgrove Resident
1027 Farmington Ave.
Pottstown PA 19464

CC: Friends, Family and some community members

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2011 OCT 24 PM 2: 37

RULES AND DIRECTIVES BRANCH USNRC

October 8, 2011

8/26/2011
76FR53498

22

U.S. NRC
Ms. Lisa Regner
Mailstop TWB-05-BO1 M
Washington, D.C. 20555

Lisa.Regner@NRC.gov

Subject: **Deny Limerick License Renewal - NRC I.D. Docket 2011-0166**

Dear Ms. Regner:

I urge NRC to deny Exelon's request to renew Limerick Nuclear Plant's license for 20 years past its current 2024 and 2029 expiration dates. Limerick Nuclear Plant must be closed, not relicensed, for many valid reasons. Approval for Limerick Nuclear Plant to be relicensed until 2049 would be reckless and would show blatant disregard for the health and safety of the public. There is more than sufficient evidence of harms and threats to justify closing Limerick. There are too many things beyond NRC's control that could lead to a catastrophic meltdown. 45-1-OR

Limerick is 3rd on the earthquake risk list. It is too dangerous to keep Limerick operating. Earthquakes and other natural disasters are more frequent and stronger. Underground pipes and cables can shake and break, then lead to loss of power, loss of cooling water, and meltdown. Limerick's substandard containment flaw means more radiation would be released. 45-2-PA

Everything has a life expectancy. Limerick's was 40 years. The older any facility gets, the more likely mechanical breakdowns and equipment failure will occur. When it's a nuclear plant, meltdown could result from corroding, deteriorating, and aging pipes, cables, and equipment. Miles of difficult to inspect corroding, deteriorating underground buried pipes and cables are a major concern. Signs of mechanical damage and breakdown already exist - three unplanned shutdowns June 2011, preceded by many others since 2007, one with loss of cooling water. While some parts can be replaced, by the nuclear industry's own admission, some equipment is too big and expensive to replace. 45-3-OS

Terrorists have made it clear they intend to attack nuclear plants. Exelon has refused to pay to guard Limerick against a 9/11 type terrorist attack with a plane or missile, even though the most deadly targets (Limerick's fuel pools) are vulnerable to such attacks. Limerick is a similar design to nuclear plants in Japan that are melting down and exploding. NRC's own report from 2000 shows people 500 miles away could be impacted by an accident or attack on such fuel pools. Deadly radioactive spent fuel rods are jam packed into Limerick's vulnerable fuel pools five stories high. Cyber attacks, now declared an act of war, could wipe out systems that could lead to meltdown. Hackers have penetrated the Pentagon and other well guarded systems. Exelon's new plan for cyber attacks gives us little comfort. 45-4-OS

No NRC policy, review, or report can make Limerick failsafe from a catastrophic meltdown. Over eight million people live within 50 miles of Limerick Nuclear Plant. Safe 45-5-OS

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E-RIDS = ADM-03
Add = L. Regner (LMR2)

evacuation is merely an illusion, even within the seriously flawed and fundamentally inadequate current 10-mile evacuation plan. Until Limerick closes, NRC should expand the evacuation plan (minimally to 50 miles) and be sure there are enough shelters and supplies available to accommodate the over 8 million people within the 50 miles. Exelon should pay for the supplies. Unless this is done, Limerick should be closed as soon as possible. 45-5-OS Cont'd

But, it doesn't take an accident or disaster for Limerick to poison the region's residents with radiation. Radiation from Limerick's routine and accidental emissions alone for the past 26 years is reason enough to deny Exelon's request. It's not credible for NRC to claim continuous radiation levels are safe for me and my family when there is no safe level of exposure according to the National Academy of Sciences and Physicians for Social Responsibility. 45-6-HH

NRC is failing to acknowledge obvious health harms from Limerick's continuous additive, cumulative, and synergistic radiation releases which get into our water, food, soil, vegetation, milk, and our bodies. NRC has no idea what health harms some of the region's residents experienced from Limerick Nuclear Plant. NRC never did any radiation monitoring or testing at Limerick. Evidence shows testing done by Exelon and DEP cannot be trusted. 45-7-HH

Exposure to radiation is known to cause cancer. It should be obvious to NRC that Limerick played a major role in our tragic, well documented cancer crisis after Limerick started operating in the mid 1980s to the late 1990s. Four cancer studies based on PA Cancer Registry and CDC data showed skyrocketing rates for several cancers far higher than national and state averages, especially in children. Our children had the highest levels of Strontium-90 radiation in their baby teeth of any group near any nuclear plant studied. Limerick Nuclear Plant released SR-90 into our air and water that got into the milk, vegetation, and food since Limerick started operating. Thyroid cancer increased by 128% from 1985 to 1997. Other cancers rose dramatically as well. 45-8-HH

Limerick Nuclear Plant is slowly destroying the vital public drinking water source for almost two million people from Pottstown to Philadelphia. Radioactive and heated wastewater is discharged by Limerick Nuclear Plant into the Schuylkill River 24/7. Limerick's cooling towers are causing significant depletion. To supplement the flow to operate Limerick, Exelon wants to pump more contaminated mine water into the river. No one can credibly assure us if drinking water will remain safe even until 2029 when Limerick's original license expires. 45-9-SW

Limerick contaminated groundwater. Radioactive leaks and spills over the years were never cleaned up. More radioactive leaks can be expected in the future through earthquakes, deterioration, and corrosion. Many residential wells are very close to Limerick. 45-10-GW

It would be both unethical and immoral for NRC to approve Exelon's requested license extensions for Limerick Nuclear Power Plant. All of the unprecedented harms, threats, and risks from Limerick Nuclear Plant will increase if NRC approves an additional 20 year Limerick license extension, until 2049. Limerick Nuclear Plant must be closed by 2029. 45-11-OR

Sincerely,

Charlene Dlishu

1618 Benjamin Dr.
Ambler, PA 19002

Oct. 21, 2011

Ms. Lisa Regner
Project Manager
NRC Environmental Review Project

Dear Ms. Regner:

I am writing to express my opposition to the re-licensure of Limerick nuclear power generating station, which is located about 20 miles from my home. There are several reasons why this re-licensure is not in the best interests of people living in the surrounding community. 46-1-OR

If this license renewal is granted, this plant will continue operating until 2049, at which time it will be over sixty years old. Cracks in concrete and corrosion in piping will inevitably develop as this facility ages. While some of this "wear and tear" may be evident to visual inspection, some of it will also occur in less accessible places, such as in underground piping systems. The Associated Press has shown that tritium leaks in underground piping systems frequently go undetected—sometimes for years—in aging nuclear power plants.[i] While no leaks of this kind have so far been documented at Limerick, the odds of these sorts of problems developing will only increase with every successive decade of the plant's working life. 46-2-OS

While the problems associated with age will develop in any nuclear power plant over time, there are additional problems with the reactors at Limerick. Limerick's reactors are boiling water reactors similar to those that catastrophically melted down last spring in Japan. Although these reactors have a later containment design, they have the same fundamentally flawed reactor pressure vessel design as those that failed at Fukushima.[ii] In the BWR design, the control rods come up through the bottom of the pressure vessel, instead of dropping down from above as in other reactor designs. While the reactor pressure vessel itself is made of very thick steel, the bottom of the BWR pressure vessel contains 60 holes through which the rods enter the vessel.[iii] In the event of a meltdown, however, these same holes can provide a "path of least resistance" through which the hot molten fuel can escape with relative ease; it then only has to melt through connecting pipes that are much thinner and weaker than the metal of the pressure vessel itself.[iv] This apparently occurred at Fukushima, where authorities now admit that reactor fuel underwent not merely a "melt-down," but a "melt-through," breaching the inner pressure vessel and in the process releasing considerable amounts of radioactive material into the environment.[v] 46-3-OS

One might be tempted to dismiss the comparison with Fukushima on the grounds Limerick in Pennsylvania is unlikely to experience a similar combination tsunami and earthquake. While the tsunami is not an issue, however, recent analysis by the Nuclear Regulatory Commission suggests that earthquakes pose a more significant threat to the Limerick reactors than was recognized at the time of their construction and initial licensure. (Incidentally, it now appears that at least one of Fukushima's reactors was significantly damaged by the earthquake even *before* the tsunami struck.)[vi] According to the NRC's own data, Limerick's two reactors are the *third* and *fourth* most likely in the country to sustain core damage in the event of an earthquake.[vii] There is a fault line called the Ramapo fault line that runs slightly north of Limerick, and two small earthquakes associated with this fault line occurred as recently as February 2009.[viii] The unexpected quake that shook Virginia's North Anna nuclear plant with *over two times the amount of force that it was designed to withstand* should make us take very seriously the NRC's data regarding Limerick's greater than previously recognized vulnerability to earthquake damage.[ix] These concerns are compounded by the fact that the manufacturer of Limerick's control rods, GE Hitachi, 46-4-PA recently acknowledged concerns that the control rods in its BWRs might not function properly in the event of an earthquake.[x]

46-4- PA Cont'd

Questions about the Limerick reactors' ability to withstand accidents and natural disasters are all the more pressing because so many people could potentially be affected if something catastrophic were to occur. Since 1990, the population within a ten-mile radius of the plant has increased by 45%, from 178,047 to 257,625.[xi] In addition, Philadelphia, with a population of 1,526,006, is only about 28 miles away. How much more might these populations increase by 2049? Bearing in mind that the NRC advised Americans within a *50 mile* radius of Fukushima to evacuate last spring, one can only imagine how difficult it would be to carry out such evacuations if the unthinkable were ever to occur at Limerick.

46-5-OS

Finally, my concerns regarding the impact of this nuclear power plant on my community are not limited to catastrophic scenarios that might potentially occur. There have been some recent studies published in health journals that show a higher incidence of certain illness—particularly among children—in communities surrounding nuclear power plants.[xii] While these studies were conducted in a variety of locations, they seem to be consistent with some of the data that Pottstown's local Alliance for a Clean Environment presents on its website regarding increased cancer and leukemia rates—also especially among children—in the greater Pottstown area.[xiii]

46-6-HH

For all of these reasons, I am asking the Nuclear Regulatory Association to deny Exelon's request to extend Limerick's operating license for an extra twenty years.

Thank you for your time.

Sincerely,

Lori Molinari

**Mendiola, Doris**

**From:** Regner, Lisa
**Sent:** Thursday, October 27, 2011 10:17 AM
**To:** Gallagher, Carol
**Cc:** Mendiola, Doris
**Subject:** Limerick Comment dictated to PM (docket NRC-2011-0166)

8/26/2011
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*Environmental Scoping comment dictated to PM (L. Regner) on October 27, 2011:*

I'm against it for two reasons:

Limerick Generating Station is old and I don't think it is strong enough to withstand plane impacts, earthquakes, or tornadoes that occur here. 47-1-PA

I am fully aware of the amount of cancer that is prevalent in this area. 47-2-HH

Doris Meyers

*Read back to Ms. Meyers twice by PM to ensure accuracy of dictated statement.*

**Lisa M Regner,** Senior Project Manager
Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Lisa.Regner@NRC.Gov
Office: O 11 H-23
Mail Stop: O 11 F-1
(301) 415-1906

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2011 OCT 28 AM 10: 36
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Template = ADM-013

1

E-RIDS = ADM-03
Add = L. Regner (LMR2)

**Mendiola, Doris**

**From:** quteasz@comcast.net
**Sent:** Thursday, October 27, 2011 3:03 PM
**To:** Regner, Lisa
**Subject:** Limerick Nuclear Plant Relicensing

Hello Ms. Regner:
Just a quick note requesting the NRC to NOT allow the relicensing of the Limerick, Pa., nuclear plant at this time.
48-1-OR

I moved to Pottstown, Pa., some time ago in perfect health. In 2006, I was diagnosed with prostate cancer. Although, I cannot prove it was a direct cause of the nuclear power plant, I feel that much further, unbiased studies and tests need to be done prior to the relicensing of the Limerick plant by reputable sources not by corporate interests groups that can manipulate the statistics in Exelon's favor.
Wouldn't it be in the best interest of our community and surrounding communities if the higher cancer rate was due to the Limerick power plant???? This question is a "no brainer".
48-2-HH
There is plenty of time for testing to be done prior to the relicensing.

Also, why the hurry??? Common sense would indicate that Exelon knows something to which we are not aware.
Why must the license be renewed at this time when they are licensed through 2024 and 2029????
48-3-LR
Again, WHY THE HURRY???
To relicense now is not in the best interest of everyone in our area.

Prior to the construction of the Limerick power plant, everyone in our surrounding area was told that our electricity would be one of the lowest in the U.S.
THIS WAS A BOLD FACE LIE!!!! IT IS ONE OF THE HIGHEST IN THE U.S.!!!
48-4-OS
Excelon lied to us then and they will distort the facts now.

PLEASE DO NOT BE IN A HURRY TO RELICENSE LIMERICK WITHOUT COMPLETE AND HONEST TESTING BY AN IMPARTIAL COMPANY. There is plenty of time after the test results.

Thank you for reading my e-mail. I hope God guides your agency into making the correct decision.

Ken Sekellick
661 N. Price St.
Pottstown, PA. 19464

quteasz@comcast.net

1

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2011 OCT 28 AM 10: 47

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8/26/2011
76FR53498

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936 Shenkel Road
Pottstown, PA 19465
October 25, 2011

U. S. NRC
C/O Lisa Regner, License Renewal
Mailstop TWB-0505-B01 M
Washington, D. C. 20555

Re: Limerick License Renewal
NRC I.D. Docket 2011-0166

Dear Lisa, NRC:

As a physician, I am writing to help you understand that nuclear reactors are not safe. I attended the medical clinic in Hiroshima right after the bombing and saw the radiation horrors caused by nuclear bombing. I have kept a close watch on similar problems by nuclear energy in the medical field since then, not only worldwide, but because of our nearby nuclear power plant. Here are some concerns.

