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Protecting People and the Environment

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Occupational Radiation Exposure at Commercial Nuclear Power Reactors and other Facilities 2017

Fiftieth Annual Report

Office of Nuclear Regulatory Research

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NUREG-0713	Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 2016, Vol. 38, U.S. Nuclear Regulatory Commission, May 2018.

Previous reports in the NUREG-0714 series, which are now combined with NUREG-0713, are as follows:

WASH-1350-R1/ WASH-1350 R6	First through Sixth Annual Reports of the Operation of the U.S. AEC's Centralized Ionizing Radiation Exposure Records and Reporting System, U.S. Atomic Energy Commission.
NUREG-75/108	Seventh Annual Occupational Radiation Exposure Report for Certain NRC Licensees, 1974, U.S. Nuclear Regulatory Commission, October 1975.
NUREG-0119	Eighth Annual Occupational Radiation Exposure Report for 1975, U.S. Nuclear Regulatory Commission, October 1976.
NUREG-0322	Ninth Annual Occupational Radiation Exposure Report for 1976, U.S. Nuclear Regulatory Commission, October 1977.
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NUREG-0593	Eleventh Annual Occupational Radiation Exposure Report for 1978, U.S. Nuclear Regulatory Commission, January 1981.
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NUREG-0714	Occupational Radiation Exposure, Thirteenth and Fourteenth Annual Reports, 1980 and 1981, Vols. 2 and 3, U.S. Nuclear Regulatory Commission, October 1983.
NUREG-0714	Occupational Radiation Exposure, Fifteenth and Sixteenth Annual Reports, 1982 and 1983, Vols. 4 and 5, U.S. Nuclear Regulatory Commission, October 1985.

ABSTRACT

This report summarizes the occupational exposure data that are maintained in the U.S. Nuclear Regulatory Commission (NRC) Radiation Exposure Information and Reporting System (REIRS) database. The bulk of the information contained in this report was compiled from the 2017 annual reports submitted by five of the seven categories[1] of NRC licensees subject to the reporting requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) 20.2206, "Reports of Individual Monitoring." Because there are no geologic repositories for high-level waste currently licensed and no NRC-licensed low-level waste disposal facilities currently in operation, only five categories are considered in this report. The annual reports submitted by these licensees consist of radiation exposure records for each monitored individual. These records are analyzed for trends and presented in this report in terms of collective dose and the distribution of dose among the monitored individuals.

Annual reports for 2017 were received from a total of **191** NRC licensees from the five categories included in this report. The summation of reports submitted by the **191** licensees indicated that **166,526** individuals were monitored, **71,238** of whom received a measurable dose (Table 3.1). When adjusted for transient individuals, there were actually **118,715** unique individuals that were monitored, **52,861** of whom received a measurable dose (see Section 5).

The collective dose incurred by these individuals was **8,521** person-rem (85,210 person-millisieverts [mSv]), which represents a **21 percent increase** from the 2016 value. The 2017 collective dose is **4 percent lower** than the 5-year average of 8,910 person-rem (2012 – 2016), which is not a statistically significant change.[2] The increase in collective dose in 2017 was due to an increase in three of the five reporting categories; industrial radiographers (**35 percent increase),** commercial nuclear power reactor licensees (**20 percent increase),** and spent fuel storage licensees (**9 percent increase).** Two reporting categories reported decreases; manufacturing and distribution (M&D) licensees (**3 percent decrease**) and fuel cycle licensees (**8 percent decrease)**. When compared to the 5-year average of collective dose for each category, fuel cycle licensees had a statistically significant decrease. The increases or decreases for the remaining four categories were not statistically significant.

The number of individuals receiving a measurable dose increased by **9 percent** from 2016, but was still **7 percent below** the 5-year average and not statistically significant. When adjusted for transients, the average measurable dose of **0.16 rem** (1.6 mSv) increased for 2017, but is not statistically significant when compared to the 5-year average. The average measurable dose is defined as the total effective dose equivalent (TEDE) divided by the number of individuals receiving a measurable dose. In 2017, two individuals exceeded **5 rem** (50 mSv) TEDE at an industrial radiography licensee. (see Section 6).

In calendar year 2017, the average annual collective dose per reactor for light-water reactor (LWR) licensees was **65** person-rem (650 person-mSv). This is a **20 percent increase** from the value reported for 2016 (Table 4.3) but is not statistically significant when compared to the 5-year average. The total outage hours at commercial nuclear power plants increased **4 percent** from

[1] Commercial nuclear power reactors and test reactor facilities; industrial radiographers; fuel processors (including uranium enrichment facilities), fabricators, and reprocessors; manufacturing and distribution of byproduct material; independent spent fuel storage installations; facilities for land disposal of low-level waste; and geologic repositories for high-level waste. There are currently no NRC licensees involved in low-level waste disposal or geologic repositories for high-level waste.

[2] This report presents additional Statistical Comparisons in Section 2.2.

2016 to 2017 [Ref. 1]. The collective dose for the LWR licensee category increased **1,051** person-rem (10,510 person-mSv) to **6,417** person-rem (64,170 person-mSv). The average annual collective dose per reactor was **118** person-rem (1,180 person-mSv) for the 34 boiling-water reactors (BWRs) and **37** person-rem (370 person-mSv) for 65 pressurized-water reactors (PWRs). The BWR 2017 value is **2 percent** higher than the 5-year average annual collective dose per BWR reactor. The 2017 value for PWR licensees is **16 percent** below the 5-year average annual collective dose per PWR reactor. Neither of these differences is statistically significant. The primary driver for the increase in collective dose for both PWRs and BWRs was a **16 percent increase** in refueling outage hours from 2016 to 2017. Refueling activities generally result in increased individual and collective doses as the reactor vessel is opened and the spent fuel is removed. Conversely, a decrease in refueling outages and activities would result in lower individual and collective dose.

There were **26,950** individuals that were monitored at two or more licensees during the monitoring year. The assessment of the average measurable dose per individual is adjusted each year to account for the reporting of a measurable dose for transient individuals by multiple licensees. The adjustment to account for transient individuals has been specifically noted in footnotes in the figures and tables for commercial nuclear power reactors.

EDITOR'S NOTE

Staff in the Offices of Nuclear Reactor Regulation, Nuclear Material Safety and Safeguards, New Reactors, and Nuclear Regulatory Research assisted in the preparation of this NUREG, serving as technical reviewers. The NRC welcomes responses from readers.

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FOREWORD

Through this annual report, the U.S. Nuclear Regulatory Commission (NRC) supports openness in its regulatory process by providing the public with accurate and timely information about the radiation protection program of NRC licensees. Toward that end, NUREG-0713, Volume 39, summarizes the 2017 occupational radiation exposure data maintained in the NRC Radiation Exposure Information and Reporting System (REIRS) database.

Seven categories of NRC licensees are required to report annually on individual exposure in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR 20.2206, "Reports of Individual Monitoring"). Specifically, these categories include commercial nuclear power reactors; industrial radiographers; fuel processors (including uranium enrichment facilities), fabricators, and reprocessors; manufacturing and distribution of byproduct material; independent spent fuel storage installations; facilities for land disposal of low-level waste; and geologic repositories for high-level waste. Because the NRC has not licensed any geologic repositories for high-level waste and all low-level waste disposal facilities are regulated by Agreement States, this report considers only the first five categories of NRC licensees. As such, this report reflects the occupational radiation exposure data that the NRC received from 191 licensees.

The data submitted by licensees consist of radiation exposure records for each monitored individual. Adjusted for transient individuals who worked at two or more facilities during the year, 118,715 were monitored and 52,861 received a measurable dose in 2017. This report analyzes and presents these records in terms of collective dose and the distribution of dose among the monitored individuals.

During 2017, these 52,861 individuals incurred a collective dose of 8,521 person-rem (85,210 person-millisieverts [mSv]), a 21 percent increase from the 2016 value of 7,057 person-rem (70,570 person-mSv). The 2017 collective dose is 4 percent lower than the 5-year average of 8,910 person-rem (89,100 person mSv) (2012 – 2016), and does not reflect a statistically significant change.[1] The 2016 – 2017 increase was due to an increase in three of the five reporting categories; industrial radiographers (35 percent increase), commercial nuclear power reactor licensees (20 percent increase), and spent fuel storage licensees (9 percent increase). Two reporting categories reported decreases; manufacturing and distribution (M&D) licensees (3 percent decrease) and fuel cycle licensees (8 percent decrease). When compared to the 5-year average of collective dose for each category, fuel cycle licensees had a statistically significant decrease. The increases or decreases for the remaining categories were not statistically significant. The average measurable dose is the total collective dose divided by the number of individuals receiving a measurable dose. Both the collective dose and the number of individuals receiving a measurable dose increased from 2016 to 2017. The average measurable dose increased to 0.16 rem (1.6 mSv) in 2017 when adjusted for transient workers, but was not a statistically significant change from the 5-year average. This value can be compared with the 0.31 rem (3.1 mSv) [Ref. 2] that the average person in the United States receives annually from natural background radiation. Worldwide annual exposures to natural background radiation are generally expected to be in the range of 0.1 rem (1 mSv) to 1.3 rem (13 mSv), with 0.24 rem (2.4 mSv) [Ref. 3] being the current average worldwide value.

[1] This report presents additional Statistical Comparisons in Section 2.2.

PREFACE

A number of U.S. Nuclear Regulatory Commission (NRC) licensees have inquired as to how the occupational radiation exposure data that are compiled from the individual exposure reports required by Title 10 of the *Code of Federal Regulations* (10 CFR) 20.2206, "Reports of Individual Monitoring," are used by the NRC staff. In combination with other sources of information, the principal uses of the data are to provide facts regarding routine occupational exposures to radiation and radioactive material that occur in connection with certain NRC-licensed activities. The NRC staff uses this data for the following purposes:

1. The data permit the evaluation of trends, both favorable and unfavorable, from the viewpoint of the effectiveness of overall NRC/licensee radiation protection and as-low-as-is-reasonably-achievable (ALARA) efforts by licensees.

2. The data assist in the evaluation of the radiological risk associated with certain categories of NRC-licensed activities and are used for comparative analyses of radiation protection performance (e.g., U.S./foreign, boiling-water reactors/pressurized-water reactors [BWRs/PWRs], civilian/military, facility/facility, nuclear industry/other industries).

3. The data are used as one of the metrics of the NRC Reactor Oversight Process to evaluate the effectiveness of the licensees' ALARA programs and also for inspection planning purposes.

4. The data permit an evaluation of radiation exposure to transient individuals.

5. The data are used to establish priorities for the use of NRC health physics resources: research, standards development, regulatory program development, and inspections conducted at NRC-licensed facilities.

6. The data provide facts for answering Congressional and administration inquiries and for responding to questions raised by the public.

7. The data are used to provide radiation exposure histories to individuals who were exposed to radiation at NRC-licensed facilities.

8. The data provide information that may be used to conduct epidemiologic studies.

9. The data also may be used in the evaluation of the NRC radiation protection standards with respect to adopting the recommendations described in the International Commission on Radiological Protection (ICRP) Publication 103 [Ref. 4].

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ABBREVIATIONS AND ACRONYMS

AEC	U.S. Atomic Energy Commission
ALARA	as low as is reasonably achievable
BWR	boiling-water reactor
CDE	committed dose equivalent
CEDE	committed effective dose equivalent
CFR	Code of Federal Regulations
D&D	decontamination and decommissioning
DDE	deep dose equivalent
DOE	U.S. Department of Energy
ERDA	Energy Research and Development Administration
EVESR	ESADA Vallecitos Experimental Superheat Reactor
FBR	fast breeder reactor
FSSR	final status survey report
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
ISFSI	independent spent fuel storage installation
ISOE	Information System on Occupational Exposure
ISOEDAT	Information System on Occupational Exposure Database
LDE	lens dose equivalent
LTP	license termination plan
LWR	light-water reactor
M&D	manufacturing and distribution
MOX	mixed oxide
mSv	millisievert
MW	megawatts
MWe	megawatts electric
MWt	megawatts thermal
MW-hr	megawatt-hour
MW-yr	megawatt-year
NEA	Nuclear Energy Agency
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NS	Nuclear Ship
OECD	Organisation for Economic Co-operation and Development
PSDAR	Post-shutdown decommissioning activities report
PWR	pressurized-water reactor

REIRS	Radiation Exposure Information and Reporting System
SDE-ME	shallow dose equivalent maximally exposed extremity
SDE-WB	shallow dose equivalent whole body
SI	international system of units
SG	steam generator
Sv	sieverts
TBD	to be determined
TEDE	total effective dose equivalent
TMI	Three Mile Island
TODE	total organ dose equivalent
UF_6	uranium hexafluoride
VBWR	Vallecitos Boiling-Water Reactor
VIS	Valley Inspection Services

1 INTRODUCTION

1.1 Background

One of the basic purposes of the Atomic Energy Act and the implementing regulations in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 20, *Standards for Protection Against Radiation*, is to protect the health and safety of the public, including the employees of the licensees conducting operations under those regulations.

On November 4, 1968, the U.S. Atomic Energy Commission (AEC) published an amendment to 10 CFR Part 20 requiring the reporting of a statistical summary of occupational radiation exposure information (but not individual exposure records) to a central repository at AEC Headquarters. At that time, there were only four categories[1] of AEC licensees required to report. These facilities were considered to have the greatest potential for significant occupational doses. Licensees were required to report the total number of individuals who were monitored per dose range (§20.407) and provide cumulative radiation exposure reports for individuals no longer employed (§20.408). Occupational exposure data were extracted from these reports and entered into the AEC Radiation Exposure Information and Reporting System (REIRS), a computer system that was maintained at the Oak Ridge National Laboratory Computer Technology Center in Oak Ridge, TN, until May 1990.

At that time, the data were transferred to a database management system and are now maintained at the Oak Ridge Institute for Science and Education, which is managed by Oak Ridge Associated Universities. The computerization of these data facilitates their collection and analysis. The data maintained in REIRS have been summarized and published in a report every year since 1969. Annual reports for each of the years 1969 through 1973 presented the data reported by both AEC licensees and contractors and were published in six documents designated as WASH-1350-R1 through WASH-1350-R6.

In January 1975, with the separation of AEC into the Energy Research and Development Administration (ERDA) and the U.S. Nuclear Regulatory Commission (NRC), each agency assumed responsibility for collecting and maintaining occupational radiation exposure information reported by the facilities under its jurisdiction. The annual reports published by the NRC on occupational exposure for calendar year 1974 and subsequent years do not contain information pertaining to ERDA facilities or contractors. Comparable information for facilities and contractors under ERDA, now the U.S. Department of Energy (DOE) is collected and published by the DOE Office of ES&H Reporting and Analysis within the Office of Environment, Health, Safety and Security in Germantown, MD.

In 1982 and 1983, 10 CFR 20.408(a) was amended to require three additional categories of NRC licensees to submit annual statistical exposure reports and individual termination exposure reports. The three additional NRC licensee categories were: (1) geologic repositories for high-level radioactive waste, (2) independent spent fuel storage installations (ISFSIs), and (3) facilities for the land disposal of low-level radioactive waste. This document presents the exposure information that was reported by NRC licensees representing one of these additional categories (i.e., ISFSIs), since there are no geologic repositories for high-level waste currently licensed and there are no low-level waste land disposal facilities currently in operation that report to the NRC.

[1] Commercial nuclear power reactors; industrial radiographers; fuel processors (including uranium enrichment facilities as of 1997), fabricators, and reprocessors; and manufacturing and distribution of specified quantities of byproduct material.

In May 1991, 10 CFR Part 20 was revised to redefine the radiation monitoring and reporting requirements of NRC licensees. Instead of submitting annual reports summarizing the total number of individuals who were monitored (§20.407) and termination reports (§20.408), licensees were required to submit an annual report of the dose received by each monitored individual (§20.2206). Licensees were required to implement the new requirements no later than January 1994. The regulations in 10 CFR 20.1502 specify conditions that require individual monitoring of external and internal occupational dose. Each licensee is also required, under 10 CFR 20.2106, to maintain records of the results of such monitoring until the Commission terminates the license.

This report summarizes information reported for the current year and previous 10 years. More licensee-specific data for the previous 10 years, such as the annual reports submitted by each commercial nuclear power reactor pursuant to 10 CFR 20.407 and 20.2206 (after 1993) and their technical specifications (before Volume 20 of this report), may be found in the documents listed on the inside of the front cover of this report for the specific year desired. Additional operating data and statistics for each commercial nuclear power reactor for the years 1973 through 1982 may be found in a series of reports, “Nuclear Power Plant Operating Experience” [Refs. 5–13]. These documents are available for viewing at all NRC public document rooms, as well as on the NRC public Web site (https://www.nrc.gov), or they may be purchased from the National Technical Information Service, as shown in the References section.

1.2 Radiation Exposure Information on the Internet

In May 1995, the NRC began disseminating radiation exposure information at a Web site on the Internet. This site allows interested parties to access the data electronically rather than through the published NUREG-0713 document. A Web site was created for radiation exposure and linked to the main NRC Web page. The Web site contains up-to-date information on radiation exposure, as well as information and guidance on reporting radiation exposure information to the NRC. Interested parties may read the documents on line or download information for further analysis. REIRView, a software package designed to validate a licensee’s annual data submittal, is available for downloading on the Web site. There are also links to other Web sites dealing with the topics of radiation and health physics. Individuals may submit requests for their dose records contained in REIRS on this Web site. In addition, organizations that have provided documentation to the NRC may submit requests for dose records contained in REIRS on this Web site.

The NRC intends to continue disseminating radiation exposure information on the Web and will focus more resources on the electronic distribution of information rather than on the publication of hard-copy reports.

The main Web address for the NRC is

https://www.nrc.gov

The NRC radiation exposure information Web URL is

https://www.reirs.com

Comments on this report or on the NRC's radiation exposure Web page should be directed to

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2 LIMITATIONS OF THE DATA

2.1 Limitations

All of the figures compiled in this report relating to exposures and occupational doses are based on the results and interpretations of the readings of various types of personnel-monitoring devices employed by each licensee. This information, obtained from routine personnel-monitoring programs, assists in characterizing the radiation exposure incident to individuals' work and is used in evaluating the radiation protection program.

Monitoring requirements are specified in 10 CFR 20.1502, which requires licensees to monitor individuals at levels sufficient to demonstrate compliance with occupational dose limits. As a minimum, monitoring must be provided for adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the applicable limits in 10 CFR 20.1201(a) and all individuals entering a high or very high radiation area. Separate dose limits have been established for minors, declared pregnant women, and members of the public. Depending on the administrative policy of each licensee, persons such as visitors and administrative individuals may also be provided with monitoring devices, even though the probability of their exposure to measurable levels of radiation is extremely small.

Pursuant to 10 CFR 20.2206(b), certain categories of licensees must submit an annual report of the results of individual monitoring carried out by the licensee for each individual for whom monitoring was required by 10 CFR 20.1502. In addition to this requirement, many licensees elect to report the doses for every individual for whom they provided monitoring. This practice increases the number of individuals that are monitored for radiation exposure. In an effort to account for this increase, the number of individuals reported as having "no measurable dose"[1] is subtracted from the total number of monitored individuals. This resulting number can then be used to calculate the average measurable dose per individual with a measurable dose, as well as the average dose per monitored individual (i.e., with or without a measurable dose).

This report can be obtained from the Web site, www.reirs.com. This report does not include compilations of non-occupational exposures, such as exposures received by medical patients from X-rays, fluoroscopy, or accelerators.

This report contains information reported by NRC licensees. Since NRC licenses all commercial nuclear power reactors, fuel processors and fabricators, and ISFSIs, information shown for these categories reflect all relevant activity in the United States. This is not the case, however, for the remaining categories of industrial radiography, manufacturing and distribution (M&D) of specified quantities of byproduct material, and low-level waste disposal. Many companies that conduct these types of activities are located in Agreement States. More than six times as many facilities are licensed and regulated by Agreement States than are licensed and regulated by the NRC. Agreement States are not required to adopt the reporting requirements in 10 CFR 20.2206. As a result, Agreement State licensees are not required to submit occupational dose reports to the NRC.

[1] The number of individuals with measurable dose includes any individual with a total effective dose equivalent (TEDE) greater than zero rem. Individuals reported with zero dose, or no detectable dose, are included in the number of individuals with no measurable exposure.

Although some Agreement State licensees voluntarily submit occupational dose reports to the NRC, these results are not included in the analyses presented in Sections 3, 5, and 6 of thisreport. NUREG-2118, "Occupational Radiation Exposure at Agreement State-Licensed Materials Facilities, 1997-2010," provides information regarding occupational radiation exposures at Agreement State-licensed facilities.

The average dose per individual, as well as the dose distributions shown for groups of licensees, also can be affected by the multiple reporting of individuals who were monitored by two or more licensees during the year. Licensees are only required to report the doses received by individuals at their licensed facilities. Section 5 contains an analysis that adjusts the data for transient individuals being counted more than once.

When examining the annual statistical data, it is important to note that all of the personnel included in the report may not have been monitored throughout the entire year. Many licensees, such as radiography firms and commercial nuclear power reactors, may monitor numerous individuals for periods of much less than a year.

Considerable attention should be given when referencing the collective totals presented in this report. The differences between the totals presented for all licensees that reported versus only those licensees that are required to report should be noted. See Section 1.1 for the categories of licensees that are required to report to REIRS. A number of licensees are not required to report to REIRS, but voluntarily report for convenient recordkeeping or because they have reported in the past and have decided to continue to do so. These licensees are listed in Appendix A, Table A2 – "Other Facilities Reporting to the NRC, 2017."

The data contained in this report are subject to change because licensees may submit corrections or additions to data for previous years.

All dose equivalent values in this report are given in units of rem in accordance with the general provisions for records in 10 CFR 20.2101(a).

1 rem = 0.01 sievert (Sv)
1 rem = 10 millisievert (mSv)
1 Curie (Ci) = 3.7 X 10^{10} Becquerel (Bq)

2.2 Statistical Comparisons

For statistical comparisons of averages, a two-sided one-sample t test with a 0.05 significance level (i.e., 95 percent confidence) is used to determine whether the difference between the two averages is significantly different. For values that are not averages, such as total collective dose, a 5-year average from the previous five years (not including the current year under consideration) is calculated with 95 percent confidence interval based on the normal distribution. If the value for the current year falls within the 5-year 95 percent confidence interval, then it is not significantly different; whereas, if the value falls outside (i.e., below the lower limit or above the upper limit), there is an indication of a statistical significant change.

Two-sided one-sample t test formula:

$$t = \frac{\overline{X} - \mu}{\frac{s}{\sqrt{N}}}$$

Where:

t = calculated t statistic

$\bar{X}$ = sample mean

μ = population mean

s = sample standard deviation

n = sample number

Example:

We wish to determine if the average measurable dose for a type of nuclear reactor differs from the previous five years. The five year mean for the average measurable dose is 0.080. The population mean is the current year's average measurable dose, 0.060. The sample standard deviation is 0.01, and the sample number is 5. Using the formula,

$$t = \frac{0.080 - 0.060}{\frac{0.01}{2.236}} = 4.472$$

The two-tailed probability value (as obtained from a Student's t distribution table) given a t-value of 4.472 is 0.006 which is statistically significant at a 0.05 significance level.

It should be noted that an analysis of the uncertainties associated with dosimetry and dose measurement is not included in this report. The inferences and statements represented in the report are based upon the data as reported by the licensees, which does not include uncertainty values associated with the dosimetric calculations. All statistical inferences are made at the population level, i.e., aggregated doses at a given site.

3 ANNUAL PERSONNEL MONITORING REPORTS – 10 CFR 20.2206

3.1 Definition of Terms and Methodologies

3.1.1 Number of Licensees Reporting

The number of licensees in each category is provided in Table 3.1 for each of the seven[1] categories that are required to report pursuant to 10 CFR 20.2206. The first column denotes the NRC license category and the program code. The program code is a five-digit number assigned by NRC to each licensee to designate the major activity or principal use authorized in the license. A full description and definition is referenced in *Consolidated Guidance about Materials Licenses*, NUREG-1556, Volume 20, Appendix G [Ref. 14]. The third column in Table 3.1 shows the number of licensees that have filed such reports during the past 11 years. All commercial nuclear power reactors, fuel processors and fabricators, and ISFSIs are required to report occupational exposures to the NRC, whether or not they are in an Agreement State.

Many companies that conduct industrial radiography and M&D activities are located in and regulated by Agreement States and are, therefore, not required to adopt the reporting requirements of 10 CFR 20.2206. However, industrial radiography and M&D licensees that are licensed and regulated by the NRC are required to report occupational exposure to the NRC. Appendix A, Table A1 lists all nonreactor licensees that reported occupational data to the NRC in 2017.

3.1.2 Number of Monitored Individuals

The number of monitored individuals refers to the total number of individuals that NRC licensees reported as being monitored for exposure to external or internal radiation during the year. This number includes both individuals for whom monitoring is required, as well as individuals for whom monitoring was voluntarily provided and reported (e.g., workers receiving a minimal dose below the monitoring threshold, visitors, service representatives, contract individuals, and administrative individuals).

The total number of individuals was determined from the number of unique personal identification numbers submitted per licensee. Uniqueness is defined by the combination of identification number and identification type [Ref. 15].

3.1.3 Number of Individuals with Measurable Dose

The number of individuals with a measurable dose includes any individual with a TEDE that is reported as a positive value.

[1] These categories are commercial nuclear power reactors and test reactor facilities; industrial radiographers; fuel processors (including uranium enrichment facilities), fabricators, and reprocessors; manufacturing and distribution of byproduct material; ISFSIs; facilities for land disposal of low-level waste; and geologic repositories for high-level waste. There are currently no NRC licensees involved in low-level waste disposal or geologic repositories for high-level waste.

Table 3.1 Average Annual Exposure Data for Certain Categories of NRC Licensees 2007–2017

NRC License Category* and Program Code	Calendar Year	Number of Licensees Reporting	Number of Monitored Individuals	Number of Individuals with Measurable TEDE	Collective TEDE (person-rem)	Average TEDE (rem)	Average Measurable TEDE per Individual (rem)
Industrial Radiography **03310** **03320**	2007	75	2,615	2,228	1,315.590	0.50	0.59
	2008	62	2,976	2,593	1,461.405	0.49	0.56
	2009	65	2,662	2,307	1,317.982	0.50	0.57
	2010	57	2,377	2,034	1,297.300	0.55	0.64
	2011	64	2,545	2,210	1,608.821	0.63	0.73
	2012	67	2,670	2,275	1,508.792	0.57	0.66
	2013	60	2,925	2,506	1,547.351	0.53	0.62
	2014	57	3,288	2,862	1,778.171	0.54	0.62
	2015	69	3,426	2,908	1,695.040	0.49	0.58
	2016	64	3,035	2,635	1,270.459	0.42	0.48
	2017	62	3,389	2,912	1,709.858	0.50	0.59
Manufacturing and Distribution **02500** **03211** **03212** **03214**	2007	23	2,106	1,463	291.326	0.14	0.20
	2008	18	1,934	1,341	222.123	0.11	0.17
	2009	17	1,939	1,388	179.539	0.09	0.13
	2010	18	976	672	146.667	0.15	0.22
	2011	16	903	702	112.023	0.12	0.16
	2012	22	1,057	713	118.709	0.11	0.17
	2013	20	994	627	114.550	0.12	0.18
	2014	19	962	656	138.631	0.14	0.21
	2015	21	949	634	155.688	0.16	0.25
	2016	21	905	606	142.958	0.16	0.24
	2017	21	940	615	139.071	0.15	0.23
Independent Spent Fuel Storage **23100** **23200**	2007	2	57	26	1.697	0.03	0.07
	2008	2	53	21	1.248	0.02	0.06
	2009	2	72	34	1.465	0.02	0.04
	2010	2	73	39	1.337	0.02	0.03
	2011	2	54	25	1.449	0.03	0.06
	2012	2	42	15	1.099	0.03	0.07
	2013	2	53	18	1.533	0.03	0.09
	2014	2	51	22	3.192	0.06	0.15
	2015	2	57	20	1.102	0.02	0.06
	2016	2	57	22	0.579	0.01	0.03
	2017	2	67	20	0.631	0.01	0.03
Fuel Cycle Licenses - Fabrication, Processing, and Uranium Enrichment, and UF_6 Production Plants **11400** **21200** **21210**	2007	10	8,402	4,007	588.837	0.07	0.15
	2008	10	7,807	3,424	538.201	0.07	0.16
	2009	11	8,918	3,738	533.721	0.06	0.14
	2010	11	9,362	4,212	541.876	0.06	0.13
	2011	11	9,535	4,361	607.202	0.06	0.14
	2012	9	7,388	3,541	438.729	0.06	0.12
	2013	8	7,476	3,942	357.067	0.05	0.09
	2014	9	6,689	3,685	366.224	0.05	0.10
	2015	7	5,296	3,033	327.112	0.06	0.11
	2016	7	5,413	2,999	277.687	0.05	0.09
	2017	7	5,058	2,930	254.997	0.05	0.09
Commercial Light-Water Reactors (LWRs) ** **41111**	2007	104	164,081	79,530	10,120.013	0.06	0.13
	2008	104	169,325	79,450	9,195.940	0.05	0.12
	2009	104	176,381	81,754	10,024.804	0.06	0.12
	2010	104	179,648	75,010	8,631.384	0.05	0.12
	2011	104	191,538	81,321	8,771.326	0.05	0.11
	2012	104	193,977	79,549	8,035.393	0.04	0.10
	2013	100	174,614	67,236	6,759.547	0.04	0.10
	2014	100	174,853	70,847	7,124.519	0.04	0.10
	2015	99	176,886	70,798	7,019.088	0.04	0.10
	2016	99	155,574	59,353	5,365.709	0.03	0.09
	2017	99	157,072	64,761	6,416.548	0.04	0.10
Grand Totals and Averages	2007	214	177,261	87,254	12,317.463	0.07	0.14
	2008	196	182,095	86,829	11,418.917	0.06	0.13
	2009	199	189,972	89,221	12,057.511	0.06	0.14
	2010	192	192,436	81,967	10,618.564	0.06	0.13
	2011	197	204,575	88,619	11,100.821	0.05	0.13
	2012	204	205,134	86,093	10,102.722	0.05	0.12
	2013	190	186,062	74,329	8,780.048	0.05	0.12
	2014	187	185,843	78,072	9,410.737	0.05	0.12
	2015	198	186,614	77,393	9,198.030	0.05	0.12
	2016	193	164,984	65,615	7,057.392	0.04	0.11
	2017	191	166,526	71,238	8,521.105	0.05	0.12

NOTE: The data shown in this table for all categories of licensees have not been adjusted to account for transient workers (see Section 5).

* These categories consist only of NRC licensees required to submit an annual report (see Section 2).

** This category includes all LWRs in commercial operation for a full year for each of the years indicated.

3.1.4 Collective Dose

The concept of collective dose is used in this report to denote the summation of the TEDE received by all monitored individuals within a category and is reported in units of person-rem. Since 10 CFR 20.2206 requires that the TEDE be reported, the collective dose is calculated by summing the TEDE for all monitored individuals in each category.

The phrase “collective dose” is used throughout this report to mean the collective TEDE, unless otherwise specified.

Before the implementation of the revised dose-reporting requirements of 10 CFR 20.2206 in 1994, the collective dose, in some cases, was calculated from the dose distributions by multiplying the number of individuals reported in each of the dose ranges by the midpoint of the corresponding dose range and then summing the products. This assumed that the midpoint of the range was equal to the arithmetic mean of the individual doses in the range. Experience has shown that the actual mean dose of individuals reported in each dose range is less than the midpoint of the range. For this reason, the resultant calculated collective doses shown in this report for these licensees may be approximately 10 percent higher than the sum of the actual individual doses. Care should be taken when comparing the actual collective dose calculated for 1994 to 2017 with the collective dose for years before 1994 because of this change in methodology.

In addition, before 1994, doses only included the external whole-body dose with no internal dose contribution. Although the contribution of internal dose to the TEDE is minimal for most licensees, it should be considered when comparing collective doses for 1994 and later with the collective dose for years before 1994. One noted exception is for fuel fabrication licensees, where the committed effective dose equivalent (CEDE), in some cases, contributes the majority of the TEDE (see Section 3.3.5).

3.1.5 Average Individual Dose

The average individual dose is obtained by dividing the collective dose by the total number of monitored individuals. This figure is usually less than the average measurable dose, because it includes the number of those individuals who received zero or less than measurable doses.

3.1.6 Average Measurable Dose

The average measurable dose is obtained by dividing the collective TEDE by the number of individuals with a measurable dose. This is the average most commonly used in this and other reports when examining trends and comparing doses received by individuals in various segments of the nuclear industry.

3.2 Annual TEDE Dose Distributions

Table 3.2 provides a statistical compilation of the occupational dose reports by categories of licensees (see Section 3.3 for a description of each licensee category). The dose distributions are generated by summing the TEDE for each individual and counting the number of individuals in each dose range. In several licensee categories, a large number of individuals received doses that were less than measurable, and 2 individuals exceeded 5 rem in 2017 (See Section 6.2). Ninety-one percent of the reported individuals with measurable doses (shown in Table 3.2) were monitored by commercial nuclear power reactors in 2017, where they received 75 percent of the total collective dose.

Table 3.2 Distribution of Annual Collective TEDE by License Category 2017

License Category (Number of sites reporting)	Number of Individuals with TEDE in the Ranges (rem) *													Total Number Monitored	Number with Meas. Dose	Total Collective Dose (TEDE) (person-rem)
	No Meas.	Meas. <0.025	0.025-0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0			
INDUSTRIAL RADIOGRAPHY																
Fixed Locations (2)	5	3	3	1	-	-	-	-	-	-	-	-	-	12	7	0.325
Temporary Job Sites (60)	472	354	391	440	500	381	284	418	102	25	8	2	-	3,377	2,905	1,709.533
Total (62)	**477**	**357**	**394**	**441**	**500**	**381**	**284**	**418**	**102**	**25**	**8**	**2**	**0**	**3,389**	**2,912**	**1,709.858**
MANUFACTURING AND DISTRIBUTION																
Type "A" Broad (2)	110	22	43	37	34	23	14	23	9	-	-	-	-	315	205	99.578
Type "B" Broad and Other (1)	-	1	-	-	-	-	-	-	-	-	-	-	-	1	1	0.010
Nuclear Pharmacies (18)	215	199	120	59	17	5	4	2	2	1	-	-	-	624	409	39.483
Total (21)	**325**	**222**	**163**	**96**	**51**	**28**	**18**	**25**	**11**	**1**	**0**	**0**	**0**	**940**	**615**	**139.071**
INDEPENDENT SPENT FUEL STORAGE																
Total (2)	**47**	**16**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**20**	**0.631**
FUEL CYCLE **																
Total (7)	**2,128**	**1,309**	**823**	**487**	**266**	**40**	**2**	**2**	**1**	**0**	**0**	**0**	**0**	**5,058**	**2,930**	**254.997**
COMMERCIAL POWER REACTORS ***																
Boiling Water (34)	30,578	8,952	11,750	6,836	3,274	952	331	139	-	-	-	-	-	62,812	32,234	4,007.342
Pressurized Water (65)	61,733	11,392	13,826	5,540	1,471	232	51	15	-	-	-	-	-	94,260	32,527	2,409.206
Total (99)	**92,311**	**20,344**	**25,576**	**12,376**	**4,745**	**1,184**	**382**	**154**	**0**	**0**	**0**	**0**	**0**	**157,072**	**64,761**	**6,416.548**
GRAND TOTALS	**95,288**	**22,248**	**26,958**	**13,402**	**5,562**	**1,633**	**686**	**599**	**114**	**26**	**8**	**2**	**0**	**166,526**	**71,238**	**8,521.105**

NOTE: The data shown in this table for all categories of licensees have not been adjusted to account for transient workers (see Section 5).

* Dose values exactly equal to the values separating ranges are reported in the next higher range.

** This category includes fabrication, processing, and uranium enrichment plants (see Section 3.3.5).

*** This category includes all reactors in commercial operation for a full year during 2017.

3.3 Summary of Occupational Dose Data by Licensee Category

3.3.1 Industrial Radiography Licensees - Fixed Location and Temporary Job Sites

Industrial radiography licenses are issued to allow the use of sealed radioactive materials, usually in exposure devices or cameras that primarily emit gamma rays for nondestructive testing of pipeline weld joints, steel structures, boilers, aircraft and ship parts, and other high-stress alloy parts. Some firms are licensed to conduct such activities in one location, usually in a permanent facility designed and shielded for radiography; others perform radiography at temporary job sites in the field. The radioisotopes most commonly used are cobalt-60 and iridium-192. As shown in Table 3.1, annual reports were received for 62 radiography licensees in 2017. Table 3.3 summarizes the reported data for the two types of industrial radiography licensees for 2015, 2016, and 2017 for comparison purposes.

The average measurable dose for individuals performing radiography at a fixed location ranged from 8 percent to 29 percent of the average measurable dose of individuals at temporary job sites over the past 3 years. This is because it is more difficult for individuals to avoid exposure to radiation at temporary job sites in the field, where conditions are not optimal and may change daily.

High exposures in radiography can be directly attributable to the type and location of the radiography field work. For example, locations such as oil drilling platforms and aerial tanks offer the radiographer little available shielding. In these situations, there may not be an opportunity to use distance as a means of reducing exposure. A relatively small number of exposed individuals involved in radiographer licensee activities usually receive average measurable doses that are higher than those received by other license categories.

In 2017, there were two instances reported in which industrial radiographers received exposures in excess of the 5 rem regulatory limit. Section 6 contains additional information on exposures to personnel in excess of regulatory limits.

Table 3.3 Annual Exposure Information for Industrial Radiography Licensees 2015–2017

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Individuals with Measurable Dose	Collective Dose (person-rem)	Average Measurable Dose (rem)
2015	Fixed Location	2	18	14	1.014	0.07
	Temporary Job Sites	67	3,408	2,894	1,694.026	0.59
	Total	**69**	**3,426**	**2,908**	**1,695.040**	**0.58**
2016	Fixed Location	2	14	6	0.835	0.14
	Temporary Job Sites	62	3,021	2,629	1,269.624	0.48
	Total	**64**	**3,035**	**2,635**	**1,270.459**	**0.48**
2017	Fixed Location	2	12	7	0.325	0.05
	Temporary Job Sites	60	3,377	2,905	1,709.533	0.59
	Total	**62**	**3,389**	**2,912**	**1,709.858**	**0.59**

Figure 3.1 shows the number of individuals with a measurable dose, the total collective dose, and the average measurable dose per individual for both types of industrial radiography licensees from 1994 through 2017. From 2016 to 2017, there was an 11 percent increase in the number of individuals with measurable TEDE and a 35 percent increase in the collective TEDE. Compared to the 5-year average of 2,637, the number of individuals with measurable TEDE was higher in 2017, but the difference was not statistically significant. Compared to the 5-year average, the collective

TEDE was higher in 2017, but the difference was not statistically significant. The average measurable TEDE increased to 0.59 rem for 2017, but was not statistically different than the 5-year average of 0.61 rem.

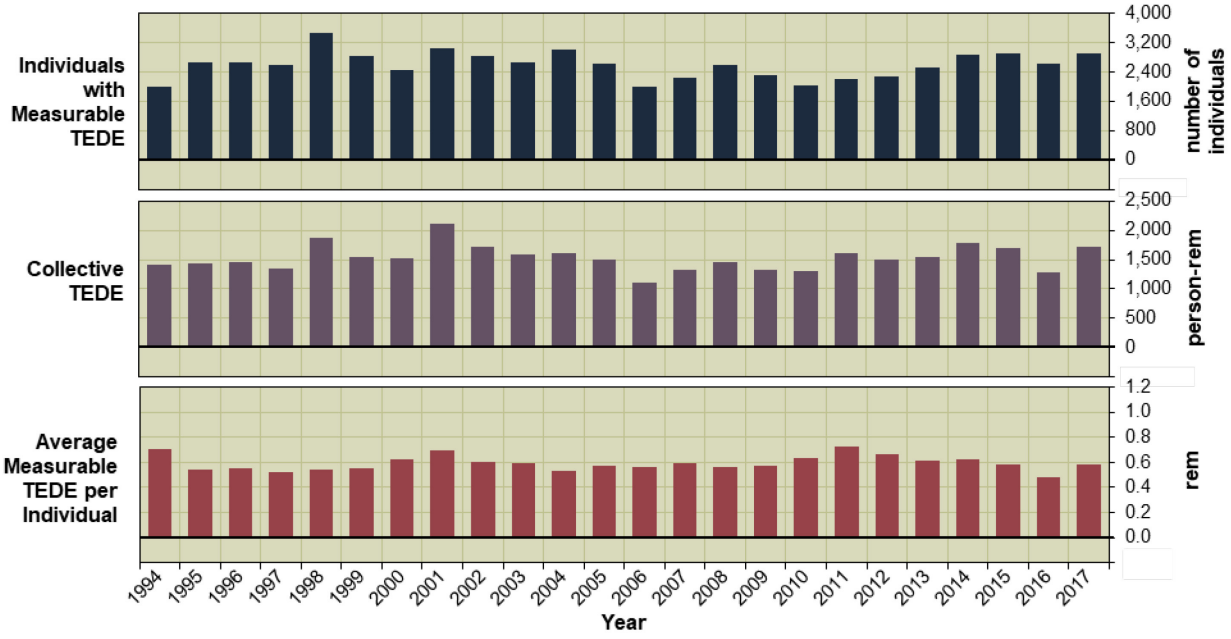


Figure 3.1 Individuals with measurable TEDE, collective TEDE, and average measurable TEDE for industrial radiography licensees 1994–2017

3.3.2 Manufacturing and Distribution Licensees – Broad-Type A, Broad-Type B, Other, and Nuclear Pharmacies

M&D licenses are issued to allow the manufacture and distribution of radionuclides in various forms for a number of diverse purposes. The products are usually distributed to organizations or companies specifically licensed by the NRC. Broad - Type A licenses are issued to larger organizations that may use many different radionuclides in many different ways and that have a comprehensive radiation protection program. Some Broad - Type A firms are medical suppliers that process, package, or distribute such products as diagnostic test kits, radioactive surgical implants, and tagged radiochemicals for use in medical research, diagnosis, and therapy. Broad-Type B licenses involve the processing, encapsulation, packaging, and distribution of the radionuclides that have been purchased in bulk quantities from production reactors and cyclotrons. Major products include gamma radiography sources, cobalt irradiation sources, well-logging sources, sealed sources for gauges and smoke detectors, and radiochemicals for nonmedical research. Note that no Broad-Type B licensees have reported to NRC since 2010. M&D Other licenses are usually issued to smaller organizations requiring a more restrictive license. These licenses are usually more specific in identifying each radionuclide, the chemical and physical form, and the authorized activities and users. Nuclear pharmacies are involved in the compounding and dispensing of radioactive materials for use in nuclear medicine procedures.

Table 3.4 presents the annual data that were reported by the three types of licensees for 2015, 2016, and 2017. As shown in the table below, the average measurable dose is generally higher for the Broad - Type A licensees, which includes only two licensees in the NRC's active licensee list.

Table 3.4 and Figure 3.2 show the number of individuals with measurable doses, the total collective dose, and the average measurable dose per individual for Broad - Type A, Broad - Type B and Other, and Nuclear Pharmacy licensees. In 2017 the number of individuals with a measurable dose increased by 1 percent and the collective TEDE decreased by 3 percent. In turn, the average measurable dose decreased by 4 percent from 0.24 rem to 0.23 rem. While the number of individuals with a measurable dose in 2017 was 5 percent less than the 5-year average of 647, the average measurable dose in 2017 (0.23 rem) was not statistically higher than the 5-year average of 0.21 rem.

The values for Broad - Type A licensees are attributed to Mallinckrodt, Inc. and International Isotopes Idaho, Inc., which accounted for 72 percent of the total collective dose in 2017.