According to the National Center for Disease Control, Pennsylvania ranks No. 1 for the highest incidence of Thyroid cancer. This occurred after installation of nuclear power plants in our area as well as in the rest of the State. Medical journals are reporting high rates of cancer near nuclear plants. An earthquake in our area is not too far fetched. And, of course, the threat of terrorism with vulnerable spent fuel are always a concern. 6-6-HH 6-7-PA

Incidentally, baby teeth studies have revealed Strontium 90 radioactive particles which can affect the child's immune system for more illness. 6-8-HH

We can't control the use of nuclear in the rest of the world, but we can keep the U. S. safer by eliminating nuclear energies. Fortunately, many of our European allies including Australia have decided to phase out reactors. We should join them to reduce human suffering. Also this can reduce our increasing costs of health care! 6-9-OR

Please listen to this advice after years of doing my best for America. Rely on more and truly safe and renewable sources like solar, wind and geothermal power. A patriotic duty to protect our kids. 6-10-AL

Limerick Power Plant is ranked in the top 3 riskiest nuclear power plants in the U.S.A. Limerick Power Plant must be closed not relicensed. 6-11-OR

Sincerely yours,

/s/ Fred S, Winter
Fred S. Winter, M. D.

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E-RIDS=ADM-03
Add= L. Regner (LMR2)

8/24/2011
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Anthony Gonyea
Onondaga Nation
Hemlock Rd. Box 319B
via Nedrow, NY 13120

Oct. 15, 2011

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2011 OCT 28 PM 4: 55
RULES AND DIRECTIVES

David J Wrona
US Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: Project ID: Limerick Generating Station
Limerick Township of Montgomery County, PA

Dear Mr. Wrona,

Thank you for providing the Onondaga Nation with information about this project. If anything changes are made, I would like to be consulted. I realize that Unit 1 and Unit 2 have licenses that may be renewed in 2024 and 2029 respectively, therefore you may send updates and information until then.

49-1-HA

In the event that during project construction, any archeological resources or remains, including, without limitation, human remains, funerary objects, sacred objects, or objects of cultural patrimony are uncovered, please immediately stop construction and contact me at (315)952-3109, or the Onondaga Nation's General Counsel Mr. Joseph Heath at (315)475-2559.

If you have any comments or questions about this matter, please do not hesitate to let me know. Thank you for your help.

Sincerely,

Anthony Gonyea

Anthony Gonyea
A Faithkeeper for the Onondaga Nation
Onondaga Nation Historic Preservation Office
Section 106 Representative

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Add = L. Regner (LUR2)

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2011 OCT 28 PM 4: 52

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**Mendiola, Doris**

**From:** Deb Penrod [deb24532@comcast.net]
**Sent:** Thursday, October 27, 2011 8:06 PM
**To:** Regner, Lisa
**Subject:** greetings from a SUPPORTER of Limerick nuclear plant

Hi,

I wanted to let you know that I am a complete and full supporter of the Limerick Nuclear plant. I am also supportive of the scientific judgement and expertise of those such as yourself who have the job of making the decisions. 50-1-SR

(I saw your name in an article in the Mercury where the writer was requesting that objections be sent to you. I thought I would take advantage of the contact information to state a contrary position.)
I grew up in coal-mining country, and never saw a stream or a creek with clear water uncontaminated by acid mine runoff until I was in my late teens. Opponents to nuclear power have usually never lived near coal truck entrances to mines and coal plants, and have probably never lost family members to mine cave-ins or black lung. Risks should be minimized as much as possible, but the world will always have something that someone objects to. Unscientific or fear-based objections to nuclear power are unproductive and do not advance safe or reasonably priced power.

I work in the pharmaceutical industry (I was first educated as a pharmacist, and then as an attorney; I now help to get new vaccines approved, and to help increase vaccination rates). The parallel I see is with the group of people who see disaster in every prescription drug product, and complain about everything the FDA approves or does. Nothing is ever 'safe' enough for them.

Please renew Limerick, using the best scientific information and risk/benfit analysis available to you. 50-2-SR

Thank you.
Debby Penrod
215 Amanda Smith Drive
PO Box 516
Pottstown, PA 19464

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E-RIDS = ADM-03
Add = L. Regner (LMR2)

**Mendiola, Doris**

**From:** DocKoenig@aol.com
**Sent:** Thursday, October 27, 2011 8:49 PM
**To:** Regner, Lisa
**Subject:** Fwd: Nuclear Limerick

8/26/2011
76FR53498

30

From: DocKoenig@aol.com
To: LisaRegner@nrc.gov
Sent: 10/27/2011 7:36:13 P.M. Eastern Daylight Time
Subj: Nuclear Limerick

Hello Lisa Limerick should not .be licensed. or relicensed at this time. They are only doing it because the plant has issues that they are trying to hide. The evacuation plan is a joke because we would not get out of our driveways. It would not have worked 10 years ago and certainly with the population growth it would be much worse. 51-1-OS

Relicense should not be permitted because all kinds of deterioration has occurred and is occurring and the present licenses do not run out until 2024 and 2029. They are doing this now because they know it would not pass if they waited for 2024 and 2029. This is an old plant and there is much corrosion and concrete deterioration that is going on . There are many miles of buried pipes that cannot checked reliably. 51-2-OS

Cancer rates are higher than the national average and NRC is going with the status quo. 51-3-HH

Also Limerick is built on a fault . Please protect our citizens from possible disaster and do not relicense Limerick, Sincerely Charlie Koenig 51-4-GE; 51-5-OR

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ERIDS=ADM-03
Add= L. Regner (LHR2)

**Mendiola, Doris**

**From:** John & Joyce Webber [jbwebberpc@comcast.net]
**Sent:** Friday, October 28, 2011 2:41 PM
**To:** Regner, Lisa
**Subject:** Exlon Limerick Relicensing

As a resident of New Hanover Twp., Montgomery County, PA (less than 5 miles from Exelon's Limerick Nuclear Power Plant), I urge you to vote AGAINST the premature relicensing of that facility. 52-1-OR

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(1) The Limerick plant was built to be used for 25 years.

(2) It has now gone far beyond its limitations. 52-2-OS

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(3) The area around the facility has exploded with homes and businesses 52-3-SE

(4) The roads to any safe place are overwhelmed with congestion with normal traffic. (5)The plant can no longer store its used fuel rods and has asked permission to begin transporting them to another facility. 52-4-OS

(5) It is one of the six most dangerous plants in the country because of its proximity to an earthquake fault. 52-5-OS

(6) The surrounding area has abnormally high cancer rates among adults and children. 52-6-HH

For all these reasons and many others too numerous to mention, it would be a truly disastrous mistake to extend Exelon's Limerick license for 20 years beyond the current licenses that do no expire until 2024 & 2029!

Please consider the thousands and thousands of people who would be lost to an accident that could be prevented.

Sincerely,

Joyce B. Webber
2338 Holly Drive
Gilbertsville, PA 19525
610-326-2584

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2011 OCT 28 PM 4:52
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Add = L. Regner (LHR2)

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8/26/2011
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2011 OCT 26 PM 4: 53

RULES AND DIRECTIVES BRANCH

**Mendiola, Doris**

| | |
|---|---|
| **From:** | Anita Baly [ajbaly@yahoo.com] |
| **Sent:** | Friday, October 28, 2011 3:06 PM |
| **To:** | Regner, Lisa |
| **Subject:** | Limerick Plant Relicensing Application is Too Early |

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Dear Lisa,

It was good to meet you at the September 22, 2011 hearing the NRC held at Sunnybrook.

As I stated then, I continue to be concerned and puzzled about the very early and pre-mature application of Exelon to extend the licenses of the towers. One of those towers does not come up for renewal until 2024 and the other 2029. I ask the NRC not to work on the relicensing question for this facility for at least ten years. The wait could only ensure better information. The public cannot possibly benefit from a decision to renew the licenses at this time. The best decision will be made based on the best possible information. The NRC does not have that best information this early. Much will happen in the next ten years. I urge the NRC to wait and see how any of it affects the prospect of continuing these plants at that later date.

8-5-LR

What can happen in the next ten years that we can all learn from relevantly could be anything. It may be better information about how natural disasters are affecting nuclear facilities; we may know more about weather patterns that could cause damage. We will certainly know more about the world situation in terms of advances in terrorist technological capabilities and goals. We will know more about how well nuclear plants in general and the Limerick facility are faring as they continue to age. If someone steps forward to fund studies, we will know yet more about cancer rates in the nuclear zone. (We do know something about that now: Joseph Mangano and others have done studies already that I assume he has provided to you, and I urge you to consider carefully.)

One big concern--because of Japan's recent experience and the fact that we had an earthquake here in the Limerick plant's territory--is refurbishing the plants so they can withstand earthquakes. It has been widely reported--by MSNBC and the AP, using NRC data--that the Limerick plant has the nation's third highest risk of being damaged by an earthquake. When the plant was built, no one thought this area would get earthquakes. Now we do. I understand that Congress is now or soon will be considering increasing earthquake preparedness capabilities at the plants. I fear that if you grant Exelon carte blanche now, the NRC would encourage them to do less than they should to make the plants safer.

8-6-PA

There can be no good reasons for relicensing now. Please wait as long as possible to do that. Better information helps everyone who wants an outcome that is right and socially beneficial--not just profitable for Exelon.

Thank you for your consideration.

Anita Baly

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Add = L. Regner (LRR2)

8/24/2011
76FR 53498

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2011 ... 9:03

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To: U.S. NRC
Lisa Regner
Mailstop TWB-05-B01M
Washington, D.C. 20555

From: Charlotte Derr
545 Rosedale Drive
Pottstown, PA 19464

Re: Limerick License Renewal - NRC 2011-0166

I implore you to not relicense the Nuclear Power Plant of LIMERICK when its license expires in 2029. If I had my wish, the power plant would be closed years before 2029. 53-1-OR

We need cleaner air and water. We need to decrease radiation. We need CLEAN, SAFE, RENEWABLE ENERGY! 53-2-AL

Thank you for your time and consideration. Future generations are at stake.

ERIDS = ADM-013

SUNSI Review Complete
Template = ADM-013

Sincerely,
Charlotte Derr
Add = L. Regner (LMR2)

**MONTGOMERY COUNTY PLANNING COMMISSION**

box 311 • norristown • pennsylvania • 19404-0311 • 610-278-3722
office location: suite 201 • one montgomery plaza • swede & airy streets • norristown pa
FAX 610-278-3941 • Website www.planning.montcopa.org

8/26/2011
76 FR 53498
34

RECEIVED

October 25, 2011

Chief, Rules Announcements, and Directives Branch
Mail Stop: TWB-05-B01M
US Nuclear Regulatory Commission
Washington, DC 205550001

RE: Environmental Scoping Comments
Limerick Nuclear Generating Station
Division of License Renewal
NRC-2011-0166

Dear NRC Staff:

We have examined the proposed relicensing review information presented by NRC staff at the Public Hearing held in Pottstown on September 22 and the information posted on the web site operated by the NRC. We feel that it is vital that any decision regarding the relicensing of the Limerick Nuclear Power Station reflect careful consideration of all relevant public health and safety, security, and environmental issues that pertain to nuclear power generation in general and the unique conditions at the nuclear power generating station situated in Limerick Township. It is our understanding that an Environmental Impact Statement will be developed which addresses relevant environmental impacts pertaining to socioeconomics, environmental justice, and noise; cultural resources, archeology, and geological science; atmospheric science, air quality; hydrological sciences; transportation and land use; radiation protection; nuclear safety, fuel cycle, waste, and accident analysis; construction, operation, refurbishment, and decommissioning; regulatory compliance; aquatic ecology; and water quality. Further it is our understanding that a detailed safety review will be conducted to review design assumptions; assess aging management of safety systems; and determine if new monitoring and inspections are needed during the expanded licensing period.

While we implore the NRC to do a full review of both environmental and public safety issues pertaining to the plant- particularly addressing radioactivity exposures during normal operation of the power station and during various types of unusual events and disasters- we additionally feel that the impact review preceding any relicensing decision should also address specific issues pertaining to the plant based upon it's conformity to the Montgomery County Comprehensive Plan and overall county development policies. Below we have itemized issues with respect to land use change and growth around the power plant, transportation and evacuation capacity, Schuylkill River, and county trails that we feel warrant consideration in the environmental impact study.

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = L. Regner (LMR2)

Land Use Change and Growth around the Power Plant:
Since the original plant was constructed, the population in the surrounding communities has grown dramatically. Limerick Township and nearby Upper Providence Township have been two of the most rapidly growing communities in the county. This growth largely fueled by access to US Route 422 Expressway and available land with suitable infrastructure, has dramatically changed the character of the area surrounding the Limerick Power Station. In the past few years, the Philadelphia Premium Outlet Mall, a 600,000 square foot retail facility, and the adjoining Costco shopping center opened along US Route 422 about one mile north of the Limerick Power Station property. The land adjoining those facilities is being considered for various types of retail and residential uses. At one time, a large gambling casino had been proposed in this location as well. Other lands in Lower Pottsgrove Township near the Limerick Power Station have also been proposed for similar types of uses.

54-2-OS

While the county planning commission has tried to promote lower densities of growth in proximity to the Limerick Plant, the local communities and the marketplace favor this location for significant development due to its proximity to the US Route 422 interchange at Township Line/ Evergreen Road. The growth that has taken place in the area around the power plant, and in particular the growth taking place in the area immediately adjoining the plant and the primary access to it, as well as the projected growth in the future, could complicate evacuation plans and the movement of appropriate emergency response personnel to the plant in the event of a disaster. Certainly this access could be even more critical in the event of a natural disaster when other roads to the plant may be impassable. The environmental assessment review needs to analyze this growth in the vicinity of the power plant to evaluate what impact it would have on plant operations and whether or not safe evacuation can take place from the newly developed areas.

Transportation and Evacuation Capacity:
The growth in the whole US Route 422 Corridor has raised numerous proposals for expanding the vehicle capacity of the 422 expressway. Current peak commuting traffic tie ups on portions of the expressway serve as evidence that it may have inadequate capacity to continue to serve as a safe evacuation corridor for the region. The county transportation plan recognizes the need for various road improvements along the US 422 Corridor to address current and future traffic demands. The first priority projects in the plan include interchange improvements at the Township Line Road/ Evergreen Road intersection which is also the primary access route to the plant; needed widening and reconstruction of the highway east of the power station between Route 29 and US Route 202 in King of Prussia, reconstruction of US Route 422 in the vicinity of Pottstown, and the reconstruction and widening of the Route 422 Bridge across the Schuylkill River at Betzwood. A passenger train line is also proposed as a first priority in the transportation plan to provide service through the western portion of the county into Norristown. The proposed route for this train line is the existing Norfolk Southern rail line that goes through the Limerick Power Station Property. Other improvements including the widening and expansion of US Route 422 from Pottstown to Route 29 and additional interchange improvements at Township Line/ Evergreen Road are proposed as secondary priorities in the county plan. In addition to these improvements, several other localized improvements that may impact evacuation feasibility are proposed in the county plan.

54-3-OS

Due to funding limitations in Pennsylvania, these projects are not likely to move forward at this time. The environmental impact review should consider the capacity of the roadway facilities to service the Limerick Plant as well as provide sufficient evacuation of the area in the event of a disaster. Possible mitigation strategies to be considered in the environmental assessment review could include the role of Exelon in funding the important road improvements needed in this area to ensure safe evacuation and access to the plant in any type of disaster. 54-3-OS Cont'd

Schuylkill River:
Since the last impact statement was prepared in 1973, the Schuylkill River has been designated as a state scenic river and as a heritage area for both the state and federal government. Due to these designations and the efforts of non- profit organizations and local government, access to the river has been expanded so that the river has become a recreation and heritage tourism destination. Use of the river in the vicinity of the plant will continue to grow. With the return of American Shad made possible through down stream fish ladders, interest in the river could even grow further in the future. 54-4-SW

The Limerick Plant withdraws sizeable portions of river water. During low flow periods, additional quantities of water are released into the river from the Wadesville Mine and Still Creek Reservoir in Schuylkill County to compensate for the water withdrawn at the plant. This process was initially approved by the Delaware River Basin Commission (DRBC) in 2003 and kept active through a series of docket amendments. Future river water use is dependent upon the ability of this water make up system to operate within various water quality and flow parameters set by DRBC. It is important to evaluate the viability of the use of the river water and water make up system to provide needed water through the expanded plant lifetime. Analysis of this aspect of plant operation needs to account for the water quality impact from the total dissolved solids in the Wadesville water among other parameters. If resumed use of the Delaware water diversion is anticipated, an evaluation of that system is required to ensure that the capacity is available in the conveyance system and that water quality objectives can be met for discharge into the East Branch of the Perkiomen Creek.

County Trails and Open Space:
The county has been working hard to develop an interconnected system of open space and trails along the Schuylkill River and within other natural resource areas of the county. In doing this, the county has provided funding to local municipalities and non-profit conservation organizations to purchase open space and park land; acquired county land and agriculture easements; and developed trails. The Limerick Generating Station site contains significant land along the Schuylkill River that has been identified as part of the Schuylkill River Greenway in the county plan. The use and management of these lands relative to the county open space and natural areas inventory plans should be evaluated in the relicensing process. 54-5-LU

The Montgomery County Open Space Plan proposes a trail along the river through the power plant property. This trail is proposed as the Schuylkill East Trail, which would be developed as unpaved trail between Mont Clare and Pottstown. Essentially the proposed route would follow an old road way between the river and Norfolk Southern rail line through the Limerick Power Station site. Though such a trail route would appear to raise significant safety concerns due its proposed proximity to the power 54-6-OS station, appropriate elements could be designed into any trail system to limit its threat to plant's security. We have found that trails can enhance the overall security of an area since they concentrate users along a defined corridor. Furthermore, trails can provide emergency access routes that could be used during different disaster events to evacuate people and provide access for emergency response. This trail and the management of undeveloped portions of the Limerick Power Station site should be considered in the environmental assessment. 54-6-OS Cont'd

Community Outreach and Education:
As part of the environmental assessment process and the evaluation of the plant safety and long term operational capacity, we think that it is important for the NRC to maintain close communication with the community surrounding the plant. Overall education about the plant and the associated risks presented by its operation should be provided in a variety of ways so that the public is better informed about the plant and the overall evaluation taking place as part of the relicensing. 54-7-LR

If you have any questions, please contact me. Also, we offer our assistance in providing local information that may be helpful to your review.

Sincerely,

Michael M. Stokes
Assistant Director
mstokes @montcopa.org
(610) 278-3729

c. Thomas Sullivan, Public Safety Department

# COUNTY OF MONTGOMERY

Commissioners

JAMES R. MATTHEWS
CHAIRMAN

JOSEPH M. HOEFFEL BRUCE L. CASTOR, Jr

THOMAS M. SULLIVAN
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October 25, 2011

8/26/2011
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2:54

RULES AND DIRECTIVES

Chief, Rules Announcements, and Directives Branch
Mail Stop: TWB-05-B01M
US Nuclear Regulatory Commission
Washington, DC 205550001

Re: Environmental Scoping Comments
Limerick Nuclear Generating Station
Division of License Renewal
NRC-2011-0166

Dear NRC Staff:

The Montgomery County Department of Public Safety would like to offer the following comments regarding the NRC relicensing review information presented at the Public Hearing held in Pottstown on September 22, 2011.

- The NRC should provide a full review of environmental and public safety issues pertaining to the plant. It is understood that emergency responders providing services to the power plant understand the hazards associated with daily operations of the plant. However, in light of events in Japan and recent seismic activity in this area, the NRC should clarify the risks associated with plant operations in times of unusual activity, outage operations, and during times of natural / man-made events that may pose a risk to the plant in terms that the public will understand in an attempt to quell public concern. 55-1-OS

- We concur that the NRC require Exelon to conform to the Montgomery County Comprehensive Plan to not only ensure cooperation in the community, but also in the region. Additionally, it is also suggested that Exelon be included in pending roadway infrastructure improvements projects as both a stake holder and possible source of funding. 55-2-OS

- It is important to note that the 10 – mile Emergency Planning Zone (EPZ) is the second largest in population in the nation. As a result of recent development and type of development in the area of LGS, it is important to review the Evacuation Time Estimate Study (ETE) on a more timely basis and account for the transient population present in the hotels that have accompanied this development. Additionally, funding should be supplied for either Exelon staff or County staff to act as a transient planning and outreach specialist to assist these transient population locations with emergency planning. 55-3-OS

- It should be noted that the Evacuation Time Estimate is currently being updated. Required highway and roadway infrastructure upgrades should be included as a part of and also as a result of any changes noted in the updated ETE. Special attention for improvement should be given to the local, county and state roads used for evacuation that feed the larger highways, as many of these roadways are no longer suitable for the amount of traffic that an EPZ evacuation could produce. 55-4-OS

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = L. Perkins (LMR2)

- The NRC should consider requiring Exelon to enhance planning for day to day emergency situations that require a response from local emergency services. Often times, Fire and EMS access is delayed due to screening of vehicles and personnel. This can cause delay in patient care to potentially life threatening illnesses. 55-5-OS

- A note should be added regarding the diversion of Delaware River water to the East Bank of the Perkiomen. Due to the residential build-up along the Perkiomen Creek area, additional consideration should be presented and discussed with the Army Corps of Engineers and the National Weather Service regarding potential flooding impact this may have on the area. 55-6-OL

- While recreation utilization is of importance and a major mission within this county, homeland security must be of a concern with any open access within the vicinity of LGS. However, we concur that with support of local law enforcement and a commitment from LGS to control and monitor access, trail throughput may be accomplished. 55-7-OS

- In an attempt to promote and increase community outreach, the NRC should consider requiring Exelon to reopen the LGS Information Visitor Center. As a result of the incident in Fukushima, Japan, the Montgomery County Department of Public Safety has a received a higher than normal volume of inquiries concerning nuclear power generation from the public. The LGS Information Center, although dated, could be upgraded to provide this service to the community to raise awareness and promote education of the nuclear power industry. This center could also be incorporated as an educational stop on the County Trail system. 55-8-OS

If you have any questions please feel free to contact me.

Very truly yours,

Thomas M. Sullivan
Director of Public Safety

CC: R. Graf, C.O.O.
M Stokes, Assistant Director of Planning
S. Mickalonis, Deputy Director for Emergency Mgt.
J. Wilson, Radiological Planning Specialist

NRDC
THE EARTH'S BEST DEFENSE

October 28, 2011

Via Electronic Mail

Ms. Cindy Bladey
Chief, Rules, Announcements, and Directives Branch
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, D.C.20555-0001
Electronic Mail: cindy.bladey@nrc.gov

RE: Natural Resources Defense Council Comments on Limerick EIS Scoping Process
NRC Docket ID: NRC-2011-0166

Dear Ms. Bladey:

The Natural Resources Defense Council (NRDC) comments today on the Nuclear Regulatory Commission's (NRC) *Notice of Intent To Prepare an Environmental Impact Statement and Conduct the Scoping Process for Limerick Generating Station, Units 1 and 2*, (hereinafter "Limerick EIS Scoping Process"). 76 Fed. Reg. 53498 (August 26, 2011).

**Summary of Comments**

Our comments specifically address the NRC's National Environmental Policy Act ((NEPA) 42 U.S.C. § 4321, *et seq*,) obligations and the need for any environmental analysis the agency conducts to include an up-to-date "Severe Accident Mitigation Alternatives" (SAMA) analysis that fully incorporates current insights into severe nuclear accident causation and mitigation. While we recognize that, as a private entity, the relicensing applicant, Exelon Generation Company, is not directly bound by NEPA, the same is not true for the NRC. Given that the applicant's ER generally serves as the basis for the Commission's eventual Draft Environmental Impact Statement (Draft EIS), and Exelon suggests it need not revise and update its SAMA analysis, we are raising this NEPA concern at this early stage in hopes that this matter may be addressed before the agency moves to relicense a facility based on a legally insufficient NEPA review.

**Specific Scoping Comments**

The original SAMA analysis for the Limerick Generating Station (LGS) is a 1989 report that was issued as the result of a ruling by the U.S. Court of Appeals for the Third Circuit,[1] which concluded that the NRC had failed to consider a "reasonable set" of Severe Accident Mitigation Design Alternatives ("SAMDAs"). In 1989, the NRC subsequently adopted this SAMDA analysis and agency staff concluded they had "discovered no substantial changes in the proposed action as previously evaluated in the FES [Final Environmental Statement] that are relevant to environmental concerns nor significant new circumstances or information relevant to environmental concerns and bearing on the licensing of [LGS]".

As the original LGS SAMDA effort in 1989 was the first mandated effort to focus on SAMAs,[2] the notion that an updated SAMA analysis need not be completed at the license renewal stage (for the exact reactor site that gave birth to the regulatory requirement) we find highly objectionable, particularly in light of the catastrophic nuclear accident that befell similar Boiling Water Reactor (BWR) units in Japan in March, 2011. It has become clear in the 770 years of combined U.S. BWR operational experience *since* 1989 that domestic and international events provide numerous examples of "new information" and make a strong case for the need to reconsider all that has been learned about newly discovered risks and vulnerabilities of nuclear power plants. 56-1-PA

It has been noted[3] that global core damage events happen at a rate that exceeds NRC's presumptions of what should be considered safe at plants within the U.S., which implies that either the NRC estimates for domestic plants are wrong or that international nuclear plants have a core damage frequency much higher than what the NRC deems safe. Either scenario is troubling and deserves the industry's full attention and effort. Exelon's 1989 effort in response to the Court was, respectfully, less than one would have hoped for in light of the seriousness of the issue. The LGS 1989 SAMDA can in no way claim necessary conservatism with regard to public safety over the total timeframe of a possible sixty year reactor lifetime.

In contrast to the 1989 SAMDA, relatively recent SAMA analyses conducted in other license renewal applications, such as those for sites at Nine Mile Point, Three Mile Island, and the Joseph M. Farley Nuclear Plant, to name a few, were considerably more thorough and addressed a range of detailed alternatives. Pursuant to regulatory analysis techniques supplied by NRC[4] and aided by an industry-supplied guidance document[5], most modern-day SAMA analyses are designed using a fairly prescriptive set of initial assumptions, baseline calculations, and cost-benefit arithmetic recipes that employ the use of sophisticated codes in their evaluation of potential risk and the benefit of removing this risk.

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[1] *Limerick Ecology Action v. NRC*, 869 F.2d 719 (3rd Cir. 1989)
[2] Or SAMDAs in this case, and we use the terms interchangeably for the purposes of these comments.
[3] *Global Implications of the Fukushima Disaster for Nuclear Power*, T. Cochran, M. McKinzie (NRDC). World Federation of Scientists' International Seminars on Planetary Emergencies. Erice, Sicily. Aug 2011.
[4] NUREG/BR-0184 *Regulatory Analysis Technical Evaluation Handbook*, Jan 1997
[5] NEI 05-01 [Rev A] *Severe Accident Mitigation Alternatives (SAMA) Analysis – Guidance Document*, Nov 2005

The most common code used is the MELCOR accident consequence code system (MACCS2)[6], which provides a modeling framework for calculating the off-site consequences of a severe accident. This code accepts an advanced set of input parameters, including population density distributions within 50 miles, detailed regional economic data obtained from multiple sources, nuclide release scenarios accounting for reactor core inventory, emergency response and exposure variables, and meteorological data for plume migration pathways. The current state of knowledge regarding the assumptions and understanding of severe accident events has expanded and improved in the intervening twenty-two years since the initial SAMDA analysis for LGS. 56-1-PA Cont'd

While we acknowledge that this analysis was limited by the knowledge available at the time, the limitations and shortcomings of a previous era in no way disqualify the claim that, in light of numerous advances in modeling capabilities, a library of discovered cost-beneficial SAMAs, and the saliency of severe accident risks following the disaster at Fukushima Daiichi, not only is there new and significant information, there are significant *volumes* of this information acquired since 1989.

In the licensee's current environmental report, the identification and treatment of new and significant information (four items in total) were developed only in the narrow context of how they may affect the dated SAMDA analysis. It should go without saying that this approach does not comprise all of the applicable new and noteworthy severe accident mitigation strategies bearing on the site in question, or serve to remedy gaps and omissions in the original SAMDA analysis.

The entire set of first-stage envisioned alternatives in the initial SAMDA analysis was no more than fifteen options. The "analysis" in the current environmental report consists of perfunctory, "back-of-the-envelope" calculations in lieu of a proper SAMA analysis. The current operator Exelon referred to these considerations as representing an "abundance of caution." We disagree.

One of the largest problems with the calculations offered, aside from only focusing on an arbitrarily limited number of alternatives, is that licensee evaluated each item of new information in isolation of the other factors that would also change the cost-benefit conclusion for a particular alternative. The effects of each changed parameter (e.g., population, offsite economic risk, cost per person-rem averted, and seismic hazards) should be evaluated in a comprehensive model that shows the aggregate benefit, as performed in all current day SAMA analyses. Unfortunately, their analysis barely scraped the surface of how this new information should actually be considered in the context of environmental impacts.