Table 3.4 Annual Exposure Information for Manufacturing and Distribution Licensees 2015–2017

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Individuals with Measurable Dose	Collective Dose (person-rem)	Average Measurable Dose (rem)
2015	M & D - Type "A" Broad	2	340	274	122.083	0.45
	M & D - Type "B" Broad and Other	3	10	3	0.182	0.06
	M & D - Nuclear Pharmacies	16	599	357	33.423	0.09
	Total	**21**	**949**	**634**	**155.688**	**0.25**
2016	M & D - Type "A" Broad	2	310	231	111.394	0.48
	M & D - Type "B" Broad and Other	0	0	0	0.000	0.00
	M & D - Nuclear Pharmacies	19	595	375	31.564	0.08
	Total	**21**	**905**	**606**	**142.958**	**0.24**
2017	M & D - Type "A" Broad	2	315	205	99.578	0.49
	M & D - Type "B" Broad and Other	1	1	1	0.010	0.01
	M & D - Nuclear Pharmacies	18	624	409	39.483	0.10
	Total	**21**	**940**	**615**	**139.071**	**0.23**

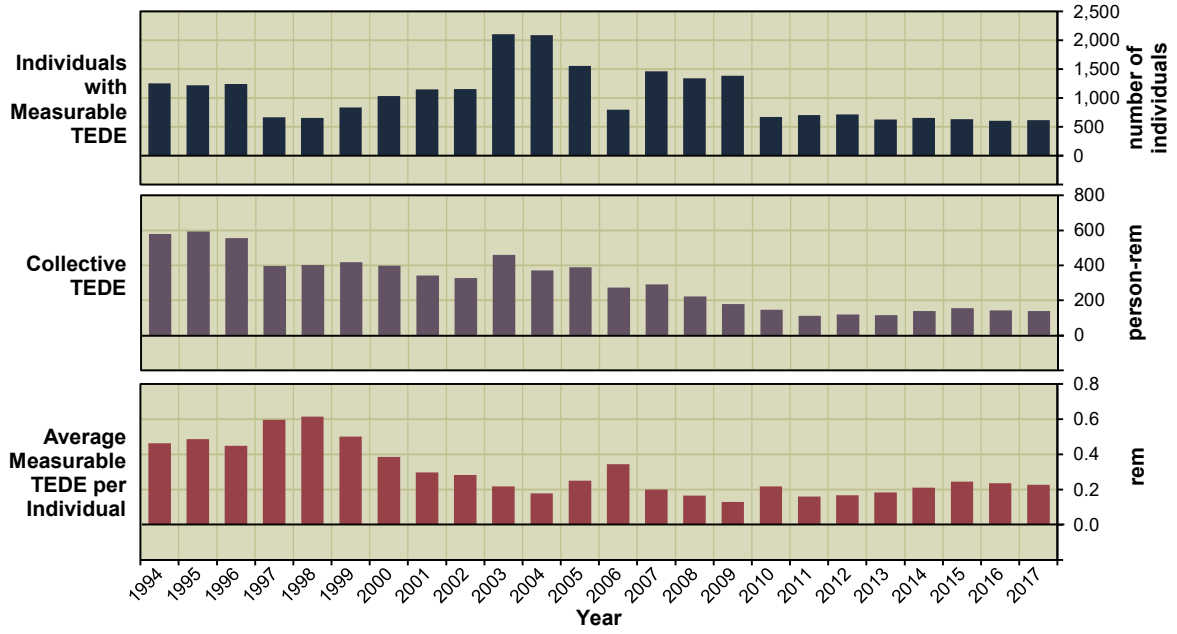


Figure 3.2 Individuals with measurable TEDE, collective TEDE, and average measurable TEDE for manufacturing and distribution licensees 1994–2017

3.3.3 Low-Level Waste Disposal Licensees

Low-level waste disposal licenses are issued to allow the receipt, possession, and disposal of low-level radioactive wastes at a land disposal facility. The licensee has the appropriate facilities to receive wastes from places such as hospitals and laboratories, store them for a short time, and dispose of them in a properly prepared burial ground. Since 1999, all licensees that have conducted these activities have been located in Agreement States, which have primary regulatory authority over the licensees' activities; therefore, there are no NRC low-level waste licensees who report radiation exposure data to REIRS.

3.3.4 Independent Spent Fuel Storage Installation Licensees

The NRC issues ISFSI licenses to allow the possession of commercial nuclear power reactor spent fuel and other associated radioactive materials for the purpose of storage. According to 10 CFR 72.3, "Definitions" [Ref. 16], spent fuel means "fuel that has been withdrawn from a nuclear reactor following irradiation, has undergone at least 1 year of decay since being used as a source of energy in a power reactor, and has not been chemically separated into its constituent elements by reprocessing. Spent fuel includes the special nuclear material, byproduct material, source material, and other radioactive materials associated with fuel assemblies." The spent fuel that is removed from the reactor is initially stored in a spent fuel pool and usually cooled for at least 5 years in the pool before it is transferred to dry cask storage at an ISFSI. The NRC has authorized transfer as early as 3 years; however, the industry norm is approximately 10 years. An ISFSI provides interim storage of spent fuel and protection and safeguarding, pending its final disposal.

The majority of ISFSI facilities are located on site at commercial nuclear power reactors. The occupational dose information from ISFSI facilities is usually included with the dose information reported by the commercial nuclear power reactors and is not reported separately to the NRC. Since 2005, two ISFSI licensees reported dose information to the NRC. One is the GE Morris facility located in Illinois and the second is the Trojan ISFSI located in Oregon. The GE Morris facility is the only spent fuel pool that is not located at an existing or former reactor site. The GE Morris ISFSI license has been renewed by the NRC until 2022. The Trojan commercial nuclear power reactor is no longer in commercial operation and has been decommissioned. However, the ISFSI facility at Trojan remains in operation and the occupational dose information is reported to the NRC under the ISFSI license. Appendix A, Table A1 summarizes the occupational dose information reported by these licensees.

Figure 3.3 shows the number of individuals with a measurable dose, the total collective dose, and the average measurable dose per individual for ISFSI facilities. Table 3.1 shows that the number of individuals with a measurable dose decreased to 20 individuals in 2017 from 22 individuals in 2016. Although the collective TEDE increased by 9 percent from 2016 to 2017, the dose increase was relatively small (0.579 person-rem in 2016 to 0.631 person-rem in 2017) and was statistically insignificant. The effect of a slight increase in the collective TEDE and the decrease in number of individuals with a measurable dose resulted in a slight (but not significantly different) increase in the average measurable TEDE per individual which remained unchanged at 0.03 rem. The average measurable dose was not significantly different from the 5-year average.

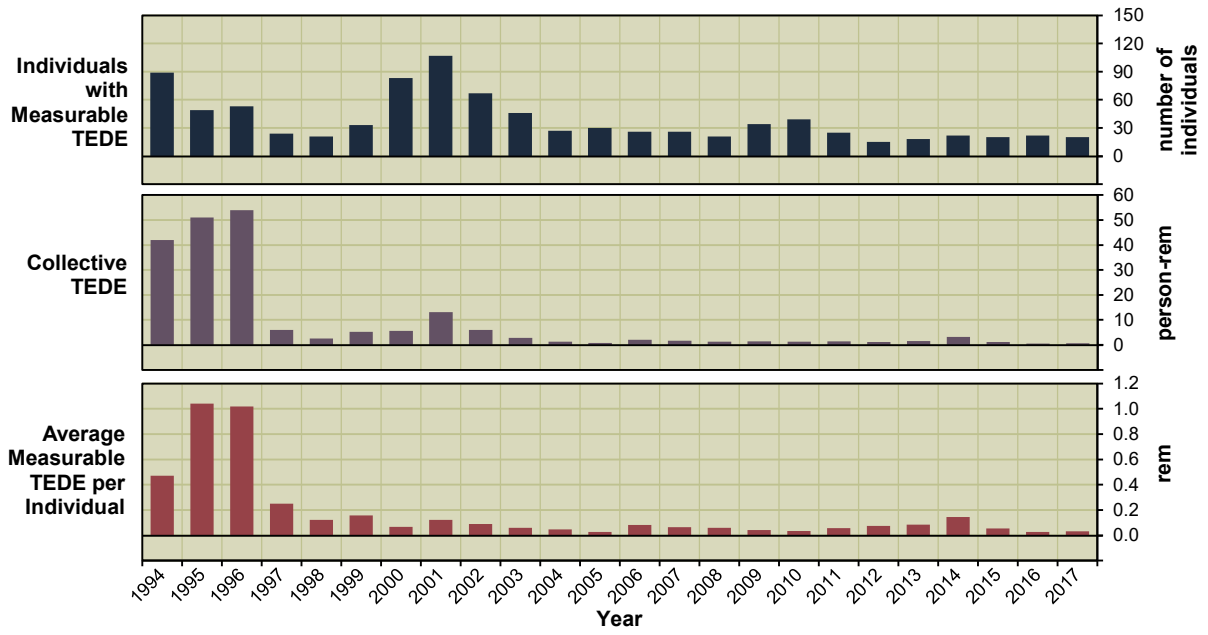


Figure 3.3 Individuals with measurable TEDE, collective TEDE, and average measurable TEDE for independent spent fuel storage installation licensees 1994–2017

3.3.5 Fuel Cycle Licensees

The fuel cycle category addresses the use and handling of special nuclear material as described in 10 CFR Part 70, *Domestic Licensing of Special Nuclear Material* [Ref. 17]. While the bulk of exposure cited in this report addresses reactor fuel production, there are other uses of special nuclear material in education, research, and homeland security. The fuel cycle facilities are licensed by the NRC to process and handle special nuclear material, source material, or both. These forms of nuclear material are highly regulated to ensure the safe use and enhanced security.

The majority of fuel cycle licenses are issued to allow the processing, enrichment, and fabrication of reactor fuels. Many of the fuel cycle facilities are different from each other—in purpose and technology—as they comprise the different stages of the Nuclear Fuel Cycle. The fuel cycle facilities that are currently operational fall into three different categories: uranium enrichment, uranium conversion, and fuel fabrication. Fuel fabrication facilities convert enriched uranium into fuel for nuclear reactors. Fabrication also can involve mixed oxide (MOX) fuel, which is a combination of uranium and plutonium. Fuel cycle facilities make nuclear fuel for commercial nuclear reactors or manufacture specialty nuclear materials for the U.S. Navy's nuclear fleet.

Figure 3.4 shows the number of individuals with a measurable dose, the total collective dose, and the average measurable dose per individual for fuel cycle licensees. The collective deep dose equivalent (DDE), the DDE average measurable dose, the collective CEDE, and the CEDE average measurable dose are also shown, because they make a significant contribution to the TEDE for fuel fabrication facilities.

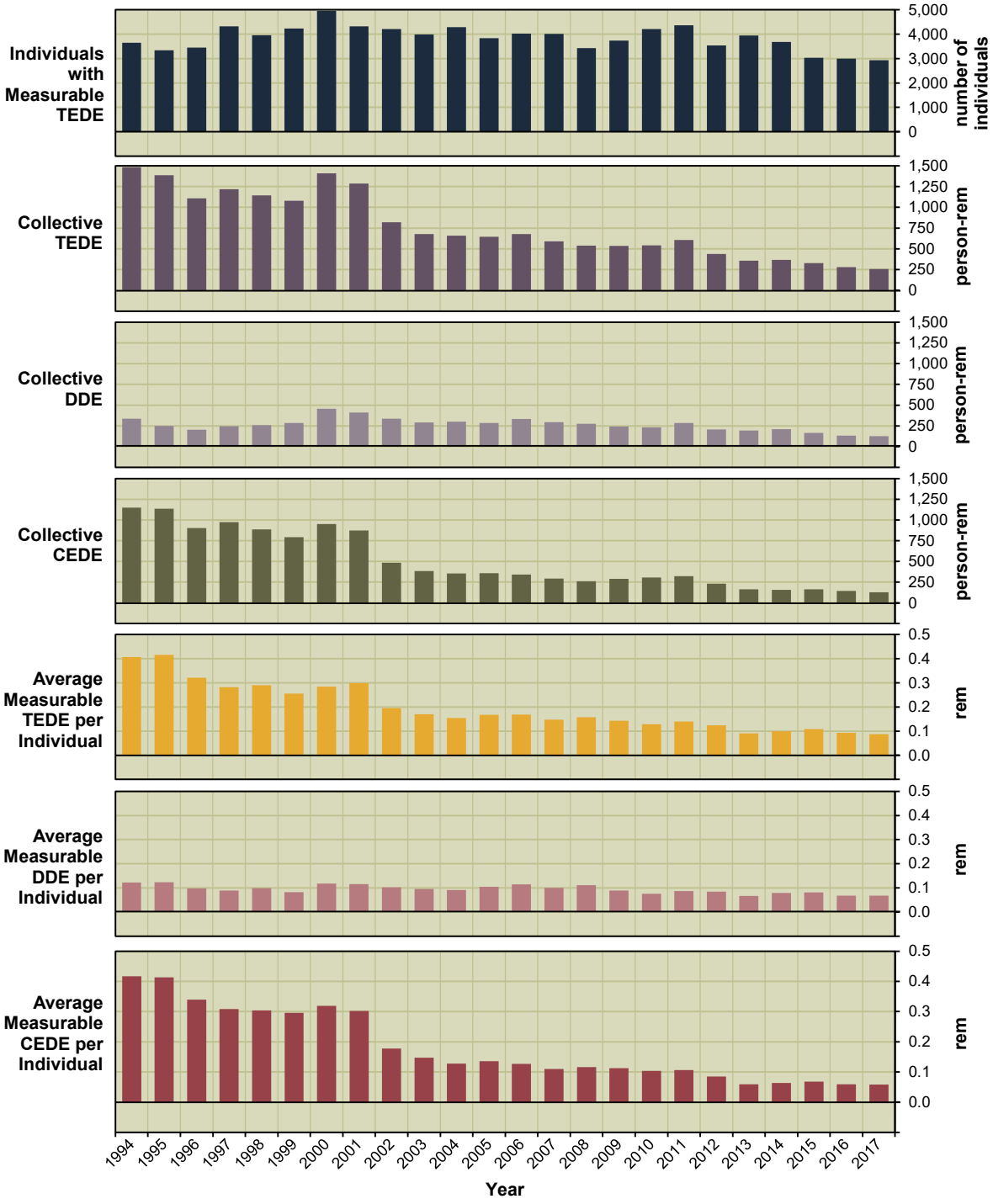


Figure 3.4 Annual exposure information for fuel cycle licensees 1994–2017

Table 3.5 shows that there were seven licensed fuel cycle (fabrication processing, uranium enrichment, and UF_6 production) facilities reporting in 2017. The collective TEDE and DDE decreased in 2017 by 8 percent and 5 percent, respectively, and the collective CEDE decreased by 11 percent from 2016. When compared to the 5-year average, the decreases in collective TEDE, collective DDE, and collective CEDE were statistically significant.

Honeywell International, Inc. reported the largest decrease (46%) in collective TEDE in 2017. Since the 2011 Fukushima Daiichi event, demand for nuclear fuel has dropped while global supply overall has increased, resulting in decreased fuel production by this licensee. In addition, after a routine outage in October of 2017, Honeywell announced in November that they were suspending operations and laying off 170 workers at the UF_6 production plant. Both of these factors contributed to the large decrease in dose in 2017.

Table 3.5 Annual Exposure Information for Fuel Cycle Licensees 2015–2017

Year	Type of License	Number of Licensees	Number of Monitored Individuals	Individuals with Meas. TEDE	Collective TEDE (person-rem)	Average Meas. TEDE (rem)	Individuals with Meas. DDE	Collective DDE (person-rem)	Average Meas. DDE (rem)	Individuals with Meas. CEDE	Collective CEDE (person-rem)	Average Meas. CEDE (rem)
2015	Fuel Cycle	7	5,296	3,033	327.112	0.11	2,027	164.856	0.08	2,390	162.256	0.07
2016	Fuel Cycle	7	5,413	2,999	277.687	0.09	1,985	133.898	0.07	2,434	143.789	0.06
2017	Fuel Cycle	7	5,058	2,930	254.997	0.09	1,879	127.017	0.07	2,220	127.980	0.06

3.3.6 Light-Water Reactor Licensees

LWR licenses are issued to utilities to allow them to use special nuclear material in a reactor that produces heat to generate electricity to be sold to consumers. There are two major types of commercial LWRs in the United States, pressurized-water reactors (PWRs) and boiling-water reactors (BWRs), each of which uses water as the primary coolant.

Table 3.1 shows the number of licensees, number of monitored individuals, number of individuals with a measurable dose, total collective dose, average collective dose and average measurable dose per individual for reactor facilities that were in commercial operation for at least 1 full year for each of the years 2007 through 2017. The values do not include reactors that have been permanently shut down or reactors that have not been in commercial operation for 1 full year. The figures for reactors have not been adjusted for the multiple counting of transient individuals (see Section 5).

Appendix B presents the reported dose distribution of individuals monitored at each plant site for the year 2017 in alphabetical order by plant name. Sections 4 and 5 contain more detailed presentations and analyses of the annual dose information reported by commercial nuclear power reactors.

3.3.7 Other Facilities Reporting to the NRC

Appendix A, Table A2 contains data for additional facilities that provided occupational radiation dose reports to the NRC in 2017. These facilities are not among the seven categories of licensees required to report under 10 CFR 20.2206 and are not included in the analyses presented in this report. However, these facilities may be of interest to researchers and are included in this report for completeness.

3.4 Summary of Intake and Internal Dose Data by Licensee Category

All internal dose estimates are based on the amount of the intake as the basis for the calculation. The intake is the total amount of radioactive material that enters the human body, and internal dose (as defined in 10 CFR 20.1003) means that portion of the dose equivalent received from radioactive material taken into the body. For each intake recorded, licensees are required to list the

radionuclide that was taken into the body, pulmonary clearance class, intake mode, and amount of the intake. An NRC Form 5, its equivalent paper document, or an electronic format containing this information is required to be completed and submitted to the NRC under 10 CFR 20.2206.

Tables 3.6 and 3.7 summarize the intake data reported to the NRC during 2017. The data are categorized by licensee type and are listed in order of radionuclide and pulmonary clearance class or pulmonary solubility type. Table 3.6 lists the intakes where the mode of intake into the body was recorded as ingestion or "other," such as absorption through the skin or injection through a puncture or wound.

Table 3.6 Intake by Licensee Category and Radionuclide Mode of Intake—Ingestion and Other 2017

Mode	Licensee Category	Program Code	Radionuclide	Number of Intake Records	Collective Intake in Microcuries (sci. notation)
Ingestion	Uranium Fuel Processing Plants	21210	Sr-90	2	2.07E-03
Ingestion	Nuclear Power Reactor	41111	Co-60	4	5.15E-01
Ingestion	Nuclear Power Reactor	41111	Mn-54	2	6.10E-02

Table 3.7 lists the intakes where the mode of intake was inhalation from ambient airborne radioactive material in the workplace. The pulmonary clearance class or pulmonary solubility type is recorded as D, W, Y (days, weeks, years) or F, M, S (fast, medium, slow), respectively, corresponding to the clearance half-time from the pulmonary region of the lung into the blood and gastrointestinal tract. The pulmonary clearance class designation depends on whether the licensee is using the nomenclature in International Commission on Radiological Protection (ICRP) Publication 30 (D, W, Y) [Ref. 18], which is described in 10 CFR Part 20, or ICRP Publication 68 (F, M, S) [Ref. 19]. Licensees that use the methodology described in ICRP Publication 30 use D, W, and Y pulmonary clearance classes to determine the dose. Licensees that use the methodology described in ICRP Publication 68 use F, M, and S pulmonary solubility types to determine the dose. The amount of material taken into the body is given in microcuries, a unit of measure of the quantity of radioactive material. For each licensee category, the maximum number of intake records and the maximum intake are highlighted in the table in bold and boxed for ease of reference.

Table 3.8 lists the number of individuals with a measurable CEDE, the collective CEDE, and the average measurable CEDE per individual for each licensee category. Neither the number of individuals with a measurable CEDE, the collective CEDE, nor the average CEDE differed significantly from their respective 5-year averages. Fuel fabrication facilities combined with the UF_6 production facility had the majority of internal doses (99.7 percent of total collective CEDE) in 2017. The UF_6 production facility had a collective dose of 21.919 person-rem with an average of 0.038 rem per individual. The average CEDE of 0.038 rem for UF_6 production facilities in 2017 did not differ statistically from the 5-year average of 0.057 rem. The fuel fabrication licensee with the highest collective dose reported 40.153 person-rem and an average of 0.118 rem per individual. This is due to the exposure of individuals to uranium during the processing and fabrication of the uranium fuel. Although not statistically significant, the average CEDE for fuel fabrication facilities decreased to 0.064 rem in 2017 which was below the 5-year average of 0.072 rem. This reduction corresponds with decreases in collective CEDE at every licensee within the fuel fabrication category.

Table 3.9 shows the distribution of internal doses (CEDE) from 1994 to 2017 for licensees required to report under 10 CFR 20.2206. For the purposes of this table, the definition of a measurable CEDE is any reported value greater than zero. As noted above, the vast majority

of the internal doses were received by individuals working at fuel fabrication facilities.
In 2017, the collective CEDE decreased by 11 percent from 2016 while the number of individuals with a measurable CEDE decreased by 9 percent. While the collective CEDE did not differ significantly from the 5-year average, the number of individuals with a measurable CEDE in 2017 (2,268) was lower than the 5-year average of 2,649. The collective CEDE of 144.627 rem in all facilities in 2016 decreased to 128.373 rem primarily as a result of a 55 percent decrease in the collective CEDE at the UF_6 production facility in 2017. With the decrease in the number of individuals reported with CEDE dose and the decrease in the collective CEDE, the average measurable CEDE decreased by 2 percent to 0.057 rem for 2017. However, the average measurable CEDE in 2017 was not statistically different from the 5-year average.

Table 3.7 Intake by Licensee Category and Radionuclide Mode of Intake—Inhalation 2017

Licensee Category	Program Code	Radionuclide	Pulmonary Clearance Class or Solubility Type	Number of Intake Records *	Collective Intake in Microcuries (sci. notation)
Nuclear Pharmacies	02500	I-123	D	1	2.12E-02
	02500	I-131	D	**65**	**8.78E-01**
Manufacturing and Distribution	03211	I-131	D	**9**	**6.80E-01**
Uranium Hexafluoride (UF_6) Production Plants	11400	Ac-227	W	418	6.93E-04
	11400	Pa-231	W	418	6.93E-04
	11400	Pb-210	D	394	5.73E-04
	11400	Po-210	W	345	4.63E-04
	11400	Ra-226	W	503	1.65E-03
	11400	Ra-228	W	323	4.13E-04
	11400	Th-228	W	323	4.13E-04
	11400	Th-230	D	2	5.00E-06
	11400	Th-230	W	572	1.66E-02
	11400	Th-230	W	**814**	3.68E-02
	11400	Th-230	Y	1	6.00E-06
	11400	Th-232	W	323	4.13E-04
	11400	Th-232	W	600	9.61E-04
	11400	U-234	D	9	1.85E-03
	11400	U-234	D	3	4.66E-04
	11400	U-234	W	571	1.53E+00
	11400	U-234	W	**814**	**3.40E+00**
	11400	U-234	Y	1	5.39E-04
	11400	U-235	D	9	8.70E-05
	11400	U-235	D	3	2.20E-05
	11400	U-235	W	571	7.13E-02
	11400	U-235	W	**814**	1.58E-01
	11400	U-235	Y	1	2.50E-05
	11400	U-238	D	9	1.54E-03
	11400	U-238	D	3	3.88E-04
	11400	U-238	W	571	1.27E+00
	11400	U-238	W	**814**	2.83E+00
	11400	U-238	Y	1	4.49E-04

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

* An intake event may involve multiple nuclides; individuals may incur multiple intakes during the year. The number of intake records given here indicates the number of separate intake reports that were submitted on NRC Form 5 reports under 10 CFR 20.2206.