In comparison, a "reasonable set" of alternatives for another recently relicensed plant included an initial consideration of 128 SAMA candidates developed from previous lists at other plants, NRC documents, and documents related to advanced power reactor designs.[7] After screening this initial set for non-applicable or previously implemented designs as well as combining/dropping common-benefit options, the applicant was still left with a set of forty unique SAMA candidates, for which it was required to enter preliminary cost estimates in a so-called "Phase I Analysis." A

[6] NUREG/CR-6613, Vol. 1, *Code Manual for MACCS2, User's Guide*, D. Chanin & M.L. Young, May 1998

[7] Joseph M. Farley Nuclear Plant - *Application for License Renewal, Appendix D. Environmental Report, Attachment F. Severe Accident Mitigation Alternatives*, Sept 2003

total of fifteen SAMA candidates survived this screening to enter more detailed cost consideration in the Phase II analysis, of which none were deemed cost-beneficial. However, in another renewal application,[8] the SAMA analysis found eleven potentially cost-beneficial options from an initial set of thirty-three.

56-1-PA Cont'd

In an NRC report discussing insights on SAMAs in connection with plant license renewals,[9] the agency authors list numerous potentially cost-beneficial SAMAs relating to station blackouts, protection and support systems, procedures and training, and external events such as flood, fire, and seismic hazards. The authors note that "averted onsite costs (AOSC) is a critical factor in cost-benefit analyses and tends to make preventative SAMAs more attractive than mitigative SAMAs." This AOSC factor was not considered in either the original SAMDA or the recently submitted environmental report.

Finally, NRDC believes that in addition to a comprehensively updated SAMA analysis, the licensee or agency must conduct a study that, as part of the supplemental environmental impact statement, presents postulated accident scenarios showing the full range and weight of environmental, economic, and health risks posed by these accidents. This type of study should model site-specific severe accidents and illustrate the full consequences of a range of severe accident scenarios so that the public and their policy makers can make informed decisions whether to continue plant operations after the existing licenses expire, thereby continuing to run the risk of a severe nuclear accident, invest in additional accident mitigation capabilities, or alternatively, avoid these risks altogether by relying on a portfolio of low carbon electricity generation alternatives that could meet future electricity service needs over the license extension period.

The SAMA analyses are inadequate in this regard because they only address isolated issues in a cost-benefit analysis that discounts the cumulative impacts on displaced populations, regional economic losses, and environmental cleanup. These types of calculations do not present a clear picture of the potential hazards or costs experienced in the event of a severe accident. Instead they tend to mask the full range of accident consequences that policy makers may wish to avoid. Recently, NRDC produced an analysis, of the type we believe should be included in the Limerick NEPA analysis, to inform ongoing relicensing efforts at the Indian Point nuclear plant site.[10]

In order to illustrate the full extent of a major accident, the NRDC study used the U.S. Department of Defense computer model HPAC (Hazard Prediction and Assessment Capability)[11] to calculate site-specific release radiological source-terms, resulting fallout plumes, and data on the effects on nearby populations. The results were compared to similar modeling of the Fukushima disaster to provide a sense of scale, and to estimate the rough magnitude of financial

[8] Three Mile Island Nuclear Station Unit 1 – *License Renewal Application, Environmental Report, Appendix E. SAMA ANALYSIS*

[9] *Perspectives on Severe Accident Mitigation Alternatives for U.S. Plant License Renewal*, T. Gosh, R. Palla, D. Helton, U.S NRC, Sept 2009 (Accession No.: ML092750488)

[10] *Nuclear Accident at Indian Point: Consequences and Costs*, M. McKinzie, Oct 2011 (http://www.nrdc.org/nuclear/indianpoint/files/NRDC-1336_Indian_Point_FSr8medium.pdf)

[11] Hazard Prediction and Assessment Capability (HPAC), version 4.0.4. Washington, D.C.: Defense Threat Reduction Agency, Apr 2004

and economic damages that would be incurred if a severe accident were to occur at Indian Point. This is not a hypothetical issue. Policy makers in several countries, including Germany and Switzerland, have made decisions not to grant nuclear plant license extensions to avoid having to endure the continuing risk of severe nuclear plant accidents.

Regardless of Exelon's own corporate understanding of its legal obligations, NEPA is clear in its well-established mandates and what it requires of the NRC. NEPA requires that federal agencies characterize environmental impacts broadly to include not only ecological effects, such as physical, chemical, radiological and biological effects, but also aesthetic, historic, cultural, economic, and social effects.[12] NEPA requires an agency to consider both the direct effects caused by an action and any indirect effects that are reasonably foreseeable. Effects include direct effects caused by the action and occurring at the same time and place and indirect effects caused by the action, but later in time or farther removed in distance, but still reasonably foreseeable.

56-1-PA

Most specifically, NEPA directs that NRC take a "hard look" at the environmental impacts of its proposed action, in this instance the relicensing of two BWR Mark 2 units for an additional 20 years, and compare them to a full range of reasonable alternatives. "What constitutes a 'hard look' cannot be outlined with rule-like precision, but it at least encompasses a thorough investigation into the environmental impacts of an agency's action and *a candid acknowledgement of the risks that those impacts entail*." *Nat'l Audubon Soc. v. Dept of the Navy*, 422 F.3d 174, 185 (4th Cir. 2005) (emphasis added). As a stalking horse for the NRC's draft EIS, the applicant's ER does not meet this standard. In taking the "hard look" required by law, the NRC must therefore address the potential environmental impacts of a range of severe accidents—and accident mitigation strategies—especially in light of the new information provided by the Fukushima nuclear disaster on the performance of BWR radiological containment in a prolonged loss-of-coolant, core-damage scenario.

For the reasons stated above, NRDC urges that NRC direct that a thorough and lawful SAMA analysis be conducted as part of (or supplement to) the required supplemental environmental impact statement, the draft of which is currently scheduled for August 2012 and the final SEIS currently scheduled for February 2013. Additionally, the full cumulative effect of severe accidents must be studied and presented as part of these documents. These analyses must make every effort to meet the current expectations of what these studies should encompass and use the necessary guidance and tools commonly utilized by the industry and NRC. The NRC's legal obligation to consider new information and determine its nuclear safety significance exists independently of whether a SAMA has or has not been prepared previously: in the event a SAMA has not been prepared, then new and potentially significant nuclear safety information must be included in the initial SAMA; if a previous SAMA exists, then it must be updated to reflect this new information, and the resulting costs and benefits of the full spectrum of reasonable accident mitigation alternatives must be considered as part of the Draft Supplemental Environmental Impact Statement, and issued for public comment.

Finally, we have grave misgivings regarding the future time-dependence, accuracy, and relevance of the licensee's current ER, as presumptively incorporated in the NRC's planned 56-2-LR

[12] 40 C.F.R. § 1508.8

SEIS for LGS license extension, given that such license extension will not become effective until the current unit operating licenses expire in 2024 (for Unit 1) and 2029 for Unit 2. We submit that any decision to relicense these units must be supported by the most timely NEPA and SAMA analysis obtainable within a reasonable interval (e.g. five years) prior to actual expiration of the existing licenses.

56-2-LR Cont'd

Intervals of 12 and 17 years are not required for corporate planning purposes and are far too long to credibly sustain the accuracy and relevance of NEPA analyses, or for the NRC to accurately project both the future condition of the plant, the future state of nuclear safety knowledge, trends in local resource use, population, and the affected environment, and the future range of reasonable electricity supply alternatives to LGS license extension. By comparison, major government owned nuclear installations, such as nuclear laboratories and weapon production sites, are required to conduct site-wide NEPA reviews of their operations and facility plans every five years. Using this federal standard for timeliness, the NRC's NEPA analysis for LGS relicensing should not commence before 2019, for Unit 1, and before 2024 for Unit 2, or should be subjected to mandatory reassessment and supplementation after those dates.

We further note, given the extended timeframes for expiration of the existing LGS operating licenses, that they easily encompass the five year timeframe that the Commission has set out for formulation and implementation of NRC staff safety recommendations to be undertaken "without unnecessary delay" in the wake of the Fukushima accident. In light of these important nuclear safety developments, we seek no reason why this proposed NEPA analysis, and hence the entire licensing proceeding that it is required to support, could not be deferred for at least five years, until the Commission has completed its decision-making and schedule for implementation of post-Fukushima safety upgrades. As noted above, to ensure the timeliness and accuracy of the NEPA analysis, the deferral could be even longer (on the order of 7 years for Unit 1), to allow for the inclusion of the results of the extended rulemakings contemplated under the Commission's regulatory response to the Fukushima accident.

56-3-OS

Preparation of the applicant's ER, and the NRC's subsequent SEIS, could then take account of these required safety modifications and enhanced severe accident coping strategies, and these would be reflected in a significantly revised SAMA analysis. In these comments, we are not formally advocating such a deferred pathway for the LGS relicensing proceeding, but merely note its plausibility and inherent advantages for all parties to the proceeding. Without such a deferral, the only sensible alternative course is to ensure the incorporation of the most up-to-date nuclear safety knowledge – "new and significant information" – regarding BWR Mark 2 reactors and severe accident mitigation into the current licensing proceeding.

Thank you for your consideration of these comments. Please do not hesitate to contact us at (202) 289-6868 if you have any questions.

Sincerely,

Geoffrey H. Fettus
Senior Project Attorney

Christopher E. Paine
Director, Nuclear Program

C. Jordan Weaver, Ph.D.
Program Scientist

**Mendiola, Doris**

**From:** lorraineruppe@aol.com
**Sent:** Friday, October 28, 2011 6:33 PM
**To:** Regner, Lisa
**Subject:** Fwd:Faultlines close to Limerick Nuclear Plant

RECEIVED 2011 NOV -1 PM 3:20 RULES AND DIRECTIVES BRANCH USNRC

Ms.Regner,

Please include this for the record concerning relicensing of Limerick Power Plant.

8/26/2011
76 FR 53498

-----Original Message-----
From: lorraineruppe <lorraineruppe@aol.com>
To: letters <letters@pottsmerc.com>
Sent: Mon, Oct 24, 2011 9:09 pm

37

Letter to Editor

Exelon is rushing the timeline to reissue a license(18 years ahead of time) to run Limerick Nuclear Plant into the unknown, yet it took more than 5 months for the NRC to get back to me concerning an already known survey of fault lines. 4-13-LR

It took five months for the Nuclear Regulatory Commission to answer my question concerning how close the nearest fault line is to Limerick Nuclear Plant. No wonder! Two faults are dangerously close. Chalfont Fault is only 9 miles East. Ramapo Fault is 17 miles Northwest. This is alarming! 4-14-GE

The 9-21-11 Mercury article said" whether or not earthquake risk is a factor in the current relicensing request for Limerick remains to be seen". It would be grossly unacceptable for the NRC to ignore Limerick's extreme vulnerability to earthquake damage..

Earthquake risk should be on the top of of NRC's relicensing concerns for Limerick. Earthquake risks are far greater for Limerick than previously realized-increased by 141%. We now know Limerick is 3rd on nation's earthquake risk list .Plus,evidence shows earthquakes in the East can be far stronger than Limerick's " design basis" can withstand. 4-15-PA

There's a good chance that an earthquake can exceed Limerick's design basis, causing a severe nuclear accident, jeopardizing the health, safety and financial well being of our entire region.

The Virginia 8-24-11 earthquake caused shaking in PA at Limerick Nuclear Plant .Since January there have been 2 small earthquakes in Philadelphia, only 21 miles from Limerick.

Shaking and breaking in miles of Limerick's buried underground pipes and cables can lead to nuclear disaster. It's disquieting that NRC uses a "visual inspection" to determine damage on buried pipes. Problems may not be identified until it's too late.

For years the NRC allowed Exelon to do its own studies, to stall and avoid responsible action on fires and earthquakes. To save money, Exelon typically concludes Limerick is "safe enough". This is unacceptable!

10-5-11, the Mercury reported a flaw was found in the mechanism to shut down the nuclear plant. The warning was tied to renewed focus on earthquake risk. It's difficult to see how Limerick's design flaws can be fixed, even if Exelon WOULD spend the money.

There is no proof whatsoever Limerick's design can withstand other threats ranging from hurricanes, tornadoes, floods, or terrorist attacks to an impact from a jet airliner.

We need precaution before there is a catastrophe. NRC should close Limerick as soon as possible.

Lorraine Ruppe

SUNSI Review Complete
Template = ADM-013

1

E-RIDS = ADM-03
Add = L. Regner (LHR2)

## Mendiola, Doris

**From:** sunbeamsky [sunbeamsky@aol.com]
**Sent:** Monday, October 31, 2011 2:28 PM
**To:** Regner, Lisa
**Subject:** power plant renewal

57-1-OR

Just wanted to voice my opinion for a no vote to renew the license for the Limerick power plant. It's in an area with high population - we could never all evacuate if necessary. 57-2-OS I also feel it's presence has led to and increase of cancer in our area. 57-3-HH
Sharon Yohn

8/24/2011
76FR53498

38

RECEIVED 2011 NOV -1 PM 3:20 RULES AND DIRECTIVES

SUNSI Review Complete
Template = ADM-013

1

E-RIDS=ADM-03
Add= L. Regner (LHR2)

**Mendiola, Doris**

**From:** Smokowicz, April [April.Smokowicz@graphicpkg.com]
**Sent:** Wednesday, November 02, 2011 8:49 AM
**To:** Regner, Lisa
**Cc:** msworkdog@verizon.net
**Subject:** Pottstown Mercury article 10/27/11

Good Morning

I know this is late according to your article, but I wanted to still send you some information.

I feel that there is a lot of people that had not known to report anything because of not knowing who to go to. I don't understand why the hospitals don't give statistical information based on areas?

58-1-HH

Anyway my daughter Tracey had Leukemia at the age of 2 1/2. Was a patient at Children's Hospital until she was 5. With several years of chemotherapy she is now 18 and in remission. We had lived on Limerick Center Road for most of our young lives and now with our kids. I don't know what other information you would need but I would be happy to get you whatever you might need.

Thank you,

Michael Smokowicz

676 King Road

Royersford PA 19468

610-792-3270

8/26/2011
76FR53498
39

RECEIVED
2011 NOV -2 AM 9:41
RULES AND DIRECTIVES BRANCH

SUNSI Review Complete
Template = ADM-013

1

E-RIDS = ADM-03
Add = L. Regner (LHR2)

8/26/2011
76FR53498

41

Sir or Madam

In Pottstown about ½ mile from the Limerick Power Plant we have four bridges. One they are not going to fix, one just was fixed, One has been in progress of being fixed for months now, last one is a ⅓ of the way of being fixed. To get out of town the only other way is toward Allentown if anything should happen. Not many people could get out on the one road. Please don't extend the license for Limerick.