** V = vapor

Table 3.7 Intake by Licensee Category and Radionuclide Mode of Intake—Inhalation 2017 (continued)

Licensee Category	Program Code	Radionuclide	Pulmonary Clearance Class or Solubility Type	Number of Intake Records *	Collective Intake in Microcuries (sci. notation)
Fuel Fabrication	21210	Am-241	W	26	1.29E-04
	21210	Pu-239	W	46	4.71E-04
	21210	Rn-220	D	109	**1.28E+03**
	21210	Sr-90	Y	211	2.88E-01
	21210	Th-228	W	35	6.66E-05
	21210	Th-232	W	4	5.70E-08
	21210	Th-232	Y	7	7.17E-05
	21210	U-232	W	18	8.95E-07
	21210	U-232	Y	133	9.24E-04
	21210	U-234	D	703	2.12E-01
	21210	U-234	W	560	4.12E-02
	21210	U-234	Y	**2,190**	3.48E+00
	21210	U-235	D	132	3.37E-03
	21210	U-235	W	61	1.25E-03
	21210	U-235	Y	574	8.88E-02
	21210	U-236	D	596	3.95E-03
	21210	U-236	W	61	8.17E-05
	21210	U-236	Y	296	3.09E-02
	21210	U-238	D	205	2.46E-02
	21210	U-238	W	531	4.93E-03
	21210	U-238	Y	966	4.11E-01
Nuclear Power Reactor	41111	Am-241	W	2	7.15E-06
	41111	Cm-242	W	1	2.05E-05
	41111	Cm-243	W	2	1.33E-05
	41111	Co-58	Y	7	3.94E-01
	41111	Co-60	Y	7	1.81E-01
	41111	Fe-55	D	1	1.33E-01
	41111	H-3	V**	**16**	**4.53E+03**
	41111	Mn-54	W	1	2.80E-02
	41111	Nb-95	W	1	3.05E-02
	41111	Ni-59	V**	1	2.39E-03
	41111	Ni-63	V**	1	1.20E-01
	41111	Np-237	W	1	3.60E-07
	41111	Pu-238	W	2	1.32E-05
	41111	Pu-239	W	1	1.85E-06
	41111	Pu-240	W	1	1.82E-06
	41111	Sr-90	Y	1	2.77E-05
	41111	U-233	Y	1	7.40E-06
	41111	U-238	Y	1	7.85E-06

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

* An intake event may involve multiple nuclides, and individuals may incur multiple intakes during the year. The number of intake records given here indicates the number of separate intake reports that were submitted on NRC Form 5 reports under 10 CFR 20.2206.

** V = vapor

Table 3.8 Collective and Average CEDE by Licensee Category 2017

Licensee Category	Licensee Name	License Number	Number with Meas. CEDE	Collective CEDE (person-rem)	Average Meas. CEDE (rem)
MANUFACTURING AND DISTRIBUTION					
02500	CARDINAL HEALTH	04-26507-01MD	2	0.002	0.001
02500	CARDINAL HEALTH	11-27664-01MD	3	0.003	0.001
02500	CARDINAL HEALTH	34-29200-01MD	**11**	0.014	0.001
02500	GE HEALTHCARE - KENTWOOD	21-26707-01MD	1	0.001	0.001
03211	INTERNATIONAL ISOTOPES IDAHO, INC.	11-27680-01	7	**0.018**	**0.003**
	Totals and Averages		**24**	**0.038**	**0.002**
INDUSTRIAL RADIOGRAPHY					
03320	QUALITY TESTING SERVICES, INC.	24-32292-01	**1**	**0.001**	**0.001**
	Totals and Averages		**1**	**0.001**	**0.001**
UF_6 PRODUCTION					
11400	HONEYWELL INTERNATIONAL, INC.	SUB-0526	**571**	**21.919**	**0.038**
	Totals and Averages		**571**	**21.919**	**0.038**
FUEL FABRICATION					
21210	BWXT NUCLEAR OPERATIONS GROUP, INC	SNM-0042	204	10.591	0.052
21210	FRAMATOME INC	SNM-1227	232	33.995	**0.147**
21210	GLOBAL NUCLEAR FUEL - AMERICAS, LLC	SNM-1097	389	18.971	0.049
21210	NUCLEAR FUEL SERVICES, INC.	SNM-0124	**485**	2.351	0.005
21210	WESTINGHOUSE ELECTRIC COMPANY, LLC	SNM-1107	339	**40.153**	0.118
	Totals and Averages		**1,649**	**106.061**	**0.064**
COMMERCIAL LIGHT-WATER REACTORS					
41111	CALVERT CLIFFS	DPR-53	1	0.031	0.031
41111	COLUMBIA GENERATING	NPF-21	2	0.005	0.003
41111	DUANE ARNOLD	DPR-49	2	0.003	0.002
41111	FARLEY	NPF-02	**7**	**0.289**	**0.041**
41111	FERMI	NPF-43	2	0.003	0.002
41111	INDIAN POINT	DPR-05	1	0.002	0.002
41111	PALISADES	DPR-20	4	0.013	0.003
41111	POINT BEACH	DPR-24	4	0.008	0.002
	Totals and Averages		**23**	**0.354**	**0.015**
Grand Totals and Averages			**2,268**	**128.373**	**0.057**

NOTE: The data values shown bolded and in boxes represent the highest value in each category.

Table 3.9 Internal Dose (CEDE) Distribution 1994–2017

Year	Number of Individuals with CEDE in the Ranges (rem) *										Indiv. with Meas. CEDE	Collective CEDE (person-rem)	Average Meas. CEDE (rem)
	Meas. 0.020	0.020-0.100	0.100-0.250	0.250-0.500	0.500-0.750	0.750-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0			
1994	3,425	577	287	683	237	141	293	69	2	-	5,714	1,170.453	0.205
1995	2,869	691	338	730	254	147	290	49	2	-	5,370	1,167.105	0.217
1996	3,096	598	305	584	324	138	187	22	2	2	5,258	931.799	0.177
1997	3,835	869	381	827	267	148	169	30	-	-	6,526	998.406	0.153
1998	3,310	932	426	746	246	140	153	21	2	-	5,976	922.935	0.154
1999	3,423	752	466	438	206	117	173	29	-	-	5,604	813.605	0.145
2000	3,275	1001	570	383	216	98	224	58	7	1	5,833	988.640	0.169
2001	1,774	827	716	364	128	53	146	82	15	1	4,106	884.134	0.215
2002	1,760	746	647	531	144	33	23	3	-	-	3,887	494.821	0.127
2003	2,208	778	726	388	116	17	5	-	-	-	4,238	395.573	0.093
2004	1,989	838	657	381	105	17	3	-	-	-	3,990	375.021	0.094
2005	1,205	706	685	341	98	33	2	-	-	-	3,070	365.258	0.119
2006	1,302	726	686	346	96	18	3	-	-	-	3,177	346.918	0.109
2007	1,480	805	646	310	52	5	3	-	-	-	3,301	300.863	0.091
2008	1,008	761	526	303	41	8	4	-	-	-	2,651	267.415	0.101
2009	1,115	711	597	229	80	21	7	-	-	-	2,760	293.251	0.106
2010	1,216	884	669	210	67	30	6	-	-	-	3,082	308.332	0.100
2011	1,243	916	628	270	72	19	14	1	-	-	3,163	322.615	0.102
2012	1,158	933	554	155	52	6	3	-	-	-	2,861	232.462	0.081
2013	1,632	758	353	149	20	1	-	-	-	-	2,913	164.799	0.057
2014	1,175	829	417	86	24	1	-	-	-	-	2,532	157.191	0.062
2015	1,036	838	442	103	16	-	-	-	-	-	2,435	162.670	0.067
2016	1,100	920	407	69	7	-	-	-	-	-	2,503	144.627	0.058
2017	1,073	766	324	99	6	-	-	-	-	-	2,268	128.373	0.057

* Dose values exactly equal to the values separating ranges are reported in the next higher range.

4 COMMERCIAL LIGHT-WATER REACTORS

4.1 Introduction

General trends in occupational radiation exposure at commercial nuclear power reactors are best evaluated within the context of other pertinent information. In this section, some of the tables and appendices that summarize dose data also show the type, capacity, amount of electricity generated, and age of the reactor. Dose data are then presented as a function of these data.

4.2 Definition of Terms and Sources of Data

4.2.1 Number of Reactors

The number of reactors shown in Tables 4.1, 4.2, and 4.3 are the number of BWRs, PWRs, and LWRs that were in commercial operation during the year listed. This is the number of reactors that the average number of individuals with a measurable dose and the average collective dose per reactor are based. Excluded are reactors that have not yet completed a first full year of commercial operation and those reactors that have been permanently defueled. The date that each reactor was declared to be in commercial operation was taken from Licensed Operating Reactors, Status Summary Report [Ref. 1].

Three Mile Island (TMI) Unit 2 was included in the compilation of data for commercially operating reactors from 1975 through 1988 and has not been included in the data analyses since 1988. TMI Unit 1 and TMI Unit 2 reported data separately beginning in 1986, but since 2001, the dose breakdowns for TMI Unit 2 have been reported with those for TMI Unit 1, as there is very little dose from activities at TMI Unit 2.

In 2013, the number of operating PWRs decreased to 65 (from 69 in 2012). Crystal River shut down in February 2013, Kewaunee closed in May 2013, and San Onofre 2 and 3 followed in June 2013. Vermont Yankee ceased commercial operations December 29, 2014, dropping the number of active BWRs from 35 to 34 in 2015. In addition, the Fort Calhoun nuclear power plant shut down permanently on October 24, 2016, and is no longer included in this report. The dose information for these operational reactors and for others that are no longer in commercial operation is listed at the end of Appendix B and the current status of plants no longer in operation can be found in Appendix E. Watts Bar Unit 2 began commercial power operation on November 21, 2016, and reported its dose information with Watts Bar Unit 1 in 2017.

4.2.2 Electric Energy Generated

The electric energy generated in megawatt-years (MW-yr) each year by each reactor is graphically represented in Appendix D. This number was obtained by dividing the megawatt-hours (MW-hr) of electricity annually produced by each facility by 8,760, the number of hours in the year, except for leap years, when the number was 8,784 hours. The number of MW-hr of electricity produced each year was obtained from Licensed Operating Reactors, Status Summary Report [Ref. 1].

For the years 1973 to 1996, the electricity generated is the gross electricity output of the reactor. For 1997 to 2017, the number reflects the net electricity produced, which is the gross electricity minus the amount the plant used for operations. This change is the result of a change in NRC power generation reporting requirements. The electricity generated in MW-yr that is presented in Tables 4.1, 4.2, and 4.3 is the summation of electricity generated by the number of reactors

included in each year. These sums are divided by the number of operating reactors included in each year to yield the average amount of electric energy generated per reactor, which is also shown in Tables 4.1, 4.2, and 4.3.

As shown in Table 4.3, in 2017, the net electricity generated at LWRs was nearly equivalent to 2016 and not significantly different from the 5-year trend. Thirty-two reactor sites had decreased power production and 28 reactor sites had increased power production from 2016 to 2017. Summer 1 had the largest percentage of decreased power production (20 percent), while Comanche Peak and Waterford both experienced a 17 percent decrease in power production. Summer was shut down 15.6 days due to equipment failure and 54.4 days due to refueling for a total of 70 days off line. Comanche Peak and Waterford were shut down 138.1 and 63 total outage days, respectively. From 2016 to 2017, Wolf Creek 1 had the largest increase in power production because the plant was online the entire year, with no outage days.

4.2.3 Collective Dose per Megawatt-Year

The number of MW-yr of electricity generated was used in determining the ratio of the average value of the annual collective dose (TEDE) to the number of MW-yr of electricity generated. The ratio was calculated by dividing the total collective dose in person-rem by the electric energy generated in MW-yr and is a measure of the dose incurred by individuals at commercial nuclear power reactors in relation to the electric energy produced.

For the years 1973 to 1996, the electricity generated is the gross electricity output of the reactor. For 1997 to 2017, the number reflects the net electricity produced. The ratio of collective dose to the number of MW-yr is calculated by year for BWRs, PWRs, and LWRs, and the ratios are presented in Tables 4.1, 4.2, and 4.3. This ratio is also calculated for each reactor site (see Appendix C). The average collective dose per MW-yr for LWRs increased to 0.07 rem/MW-yr in 2017. This value is not statistically different from the 5-year average of 0.08 rem/MW-yr.

4.2.4 Average Maximum Dependable Capacity

The average maximum dependable capacity, as shown in Tables 4.1, 4.2, and 4.3, is calculated by dividing the sum of the net maximum dependable capacities of the reactors in megawatts (net megawatts electric [MWe]) by the number of reactors included each year. The net maximum dependable capacity is defined as the gross electrical output as measured at the output terminals of the turbine generator during the most restrictive seasonal conditions less the normal station service loads. The capacity of each plant was found in Licensed Operating Reactors, Status Summary Report [Ref. 1]. As shown in Table 4.3 tor 2017, the value for the average electricity generated per reactor was the highest reported since 1994.

4.2.5 Percent of Maximum Dependable Capacity Achieved

The percent of maximum dependable capacity achieved is shown for all LWRs in Table 4.3. This parameter gives an indication of the overall power generation performance of LWRs as compared with the maximum dependable capacity that could have been obtained in a given year. It is calculated by dividing the average electricity generated per reactor by the average maximum dependable capacity for each year.

Table 4.1 Summary of Information Reported by Commercial Boiling-Water Reactors 1994–2017

Year	Number of Reactors Included*	No. of Individuals with Measurable Dose**	Annual Collective Dose (person-rem)	Average Measurable Dose per Individual (rem)**	Average Collective Dose per Reactor (person-rem)	Average No. Individuals with Measurable Doses per Reactor**	Electricity Generated*** (MW-yr)	Average Collective Dose per MW-yr (person-rem/ MW-yr)	Average Electricity Generated per Reactor (MW-yr)	Average Maximum Dependable Capacity Net (MWe)	Maximum Dependable Capacity Achieved
1994	37	39,171	12,098	0.31	327	1,059	22,139.0	0.55	598	801	75%
1995	37	35,686	9,471	0.27	256	964	24,737.0	0.38	669	835	80%
1996	37	37,792	9,466	0.25	256	1,021	24,322.2	0.39	657	838	78%
1997	37	34,021	7,603	0.22	205	919	22,866.1	0.33	618	845	73%
1998	36	32,899	6,829.296	0.21	190	914	23,781.2	0.29	661	874	76%
1999	35	31,482	6,434.430	0.20	184	899	26,962.6	0.24	770	885	87%
2000	35	31,186	6,089.676	0.20	174	891	28,476.9	0.21	814	893	91%
2001	35	28,797	4,835.397	0.17	138	823	28,730.4	0.17	821	895	92%
2002	35	30,978	6,107.767	0.20	175	885	29,460.0	0.21	842	907	93%
2003	35	30,759	5,659.434	0.18	162	879	29,094.4	0.19	831	912	91%
2004	35	33,948	5,450.982	0.16	156	970	29,424.8	0.19	841	893	94%
2005	35	33,544	5,995.975	0.18	171	958	29,386.8	0.20	840	946	89%
2006	35	34,159	4,989.761	0.15	143	976	30,238.4	0.17	864	954	91%
2007	35	37,515	5,388.416	0.14	154	1,072	30,189.3	0.18	863	955	90%
2008	35	34,642	4,522.413	0.13	129	990	31,248.3	0.14	893	957	93%
2009	35	36,207	5,282.869	0.15	151	1,034	30,762.7	0.17	879	959	92%
2010	35	37,214	4,807.656	0.13	137	1,063	31,274.6	0.15	894	961	93%
2011	35	38,202	4,976.503	0.13	142	1,091	30,549.7	0.16	873	937	93%
2012	35	38,164	4,200.281	0.11	120	1,090	30,485.4	0.14	871	968	90%
2013	35	36,513	4,459.270	0.12	127	1,043	31,221.1	0.14	892	967	92%
2014	35	33,706	3,798.108	0.11	109	963	31,904.2	0.12	912	976	93%
2015	34	35,346	4,155.273	0.12	122	1,040	31,720.1	0.13	933	992	94%
2016	34	31,299	3,339.055	0.11	98	921	31,464.8	0.11	925	995	93%
2017	34	32,234	4,007.342	0.12	118	948	31,820.0	0.13	936	995	94%

* Includes only those reactors that had been in commercial operation for at least 1 full year as of December 31 of each of the indicated years.
** Figures are not adjusted for the multiple reporting of transient individuals (see Section 5).
*** Beginning in 1997, the electricity reflects the net electricity generated.

Table 4.2 Summary of Information Reported by Commercial Pressurized-Water Reactors 1994–2017

Year	Number of Reactors Included*	No. of Individuals with Measurable Dose**	Annual Collective Dose (person-rem)	Average Measurable Dose per Individual (rem)**	Average Collective Dose per Reactor (person-rem)	Average No. Individuals with Measurable Doses per Reactor**	Electricity Generated*** (MW-yr)	Average Collective Dose per MW-yr (person-rem/ MW-yr)	Average Electricity Generated per Reactor (MW-yr)	Average Maximum Dependable Capacity Net (MWe)	Maximum Dependable Capacity Achieved
1994	70	44,283	9,574	0.22	137	633	52,397.6	0.18	749	928	81%
1995	70	49,985	11,762	0.24	168	714	54,138.2	0.22	773	929	83%
1996	72	46,852	9,417	0.20	131	651	55,337.8	0.17	769	935	82%
1997	72	50,690	9,546	0.19	133	704	48,985.3	0.19	680	943	72%
1998	69	38,586	6,358.096	0.16	92	559	53,288.7	0.12	772	942	82%
1999	69	43,938	7,231.281	0.16	105	637	56,235.0	0.13	815	942	87%
2000	69	42,922	6,562.006	0.15	95	622	57,529.9	0.11	834	943	88%
2001	69	38,773	6,273.155	0.16	91	562	58,822.4	0.11	852	946	90%
2002	69	42,264	6,018.423	0.14	87	613	59,369.7	0.10	860	947	91%
2003	69	44,054	6,296.136	0.14	91	638	57,920.6	0.11	839	949	88%
2004	69	35,901	4,916.915	0.14	71	520	60,398.7	0.08	875	943	93%
2005	69	44,583	5,459.832	0.12	79	646	59,790.9	0.09	867	955	91%
2006	69	46,106	6,031.425	0.13	87	668	59,751.3	0.10	866	960	90%
2007	69	42,015	4,731.597	0.11	69	609	61,955.6	0.08	898	961	93%
2008	69	44,808	4,673.527	0.10	68	649	60,586.0	0.08	878	964	91%
2009	69	45,547	4,741.935	0.10	69	660	60,467.9	0.08	876	966	91%
2010	69	37,796	3,823.728	0.10	55	548	60,859.4	0.06	882	967	91%
2011	69	43,119	3,795.601	0.09	55	625	59,682.5	0.06	865	937	92%
2012	69	41,385	3,835.112	0.09	56	600	57,272.5	0.07	830	974	85%
2013	65	30,723	2,300.277	0.07	35	473	58,785.5	0.04	904	987	92%
2014	65	37,141	3,326.411	0.09	51	571	59,262.2	0.06	912	989	92%
2015	65	35,452	2,863.815	0.08	44	545	59,377.2	0.05	913	990	92%
2016	65	28,054	2,026.654	0.07	31	432	60,052.5	0.03	924	1,001	92%
2017	65	32,527	2,409.206	0.07	37	500	60,148.9	0.04	925	1,001	92%

* Includes only those reactors that had been in commercial operation for at least 1 full year as of December 31 of each of the indicated years.
** Figures are not adjusted for the multiple reporting of transient individuals (see Section 5).
*** Beginning in 1997, the electricity reflects the net electricity generated.

Table 4.3 Summary of Information Reported by Commercial Light-Water Reactors 1994–2017

Year	Number of Reactors Included*	No. of Individuals with Measurable Dose**	Annual Collective Dose (person-rem)	Average Measurable Dose per Individual (rem)**	Average Collective Dose per Reactor (person-rem)	Average No. Individuals with Measurable Doses per Reactor**	Electricity Generated*** (MW-yr)	Average Collective Dose per MW-yr (person-rem/ MW-yr)	Average Electricity Generated per Reactor (MW-yr)	Average Maximum Dependable Capacity Net (MWe)	Maximum Dependable Capacity Achieved
1994	107	83,454	21,672	0.26	203	780	74,536.6	0.29	697	884	79%
1995	107	85,671	21,233	0.25	198	801	78,875.2	0.27	737	896	82%
1996	109	84,644	18,883	0.22	173	777	79,660.0	0.24	731	902	81%
1997	109	84,711	17,149	0.20	157	777	71,851.4	0.24	659	910	72%
1998	105	71,485	13,187.392	0.18	126	681	77,069.9	0.17	734	918	80%
1999	104	75,420	13,665.711	0.18	131	725	83,197.6	0.16	800	923	87%
2000	104	74,108	12,651.682	0.17	122	713	86,006.8	0.15	827	926	89%
2001	104	67,570	11,108.552	0.16	107	650	87,552.8	0.13	842	929	91%
2002	104	73,242	12,126.190	0.17	117	704	88,829.7	0.14	854	934	91%
2003	104	74,813	11,955.570	0.16	115	719	87,015.0	0.14	837	936	89%
2004	104	69,849	10,367.897	0.15	100	672	89,823.5	0.12	864	926	93%
2005	104	78,127	11,455.807	0.15	110	751	89,177.7	0.13	857	952	90%
2006	104	80,265	11,021.186	0.14	106	772	89,989.7	0.12	865	958	90%
2007	104	79,530	10,120.013	0.13	97	765	92,144.9	0.11	886	959	92%
2008	104	79,450	9,195.940	0.12	88	764	91,834.3	0.10	883	961	92%
2009	104	81,754	10,024.804	0.12	96	786	91,230.6	0.11	877	964	91%
2010	104	75,010	8,631.384	0.12	83	721	92,134.0	0.09	886	965	92%
2011	104	81,321	8,771.326	0.11	84	782	90,232.2	0.10	868	967	90%
2012	104	79,549	8,035.393	0.10	77	765	87,757.9	0.09	844	972	87%
2013	100	67,236	6,759.547	0.10	68	672	90,006.6	0.08	900	980	92%
2014	100	70,847	7,124.519	0.10	71	708	91,166.4	0.08	912	985	93%
2015	99	70,798	7,019.088	0.10	71	715	91,097.3	0.08	920	991	93%
2016	99	59,353	5,365.709	0.09	54	600	91,517.3	0.06	924	999	93%
2017	99	64,761	6,416.548	0.10	65	654	91,968.8	0.07	929	999	93%

* Includes only those reactors that had been in commercial operation for at least 1 full year as of December 31 of each of the indicated years.
** Figures are not adjusted for the multiple reporting of transient individuals (see Section 5).
*** Beginning in 1997, the electricity reflects the net electricity generated.