59-1-OS

Barbara Miller
761 N. Hanover St
Pottstown, Pa
19464

P.S. After they fixed the bridges. Still what about know we had that earthquake in Virginia. With changes in weather all over the world I think its a sign of things to come.

RECEIVED
RULES AND DIRECTIVES
2:48

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = L. Regner (LHR2)

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

**LIMERICK GENERATING STATION**
**Environmental Scoping Comments**
**Division of License Renewal**
**NRC-2011-0166**

## Written Comment Form

*Must be received on or before October 28, 2011. Please print clearly.*

Name: Debra Schneider

Title: Citizen

Organization: United States of America

Address: 585 Manatawny St

City: Pottstown State: PA Zip Code: 19464

**Comment:**

- No Way to Evacuate Area 60-1-OS
- Earthquake fault 60-2-GE
- Do not Extend - Plenty of SAFE alternatives, - water - solar - wind - Geothermal 60-3-AL
- Spent fuel - Storage - Uranium mining - Dirty 60-4-RW
- 12 years Ahead of time - ~~Cerentently~~ Certently no way to guarentee safety 60-5-LR
- Too Expensive 60-6-OS
- Deterioration of Cement + Rebar - Crumbles over time 60-7-OS
- They want increase emmission's - Pollutants 60-8-AM
- Dirty polleted mine water 60-9-SW
- High infant mortallity rate + neonatal Cancer increases
- thyroid Cancer rates 70% higher 60-10-HH
- Nuclear Waste - Nothing Clean 60-11-RW

*Use other side if more space is needed.* - Go back + look at Structural Error's when plant was being buil 60-12-OS

Comment Forms may be mailed to:
Chief, Rules, Announcements, and Directives Branch
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

- NRC Should not be Considering this so far in advance - No way to assure Safety - Shut it Down - 60-13-LR

Do you want to live near Limerick PA?
The Is suppose to be protecting the peoples interests –

**Comment (Continued):**

- Radiation in air + water
- Radioactive ground water
- Cancer increase esp children
- Deadly waste – above ground + unprotected
- Accidents + leaks – many shut down
+ Risk of Meltdown Earthquake, flood, hurricane – aging equipment
- Updated evacuation plan
- ~~[illegible]~~ increased population
- increase costs – medicals problems

60-14-RW

60-15-HH

60-16-OS

60-17-OS

60-18-OS

Can replace with clean, renewable energy before current license expires

60-19-AL

- Should have been more public notice of hearing – Mail notices so people have an opportunity to attend

60-20-LR

Depleted water due to fracking up river.

60-21-SW

Nuclear Energy is Dirty + Expensive
Since Limerick was built we have had some of the most expensive energy – Higher Rates

60-22-OS

? After Fukushima – Limerick listed as one of top 10 to have very serious problem when we have an Earthquake –

60-23-OS

*If needed, use additional sheets.*

2 Storage of spent fuels – Look at Fukushima similar system

60-24-OS

3 Mining + Enriching of Uranium + Plutonium – Filthy –

60-25-OS

# APPENDIX B
# NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

# NATIONAL ENVIRONMENTAL POLICY ACT ISSUES FOR LICENSE RENEWAL OF NUCLEAR POWER PLANTS

The table in this appendix summarizes the National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants identified in Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51. Data supporting this table are contained in NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Throughout this supplemental environmental impact statement (SEIS), “generic” issues are also referred to as Category 1 issues, and “site-specific” issues are also referred to as Category 2 issues.

**Table B–1. Summary of Issues and Findings**

| Issue | Type of Issue | Findings |
|---|---|---|
| **Surface Water Quality, Hydrology, and Use** | | |
| Impacts of refurbishment on surface water quality | Generic | SMALL. Impacts are expected to be negligible during refurbishment because best management practices are expected to be employed to control soil erosion and spills. |
| Impacts of refurbishment on surface water use | Generic | SMALL. Water use during refurbishment will not increase appreciably or will be reduced during plant outage. |
| Altered current patterns at intake and discharge structures | Generic | SMALL. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Altered salinity gradients | Generic | SMALL. Salinity gradients have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Altered thermal stratification of lakes | Generic | SMALL. Generally, lake stratification has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term. |
| Temperature effects on sediment transport capacity | Generic | SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Scouring caused by discharged cooling water | Generic | SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term. |
| Eutrophication | Generic | SMALL. Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term. |

| Issue | Type of Issue | Findings |
| --- | --- | --- |
| Discharge of chlorine or other biocides | Generic | SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term. |
| Discharge of sanitary wastes and minor chemical spills | Generic | SMALL. Effects are readily controlled through National Pollutant Discharge Elimination System (NPDES) permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term. |
| Discharge of other metals in wastewater | Generic | SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term. |
| Water use conflicts (plants with once-through cooling systems) | Generic | SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems. |
| Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow) | Site-specific | SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on in-stream and riparian communities near these plants could be of moderate significance in some situations. See § 51.53(c)(3)(ii)(A). |
| **Aquatic Ecology (all plants)** | | |
| Refurbishment | Generic | SMALL. During plant shutdown and refurbishment there will be negligible effects on aquatic biota because of a reduction of entrainment and impingement of organisms or a reduced release of chemicals. |
| Accumulation of contaminants in sediments or biota | Generic | SMALL. Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with those of another metal. It is not expected to be a problem during the license renewal term. |
| Entrainment of phytoplankton and zooplankton | Generic | SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term. |
| Cold shock | Generic | SMALL. Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations, or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term. |

| Issue | Type of Issue | Findings |
|---|---|---|
| Thermal plume barrier to migrating fish | Generic | SMALL. Thermal plumes have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Distribution of aquatic organisms | Generic | SMALL. Thermal discharge may have localized effects but is not expected to affect the larger geographical distribution of aquatic organisms. |
| Premature emergence of aquatic insects | Generic | SMALL. Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term. |
| Gas supersaturation (gas bubble disease) | Generic | SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term. |
| Low dissolved oxygen in the discharge | Generic | SMALL. Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term. |
| Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses | Generic | SMALL. These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Stimulation of nuisance organisms (e.g., shipworms) | Generic | SMALL. Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term. |
| **Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)** | | |
| Entrainment of fish and shellfish in early life stages | Site-specific | SMALL, MODERATE, OR LARGE. The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid. See § 51.53(c)(3)(ii)(B). |
| Impingement of fish and shellfish | Site-specific | SMALL, MODERATE, OR LARGE. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. See § 51.53(c)(3)(ii)(B). |

| Issue | Type of Issue | Findings |
|---|---|---|
| Heat shock | Site-specific | SMALL, MODERATE, OR LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants. See § 51.53(c)(3)(ii)(B). |
| **Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)** | | |
| Entrainment of fish and shellfish in early life stages | Generic | SMALL. Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term. |
| Impingement of fish and shellfish | Generic | SMALL. The impacts of impingement have not been found to be a problem at operating nuclear power plants with this type of cooling system and are not expected to be a problem during the license renewal term. |
| Heat shock | Generic | SMALL. Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term. |
| Impacts of refurbishment on groundwater use and quality | Generic | SMALL. Extensive dewatering during the original construction on some sites will not be repeated during refurbishment on any sites. Any plant wastes produced during refurbishment will be handled in the same manner as in current operating practices and are not expected to be a problem during the license renewal term. |
| Groundwater use conflicts (potable and service water; plants that use <100 gallons per minute [gpm]) | Generic | SMALL. Plants using less than 100 gpm are not expected to cause any groundwater use conflicts. |
| Groundwater use conflicts (potable and service water, and dewatering plants that use >100 gpm) | Site-specific | SMALL, MODERATE, OR LARGE. Plants that use more than 100 gpm may cause groundwater use conflicts with nearby groundwater users. See § 51.53(c)(3)(ii)(C). |
| Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river) | Site-specific | SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal. See § 51.53(c)(3)(ii)(A). |
| Groundwater use conflicts (Ranney wells) | Site-specific | SMALL, MODERATE, OR LARGE. Ranney wells can result in potential groundwater depression beyond the site boundary. Impacts of large groundwater withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal. See § 51.53(c)(3)(ii)(C). |

| Issue | Type of Issue | Findings |
|---|---|---|
| Groundwater quality degradation (Ranney wells) | Generic | SMALL. Groundwater quality at river sites may be degraded by induced infiltration of poor-quality river water into an aquifer that supplies large quantities of reactor cooling water. However, the lower quality infiltrating water would not preclude the current uses of groundwater and is not expected to be a problem during the license renewal term. |
| Groundwater quality degradation (saltwater intrusion) | Generic | SMALL. Nuclear power plants do not contribute significantly to saltwater intrusion. |
| Groundwater quality degradation (cooling ponds in salt marshes) | Generic | SMALL. Sites with closed-cycle cooling ponds may degrade groundwater quality. Because water in salt marshes is brackish, this is not a concern for plants located in salt marshes. |
| Groundwater quality degradation (cooling ponds at inland sites) | Site-specific | SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade groundwater quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses. See § 51.53(c)(3)(ii)(D). |
| **Terrestrial Ecology** | | |
| Refurbishment impacts | Site-specific | SMALL, MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application. See § 51.53(c)(3)(ii)(E). |
| Cooling tower impacts on crops and ornamental vegetation | Generic | SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Cooling tower impacts on native plants | Generic | SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Bird collisions with cooling towers | Generic | SMALL. These collisions have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term. |
| Cooling pond impacts on terrestrial resources | Generic | SMALL. Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites. |
| Power line right-of-way management (cutting and herbicide application) | Generic | SMALL. The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites. |
| Bird collisions with power lines | Generic | SMALL. Impacts are expected to be of small significance at all sites. |

| Issue | Type of Issue | Findings |
|---|---|---|
| Impacts of electromagnetic fields on flora and fauna | Generic | SMALL.  No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified.  Such effects are not expected to be a problem during the license renewal term. |
| Floodplains and wetland on power line right-of-way | Generic | SMALL.  Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland.  No significant impact is expected at any nuclear power plant during the license renewal term. |
| **Threatened or Endangered Species** | | |
| Threatened or endangered species | Site-specific | SMALL, MODERATE, OR LARGE.  Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species.  However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected.  See § 51.53(c)(3)(ii)(E). |
| **Air Quality** | | |
| Air quality during refurbishment (nonattainment and maintenance areas) | Site-specific | SMALL, MODERATE, OR LARGE.  Air quality impacts from plant refurbishment associated with license renewal are expected to be small.  However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas.  The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage.  See § 51.53(c)(3)(ii)(F). |
| Air quality effects of transmission lines | Generic | SMALL.  Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases. |
| **Land Use** | | |
| Onsite land use | Generic | SMALL.  Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant. |
| Power line right-of-way | Generic | SMALL.  Ongoing use of power line rights-of-way would continue with no change in restrictions.  The effects of these restrictions are of small significance. |
| **Human Health** | | |
| Radiation exposures to the public during refurbishment | Generic | SMALL.  During refurbishment, the gaseous effluents would result in doses that are similar to those from current operation.  Applicable regulatory dose limits to the public are not expected to be exceeded. |
| Occupational radiation exposures during refurbishment | Generic | SMALL.  Occupational doses from refurbishment are expected to be within the range of annual average collective doses experienced for pressurized-water reactors and boiling-water reactors.  Occupational mortality risk from all causes, including radiation, is in the mid-range for industrial settings. |

| Issue | Type of Issue | Findings |
|---|---|---|
| Microbiological organisms (occupational health) | Generic | SMALL. Occupational health impacts are expected to be controlled by the continued application of accepted industrial hygiene practices to minimize worker exposures. |
| Microbiological organisms (public health)(plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river) | Site-specific | SMALL, MODERATE, OR LARGE. These organisms are not expected to be a problem at most operating plants, except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically. See § 51.53(c)(3)(ii)(G). |
| Noise | Generic | SMALL. Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term. |
| Electromagnetic fields – acute effects (electric shock) | Site-specific | SMALL, MODERATE, OR LARGE. Electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been found to be a problem at most operating plants and generally is not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site. See § 51.53(c)(3)(ii)(H). |
| Electromagnetic fields – chronic effects | Uncategorized | UNCERTAIN. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a consensus scientific view has not been reached. |
| Radiation exposures to public (license renewal term) | Generic | SMALL. Radiation doses to the public will continue at current levels associated with normal operations. |
| Occupational radiation exposures (license renewal term) | Generic | SMALL. Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits. |
| **Socioeconomic Impacts** | | |
| Housing impacts | Site-specific | SMALL, MODERATE, OR LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures, that limit housing development, are in effect. Moderate or large housing impacts of the workforce, associated with refurbishment, may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development. See § 51.53(c)(3)(ii)(I). |
| Public services: public safety, social services, and tourism and recreation | Generic | SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites. |

| Issue | Type of Issue | Findings |
|---|---|---|
| Public services: public utilities | Site-specific | SMALL OR MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability. See § 51.53(c)(3)(ii)(I). |
| Public services: education (refurbishment) | Site-specific | SMALL, MODERATE, OR LARGE. Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors. See § 51.53(c)(3)(ii)(I). |
| Public services: education (license renewal term) | Generic | SMALL. Only impacts of small significance are expected |
| Offsite land use (refurbishment) | Site-specific | SMALL OR MODERATE. Impacts may be of moderate significance at plants in low population areas. See § 51.53(c)(3)(ii)(I). |
| Offsite land use (license renewal term) | Site-specific | SMALL, MODERATE, OR LARGE. Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal. See § 51.53(c)(3)(ii)(I). |
| Public services: transportation | Site-specific | SMALL, MODERATE, OR LARGE. Transportation impacts (level of service) of highway traffic generated during plant refurbishment and during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites. See § 51.53(c)(3)(ii)(J). |
| **Issue** | **Type of Issue** | **Findings** |
| Historic and archaeological resources | Site-specific | SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection. See § 51.53(c)(3)(ii)(K). |
| Aesthetic impacts (refurbishment) | Generic | SMALL. No significant impacts are expected during refurbishment. |
| Aesthetic impacts (license renewal term) | Generic | SMALL. No significant impacts are expected during the license renewal term. |
| Aesthetic impacts of transmission lines (license renewal term) | Generic | SMALL. No significant impacts are expected during the license renewal term. |
| **Postulated Accidents** | | |
| Design-basis accidents | Generic | SMALL. The NRC staff has concluded that the environmental impacts of design-basis accidents are of small significance for all plants. |