The decrease in maximum dependable capacity from 1996 to 1997 was due to the change from measuring the gross electricity generated to the net electricity generated. The percent of maximum dependable capacity for LWRs remained unchanged in 2017 at 93 percent. This value is not statistically different from the 5-year average of 92 percent.

4.3 Annual TEDE Distributions

Table 4.4a summarizes the distribution of the annual TEDE doses received by individuals (unadjusted for transient workers) at all commercial LWRs during each of the years 1994 through 2017. This distribution is the sum of the annual dose distributions reported by each licensed LWR each year. As previously noted, Appendix B shows the distribution reported by each LWR site for 2017. Table 4.4a includes only those reactors that have been in operation for at least a full year. In 2017, the total collective dose increased by 20 percent to a value of 6,417 person-rem. This value does not represent a statistically significant difference from the 5-year average of 6,861 person-rem.

Each year, this report identifies the reactors with the largest increases and decreases in collective dose from the previous year and identifies the main reasons for these changes. The changes generally are driven by whether the sites had an increase or decrease in outages from one year to the next. During an outage, more work is performed by individuals working in radiation areas, thereby resulting in increased collective doses. This is particularly true during a refueling outage, which entails the opening of the reactor vessel by removing the vessel head and transferring spent fuel to the spent fuel pool. In addition, the sites usually schedule maintenance and inspections during a refueling outage, which tend to increase the collective dose. If a site does not have a refueling outage during a year, the collective dose for that site is normally much lower. For example, in 2017 Palisades was the PWR with the largest percentage increase in collective dose which increased from 5.667 person-rem in 2016, to 154.142 person-rem in 2017. This increase in collective dose coincided with an increase in outage days in 2017, increasing from zero days in 2016 to 32.9 in 2017. Outage days for PWRs ranged from 2.2 to 232.1 days during 2017. Harris had the largest percentage decrease in collective dose (43.876 to 0.217 person-rem) along with the fewest number of total outage days (2.2) in 2017.

For BWRs from 2016 to 2017, Perry had an 800 percent increase in collective dose. In 2016, Perry had 14.6 total outage days and reported a collective dose of 36.389 person-rem, while in 2017 Perry had over 29 total outage days (refueling outage) and reported a collective dose of 327.717 person-rem. In 2017, Oyster Creek had an 87 percent decrease in collective dose. In 2016, Oyster Creek had 51.3 total outage days and reported a dose of 133.603 person-rem, while in 2017 Oyster Creek had only 2.4 total outage days and reported a collective dose of 17.511 person-rem.

For all LWRs, the refueling outage hours increased by 16% from 2016 to 2017 (13% for BWRs and 17% for PWRs) which was a primary factor in the increase in collective dose.

Table 4.4b summarizes the distribution of the annual TEDE doses received by unique individuals (adjusted for transient workers) at all commercial LWRs during each of the years 1994 through 2017. The values do not include reactors that have been permanently shut down or reactors that have not been in commercial operation for 1 full year. See Section 5 for a detailed analysis of the impact of transient individuals on the distribution of annual doses in 2017.

Table 4.4a Summary of Distribution of Annual Doses* at Commercial Light-Water Reactors** 1994–2017

Year	Number of Individuals with Annual Doses* in the Ranges (rem) *** Note: Numbers of individuals shown have not been adjusted for the multiple reporting of transient individuals (see Section 5).												Total Number Monitored	Number with Measurable Exposure	Collective Dose (person-rem)	Average Measurable Dose (person-rem)
	No Measurable Exposure	Measurable <0.1	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
1994	85,145	36,528	18,633	14,246	6,800	3,502	3,323	215	6	-	-	-	168,398	83,253	21,534.000	0.259
1995	81,032	38,575	20,245	15,279	6,884	3,336	3,077	125	5	-	-	-	168,558	87,526	21,674.000	0.248
1996	78,197	39,426	19,955	14,201	5,809	2,648	2,342	68	-	-	-	-	162,646	84,449	18,874.000	0.223
1997	80,163	41,759	19,951	13,396	5,394	2,240	1,671	59	3	-	-	-	164,636	84,473	17,136.000	0.203
1998	77,080	37,039	17,189	10,467	3,930	1,562	1,129	35	-	-	-	-	148,431	71,351	13,169.366	0.185
1999	74,867	39,663	18,063	10,964	3,994	1,569	1,141	24	2	-	-	-	150,287	75,420	13,665.711	0.181
2000	73,793	40,301	17,598	10,310	3,525	1,375	976	23	-	-	-	-	147,901	74,108	12,651.682	0.171
2001	73,206	37,461	16,078	9,231	2,930	1,060	747	63	-	-	-	-	140,776	67,570	11,108.552	0.164
2002	76,270	41,588	16,752	9,426	3,121	1,245	1,003	105	2	-	-	-	149,512	73,242	12,126.190	0.166
2003	77,889	42,720	17,231	9,589	3,139	1,233	864	37	-	-	-	-	152,702	74,813	11,955.570	0.160
2004	80,473	41,583	15,626	8,245	2,733	978	668	16	-	-	-	-	150,322	69,849	10,367.897	0.148
2005	82,574	46,444	17,754	9,191	2,934	1,104	683	17	-	-	-	-	160,701	78,127	11,455.807	0.147
2006	84,558	48,571	18,269	9,312	2,675	904	532	2	-	-	-	-	164,823	80,265	11,021.186	0.137
2007	84,551	49,998	17,672	8,294	2,329	824	402	11	-	-	-	-	164,081	79,530	10,120.013	0.127
2008	89,875	51,831	17,337	7,578	1,847	583	269	5	-	-	-	-	169,325	79,450	9,195.940	0.116
2009	94,627	52,670	17,417	8,352	2,161	741	413	-	-	-	-	-	176,381	81,754	10,024.804	0.123
2010	104,638	49,571	16,042	6,656	1,801	602	333	5	-	-	-	-	179,648	75,010	8,631.384	0.115
2011	110,217	55,407	16,651	6,753	1,675	559	276	-	-	-	-	-	191,538	81,321	8,771.326	0.108
2012	114,428	55,735	15,593	6,072	1,509	385	242	13	-	-	-	-	193,977	79,549	8,035.393	0.101
2013	107,378	47,190	13,158	5,088	1,227	380	191	2	-	-	-	-	174,614	67,236	6,759.547	0.101
2014	104,006	50,110	13,650	5,231	1,167	421	235	33	-	-	-	-	174,853	70,847	7,124.519	0.101
2015	106,088	50,067	13,856	4,980	1,230	421	242	2	-	-	-	-	176,886	70,798	7,019.088	0.099
2016	96,221	43,386	10,938	3,829	865	243	92	-	-	-	-	-	155,574	59,353	5,365.709	0.090
2017	92,311	45,920	12,376	4,745	1,184	382	154	-	-	-	-	-	157,072	64,761	6,416.548	0.099

* These doses are annual TEDE doses.

** Summary of reports submitted in accordance with 10 CFR 20.2206 by BWRs and PWRs that had been in commercial operation for at least 1 full year as of December 31 of each of the indicated years. Figures shown have not been adjusted for the multiple reporting of transient individuals (see Section 5).

*** Dose values exactly equal to the values separating ranges are reported in the next higher range.

Table 4.4b Summary of Distribution of Annual Doses* at Commercial Light-Water Reactors**, Adjusted for Transients 1994–2017

Year	Number of Individuals with Annual Doses* in the Ranges (rem) *** Note: Numbers of individuals shown have been adjusted for the multiple reporting of transient individuals (see Section 5).												Total Number Monitored	Number with Measurable Exposure	Collective Dose (person-rem)	Average Measurable Dose (person-rem)
	No Measurable Exposure	Measurable <0.1	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
1994	67,700	29,847	14,841	11,716	6,124	3,586	4,222	508	40	-	-	-	138,584	70,884	21,534.000	0.304
1995	61,505	29,588	15,097	12,020	6,121	3,300	3,906	595	133	2	-	-	132,267	70,762	21,674.000	0.306
1996	58,292	30,021	14,831	11,340	5,418	2,831	3,194	408	67	-	-	-	126,402	68,110	18,874.000	0.277
1997	58,647	31,751	14,881	10,902	5,228	2,447	2,598	286	41	-	-	-	126,781	68,134	17,136.000	0.252
1998	57,041	27,905	12,829	8,802	3,930	1,839	1,829	182	15	1	-	-	114,373	57,332	13,169.366	0.230
1999	55,121	29,271	13,278	9,017	3,806	1,908	1,898	245	18	-	-	-	114,562	59,441	13,665.711	0.230
2000	53,324	28,480	12,921	8,679	3,571	1,644	1,734	186	18	-	-	-	110,557	57,233	12,651.682	0.221
2001	52,636	27,246	11,491	7,659	2,907	1,323	1,392	221	53	-	-	-	104,928	52,292	11,108.552	0.212
2002	53,440	28,523	11,610	7,668	3,004	1,479	1,820	320	35	1	-	-	107,900	54,460	12,126.190	0.223
2003	54,028	29,161	11,971	8,190	3,253	1,527	1,651	184	18	-	-	-	109,983	55,955	11,955.570	0.214
2004	57,420	28,863	11,178	7,335	2,873	1,233	1,190	188	13	-	-	-	110,293	52,873	10,367.897	0.196
2005	56,709	31,035	12,422	7,813	3,106	1,537	1,490	147	3	-	-	-	114,262	57,553	11,455.807	0.199
2006	57,546	32,439	12,687	7,802	2,971	1,415	1,407	82	2	-	-	-	116,351	58,805	11,021.186	0.187
2007	57,314	32,706	11,961	7,396	2,714	1,284	1,100	97	9	-	-	-	114,581	57,267	10,120.013	0.177
2008	61,336	33,832	12,322	6,786	2,430	1,026	922	38	-	-	-	-	118,692	57,356	9,195.940	0.160
2009	66,310	35,877	12,318	7,317	2,562	1,174	1,144	68	4	-	-	-	126,774	60,464	10,024.804	0.166
2010	74,218	33,873	11,670	6,356	2,231	946	832	42	3	-	-	-	130,171	55,953	8,631.384	0.154
2011	78,090	36,745	12,119	6,307	2,226	1,008	837	23	-	-	-	-	137,355	59,265	8,771.326	0.148
2012	79,222	36,990	11,943	5,904	1,962	774	672	37	-	-	-	-	137,504	58,282	8,035.393	0.138
2013	76,261	32,326	10,166	5,231	1,680	674	430	18	-	-	-	-	126,786	50,525	6,759.547	0.134
2014	73,390	32,917	10,285	5,212	1,685	695	589	58	-	-	-	-	124,831	51,441	7,124.519	0.138
2015	71,980	31,806	10,208	5,034	1,686	708	647	27	3	-	-	-	122,099	50,119	7,019.088	0.140
2016	67,685	29,063	8,736	4,196	1,236	429	332	16	1	-	-	-	111,694	44,009	5,365.709	0.122
2017	62,882	29,448	9,210	4,695	1,666	671	532	11	-	-	-	-	109,115	46,233	6,416.548	0.139

* These doses are annual TEDE doses.

** Summary of reports submitted in accordance with 10 CFR 20.2206 by BWRs and PWRs that had been in commercial operation for at least 1 full year as of December 31 of each of the indicated years.

*** Dose values exactly equal to the values separating ranges are reported in the next higher range.

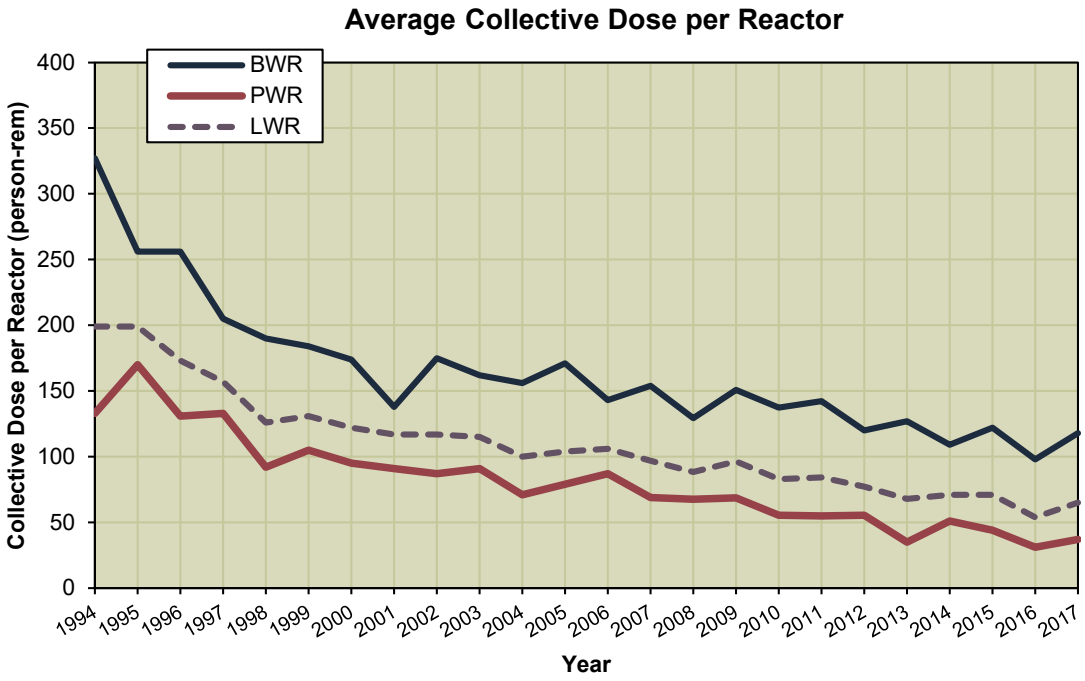
4.4 Average Annual TEDE Doses

Some of the data presented in Tables 4.1, 4.2, and 4.3 are graphically displayed in Figure 4.1, where it can be seen that the average collective dose and average number of individuals per BWR have been higher than those for PWRs for the entire 24 years depicted. BWRs generally have higher collective doses because the steam produced directly from the reactor is used to drive turbines to produce electricity, which results in radioactivity being present in both the reactor and turbine systems. PWR systems are designed to keep the radioactivity within the reactor vessel and primary system and not in the turbine systems.

In 2017, the average collective dose per reactor for BWRs was 118 person-rem and the average collective dose per reactor for PWRs was 37 person-rem. In comparison with the 2016 values, the average collective dose per reactor for BWRs increased by 20 percent and the average collective dose per reactor for PWRs increased by 19 percent. Neither of these increases was significantly different from the 5-year average. The average collective dose per reactor for LWRs increased by 20 percent from 2016 but was not significantly different from the 5-year trend. This is the eleventh year since tracking began in 1973 that the average collective dose per reactor for LWRs has been below 100 person-rem. The overall decreasing trend in average reactor collective doses since 1994 indicates that licensees are continuing to successfully implement as low as is reasonably achievable (ALARA) dose reduction processes at their facilities. Further impacting this decreasing trend, in 2017, six LWRs reported 80 percent and greater decreases in collective dose due to fewer outages. In 2017, the number of individuals with a measurable dose per reactor increased to 948 for BWRs and increased to 500 for PWRs. Neither of these increases were statistically significant when compared to the 5-year average. A primary factor in the increase in collective dose in 2017 was the increase in refueling outage hours for both reactor types (13% for BWRs and 17% for PWRs). Five BWRs and 3 PWRs had no refueling outages during 2017.

Figures 4.2 and 4.3 are plots of most of the other information that is presented in Tables 4.1, 4.2, and 4.3. Table 4.3 shows that the net electricity generated increased slightly from 91,517 MW-yr in 2016 to 91,969 MW-yr in 2017, while the number of operating reactors remained the same at 99 in 2017. The net electricity generated in 2017 was not significantly different than the 5-year trend. Table 4.3 also shows that the value for the total collective dose for all LWRs increased by 20 percent to 6,417 person-rem in 2017 from 5,366 person-rem in 2016, and was not a statistically significant increase from the 5-year trend. Table 4.3 shows that the average measurable dose per individual increased by 11 percent to 0.10 rem (not adjusted for transient individuals), and was not statistically significant when compared to the 5-year average.

The decrease seen in dose trends since 1994 may be attributed to several factors. Utilities have completed the tasks initiated as a result of the lessons learned from the 1979 TMI accident, and they are increasing efforts to avoid and reduce exposure. The concept of keeping exposures to ALARA levels is continually being stressed, and most utilities have established programs to collect and share information relative to exposure control processes, techniques, and procedures.



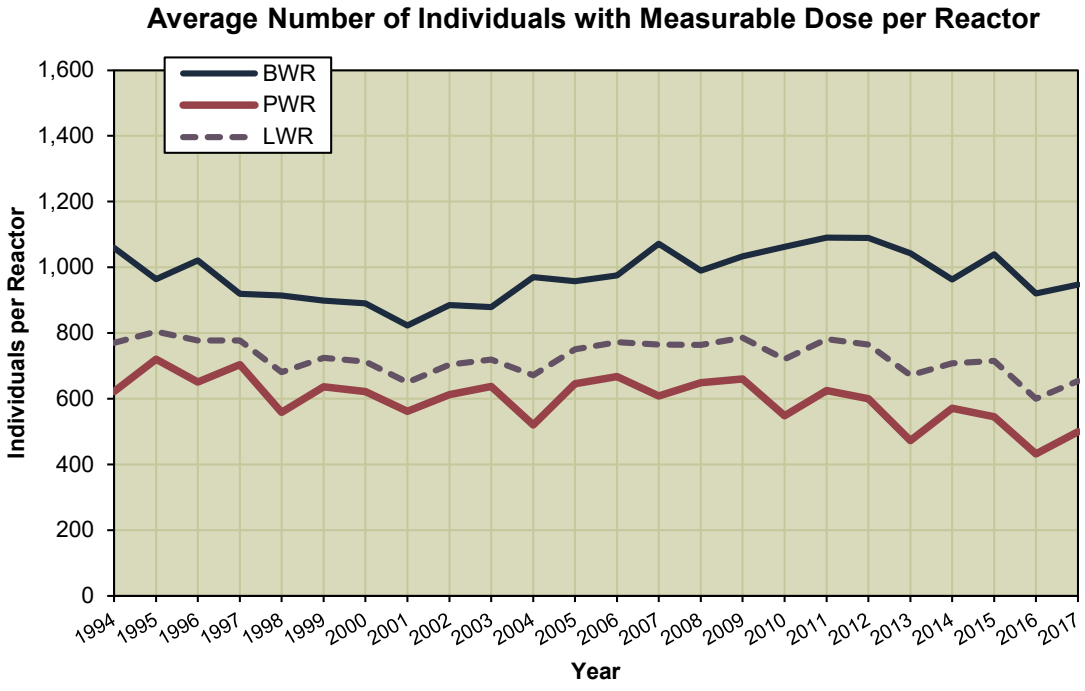
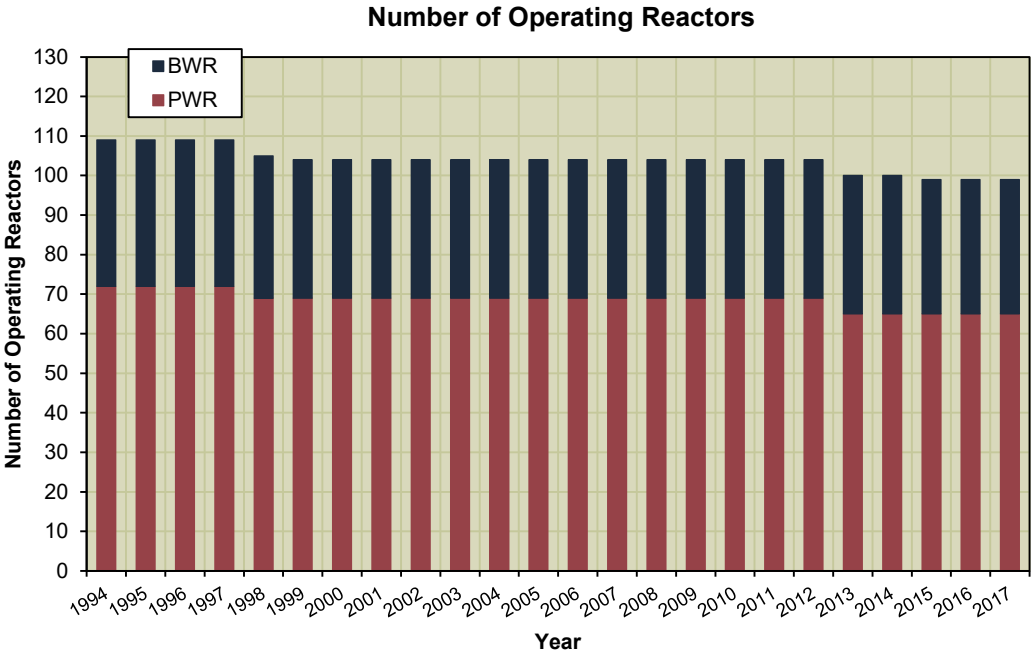
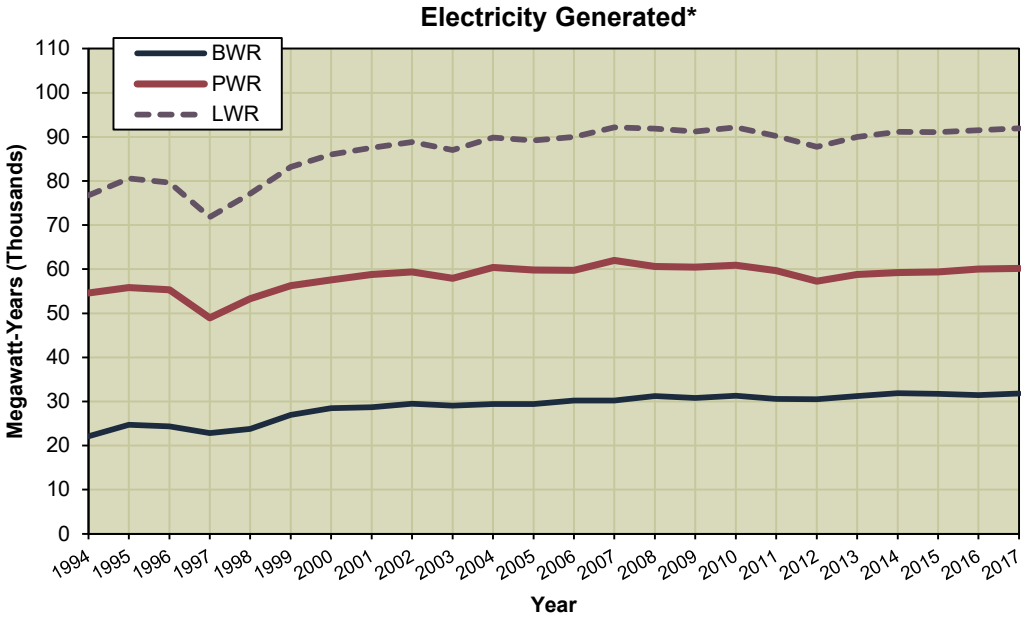