| Issue | Type of Issue | Findings |
|---|---|---|
| Severe accidents | Site-specific | SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives. See § 51.53(c)(3)(ii)(L). |
| **Uranium Fuel Cycle and Waste Management** | | |
| Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high-level waste) | Generic | SMALL. Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, are small. |
| Offsite radiological impacts (collective effects) | Generic | The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high-level waste, and spent fuel disposal is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations.<br>This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years, as well as doses outside the United States. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effects which will not ever be mitigated (for example no cancer cure in the next thousand years), and that these doses projected over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very |
| **Issue** | **Type of Issue** | **Findings** |
| Offsite radiological impacts (collective effects)<br><br>[*continued from previous page*] | Generic | small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations.<br>Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1 (Generic). |

| Issue | Type of Issue | Findings |
|---|---|---|
| Offsite radiological impacts (spent fuel and high-level waste disposal) | Generic | For the high-level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if it is assumed that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 milliroentgen equivalent man (millirem) per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about $3x10^{-3}$.<br>Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other Federal agencies have expended considerable effort to develop models for the design and for the licensing of a high-level waste repository, |

| Issue | Type of Issue | Findings |
|---|---|---|
| Offsite radiological impacts (spent fuel and high-level waste disposal)<br><br>[*continued from the previous page*] | Generic | especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to the population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, the Environmental Protection Agency's (EPA) generic repository standards in 40 CFR Part 191 generally provide an indication of the order of magnitude of cumulative risk to the population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR Part 191 protect the population by imposing the amount of radioactive material released over 10,000 years. The cumulative release limits are based on the EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric ton (MTHM) repository.<br>Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated.<br>Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered in Category 1 (Generic). |
| Nonradiological impacts of the uranium fuel cycle | Generic | SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small. |

| Issue | Type of Issue | Findings |
|---|---|---|
| Low-level waste storage and disposal | Generic | SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional onsite land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small.<br>Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements. |
| Mixed waste storage and disposal | Generic | SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements. |
| Onsite spent fuel | Generic | SMALL. The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available. |
| Nonradiological waste | Generic | SMALL. No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants. |
| Transportation | Generic | SMALL. The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by the NRC up to 62,000 megawatt days per metric ton uranium (MWd/MTU) and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4, “Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor.” If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in § 51.52. |

| Issue | Type of Issue | Findings |
|---|---|---|
| **Decommissioning** | | |
| Radiation doses | Generic | SMALL. Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by the buildup of long-lived radionuclides during the license renewal term. |
| Waste management | Generic | SMALL. Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected. |
| Air quality | Generic | SMALL. Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term. |
| Water quality | Generic | SMALL. The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts. |
| Ecological resources | Generic | SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts. |
| Socioeconomic impacts | Generic | SMALL. Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year license renewal period, but they might be decreased by population and economic growth. |
| **Environmental Justice** | | |
| Environmental justice | Uncategorized | NONE. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews. |

Table source: Table B–1 in Appendix B, Subpart A, to 10 CFR Part 51

# APPENDIX C
# APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS

# APPLICABLE REGULATIONS, LAWS, AND AGREEMENTS

The Atomic Energy Act of 1954, as amended (42 USC § 2011 et seq.), authorizes the U.S. Nuclear Regulatory Commission (NRC) to enter into agreement with any state to assume regulatory authority for certain activities (see 42 USC § 2012 et seq.). For example, through the Agreement State Program, Pennsylvania assumed regulatory responsibility over certain byproduct, source, and quantities of special nuclear materials not sufficient to form a critical mass. The Bureau of Radiation Protection, Pennsylvania Department of Environmental Protection, administers the Pennsylvania State Agreement Program.

In addition to carrying out some Federal programs, state legislatures develop their own laws. State statutes supplement, as well as implement, Federal laws for protection of air, water quality, and groundwater. State legislation may address solid waste management programs, locally rare and endangered species, and historic and cultural resources.

The Clean Water Act (33 USC § 1251 et seq., herein referred to as CWA) allows for primary enforcement and administration through state agencies, given that the state program is at least as stringent as the Federal program. The state program must conform to the CWA and to the delegation of authority for the Federal National Pollutant Discharge Elimination System (NPDES) program from the U.S. Environmental Protection Agency (EPA) to the state. The primary mechanism to control water pollution is the requirement for direct dischargers to obtain an NPDES permit, or in the case of states where the authority has been delegated from the EPA, a State Pollutant Discharge Elimination System permit, under the CWA. In Pennsylvania, the Pennsylvania Department of Environmental Protection issues and enforces NPDES permits.

One important difference between Federal regulations and certain state regulations is the definition of waters that the state regulates. Certain state regulations may include underground waters, whereas the CWA only regulates surface waters. The Delaware River Basin Commission regulates the Groundwater Protection Area in Southeastern Pennsylvania.

## C.1. Federal and State Environmental Requirements

Limerick Generating Station, Units 1 and 2 (LGS) is subject to Federal and state requirements for its environmental program.

Table C–1 lists the principle Federal and state environmental regulations and laws applicable to the review of the environmental resources that could be affected by this project that may affect license renewal applications for nuclear power plants. See Table C–2 of this supplemental environmental impact statement for LGS's compliance status with these requirements.

**Table C–1. Federal and State Environmental Requirements**

| Law/regulation | Requirements |
|---|---|
| **Current operating license and license renewal** | |
| Atomic Energy Act (42 U.S.C. § 2011 et seq.) | This Act is the fundamental U.S. law on both the civilian and the military uses of nuclear materials. On the civilian side, it provides for both the development and the regulation of the uses of nuclear materials and facilities in the United States. The Act requires that civilian uses of nuclear materials and facilities be licensed, and it empowers the NRC to establish by rule or order, and to enforce, such standards to govern these uses as "the Commission may deem necessary or desirable in order to protect health and safety and minimize danger to life or property." |
| 10 CFR Part 51. Title 10 Code of Federal Regulations (10 CFR) Part 51, Energy | "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." This part contains environmental protection regulations applicable to the NRC's domestic licensing and related regulatory functions. |
| 10 CFR Part 54 | "Requirements for Renewal of Operating Licenses for Nuclear Power Plants." This part focuses on managing adverse effects of aging rather than noting all aging mechanisms. The rule is intended to ensure that important systems, structures, and components will maintain their intended function during the period of extended operation. |
| 10 CFR Part 50 | "Domestic Licensing of Production and Utilization Facilities." Regulations that the NRC issues under the Atomic Energy Act of 1954, as amended (68 Stat. 919), and Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242), provide for the licensing of production and utilization facilities. This part also gives notice to all persons who knowingly supply—to any licensee, applicant, contractor, or subcontractor—components, equipment, materials, or other goods or services that relate to a licensee's or applicant's activities subject to this part, that they may be individually subject to NRC enforcement action for violation of § 50.5. |
| **Air quality protection** | |
| Clean Air Act (CAA) (42 USC § 7401 et seq.) | The Clean Air Act (CAA) is a comprehensive Federal law that regulates air emissions. Among other things, this law authorizes EPA to establish National Ambient Air Quality Standards (NAAQS) to protect public health and public welfare and to regulate emissions of hazardous air pollutants. EPA has promulgated NAAQS for six criteria pollutants: sulfur dioxide, nitrogen dioxide, carbon monoxide (CO), ozone, lead, and particulate matter. All areas of the United States must maintain ambient levels of these pollutants below the ceilings established by the NAAQS. |
| Pennsylvania Air Pollution Control Act (P.L. 2119) | The Pennsylvania Air Pollution Control Act establishes procedures for the protection of health and public safety during emergency conditions, creating a stationary air contamination source permit system and providing additional remedies for abating air pollution. |
| **Land use resources protection** | |
| Coastal Zone Management Act (16 USC § 1451 et seq.) | The Coastal Zone Management Act (CZMA) was established to preserve, protect, develop and where possible, restore or enhance, the resources of the Nation's coastal zone. |
| **Water resources protection** | |
| Clean Water Act (CWA) (33 USC § 1251 et seq.) and the NPDES (40 CFR 122) | The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. |

| Law/regulation | Requirements |
|---|---|
| Wild and Scenic River Act (16 USC § 1271 et seq.) | The Wild and Scenic River Act created the National Wild and Scenic Rivers System, which was established to protect the environmental values of free flowing streams from degradation by affecting activities, including water resources projects. |
| Safe Drinking Water Act (42 USC § 300f et seq.) | The Safe Drinking Water Act (SDWA) is the principal Federal law that ensures safe drinking water for the public. Under the SDWA, EPA is required to set standards for drinking water quality and oversees all states, localities, and water suppliers that implement these standards. |
| Pennsylvania Code, Title 25, *Environmental Protection*, Part I, Department of Environmental Protection, Chapter 92a, National Pollutant Discharge Elimination System Permitting, Monitoring, and Compliance (25 Pa Code 92a). | The regulatory provisions contained in this Pennsylvania code implement the NPDES Program by the Pennsylvania Department of Environmental Protection under the Federal Act. |
| Pennsylvania Code, Title 25, *Environmental Protection*, Part 1, Department of Environmental Protection Chapter 93, Water Quality Standards (25 Pa Code 93) | This code sets forth water quality standards for surface waters in the State of Pennsylvania, including wetlands. These standards are based upon water uses that are to be protected and will be considered by the Pennsylvania Department of Environmental Protection in implementing its authority under the Clean Streams Law and other statutes that authorize protection of surface water quality. |
| Pennsylvania Code, Title 25, *Environmental Protection*, Part V, Delaware River Basin Commission, Chapter 901, General Provisions (20 Pa Code 901) | This code incorporates by reference among other things Parts 401, “Rules of Practice and Procedures,” “Basin Regulations; Water Code and Administrative Manual Part III Water Quality Regulations,” and 430, “Ground Water Protection Area: Pennsylvania,” of 18 CFR containing regulations on conservation of power and water resources. |
| Pennsylvania’s Clean Streams Law (35 P.S. Section 691.1 et seq.) | The Clean Streams Law provides additional remedies for abating pollution of waters; regulates discharges of sewage and industrial wastes; regulates the operation of mines; and regulates the impact of mining upon water quality, supply, and quantity. The law places responsibilities on landowners and land occupiers, and maintains primary jurisdiction over surface coal mining in Pennsylvania. |
| Pennsylvania Safe Drinking Water Act (P.L. 206, No. 43 and 25 PA Code 109) | The Pennsylvania Safe Drinking Water Act protects the public health and safety by assuring that public water systems provide a safe and adequate supply of water for human consumption by establishing drinking water quality standards, permit requirements, and design and construction standards. |
| **Waste management and pollution prevention** | |
| Resource Conservation and Recovery Act (RCRA) (42 USC § 6901 et seq.) | RCRA gives EPA authority to control hazardous waste. Before a material can be classified as a hazardous waste, it first must be a solid waste as defined under the Resource Conservation and Recovery Act (RCRA). Hazardous waste is classified under Subtitle C of the RCRA. Parts 261, “Identification and Listing of Hazardous Waste,” and 262, “Standards Applicable to Generators of Hazardous Waste,” of 40 CFR contain all applicable generators of hazardous waste regulations. |

| Law/regulation | Requirements |
|---|---|
| Pollution Prevention Act (42 USC § 13101 et seq.) | The Pollution Prevention Act formally established a national policy to prevent or reduce pollution at its source whenever feasible. The Act supplies funds for state and local pollution prevention programs through a grant program to promote the use of pollution prevention techniques by business. |
| **Protected species** | |
| Endangered Species Act (ESA) (16 USC § 1531 et seq.) | The Endangered Species Act (ESA) forbids any government agency, corporation, or citizen from taking (e.g., harming or killing) endangered animals without an Endangered Species Permit. The ESA also requires Federal agencies to consult with the U.S. Fish and Wildlife Service or National Marine Fisheries Service if any Federal action may adversely affect any listed species or designated critical habitat. |
| Magnuson–Stevens Fishery Conservation and Management Act (MSA) (P.L. 94-265), as amended through January 12, 2007 | The Magnuson–Stevens Fishery Conservation and Management Act (MSA) includes requirements for Federal agencies to consider the impact of Federal actions on essential fish habitat and to consult with the National Marine Fisheries Service if any activities may adversely affect essential fish habitat. |
| Marine Mammal Protection Act (MMPA) (16 USC § 1361 et seq.) | The Marine Mammal Protection Act (MMPA) prohibits the take of marine mammals in U.S. waters or by U.S. citizens on the high seas without an MMPA Take Permit issued by the National Marine Fisheries Service. MMPA also prohibits importation of marine mammals and marine mammal products into the United States. |
| Fish and Wildlife Coordination Act (16 USC § 661 et seq.) | To minimize adverse impacts of proposed actions on fish and wildlife resources and habitat, the Fish and Wildlife Coordination Act requires that Federal agencies consult Government agencies regarding activities that affect, control, or modify waters of any stream or bodies of water. It also requires that justifiable means and measures be used in modifying plans to protect fish and wildlife in these waters. |
| Pennsylvania Code, Title 58, *Recreation*, Part II, Fish and Boat Commission, Chapter 75, Endangered Species (58 PA Code 75) | This code provides a lists of endangered, threatened, and candidate species in the State of Pennsylvania. The code prohibits the catching, taking, killing, possessing, importing or exporting from the State of Pennsylvania, selling, or offering to sale or purchase of any species listed without a special permit from Executive Director of the Pennsylvania Fish and Boat Commission. |
| **Historic preservation** | |
| National Historic Preservation Act (NHPA) (16 USC § 470 et seq.) | The National Historic Preservation Act (NHPA) directs Federal agencies to consider the impact of their actions on historic properties. To comply with NHPA, Federal agencies must consult with State Historic Preservation Officers and, when applicable, tribal historic preservations officers. NHPA also encourages state and local preservation societies. |

## C.2. Operating Permits and Other Requirements

Table C–2 lists the permits and licenses issued by Federal, state, and local authorities for activities at LGS.