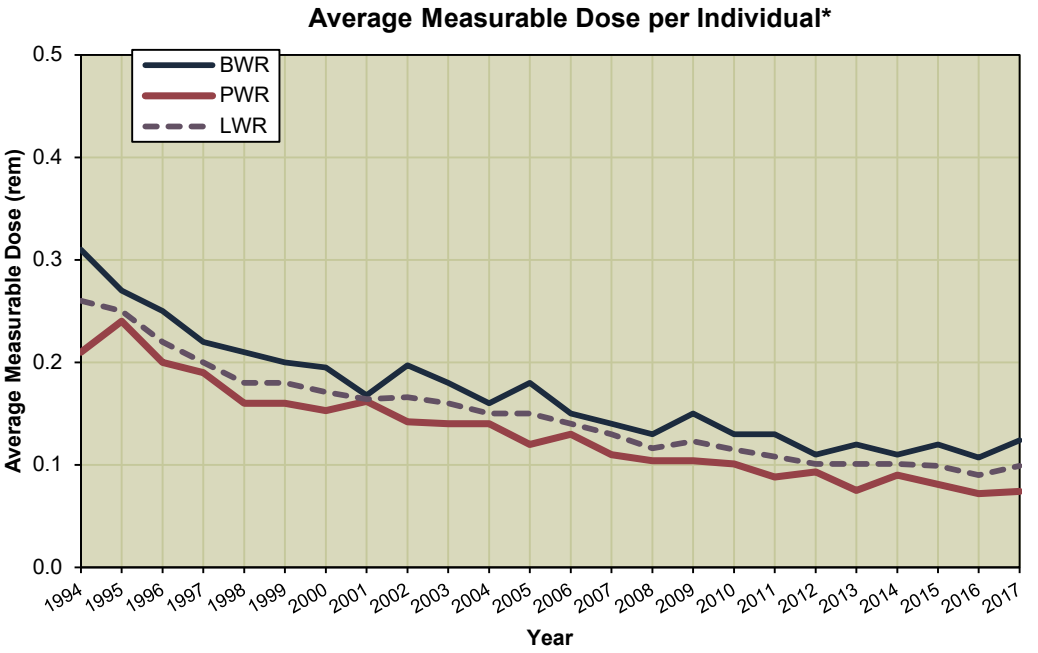
Figure 4.1 Average collective dose per reactor and average number of individuals with measurable dose per reactor 1994–2017

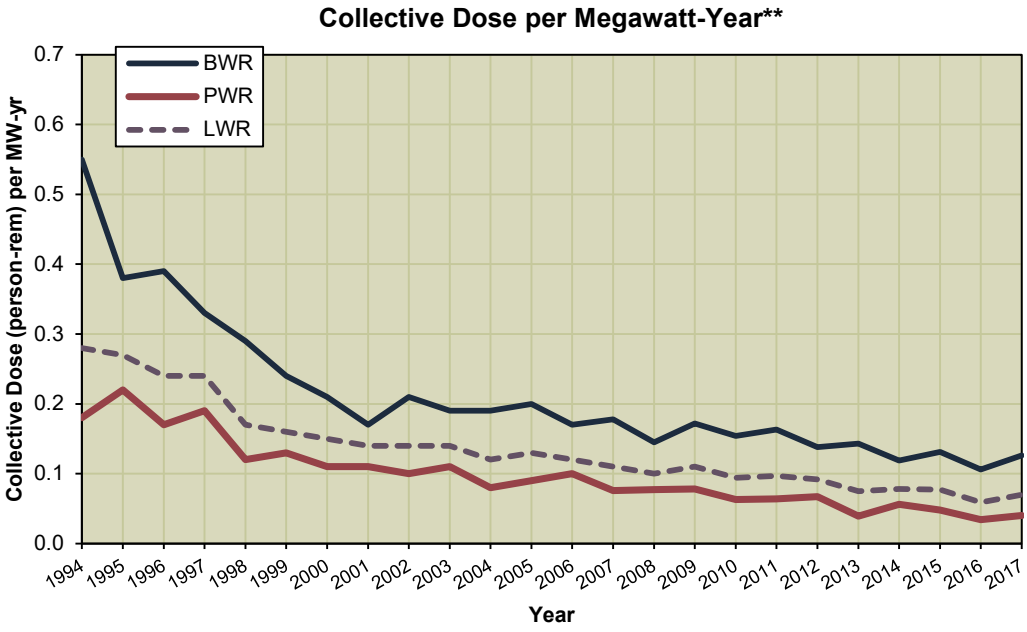




* Gross electricity is shown for 1994–1996, net electricity is shown for 1997–2017.

Figure 4.2 Number of operating reactors and electricity generated 1994–2017





* Not adjusted for transient workers. See Section 5.
** Gross electricity is shown for 1994–1996, net electricity is shown for 1997–2017.

Figure 4.3 Average measurable dose per individual and collective dose per megawatt-year 1994–2017

To further assist in the identification of any trends that might exist, Figures 4.4a and 4.4b display the average and median values of the collective dose per reactor for BWRs and for PWRs for the years 1994 through 2017. The median values are included here for statistical completeness and are not used in other sections of this report. The ranges of the values reported each year are shown by the vertical lines with a small bar at each end marking the two extreme values.

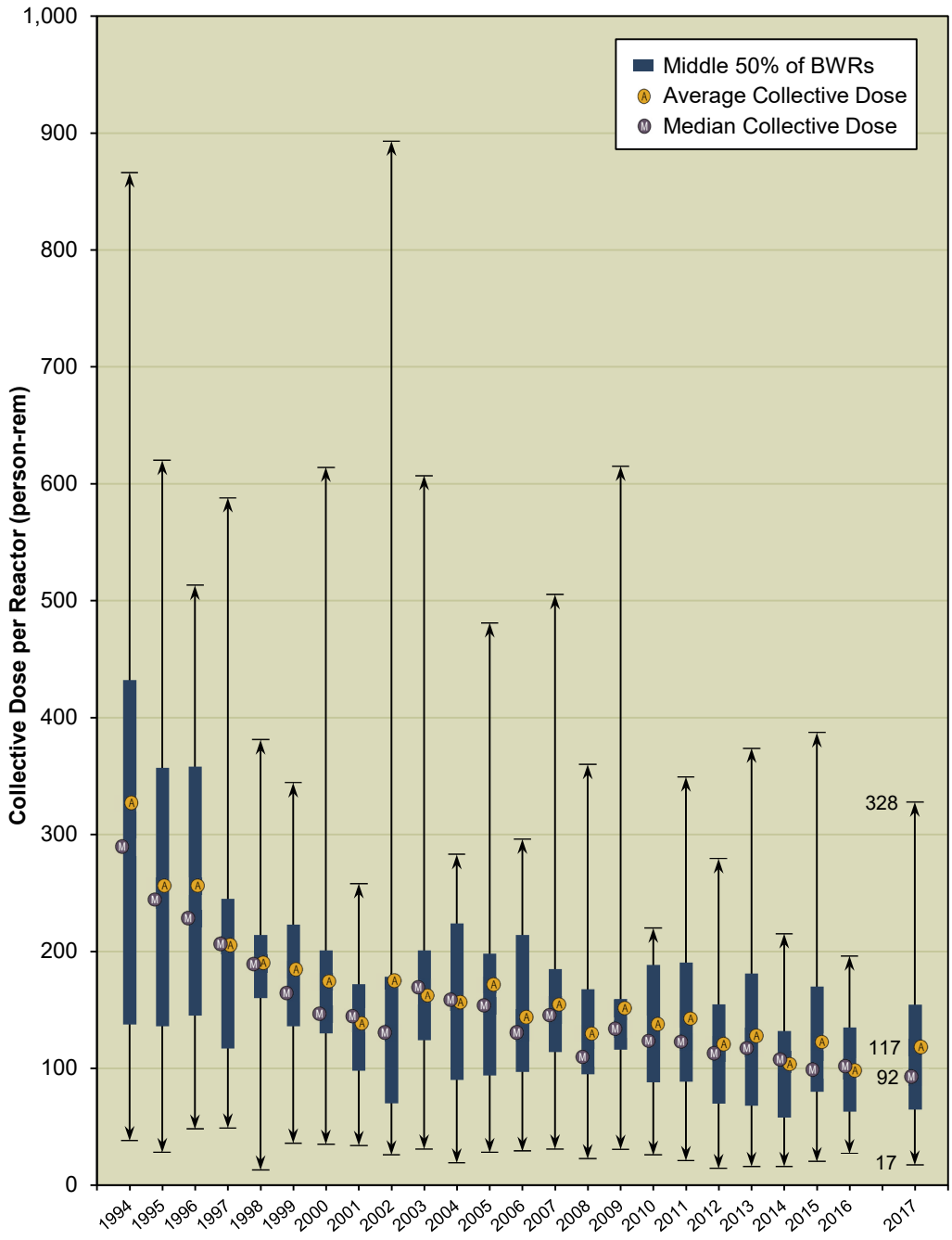


Figure 4.4a Average, median, and extreme values of the collective dose per BWR reactor 1994–2017

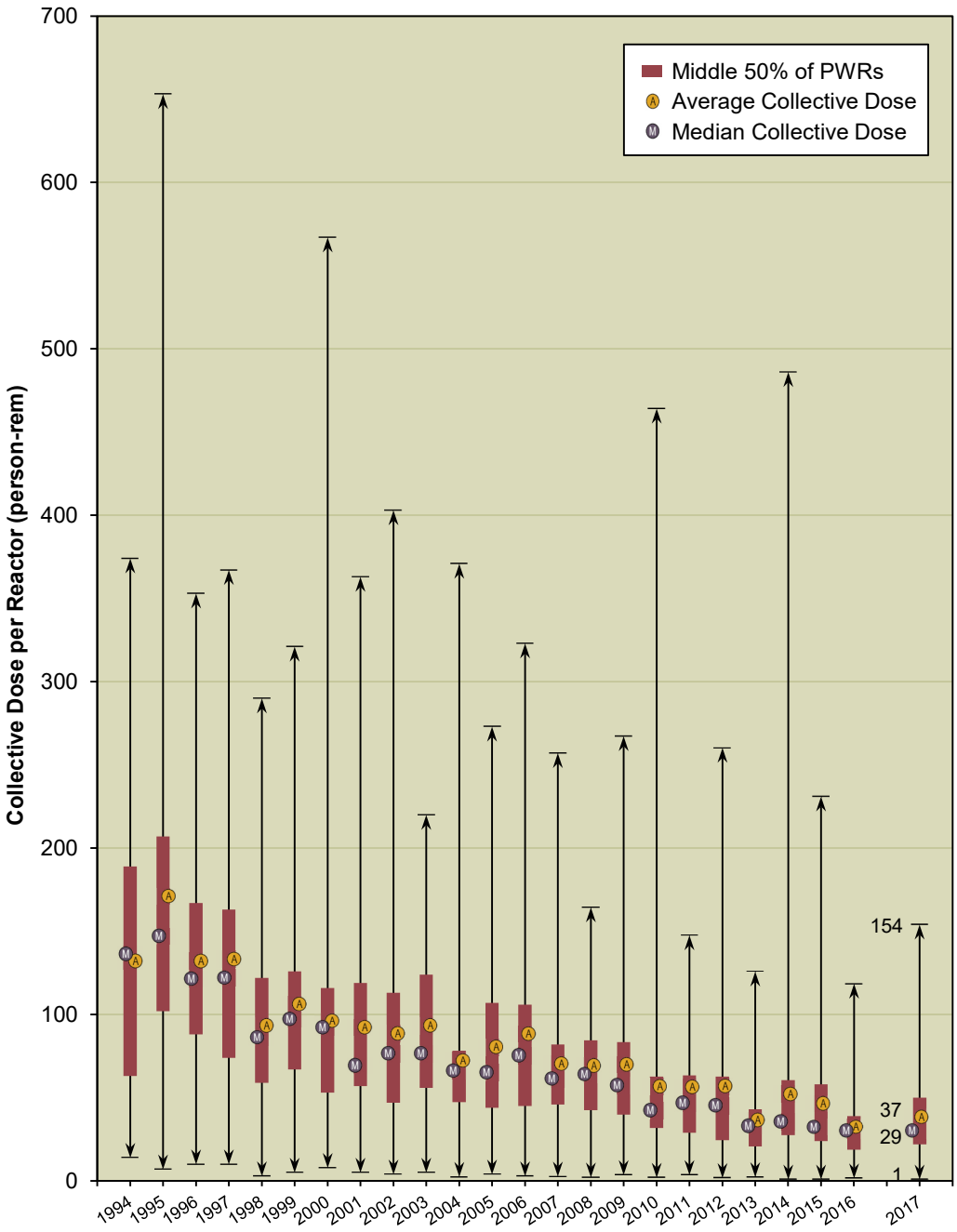


Figure 4.4b Average, median, and extreme values of the collective dose per PWR reactor 1994–2017

The rectangles indicate the range of values of the collective dose exhibited by those plants ranked in the 25th through the 75th percentiles. Figure 4.4a shows that the median collective dose for BWRs decreased from 101 person-rem in 2016 to 92 person-rem in 2017. The median collective dose in 2017 is significantly lower than the 5-year median of 107 person-rem. The median collective dose for PWRs remained the same at 29 person-rem in 2017 and was not significantly lower than the 5-year median of 34 person-rem. Figure 4.4a and Figure 4.4b show that, in 2017, 50 percent of the BWRs reported collective doses between 65 and 155 person-rem, while 50

percent of the PWRs reported collective doses between 22 and 50 person-rem. The middle 50 percent of BWRs and PWRs in Figure 4.4a and 4.4b are the reactors between the 25 percent and 75 percent dose ranges. These values are based on annual collective dose values, not the 3-year rolling average that is presented in Section 4.5. Nearly every year, the median collective dose is less than the average, which indicates that more of the reactors tend to be at lower collective doses than is reflected by the average. This is a result of the wide difference between the maximum and minimum annual collective doses at power plants and the fact that some plants accrue higher collective doses during refueling outages. The plants that have outages during the year (and thus higher collective doses) increase the value of the average collective dose, while the median (or middle-point of the doses) remains lower.

4.5 Three-Year Average Collective TEDE per Reactor

The 3-year average collective dose per reactor is one of the metrics that the NRC uses in the Reactor Oversight Process to evaluate the effectiveness of the licensee's ALARA program. Tables 4.5 and 4.6 list the sites that had been in commercial operation for at least 3 years as of December 31, 2017, and show the values of several parameters for each of the sites. These tables also give averages for the two types of reactors.

Based on the 102 reactor-years of operation accumulated over a 3-year period by the 34 BWRs listed, the average 3-year collective TEDE per reactor was found to be 113 person-rem, the average measurable TEDE per individual was 0.116 rem, and the average collective TEDE per MW-yr was 0.12 rem. For BWRs, although most values decreased slightly from 2016 to 2017, the changes in these values were not statistically significant when compared to the 5-year average.

Based on the 193 reactor-years of operation accumulated over a 3-year period at the 65 PWRs listed, the average annual collective TEDE per reactor, average measurable TEDE per individual, and average collective TEDE per MW-yr were found to be 37 person-rem, 0.075 rem, and 0.04 rem, respectively. Each of these values was significantly lower in 2017 when compared to the 5-year trend.

In addition to the listings provided in Tables 4.5 and 4.6, the quartile ranking is used by the NRC as a factor in planning the number of inspection hours assigned per site. For this reason, Tables 4.7 and 4.8 have been included in the 2017 annual report for BWRs and PWRs, respectively. These tables show the plant name, 3-year collective TEDE per reactor year, the percent change in the 3-year average from the previous 3-year period, and the quartile ranking from the previous period if the ranking has changed.

Table 4.5 Three-Year Totals and Averages Listed in Ascending Order of Collective TEDE per BWR 2015–2017

Plant Name*	Reactor Years	Three-year Collective TEDE per Reactor Year 2015-2017 (person-rem)	Three-year Collective TEDE per Site (person-rem)	Number of Workers with Measurable TEDE	Average TEDE per Worker (rem)	Total MW-Yrs	Average TEDE per MW-Yr (rem)
DUANE ARNOLD	3	49.463	148.390	1,745	0.085	1,730.6	0.09
OYSTER CREEK	3	57.941	173.824	1,816	0.096	1,745.5	0.10
DRESDEN 2,3	6	68.326	409.957	5,706	0.072	5,260.9	0.08
FITZPATRICK	3	70.428	211.285	1,764	0.120	2,217.2	0.10
LIMERICK 1,2	6	72.554	435.322	4,979	0.087	6,507.8	0.07
QUAD CITIES 1,2	6	80.983	485.897	5,623	0.086	5,321.8	0.09
HATCH 1,2	6	81.854	491.125	4,379	0.112	4,985.8	0.10
COOPER STATION	3	84.448	253.345	2,104	0.120	2,241.3	0.11
GRAND GULF	3	86.749	260.247	2,575	0.101	2,869.7	0.09
MONTICELLO	3	91.473	274.418	1,974	0.139	1,760.4	0.16
NINE MILE POINT 1,2	6	93.054	558.324	4,684	0.119	5,416.5	0.10
CLINTON	3	95.144	285.431	3,018	0.095	2,894.8	0.10
SUSQUEHANNA 1,2	6	101.493	608.958	5,413	0.112	6,947.1	0.09
BRUNSWICK 1,2	6	102.303	613.819	6,164	0.100	5,256.9	0.12
HOPE CREEK 1	3	113.888	341.664	4,988	0.068	3,396.0	0.10
BROWNS FERRY 1,2,3	9	115.857	1,042.710	8,178	0.128	9,330.2	0.11
PEACH BOTTOM 2,3	6	132.605	795.632	6,901	0.115	7,246.8	0.11
PILGRIM 1	3	141.950	425.849	3,753	0.113	1,764.0	0.24
RIVER BEND 1	3	157.546	472.638	2,920	0.162	2,407.6	0.20
COLUMBIA GENERATING	3	165.405	496.215	4,398	0.113	2,958.3	0.17
FERMI 2	3	184.899	554.696	4,670	0.119	2,876.6	0.19
LASALLE 1,2	6	235.173	1,411.040	7,969	0.177	6,476.9	0.22
PERRY	3	250.295	750.884	3,444	0.218	3,392.1	0.22
Totals and Averages	**102**	**-**	**11,501.670**	**99,165**	**0.116**	**95,004.8**	**0.12**
Average per Reactor-Year	**-**	**112.761**	**-**	**972**	**-**	**931.4**	**-**

* Sites where not all reactors had completed three full years of commercial operations as of December 31, 2017, are not included.

Table 4.6 Three-Year Totals and Averages Listed in Ascending Order of Collective TEDE per PWR 2015–2017

Plant Name*	Reactor Years	Three-year Collective TEDE per Reactor Year 2015-2017 (person-rem)	Three-year Collective TEDE per Site (person-rem)	Number of Workers with Measurable TEDE	Average TEDE per Worker (rem)	Total MW-Yrs	Average TEDE per MW-Yr (rem)
OCONEE 1,2,3	9	17.750	159.749	3,484	0.046	7,410.4	0.02
PALO VERDE 1,2,3	9	19.631	176.680	3,407	0.052	11,084.2	0.02
DIABLO CANYON 1,2	6	23.815	142.888	2,388	0.060	6,330.4	0.02
GINNA	3	24.073	72.218	1,108	0.065	1,656.4	0.04
PRAIRIE ISLAND 1,2	6	24.140	144.841	2,065	0.070	2,785.0	0.05
FARLEY 1,2	6	24.522	147.133	2,420	0.061	4,884.7	0.03
CALLAWAY 1	3	24.537	73.611	1,252	0.059	3,222.4	0.02
BRAIDWOOD 1,2	6	28.472	170.831	2,771	0.062	6,797.3	0.03
SOUTH TEXAS 1,2	6	28.643	171.855	1,946	0.088	7,173.5	0.02
CALVERT CLIFFS 1,2	6	30.133	180.798	2,173	0.083	5,083.0	0.04
COOK 1,2	6	30.257	181.541	2,769	0.066	5,647.4	0.03
BYRON 1,2	6	30.799	184.793	3,042	0.061	6,646.7	0.03
POINT BEACH 1,2	6	32.041	192.246	1,721	0.112	3,403.9	0.06
BEAVER VALLEY 1,2	6	32.177	193.060	2,578	0.075	5,144.9	0.04
VOGTLE 1,2	6	33.266	199.593	2,559	0.078	6,666.1	0.03
COMANCHE PEAK 1,2	6	33.422	200.533	2,326	0.086	6,582.6	0.03
HARRIS 1	3	34.024	102.071	1,574	0.065	2,625.0	0.04
CATAWBA 1,2	6	34.502	207.011	2,941	0.070	6,580.9	0.03
NORTH ANNA 1,2	6	34.677	208.061	2,450	0.085	5,424.5	0.04
WATTS BAR 1,2	4	36.120	144.481	2,239	0.065	3,806.8	0.04
INDIAN POINT 2,3	6	39.354	236.125	4,176	0.057	5,334.5	0.04
SUMMER 1	3	39.376	118.128	1,804	0.065	2,589.9	0.05
ROBINSON 2	3	39.605	118.816	1,973	0.060	2,064.6	0.06
MILLSTONE 2,3	6	40.111	240.663	2,792	0.086	5,776.5	0.04
DAVIS-BESSE 1	3	40.363	121.088	1,097	0.110	2,530.2	0.05
SEABROOK	3	42.305	126.916	1,799	0.071	3,451.4	0.04
WATERFORD 3	3	43.506	130.519	2,132	0.061	3,071.1	0.04
SALEM 1,2	6	43.710	262.262	3,433	0.076	5,992.7	0.04
TURKEY POINT 3,4	6	43.932	263.593	2,944	0.090	4,509.3	0.06
MCGUIRE 1,2	6	44.107	264.642	3,882	0.068	6,645.6	0.04
SURRY 1,2	6	47.571	285.424	2,701	0.106	4,660.8	0.06
SEQUOYAH 1,2	6	48.298	289.790	3,448	0.084	5,937.0	0.05
ARKANSAS 1,2	6	55.723	334.336	5,365	0.062	4,569.1	0.07
ST. LUCIE 1,2	6	55.973	335.838	3,362	0.100	5,375.7	0.06
WOLF CREEK 1	3	56.291	168.872	2,793	0.060	3,145.4	0.05
THREE MILE ISLAND 1	3	90.310	270.931	2,772	0.098	2,345.0	0.12
PALISADES	3	130.165	390.496	1,898	0.206	2,221.2	0.18
Totals and Averages	**193**	**-**	**7,212.433**	**95,584**	**0.075**	**179,176.1**	**0.04**
Averages per Reactor-Year	**-**	**37.370**	**-**	**495**	**-**	**923.6**	**-**

* Watts Bar 2 became operational in October 2016 and therefore the first full year of operation was 2017. Data for Unit 2 for 2017 is included with Unit 1 for this 3-year period, resulting in 4 reactor-years of operation for the two units combined.