**Table C–2. Licenses and Permits**

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Operating license | NPF-39 | Issued: 08/8/1985<br>Expires: 10/26/2024 | NRC |
| Operating license | NPF-85 | Issued: 08/25/1989<br>Expires: 06/22/2029 | NRC |
| NPDES Permit | PA0051926 | Issued: 03/31/2006<br>Expires: 03/31/2011<br>(administratively continued) | Pennsylvania Department of Environmental Protection (PADEP) |
| NPDES Permit | PA0052221 | Issued: 07/1/2009<br>Expires: 06/30/2014 | PADEP |
| Submission of project for Delaware River Basin Commission (DRBC) approval and determination as to whether project impairs or conflicts with the DRBC comprehensive plan | D-69-210 CP | Issued: 11/7/1975<br>(Rev. 12–11/02/2004)<br>Expires: No expiration date indicated | DRBC |
| Submission of project for DRBC approval and determination as to whether project impairs or conflicts with the DRBC comprehensive plan | D-69-52 CP | Issued: 02/18/1981<br>Expires: No expiration date indicated | DRBC |
| Submission of project for DRBC approval and determination as to whether project impairs or conflicts with the DRBC comprehensive plan | D-77-110 CP | Issued: 10/24/1984<br>Expires: No expiration date indicated | DRBC |
| Submission of project for DRBC approval and determination as to whether project impairs or conflicts with the DRBC comprehensive plan | D-65-76 CP | Issued: 12/18/1981<br>Expires: No expiration date indicated | DRBC |
| Title V Operating Permit | TVOP-46-00038 | Issued: 12/07/2009<br>Expires: 12/07/2014 | PADEP |
| Approval of design modifications, operation, and maintenance of Bradshaw Reservoir Dam | D09-181A | Issued: 12/30/1986<br>Expires: 12/30/2036 | PADEP |

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Maintenance Dredging Permit | 19616 | Issued: 07/16/1976<br>Expires: No date listed on permit | PADEP |
| Maintenance Dredging Permit | 19615 | Issued: 07/16/1976<br>Expires: No date listed on permit | PADEP |
| General Permit No. 11 for Maintenance Dredging | 044610317 | Issued: 12/07/2010<br>Expires: No expiration date indicated | PADEP |
| Permit to operate a public water system or a substantially modified facility | 4696508 | Issued: 03/25/1997<br>Expires: No date listed on permit | PADEP |
| Permit to operate a public water system or a substantially modified facility | 4606501 | Issued: 06/30/2006<br>Expires: No date listed on permit | PADEP |
| Permit to operate a public water system or a substantially modified facility | 4609503 | Issued: 11/20/2009<br>Expires: No date listed on permit | PADEP |
| Notification of regulated waste activity to obtain an EPA identification number for hazardous waste | PAD000797951 | Issued: 01/01/2001<br>Expires: N/A | EPA |
| Certificate of registration/permit to operate storage tanks | None | Issued: 02/04/2011<br>Expires: Renewed Annually | PADEP |
| Hazardous Materials Certificate of Registration | 070810 750 001SU | Issued: 06/09/2010<br>Expires: 06/30/2013 | U.S. Department of Transportation |
| Fire Marshall approval for storage and handling of flammable and combustible liquid | 172,943 | Issued: 02/25/1972<br>Expires: No date listed on approval | Pennsylvania Department of Labor and Industry, Boiler Section |
| Fire Marshall approval for storage and handling of flammable and combustible liquid | 186,609 | Issued: 08/15/1977<br>Expires: No date listed on approval | Pennsylvania Department of Labor and Industry, Boiler Section |
| Fire Marshall approval for storage and handling of flammable and combustible liquid | 186,610 | Issued: 08/15/1977<br>Expires: No date listed on approval | Pennsylvania Department of Labor and Industry, Boiler Section |

| Permit | Number | Dates | Responsible Agency |
|---|---|---|---|
| Fire Marshall approval for storage and handling of flammable and combustible liquid | 187,162 | Issued: 11/17/1977<br>Expires: No date listed on approval | Pennsylvania Department of Labor and Industry, Boiler Section |
| Environmental laboratory certificate of accreditation under PA Code 252 | PA Lab ID No. 46-0128, Cert. 003 | Issued: 08/31/2010<br>Expires: Renewed Annually | PADEP |
| Permit to operate encroachment | E 09-77A | Issued: 02/12/1988<br>Expires: 02/11/2038 | PADEP |
| Approval for disposal of licensed material generated by licensee’s activities | N/A | Issued: 07/10/1996 (NRC)<br>Issued: 03/23/1998 (PADEP)<br>Expires: No date listed on approvals | NRC and PADEP |

Source: Exelon 2011

## C.3. Reference

[Exelon] Exelon Generation Company, LLC. 2011. *License Renewal Application, Limerick Generating Station, Units 1 and 2, Appendix E, Applicant’s Environmental Report, Operating License Renewal Stage.* Agencywide Documents Access and Management System (ADAMS) Accession No. ML11179A104.

# APPENDIX D
# CONSULTATION CORRESPONDENCE

# CONSULTATION CORRESPONDENCE

## D.1. Background

The Endangered Species Act of 1973, as amended; the Magnuson Stevens Fisheries Management Act of 1996, as amended; and the National Historic Preservation Act of 1966 (NHPA) require that Federal agencies consult with applicable State and Federal agencies and groups before taking action that may affect threatened or endangered species, essential fish habitat, or historic and archaeological resources, respectively. This appendix contains consultation documentation.

Table D–1 lists the consultation documents sent between the U.S. Nuclear Regulatory Commission (NRC) and other agencies. The NRC staff is required to consult with these agencies based on the requirements of the statutes listed above.

**Table D–1. Consultation Correspondence**

| Author | Recipient | Date of Letter/email |
|---|---|---|
| Wrona, D., NRC | M. Roberts, U.S. Fish and Wildlife Service (USFWS) | September 8, 2011 ML11258A248 |
| Wrona, D., NRC | O. Braun, Pennsylvania Game Commission | September 8, 2011 ML11234A065 |
| Wrona, D., NRC | C. Urbarn, Pennsylvania Fish & Boat Commission | September 8, 2011 ML11234A024 |
| Wrona, D., NRC | H. Ellis, Absentee-Shawnee Tribe of Oklahoma | September 13, 2011 ML112340045 |
| Wrona, D., NRC | B. Obermeyer, Delaware Tribe | September 13, 2011 ML112340045 |
| Wrona, D., NRC | R. Dushane, Cultural Resource Officer, Eastern Shawnee Tribe of Oklahoma | September 13, 2011 ML112340045 |
| Wrona, D., NRC | C. Halftown, Heron Clan Representative, Cayuga Nation | September 13, 2011 ML112340045 |
| Wrona, D., NRC | T. Francis, Tribal Historic Preservation Office, Delaware Nation | September 13, 2011 ML112340045 |
| Wrona, D., NRC | R. Hill, Tonawanda Seneca Nation | September 13, 2011 ML112340045 |
| Wrona, D., NRC | N. Patterson, Tuscarora Nation | September 13, 2011 ML112340045 |
| Wrona, D., NRC | J. Bergevin, Oneida Indian Nation | September 13, 2011 ML112340045 |
| Wrona, D., NRC | C. Burke, Oneida Nation of Wisconsin | September 13, 2011 ML112340045 |
| Wrona, D., NRC | T. Gonyea, Onondaga Nation | September 13, 2011 ML112340045 |
| Wrona, D., NRC | L. Watt, Seneca Nation of Indians | September 13, 2011 ML112340045 |

| Author | Recipient | Date of Letter/email |
|---|---|---|
| Wrona, D., NRC | P. Barton, Seneca-Cayuga Tribe of Oklahoma | September 13, 2011 ML112340045 |
| Wrona, D., NRC | S. White, Stockbridge-Munsee Band of the Mohican Nation of Wisconsin | September 13, 2011 ML112340045 |
| Wrona, D., NRC | A. Printup, St. Regis Mohawk Tribe | September 13, 2011 ML112340045 |
| Wrona, D., NRC | K. Jumper, Shawnee Tribe | September 13, 2011 ML112340045 |
| Wrona, D., NRC | J. Cutler, Pennsylvania Historic and Museum Commission | September 15, 2011 ML11221A265 |
| Wrona, D., NRC | C. Firestone, Pennsylvania Department of Conservation & Natural Resources | September 16, 2011 ML11230B346 |
| Wrona, D., NRC | T. McCulloch, Advisory Council on Historical Preservation | September 16, 2011 ML11245A083 |
| Obermeyer, B., Delaware Tribe Historic Preservation Office | D. Wrona, NRC | September 23, 2011 ML11279A113 |
| White, S., Stockbridge-Munsee Tribal Historic Preservation Office | D. Wrona, NRC | September 28, 2011 ML11279A114 |
| Urban, C., Pennsylvania Fish & Boat Commission | D. Wrona, NRC | October 5, 2011 ML11291A077 |
| Gonyea, A., Onondaga Nation | D. Wrona, NRC | October 15, 2011 ML11305A006 |
| McLearn, D., Pennsylvania Historical & Museum Commission, Bureau for Historic Preservation | D. Wrona, NRC | October 26, 2011 ML11307A383 |
| Mowery, O., Pennsylvania Game Commission | D. Wrona, NRC | November 17, 2011 ML11339A042 |
| Riley, C., USFWS | D. Wrona, NRC | November 22, 2011 ML11339A043 |
| Susco, J., NRC | D. Morris, National Marine Fisheries Service | May 30, 2012 ML12138A347 |
| Colligan, M., National Marine Fisheries Service | J. Susco, NRC | June 27, 2012 ML12226A163 |

# APPENDIX E
# CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

# CHRONOLOGY OF ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and external parties as part of its environmental review for Limerick Generating Station, Units 1 and 2 (LGS). All documents, with the exception of those containing proprietary information, are available electronically from the NRC's Public Electronic Reading Room found on the Internet at the following Web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents in ADAMS. The ADAMS accession number for each document is included in the following list. To locate a reference in ADAMS, click on the "Simple Search" tab at the top of the web page, and enter the ADAMS accession number in the search box.

## E.1. Environmental Review Correspondence

Table E–1 lists the environmental review correspondence in date order beginning with the request by Exelon to renew the operating license for LGS.

**Table E–1. Environmental Review Correspondence**

| Date | Correspondence Description | ADAMS No. |
|---|---|---|
| June 22, 2011 | Letter from Exelon forwarding the LGS license renewal application and request to renew operating licenses for additional 20 years | ML11179A096 |
| June 30, 2011 | NRC press release announcing the availability of license renewal application for LGS | ML11181A084 |
| July 13, 2011 | Letter to Exelon, "Receipt and Availability of the License Renewal Application for the Limerick Generating Station, Units 1 and 2" | ML11180A040 |
| July 26, 2011 | *Federal Register* Notice of Receipt and Availability of Application for Renewal of Limerick Generating Station, Units 1 and 2 Facility Operating License Nos. NPF-39 and NPF-85 for an Additional 20-Year Period (76 FR 44624) | ML11180A178 |
| August 12, 2011 | Letter to Exelon, "Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from Exelon Generating Station Company, LLC for Renewal of the Operating Licenses for Limerick Generating Station, Units 1 and 2" | ML11206A206 |
| August 17, 2011 | Letter to Exelon, "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for License Renewal for the Limerick Generating Station, Units 1 and 2" | ML111213A206 |
| August 24, 2011 | *Federal Register* Notice of Acceptance for Docketing of the Application and Notice for Opportunity for Hearing Regarding the Renewal of Facility Operating License Nos. NPF-39 and NPF-85 for an Additional 20 Years Period, Exelon Generation Company , LLC, Limerick Generating Station (76 FR 52992) | ML11206A206 |
| August 26, 2011 | *Federal Register* Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process for Limerick Generating Station, Units 1 and 2 (76 FR 53498) | ML11214A048 |

| Date | Correspondence Description | ADAMS No. |
|---|---|---|
| September 7, 2011 | NRC press release announcing the LGS license renewal environmental scoping meeting | ML11250A162 |
| September 8, 2011 | Letter to Mr. Mark Roberts, U.S. Fish and Wildlife Service | ML11258A248 |
| September 8, 2011 | Letter to Ms. Olivia Braun, Environmental Planner, Pennsylvania Game Commission | ML11234A650 |
| September 8, 2011 | Letter to Mr. Chris Urban, Pennsylvania Fish and Boat Commission | ML11234A024 |
| September 13, 2011 | Letter to Henryetta Ellis, Absentee-Shawnee Tribe of Oklahoma | ML112340045 |
| September 13, 2011 | Letter to Clint Halftown, Heron Clan Representative, Cayuga Nation | ML112340045 |
| September 13, 2011 | Letter to Ms. Tamara Francis, Tribal Historic Preservation Office, Delaware Nation | ML112340045 |
| September 13, 2011 | Letter to Dr. Brice Obermeyer, Delaware Tribe | ML112340045 |
| September 13, 2011 | Letter to Ms. Robin Dushane, Cultural Resource Officer, Eastern Shawnee Tribe of Oklahoma | ML112340045 |
| September 13, 2011 | Letter to Chief Rogers Hill, Tonawanda Seneca Nation | ML112340045 |
| September 13, 2011 | Letter to Mr. Neil Patterson, Director, Tuscarora Nation | ML112340045 |
| September 13, 2011 | Letter to Ms. Kim Jumper, Tribal Historic Officer, Shawnee Tribe | ML112340045 |
| September 13, 2011 | Letter to Mr. Arnold Printup, Historic Preservation Officer, St. Regis Mohawk Tribe | ML112340045 |
| September 13, 2011 | Letter to Ms. Sherry White, Cultural Preservation Officer, Stockbridge-Munsee Band of the Mohican Nation of Wisconsin | ML112340045 |
| September 13, 2011 | Letter to Mr. Paul Barton, Historic Preservation Officer Seneca-Cayuga Tribe of Oklahoma | ML112340045 |
| September 13, 2011 | Letter to Ms. Lane Watt, Tribal Historic Preservation Office Seneca Nation of Indians | ML112340045 |
| September 13, 2011 | Letter to Mr. Tony Gonyea, Faithkeeper, Onondaga Nation | ML112340045 |
| September 13, 2011 | Letter to Ms. Corina Burke, Tribal Historic Preservation Office Oneida Nation of Wisconsin | ML112340045 |
| September 13, 2011 | Letter to Mr. Jesse Bergevin, Historian, Oneida Indian Nation | ML112340045 |
| September 15, 2011 | Letter to Ms. Jean Cutler, Deputy State Historic Preservation Officer, Pennsylvania Historical and Museum Commission | ML11221A265 |
| September 16, 2011 | Letter to Mr. Chris Firestone, Pennsylvania Department of Conservation & Natural Resources | ML11230B346 |
| September 16, 2011 | Letter to Mr. Tom McCulloch, Advisory Council on Historic Preservation | ML11245A083 |
| September 23, 2011 | Letter from Dr. Brice Obermeyer, Delaware Tribe Historic Preservation Office | ML11279A113 |
| September 28, 2011 | Letter from Ms. Sherry White, Tribal Historic Preservation Officer, Stockbridge-Munsee Tribal Historic Preservation Office | ML11279A114 |