Table 4.7 Three-Year Collective TEDE per Reactor-Year for BWRs 2015-2017

	Plant Name	Three-Year Coll. TEDE per Reactor Year 2015-2017	Percent Change From (2014-2016)	2014-2016 Quartile (if changed)	
1st Quartile	DUANE ARNOLD	49.463	-41% ▼	2	
	OYSTER CREEK	57.941	-42% ▼	2	
	DRESDEN 2,3	68.326	3% ▲	-	
	FITZPATRICK	70.428	14% ▲	-	
	LIMERICK 1,2	72.554	12% ▲	-	
	QUAD CITIES 1,2	80.983	4% ▲	2	
2nd Quartile	HATCH 1,2	81.854	-15% ▼	-	
	COOPER STATION	84.448	-41% ▼	4	
	GRAND GULF	86.749	-35% ▼	3	
	MONTICELLO	91.473	42% ▲	1	
	NINE MILE POINT 1,2	93.054	-18% ▼	3	
	CLINTON	95.144	92% ▲	1	
3rd Quartile	SUSQUEHANNA 1,2	101.493	-7% ▼	2	
	BRUNSWICK 1,2	102.303	-7% ▼	-	
	HOPE CREEK 1	113.888	-1% ▼	-	< *Average 112.761*
	BROWNS FERRY 1,2,3	115.857	-4% ▼	-	
	PEACH BOTTOM 2,3	132.605	-23% ▼	4	
4th Quartile	PILGRIM 1	141.950	42% ▲	2	
	RIVER BEND 1	157.546	119% ▲	1	
	COLUMBIA GENERATING	165.405	42% ▲	3	
	FERMI 2	184.899	13% ▲	-	
	LASALLE 1,2	235.173	17% ▲	-	
	PERRY	250.295	48% ▲	-	
	Average per Reactor-Year	**112.761**	**2% ▲**		

Table 4.8 Three-Year Collective TEDE per Reactor-Year for PWRs 2015–2017

	Plant Name	Three-Year Coll. TEDE per Reactor Year 2015-2017	Percent Change From (2014-2016)	2014-2016 Quartile (if changed)	
1st Quartile	OCONEE 1,2,3	17.750	-31% ▼	-	
	PALO VERDE 1,2,3	19.631	-3% ▼	-	
	DIABLO CANYON 1,2	23.815	-12% ▼	-	
	GINNA	24.073	-14% ▼	-	
	PRAIRIE ISLAND 1,2	24.140	-20% ▼	2	
	FARLEY 1,2	24.522	-4% ▼	-	
	CALLAWAY 1	24.537	-15% ▼	-	
	BRAIDWOOD 1,2	28.472	27% ▲	-	
	SOUTH TEXAS 1,2	28.643	14% ▲	-	
	CALVERT CLIFFS 1,2	30.133	-7% ▼	2	
2nd Quartile	COOK 1,2	30.257	2% ▲	1	
	BYRON 1,2	30.799	4% ▲	-	
	POINT BEACH 1,2	32.041	-17% ▼	3	
	BEAVER VALLEY 1,2	32.177	-5% ▼	-	
	VOGTLE 1,2	33.266	-28% ▼	3	
	COMANCHE PEAK 1,2	33.422	-8% ▼	-	
	HARRIS 1	34.024	-1% ▼	-	
	CATAWBA 1,2	34.502	-8% ▼	-	
	NORTH ANNA 1,2	34.677	-11% ▼	-	
3rd Quartile	WATTS BAR 1,2	36.120	12% ▲	2	*Average 37.370*
	INDIAN POINT 2,3	39.354	-14% ▼	-	
	SUMMER 1	39.376	-34% ▼	4	
	ROBINSON 2	39.605	34% ▲	1	
	MILLSTONE 2,3	40.111	-17% ▼	4	
	DAVIS-BESSE 1	40.363	-62% ▼	4	
	SEABROOK	42.305	-8% ▼	-	
	WATERFORD 3	43.506	-6% ▼	-	
	SALEM 1,2	43.710	11% ▲	-	
4th Quartile	TURKEY POINT 3,4	43.932	-2% ▼	3	
	MCGUIRE 1,2	44.107	4% ▲	3	
	SURRY 1,2	47.571	0% ▲	-	
	SEQUOYAH 1,2	48.298	-9% ▼	-	
	ARKANSAS 1,2	55.723	5% ▲	-	
	ST. LUCIE 1,2	55.973	-13% ▼	-	
	WOLF CREEK 1	56.291	-12% ▼	-	
	THREE MILE ISLAND 1	90.310	35% ▲	-	
	PALISADES	130.165	-46% ▼	-	
	Average per Reactor-Year	**37.370**	**-11%** ▼		

4.6 International Occupational Radiation Exposure

In 1992, the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (NEA/OECD), with sponsorship from the International Atomic Energy Agency (IAEA), created the Information System on Occupational Exposure (ISOE) Program as an international forum for representatives from nuclear electric utilities and regulatory agencies to share dose reduction information, operational experience, and information to improve the optimization of radiological protection at commercial nuclear power plants. The ISOE database, ISOEDAT, includes occupational exposure information for 400 operating units and 80 units in cold-shutdown or some stage of decommissioning in 29 countries, covering about 90 percent of the world's operating commercial nuclear power reactors. One of the purposes of ISOEDAT is to allow a comparison of radiation protection effectiveness and trends among the participating countries and among the various types of commercial nuclear power reactors.

As part of the agency's international cooperative research program initiatives, the NRC joined the ISOE Program as a regulatory member in December 1994. The NRC's REIRS database is the U.S. system comparable with ISOEDAT on the global scale. Since joining the ISOE Program, the NRC has leveraged experience in data management and analysis of the REIRS database, as well as provided input to NEA/OECD and IAEA for streamlining certain ISOEDAT methods for capturing, maintaining, and displaying data.

Figures 4.5 and 4.6 show the average collective dose per reactor for both PWRs and BWRs for the United States and participating reactors from ISOEDAT. For PWRs, the international average collective dose per unit decreased in 2017, while the U.S. average increased. The international average for BWRs decreased to 29 person-rem per reactor in 2017, which is approximately 25 percent of the average for U.S. BWRs (118 person-rem per reactor).

It should be noted that the information from reactor sites in Japan has been affected by the Fukushima Daiichi event that occurred in 2011. Following the earthquake and tsunami at the Fukushima Daiichi and Daini reactor sites, all Japanese reactors were shut down to assess safety concerns. While these plants ceased power production, they were still officially counted as "operational" reactors. The collective dose at these sites decreased significantly as most operational activities were not required as the reactors were not producing power. Similarly, the collective dose data for German reactors in the ISOE database includes reactors that were shut down in 2011 by the German government following the Fukushima event. This resulted in a significant reduction in the average collective dose per reactor as operational activities ceased. The decrease in the average collective dose per reactor from these two countries decreased the overall international averages for both types of reactors since 2011. Since the Japan data represent a large percent (30 percent of the total BWRs), the decrease in the average collective dose per BWR in Japan is the primary factor in the decrease for international BWRs since 2011 as can be seen in Figure 4.6.

The data were compiled from the ISOEDAT online database. The NEA publishes an annual report entitled "Occupational Exposures at Nuclear Power Plants" that is available on the ISOE Web site at www.isoe-network.net.

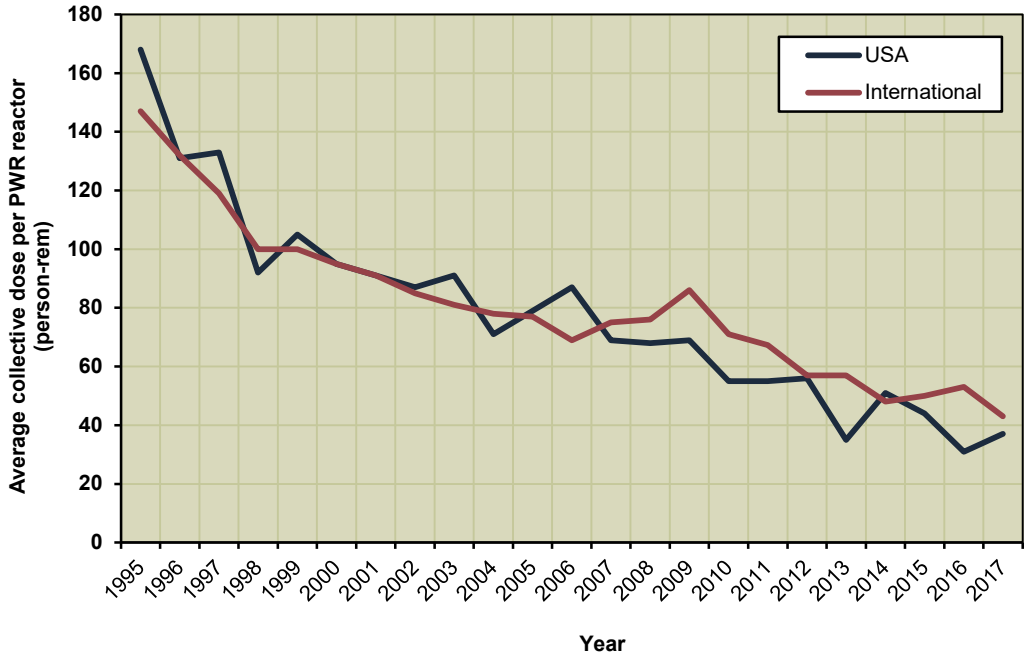


Figure 4.5 Average collective dose per PWR reactor 1995–2017

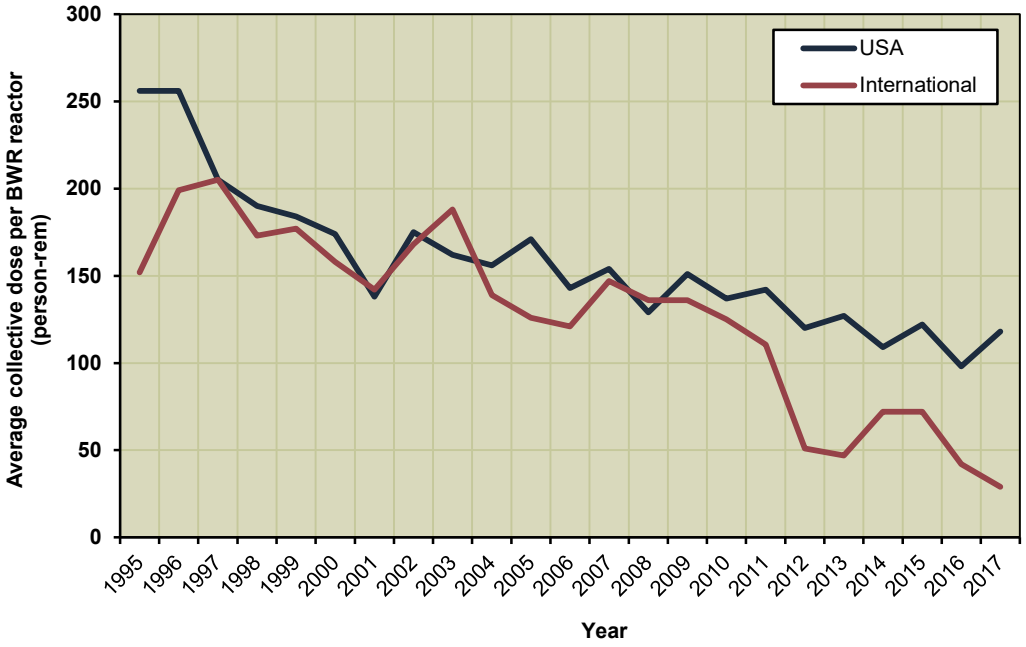


Figure 4.6 Average collective dose per BWR reactor 1995–2017

4.7 Decontamination and Decommissioning of Commercial Nuclear Power Reactors

The NRC regulates the decontamination and decommissioning (D&D) of commercial nuclear power reactors. The purpose of the NRC Decommissioning Program is to ensure that NRC-licensed sites are decommissioned in a safe, timely, and effective manner so that they can be returned to beneficial use and to ensure that stakeholders are informed and involved in the process, as appropriate.

The NRC Office of Nuclear Material Safety and Safeguards (NMSS) has project management responsibilities for decommissioning commercial nuclear power reactors. The NRC's commercial nuclear power reactor decommissioning activities include project management, technical review of licensee submittals in support of decommissioning, licensing amendments and exemptions in support of the progressive stages of decommissioning, inspections of decommissioning activities, support for the development of rulemaking guidance, public outreach efforts, international activities, and participation in industry conferences and workshops. The NMSS staff regularly coordinates with other offices on issues affecting all commercial nuclear power reactors, both operating and decommissioning, and specifically in regard to the ISFSIs at reactor sites undergoing decommissioning [Ref. 20].

Decommissioning Process

The decommissioning process begins when a licensee decides to permanently cease operations. The major steps that comprise the commercial nuclear power reactor decommissioning process are notification of cessation of operations; submittal and review of the post-shutdown decommissioning activities report (PSDAR); submittal, review, and approval of the license termination plan (LTP); implementation of the LTP; and completion of decommissioning. The flowchart in Figure 4.7 illustrates the D&D process.

Notification

When a licensee has decided to permanently cease operations, it is required to submit a written notification to the NRC. In addition, the licensee is required to notify the NRC in writing once fuel has been permanently removed from the reactor vessel.

Post-Shutdown Decommissioning Activities Report

Within 2 years of cessation of operations, the licensee must submit a PSDAR to the NRC and a copy to the affected State(s). The PSDAR must include a description and schedule for the planned decommissioning activities, an estimate of the expected costs, and a discussion of the means for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate, previously issued environmental impact statements. The NRC will provide notice of receipt of the PSDAR in the Federal Register and make the PSDAR available for public comment. In addition, the NRC will hold a public meeting in the vicinity of the licensee's facility to discuss the PSDAR.

License Termination Plan

Each commercial nuclear power reactor licensee must submit an application for termination of its license. An LTP must be submitted at least 2 years before the license termination date. The NRC and licensee hold pre-submittal meetings to agree on the format and content of the LTP. These

meetings are intended to improve the efficiency of the LTP development and review process. The LTP must include the following: a site characterization; the identification of remaining dismantlement activities; plans for site remediation; detailed plans for the final radiation survey; a description of the end use of the site, if restricted; an updated site-specific estimate of remaining decommissioning costs; and a supplement to the environmental report describing any new information or significant environmental change associated with the licensee's proposed termination activities. In addition, the licensee must demonstrate that it will meet the applicable requirements of the License Termination Rule in 10 CFR Part 20, Subpart E, "Radiological Criteria for License Termination."

The NRC will provide notice of receipt of the LTP in the Federal Register and make the LTP available for public comment. In addition, the NRC will hold a public meeting in the vicinity of the licensee's facility to discuss the LTP and the LTP review process.

Implementation of the License Termination Plan

After approval of the LTP, the licensee or responsible party must complete decommissioning in accordance with the approved LTP. The NRC staff will periodically inspect the decommissioning activities at the site to ensure compliance with the LTP. These inspections will normally include in-process and confirmatory radiological surveys.

Decommissioning must be completed within 60 years of permanent cessation of operations, unless otherwise approved by the NRC.

Completion of Decommissioning

At the conclusion of decommissioning activities, the licensee will submit a final status survey report (FSSR), which identifies the final radiological conditions of the site and requests that the NRC either (1) terminate the 10 CFR Part 50 license, or (2) reduce the 10 CFR Part 50 license boundary to the footprint of the ISFSI. For decommissioning commercial nuclear power reactors with no ISFSI or an ISFSI holding a specific license under 10 CFR Part 72, completion of reactor decommissioning will result in the termination of the 10 CFR Part 50 license. The NRC will approve the FSSR and the licensee's request if it determines that the licensee has met both of the following conditions: the remaining dismantlement has been performed in accordance with the approved LTP, and the final radiation survey and associated documentation demonstrate that the facility and site are suitable for release in accordance with the License Termination Rule.

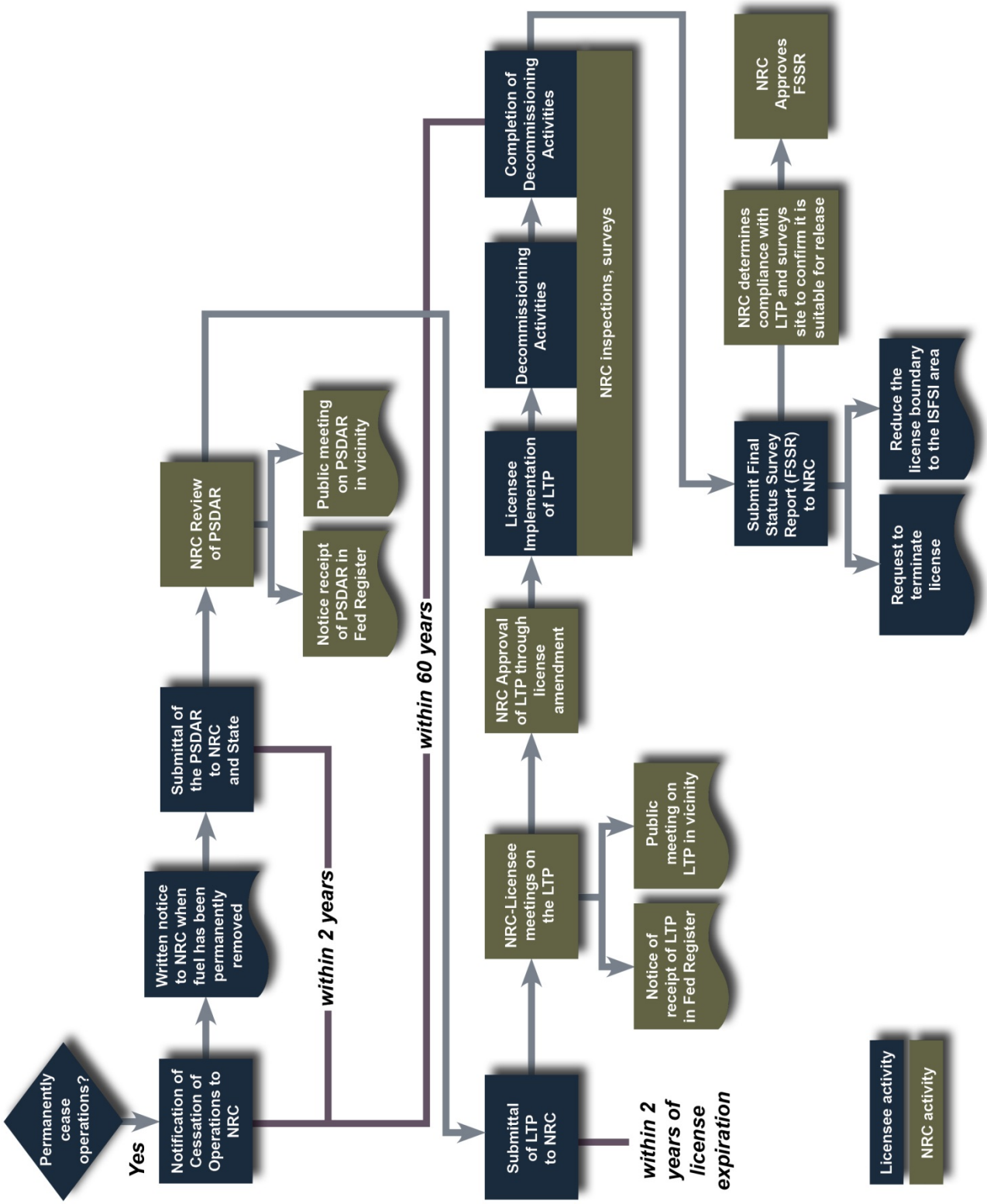


Figure 4.7 D&D process flowchart

Status of Decommissioning Activities at Commercial Nuclear Power Reactors

While 99 commercial nuclear power reactors are currently in operation, several shutdown power reactors have undergone the D&D process. As more commercial nuclear power reactors permanently shut down, either because they have reached the end of their operating license or shut down for other reasons, there will be a commensurate increase in activities involving radiation exposure related to D&D. For this reason, there is an increased need to provide further information on plants undergoing D&D.

Appendix B contains a list of the plants that are no longer in commercial operation, along with the dose distribution and collective dose for these plants. It should be noted that these plants may be in different stages of D&D, so that a comparison of the dose at one plant versus another would not be meaningful. In addition, Appendix B lists the plant units that are no longer in commercial operation but report along with other units at the site. Under the licensing conditions and reporting requirements, it is permissible to report this information together in one report. Table 4.9 lists the plants that have ceased operation and have changed operational status as of the date shown [Ref. 20]. In addition, Appendix E provides descriptions of the decommissioning activities currently underway at these commercial nuclear power reactors, as well as the total collective TEDE for each plant, based on available data through 2017.