| Date | Correspondence Description | ADAMS No. |
| --- | --- | --- |
| October 5, 2011 | Letter from Mr. Chris Urban, Pennsylvania Fish and Boat Commission | ML11291A077 |
| October 15, 2011 | Letter from Mr. Anthony Gonyea, Onondaga Nation | ML11305A006 |
| October 26, 2011 | Letter from Mr. Douglas McLearen, Pennsylvania Historical and Museum Commission | ML11307A383 |
| November 17, 2011 | Letter from Ms. Olivia Mowery, Pennsylvania Game Commission | ML11339A042 |
| November 22, 2011 | Letter from Mr. Clinton Riley, U.S. Fish and Wildlife Service | ML11339A043 |
| February 24, 2012 | Letter to Exelon, “Request for Additional Information for the Review of the Limerick Generating Station, Units 1 and 2, License Renewal Application Environmental Review” | ML12041A443 |
| March 27, 2012 | Letter from Exelon, “Limerick Generating Station, Units 1 and 2–Response to NRC Request for Additional Information, Dated February 28, 2012, Related to the License Renewal Application” | ML12088A366 |
| April 11, 2012 | Memorandum, “Summary of Telephone Conference Call on February 23, 2012, Between the U.S. Nuclear Regulatory Commission and Exelon Generation Company, LLC, Concerning Request for Additional Information Pertaining to the Limerick Generating Station License Renewal Application” | ML12083A211 |
| May 21, 2012 | Summary of Site Audit Related to the Environmental Review of the License Renewal Application for Limerick Generating Station, Units 1 and 2 | ML12124A127 |
| May 30, 2012 | Letter to Mr. Daniel Morris, National Marine Fisheries Service | ML12138A347 |
| June 27, 2012 | Letter from Ms. Mary Colligan, National Marine Fisheries Service | ML12226A163 |

# APPENDIX F
# DESCRIPTION OF PROJECTS CONSIDERED IN THE CUMULATIVE IMPACT ANALYSIS

# DESCRIPTION OF PROJECTS CONSIDERED IN THE CUMULATIVE IMPACTS ANALYSIS

## F.1. Description of Projects Considered

To evaluate cumulative impacts, the incremental impacts of the proposed action, as described in Sections 4.1–4.9, are combined with other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. The U.S. Nuclear Regulatory Commission (NRC) staff (staff) used the information in the environmental report (ER); responses to requests for additional information (RAIs); information from other Federal, State, and local agencies; scoping comments; and information gathered during the visits to the Limerick Generating Station, Units 1 and 2 (LGS) site to identify other past, present, and reasonably foreseeable actions. Other actions and projects that were identified during this review, and considered in the staff's independent analysis of the potential cumulative effects, are described in Table F–1.

**Table F–1. Projects and Actions Considered in the Cumulative Impacts Analysis**

| Project Name | Summary of Project | Location | Status |
|---|---|---|---|
| Moser Generating Station Oil Plant | 60 MW, 3 unit oil-fired peaking plant | Lower Pottstown Township, approximately 2 miles (mi) west (W) of LGs | Operational (Exelon Corp. 2012); (Exelon 2011) |
| Linfield Energy Center | 616 MW, 3 unit natural gas plant | 3 mi northwest (NW) of LGS | Air-quality permitted in 2002, but project "withdrawn" and not constructed (EJN); (Enviro 2002) |
| Schuylkill Generating Station | 196 MW, 3 unit oil power plant | 29 mi NW of LGS | Operational (Exelon Corp. 2012) |
| Cromby Generation Station | 2 unit fossil fuel power plant located on the Schuylkill River | 8 mi south (S) of LGS | Both units were retired from service in 2011 (Exelon Corp. 2012) |
| Titus Coal Plant | 261 MW, 5 unit coal power plant | 18 mi NW of LGS | Operational (GEO 2012a) |
| Ontelaunee Energy Center Gas Plant | 728 MW, 3 unit gas power plant | 23 mi northeast (NE) of LGS | Operational (GEO 2012b) |
| Montenay Montgomery LP Waste Plant | 32 MW, 1 unit waste power plant | 17 mi southeast (SE) of LGS | Operational (GEO 2012c) |
| Grays Ferry Cogeneration Gas Plant | 193 MW, 2 unit gas power plant | 29 mi SE of LGS | Operational (GEO 2012d) |

| Project Name | Summary of Project | Location | Status |
|---|---|---|---|
| Chester Generating Station Oil Plant | 56 MW, 3 unit oil power plant | 20 mi southwest (SW) of LGS | Operational (GEO 2012e) |
| Philadelphia Refinery Waste Plant | 30 MW, 3 unit waste power plant | 30 mi SE of LGS | Operational (GEO 2012f) |
| Delaware Generating Station Oil Plant | 392 MW, 4 unit oil power plant | 30 mi SE of LGS | Operational (GEO 2012g) |
| Eddystone Generation Station Coal Plant | 1,589 MW, 8 unit coal power plant | 20 mi SE of LGS | Operational (GEO 2012h) |
| Florida Power & Light Energy Marcus Hook Gas Plant | 836 MW, 4 unit gas power plant | 30 mi SE of LGS | Operational (GEO 2012i) |
| Chester Operational Coal Plant | 67 MW, 1 unit coal power plant | 29 mi SE of LGS | Operational (GEO 2012j) |
| Royersford Borough | Sewage/wastewater treatment plant that discharges 54 millions of gallons per day (mgd) to the Schuylkill River | 4 mi SE of LGS | Operational (EPA 2012a) |
| Spring City Borough | Sewage/wastewater treatment plant that discharges .345 mgd to the Schuylkill River | 7 mi SE of LGS | Operational (EPA 2012a) |
| Limerick Township Municipal Authority | Sewage/wastewater treatment plant that discharges 1.7 mgd to the Schuylkill River | 3 mi SE of LGS | Operational (EPA 2012a) |
| East Vincent Municipal Authority | Sewage/wastewater treatment plant that discharges .5 mgd to the Schuylkill River | 4 mi S of LGS | Operational (EPA 2012a) |
| North Coventry Municipal Authority | Sewage/wastewater treatment plant that discharges 1.5 mgd to the Schuylkill River | 2 mi W of LGS | Operational (EPA 2012a) |
| Phoenixville Borough Sewage Treatment Plant | Sewage/wastewater treatment plant that discharges 4 mgd to the Schuylkill River | 9 mi SE of LGS | Operational (EPA 2012a) |
| Lower Frederick Township Sewage Treatment Plant | Sewage/wastewater treatment plant that discharges .2 mgd to the Perkiomen Creek | 7 mi NE of LGS | Operational (EPA 2012a) |

| Project Name | Summary of Project | Location | Status |
|---|---|---|---|
| Schwenksville Borough Authority Sewage Treatment Plant | Sewage/wastewater treatment plant that discharges .3 mgd to the Perkiomen Creek | 7 mi NE of LGS | Operational (EPA 2012a) |
| Pottstown Water Treatment Plant | Sewage/wastewater treatment plant withdraws up to 5 mgd from the Schuylkill River | 2 mi W of LGS | Operational (EPA 2012b) |
| Pennsylvania American Water Company, Shady Lane Water Treatment Plant | Sewage/wastewater treatment plant that discharges .111 mgd to the Schuylkill River | 2 mi S of LGS | Operational (EPA 2012a) |
| JBS Souderton Inc., Industrial Waste Water Treatment Plant | Sewage/wastewater treatment plant that discharges .832 mgd to the Skippack Creek at River Mile 92.47 – 32.3 – 3.0 – 12.8 (Delaware River – Schuylkill River – Perkiomen Creek – Skippack Creek) | 15 mi NE of LGS | Operational (DRBC 2011) |
| Warwick Drainage Company | Public wastewater collection, treatment, and disposal that discharges .0135 mgd to the French Creek (Schuylkill River Tributary) | 8 mi NW of LGS | Operational (EPA 2012a) |
| Doehler-Jarvis Limited Partnership | Aluminum die casting | 5 mi W of LGS | Operational (EPA 2012a) |
| Sun Co., Inc. | Major gas service station | 3 mi NE of LGS | Operational (EPA 2012a) |
| Pottstown Trap Sanatoga Quarry | Quarry | 3,650 feet NW, directly adjacent to Schuylkill River and contiguous with the LGS plant site property | Operational (Exelon 2011) |
| Uniform Tubes, Inc. | Steel parts manufacturing | 6 mi SE of LGS | Operational (EPA 2012a) |
| Plotts Oil Co. | Heating oil distribution | 4 mi SE of LGS | Operational (EPA 2012a) |
| Specialty Chemical Systems | Inorganic chemical production | 4 mi SE of LGS | Operational (EPA 2012a) |
| Spring City Electric Manufacturing Company | Iron foundry discharges | 4 mi SE of LGS | Operational (EPA 2012a) |
| Unitech Services Group, Inc. | Industrial launderer | 3 mi SE of LGS | Operational (EPA 2012a) |

| Project Name | Summary of Project | Location | Status |
|---|---|---|---|
| Smurfit-Stone Container | Paper packaging | 9 mi SE of LGS | Operational (EPA 2012a) |
| Wyeth Pharmaceuticals | Biotechnology research and development | 8 mi SE of LGS | Operational (EPA 2012a) |
| GlaxoSmithKline | Pharmaceutical manufacturing | 7 mi SE of LGS | Operational (EPA 2012a) |
| Evansburg State Park | 3,349 acre state park in south-central Montgomery County between Norristown and Collegeville | 10 mi east of LGS | Operational (DCNR 2012a) |
| Fort Washington State Park | 493 acre state park in Springfield and Whitemarsh Townships, Montgomery County | 20 mi SE of LGS | Operational (DCNR 2012b) |
| Norristown Farm Park | 690 acre park in East Norriton and West Norriton Townships and the Borough of Norristown | 14 mi SE of LGS | Operational (DCNR 2012c) |
| Marsh Creek State Park | 1,727 acre state park in Chester County | 11 mi SW of LGS | Operational (DCNR 2012d) |
| Pickering Creek Preserve | 25 acre park in Schuylkill Township | 13 mi SE of LGS | Operational |
| Valley Forge National Park | 3,500 acre national historic park | 11 mi SE of LGS | Operational |
| French Creek State Park | 7,730 acre state park in North Coventry and Warwick Townships in Chester County and Robeson and Union Townships in Berks County | 10 mi W of LGS | Operational (DCNR 2012e) |
| Ridley Creek State Park | 2,606 acres of Delaware County woodlands and meadows | 25 mi SE of LGS | Operational (DCNR 2012f) |
| Independent Spent Fuel Storage Installation (ISFSI) | The ISFSI provides dry storage for spent fuel at the LGS site | At LGS | Operational (Exelon 2011) |
| Recticon/Allied Steel Corp. | Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site | 1 mi S of LGS | CERCLA site (EPA) |
| Occidental Chemical Corporation Remediation Site (Formerly Firestone Tire and Rubber Manufacturing Facility) | Occidental Chemical Corporation is remediating under the oversight of EPA | 2.5 mi W of LGS | Superfund site (Exelon 2011) |

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| NRC FORM 335<br>(12-2010)<br>NRCMD 3.7<br><br>U.S. NUCLEAR REGULATORY COMMISSION<br><br>**BIBLIOGRAPHIC DATA SHEET**<br>*(See instructions on the reverse)* | 1. REPORT NUMBER<br>(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)<br>NUREG-1437, Supplement 49 |
|---|---|
| 2. TITLE AND SUBTITLE<br>Generic Environmental Impact Statement for License Renewal of Nuclear Plants<br>Supplement 49 Regarding Limerick Generating Station, Units 1 and 2<br>Draft Report | 3. DATE REPORT PUBLISHED<br>MONTH: April<br>YEAR: 2013<br><br>4. FIN OR GRANT NUMBER |
| 5. AUTHOR(S)<br>See Chapter 10 | 6. TYPE OF REPORT<br>Technical<br><br>7. PERIOD COVERED (Inclusive Dates) |

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)

Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)

Same os above

10. SUPPLEMENTARY NOTES

Docket Nos. 50-352, 50-353

11. ABSTRACT (200 words or less)

This draft supplemental environmental impact statement has been prepared in response to an application submitted by Exelon Generation Company, LLC (Exelon) to renew the operating license for Limerick Generating Station, Units 1 and 2 (LGS) for an additional 20 years.
This draft supplemental environmental impact statement includes the preliminary analysis that evaluates the environmental impacts of the proposed action and alternatives to the proposed action. Alternatives considered include natural gas combined-cycle (NGCC); supercritical pulverized coal; new nuclear; wind power; purchased power; and not renewing the license (the no action alternative).
The U.S. Nuclear Regulatory Commission's preliminary recommendation is that the adverse environmental impacts of license renewal for LGS are not great enough to deny the option of license renewal for energy planning decisionmakers. This recommendation is based on the following:

- the analysis and findings in NUREG 1437, Volumes 1 and 2, Generic Environmental Impact Statement for License Renewal of Nuclear Plants;
- the environmental report submitted by Exelon;
- consultation with Federal, state, and local agencies;
- the NRC's environmental review; and
- consideration of public comments received during the scoping process

| 12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.) | 13. AVAILABILITY STATEMENT |
|---|---|
| Limerick Generating Station, Units 1 and 2<br>Limerick<br>Exelon Generation Company, LLC<br>Exelon<br>Supplemental to the Generic Environmental Impact Statement, SEIS<br>Generic Environmental Impact Statement, GEIS<br>National Environmental Policy Act, NEPA<br>License Renewal<br>NUREG-1437, Supplement 49 | unlimited<br><br>14. SECURITY CLASSIFICATION<br>*(This Page)* unclassified<br>*(This Report)* unclassified<br><br>15. NUMBER OF PAGES<br><br>16. PRICE |

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**Generic Environmental Impact Statement for License Renewal of Nuclear Plants**
**Regarding Limerick Generating Station, Units 1 and 2**

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