Table 4.9 Plants No Longer in Operation 2017

Plant Name	Date of First Commercial Operation	Ceased Operations	License Termination Plan Approved by NRC	PSDAR Submitted	Plant Status	Completion of Decommissioning
BIG ROCK POINT	**3/29/1963**	**8/1997**	**TBD**	**9/1997**	**ISFSI only**	**2007**
CRYSTAL RIVER 3	12/1/1976	2/2013	TBD	12/2013	SAFSTOR	2073
DRESDEN 1	8/1/1960	10/1978	TBD	6/1998	SAFSTOR	2036
FERMI 1	5/10/1963	9/1972	TBD	4/1998	SAFSTOR	2032
FORT CALHOUN	6/20/1974	10/2016	TBD	3/2017	SAFSTOR	2065
HADDAM NECK	**12/27/1974**	**12/1996**	**TBD**	**8/1997**	**ISFSI only**	**2007**
HUMBOLDT BAY 3	8/1/1963	7/1976	2012	2/1998	DECON	2019
INDIAN POINT 1	3/26/1962	10/1974	TBD	1/1996	SAFSTOR	2026
KEWAUNEE	12/1/1973	5/2013	TBD	2/2013	SAFSTOR	2073
LACROSSE	11/1/1969	4/1987	TBD	5/1991	DECON	2026
MAINE YANKEE	**6/29/1973**	**8/1997**	**TBD**	**8/1997**	**ISFSI only**	**2005**
MILLSTONE 1	12/28/1970	7/1998	TBD	6/1999	SAFSTOR	2056
PEACH BOTTOM 1	1/24/1966	10/1974	TBD	6/1998	SAFSTOR	2034
RANCHO SECO	**4/17/1975**	**6/1989**	**TBD**	**3/1997**	**ISFSI only**	**2009**
SAN ONOFRE 1	1/1/1968	11/1992	TBD	12/1998	SAFSTOR	2030
SAN ONOFRE 2	1/1/1983	6/2013	TBD	TBD	DECON	2030
SAN ONOFRE 3	1/1/1984	6/2013	TBD	TBD	DECON	2030
THREE MILE ISLAND 2	12/30/1978	3/1979	TBD	TBD	Post-Defueling Monitored Storage	2053
TROJAN	**5/20/1976**	**11/1992**	**2/2001**	**8/1995**	**ISFSI only**	**2004**
VERMONT YANKEE	11/30/1972	12/2014	TBD	12/2014	SAFSTOR	2073
YANKEE ROWE	**12/24/1963**	**10/1991**	**TBD**	**-**	**ISFSI only**	**2007**
ZION 1	12/31/1973	2/1997	TBD	2/2000	DECON	2020
ZION 2	9/17/1974	9/1996	TBD	2/2000	DECON	2020

NOTE: Information regarding the latest decommissioning status of plants listed in this table can be found in Status of the Decommissioning Program: 2017 Annual Report from the NRC's public library under ADAMS Accession No. ML16285A207. Rows displayed in gray with bold text represent plants that have completed decommissioning.

TBD = To Be Determined.

SAFSTOR = (often considered 'delayed DECON'): a nuclear facility that is maintained and monitored in a condition that allows the radioactivity to decay; afterwards, it is dismantled.

DECON = (immediate dismantlement): soon after the nuclear facility closes, equipment, structures, and portions of the facility containing radioactive contaminants are removed or decontaminated to a level that permits release of the property and termination of the NRC license.

5 TRANSIENT INDIVIDUALS AT NRC-LICENSED FACILITIES

The following analysis examines the individuals who had more than one Form 5 dose record at more than one NRC-licensed facility during the monitoring year. These individuals are defined as transient because they worked at more than one facility during the monitoring year.

The term “monitoring year” is used here in accordance with the definition given in 10 CFR 20.1003, which defines a year as “the period of time beginning in January used to determine compliance with the provisions of 10 CFR Part 20. The licensee may change the start date of the monitoring year used to determine compliance, provided that the change is made at the beginning of the monitoring/calendar year and that no day is omitted or duplicated in consecutive years.”

Examination of the data reported for individuals who began and terminated two or more periods of employment with two or more different facilities within one monitoring year is useful in many ways. For example, the number of transients and the individual doses received by them can be determined from examining these data.

Additionally, the distribution of the doses received by transient individuals can be useful in determining the impact that the inclusion of these individuals in each of two or more licensees’ annual reports has on the annual summary (as reported in Appendix B) for all commercial nuclear power reactors and all NRC licensees combined (one of the issues mentioned in Section 2). Table 5.1 shows the actual distribution of transient individual doses as determined from the NRC Form 5 termination reports and compares it with the reported distribution of the doses of these individuals as they would have appeared in a summation of the annual reports submitted by each of the licensees.

In 2017, over 98 percent of the transient individuals were reported by commercial nuclear power reactors. For this reason, these data are shown separately in Table 5.1.

Table 5.1 illustrates the impact that the multiple reporting of these transient individuals had on the summation of the dose reports for 2017. Each licensee reports the radiation dose received by individuals monitored at its facility. Many of these individuals are monitored at more than one facility during the year. When these dose records are summed for all licensees, they appear to be separate individuals reported by each facility. If an individual visited five facilities during a year, this individual would appear in the summation to be five different people, with one dose record for each of the five facilities. When these dose records are summed per individual, these records appear as one person, with a total annual dose that accurately represents the dose received for the entire monitoring year. Thus, while the total collective dose would remain the same, the number of individuals, their dose distributions, and average doses would be affected by this multiple reporting.

For example, in 2017, Table 5.1 shows that the initial summation (see line [2] Transients, As Reported) of the Form 5 reports for reactor licensees indicated that no individuals received a dose greater than 2.0 rem. After accounting for those individuals who were reported more than once, the corrected distribution indicated that there were 11 transient individuals who received doses between 2.0 and 3.0 rem. Correcting for the multiple counting of individuals also had a significant effect (see line [3] Transients, Actual) on the average measurable dose for these individuals. The corrected average measurable dose for transient individuals is twice as high as the value calculated by the summation of the Form 5 records. For all reporting licensees, the transient individuals represent 35 percent of the workforce that received a measurable dose. The correction for the transient individuals increased the average measurable dose from 0.11 rem to 0.22 rem for

the transient workforce for all licensees. It should be noted that the analysis of transient individuals does not include individuals who may have been exposed at facilities that are not required to report to the NRC (see Section 1), such as Agreement State licensees and DOE facilities.

One purpose of the REIRS database, which tracks occupational radiation exposures at NRC-licensed facilities, is to identify individuals who may have exceeded the occupational radiation dose limits because of multiple exposures at different facilities throughout the year. The REIRS database stores the radiation dose information for an individual by his/her unique identification number and identification type [Ref. 15, Section 1.5] and sums the dose for all facilities during the monitoring year. An individual exceeding the 5 rem per year regulatory limit (TEDE) would be identified in Table 5.1 in one of the dose ranges greater than 5 rem. In 2017, there were 127 unique individuals receiving doses between 2 to 3 rem, 27 individuals receiving between 3 to 4 rem, 8 individuals receiving between 4 to 5 rem, and 2 individuals between 5 to 6 rem, as reported by NRC licensees to the REIRS database. See Section 6 for more information on individuals who received exposures in excess of the NRC regulatory limits.

Table 5.1 Effects of Transient Individuals on Annual Statistical Compilations 2017

License Category	Number of Individuals with TEDE in the Ranges (rem) *												Total Number Monitored	Number with Measurable TEDE	Collective TEDE (person-rem)	Average Meas. TEDE (rem)
	No Measurable Exposure	Measurable <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
COMMERCIAL LIGHT-WATER REACTORS																
(1) Form 5 Summation	92,311	45,920	12,376	4,745	1,184	382	154	-	-	-	-	-	157,072	64,761	6,416.548	0.10
(2) Transients, As Reported	37,666	25,106	7,641	2,900	747	264	103	-	-	-	-	-	74,427	36,761	3,944.833	0.11
(3) Transients, Actual	8,237	8,634	4,475	2,850	1,229	553	481	11	-	-	-	-	26,470	18,233	3,944.833	0.22
Corrected Distribution (1-[2-3]) **	**62,882**	**29,448**	**9,210**	**4,695**	**1,666**	**671**	**532**	**11**	**-**	**-**	**-**	**-**	**109,115**	**46,233**	**6,416.548**	**0.14**
ALL LICENSEES																
(1) Form 5 Summation	95,288	49,206	13,402	5,562	1,633	686	599	114	26	8	2	-	166,526	71,238	8,521.105	0.12
(2) Transients, As Reported	37,834	25,205	7,685	2,919	751	264	103	-	-	-	-	-	74,761	36,927	4,043.304	0.11
(3) Transients, Actual	8,400	8,759	4,547	2,905	1,257	569	499	13	1	-	-	-	26,950	18,550	4,043.304	0.22
Corrected Distribution (1-[2-3]) **	**65,854**	**32,760**	**10,264**	**5,548**	**2,139**	**991**	**995**	**127**	**27**	**8**	**2**	**-**	**118,715**	**52,861**	**8,521.105**	**0.16**

* Dose values exactly equal to the values separating ranges are reported in the next higher range.
** The corrected distribution only applies to the number of individuals.

6 EXPOSURES TO PERSONNEL IN EXCESS OF REGULATORY LIMITS

6.1 Reporting Categories

Doses in excess of regulatory limits are sometimes referred to as “overexposures.” The phrase “doses in excess of regulatory limits” is preferred to “overexposures” because the latter suggests that an individual has been subjected to an unacceptable biological risk, which may or may not be the case.

Regulations in 10 CFR 20.2202 and 10 CFR 20.2203 require that all licensees submit reports of all incidents involving personnel radiation doses that exceed certain levels, thus providing for investigations and corrective actions as necessary. Based on the magnitude of the dose, the occurrence may be placed into one of three categories as follows:

1. Category A
   10 CFR 20.2202(a)(1) — a TEDE to any individual of 25 rem or more, a lens dose equivalent of 75 rem or more, or a shallow dose equivalent to the skin or extremities of 250 rads or more. The Commission must be notified immediately of these events and the U.S. Congress is notified annually through the U.S. NRC Abnormal Occurrence Report.

2. Category B
   10 CFR 20.2202(b)(1) — in a 24-hour period, the Commission must be notified of the following events: a TEDE to any individual exceeding 5 rem, a lens dose equivalent exceeding 15 rem, or a shallow dose equivalent to the skin or extremities exceeding 50 rem.

3. Category C
   10 CFR 20.2203 — in addition to the notification required by 10 CFR 20.2202 (Category A or B events), each licensee must submit a written report within 30 days after learning of any of the following occurrences:

   a. any incident for which notification is required by 10 CFR 20.2202; or

   b. doses that exceed the limits in §20.1201, §20.1207, §20.1208, or §20.1301 (for adults, minors, the embryo/fetus of a declared pregnant woman, and the public, respectively) or any applicable limit in the license; or

   c. levels of radiation or concentrations of radioactive material that exceed any applicable license limit for restricted areas or that, for unrestricted areas, are in excess of 10 times any applicable limit set forth in 10 CFR Part 20 or in the license (whether or not involving a dose of any individual in excess of the limits in §20.1301); or

   d. for licensees subject to the provisions of the U.S. Environmental Protection Agency’s generally applicable environmental radiation standards in 40 CFR Part 190, levels of radiation or releases of radioactive material in excess of those standards or license conditions related to those standards.

Doses in excess of regulatory limits that are reported as either Category A, B, or C typically undergo a review and evaluation process by the licensee, NRC inspectors, and NRC Headquarters staff. Preliminary dose estimates submitted by licensees are often conservatively

high and do not represent the final (legal) dose of record assigned for the event. It is, therefore, not uncommon for a dose in excess of a regulatory limit event to be reassessed and the final assigned dose to be categorized as not having been in excess of a regulatory limit. In other cases, the exposure event may not be identified until a later date, such as during the next scheduled audit or inspection of the licensee's event records.

6.2 Summary of Occupational Radiation Doses in Excess of NRC Regulatory Limits

The exposure events summary presented here is for events that occurred in 2007 through 2017. An event that has been reassessed and determined not to be a dose in excess of a regulatory limit is not included in this report. In addition, events that occurred in prior years are added to the summary in the appropriate year of occurrence. The reader should note that the summary presented here represents a snapshot of the status of events as of the publication date of this report. Previous or future reports may not correlate in the exact number of events because of the review cycle and reassessment of the events.

It is important to note that this summary of events includes:
- occupational radiation doses in excess of the annual 5 rem regulatory limit;
- events at NRC-licensed facilities; and
- the dose of record assigned to an individual.

It **does not** include:
- medical events as defined in 10 CFR Part 35;
- doses in excess of the regulatory limits to the general public;
- Agreement State-licensed activities or DOE facilities; or
- exposures to dosimeters that, upon evaluation, have been determined to be high dosimeter readings only and are not assigned to an individual as the dose of record by the licensee.

In 2017, there were no Category A occurrences, two Category B occurrences, and no Category C occurrences reported under the licensed activities included in this report.

Valley Inspection Services (VIS) reported that a radiographer's dosimetry results for the monitoring period of September and October 2017 indicated that the employee had received a year-to-date total exposure of 5.077 rem. The radiographer worked with various exposure devices and sources throughout the year. VIS investigated the incident and the Pennsylvania Department of Environmental Protection performed a reactive inspection on December 12, 2017. The cause of the event was determined to stem from a job location where the dosimeter was not on the employee's body, but instead was on the employee's jacket, which was accidentally positioned closer to the source than the employee. The radiographer was limited to non-radiation work for the remainder of 2017 and retrained to adhere to the company requirements to maintain occupational exposure ALARA. Dosimetry will be changed out every month. Annual radiation safety training was conducted early and a discussion was held with all employees to reinforce ALARA principles, which will be enforced by random audits to determine effectiveness.

VIS reported that a radiographer received a total of 5.049 rem in 2017. On June 21, 2017, while setting up radiographic equipment to test a weld, the dosimetry badge was torn loose from its holder and fell next to a grinder without the individual's knowledge. The individual proceeded to enter the tank to place film for exposures. The assistant took seven radiographs on the outside of the tank. After completing the testing and all radiographs had been taken, the assistant noticed

the dosimetry badge lying in front of the insert next to the grinder. The radiation safety officer was notified immediately and sent the dosimetry badge out to be processed.

6.3 Summary of Annual Dose Distributions for Certain NRC Licensees

Table 6.1 gives a summary of the annual occupational dose records reported to the NRC, as required by 10 CFR 20.2206, by certain categories of NRC licensees. Table 6.1 shows that for the past 11 years, the percentage of individuals with less than 2 rem has been greater than 99 percent.

6.4 Maximum Occupational Radiation Doses Below NRC Regulatory Limits

Certain researchers have expressed an interest in a listing of the maximum doses received at NRC licensees that do not exceed the regulatory limits. This information allows for an examination of these doses and could possibly provide insights for where certain improvements could be made in the licensee's radiation protection program. Table 6.2 shows the maximum doses for each dose category required to be reported to the NRC. In addition, the number of doses in certain dose ranges is shown to reflect the number of doses that approach NRC regulatory limits. As shown in Table 6.2, 68 individuals exceed half of the TEDE dose limit, 13 individuals exceeded 75 percent of the TEDE dose limit, and 2 individuals exceeded 95 percent of the TEDE dose limit. The other dose category where individuals exceeded 50 percent of the dose limit was the shallow dose equivalent to the maximally exposed extremity (SDE-ME).

Table 6.1 Summary of Annual Dose Distributions for Certain* NRC Licensees 2007–2017

Year	Total Number of Monitored Individuals		Individuals with Dose (TEDE) ***			
			< 2 rem	> 2 rem	< 5 rem	> 5 rem
	Reported Number	Corrected Number **	%	Number	%	Number
2007	177,261	126,738	99.8%	246	100%	-
2008	182,095	132,273	99.9%	169	100%	-
2009	189,972	139,381	99.9%	181	100%	-
2010	192,436	142,523	99.9%	185	100%	-
2011	204,575	149,971	99.9%	199	100%	-
2012	205,134	148,316	99.9%	207	100%	-
2013	186,062	138,233	99.8%	142	100%	-
2014	185,843	135,817	99.8%	224	100%	-
2015	186,614	131,827	99.9%	133	99.9%	2
2016	164,984	121,129	99.9%	81	100%	-
2017	166,526	118,715	99.9%	164	99.9%	2

* Licensees required to submit radiation exposure reports to the NRC under 10 CFR 20.2206.
** This column lists the actual number of persons who may have been counted more than once because they worked at more than one facility during the calendar year (see Section 5).
*** Data for 2007–2017 are based on the distribution of individual doses after adjusting for the multiple counting of transient individuals (see Section 5).

Table 6.2 Maximum Occupational Doses for Each Exposure Category* 2017

Dose Category**	Annual Dose Limit 10CFR20***	Maximum Dose Reported (rem)	Max Dose Percent of the Limit	Number of Individuals with Measurable Dose	Number of Individuals >25% of the Limit	Number of Individuals >50% of the Limit	Number of Individuals >75% of the Limit	Number of Individuals >95% of the Limit	Number of Individuals > Limit
SDE-ME	50 rem	33.230	66%	44,470	51	7	-	-	-
SDE-WB	50 rem	10.031	20%	49,620	-	-	-	-	-
LDE	15 rem	5.124	34%	48,783	15	-	-	-	-
CEDE		0.627		2,266					
CDE		5.224		1,783					
DDE		5.077		49,415					
TEDE	5 rem	5.077	102%	50,463	649	68	13	2	2
TODE	50 rem	5.278	11%	49,901	-	-	-	-	-

* Only records reported by licensees required to report under 10 CFR 20.2206 are included. Numbers have been adjusted for the multiple reporting of transient individuals.

** SDE-ME = shallow dose equivalent to the maximally exposed extremity
SDE-WB= shallow dose equivalent to the whole body
LDE = lens dose equivalent to the lens of the eye
CEDE = committed effective dose equivalent
CDE = committed dose equivalent
DDE = deep dose equivalent
TEDE = total effective dose equivalent
TODE = total organ dose equivalent

*** Shaded boxes represent dose categories that do not have specific dose limits defined in 10 CFR Part 20.

7 REFERENCES

1. *Monthly Operating Report Data*, provided by the Institute of Nuclear Power Operations (INPO) and compiled by Idaho National Laboratory's Risk Assessment and Management Services Department under contract to the NRC.

2. National Council on Radiation Protection and Measurements*, Ionizing Radiation Exposure of the Population of the United States*, Report No. 160, 2009.

3. United Nations, *Sources and Effects of Ionizing Radiation, United Nations Scientific Committee on the Effects of Atomic Radiation UNSCEAR 2008 Report to the General Assembly, Volume I*, General Assembly of Official Records, United Nations, New York, 2010.

4. International Commission on Radiological Protection Publication 103, *The 2007 Recommendations of the International Commission on Radiological Protection*, Annals of the ICRP 37 (2–4), 2007.

5. U.S. Atomic Energy Commission, *Nuclear Power Plant Operating Experience During 1973*, USAEC Report 00E-ES-004, December 1974.

6. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience 1974–1975*, USNRC Report NUREG-0227, April 1977.*

7. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience 1976*, USNRC Report NUREG-0366, December 1977.*

8. M. R. Beebe, *Nuclear Power Plant Operating Experience—1977*, USNRC Report NUREG 0483, February 1979.*

9. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience — 1978*, USNRC Report NUREG-0618, December 1979.*

10. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience — 1979*, USNRC Report NUREG/CR-1496, May 1981.*

11. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience— 1980*, USNRC Report NUREG/CR-2378, ORNL/NSIC-191, October 1982.*

12. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience— 1981*, USNRC Report NUREG/CR-3430, ORNL/NSIC-215, Vol. 1, December 1983.*

13. U.S. Nuclear Regulatory Commission, *Nuclear Power Plant Operating Experience— 1982*, USNRC Report NUREG/CR-3430, ORNL/NSIC-215, Vol. 2, January 1985.*

* Report is available for purchase from the National Technical Information Service, Springfield, VA, 22161, and/or the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328.

14. U.S. Nuclear Regulatory Commission, *Consolidated Guidance about Materials Licenses,* USNRC Report NUREG‑1556, Volume 20, December 2000.*

15. U.S. Nuclear Regulatory Commission, *Instructions for Recording and Reporting Occupational Radiation Exposure Data*, USNRC Regulatory Guide 8.7, Rev. 4, May 2018.

16. 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*. July 18, 1990.

17. 10 CFR Part 70, *Domestic Licensing of Special Nuclear Material*, title 10, sec. 70. 2015.

18. International Commission on Radiological Protection Publication 30, *Limits for Intakes of Radionuclides by Workers*, Annals of the ICRP Volume 2 No 3/4, 1972.

19. International Commission on Radiological Protection Publication 68, *Dose Coefficients for Intakes of Radionuclides by Workers*, Annals of the ICRP Volume 24/4, December 1994.

20. U.S. Nuclear Regulatory Commission, *2017–2018 Information Digest*, USNRC Report NUREG 1350, Volume 29, December 2017.

21. U.S. Nuclear Regulatory Commission, Division of Decommissioning, Uranium Recovery, and Waste Programs, Office of Nuclear Material Safety and Safeguards, *Status of the Decommissioning Program, 2017 Annual Report*, ADAMS Accession No. ML17276B120.

22. U.S. Nuclear Regulatory Commission, Locations of Power Reactor Sites Undergoing Decommissioning. Available at: https://www.nrc.gov/info-finder/decommissioning/power-reactor/ - last reviewed/updated July 2018.

23. https://www.nrc.gov/reading-rm/basic-ref/glossary.html – last reviewed/updated July 2018.

* Report is available for purchase from the National Technical Information Service, Springfield, VA, 22161, and/or the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20402-9328.

APPENDIX A

ANNUAL TEDE FOR NONREACTOR NRC LICENSEES AND OTHER FACILITIES REPORTING TO THE NRC

2017

Table A1 Annual TEDE for Nonreactor NRC Licensees 2017

PROGRAM CODE - LICENSEE NAME	LICENSE #	Number of Individuals with Whole Body Doses in the Ranges (rem)*												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE (person-rem)	Average Meas. TEDE (rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
INDUSTRIAL RADIOGRAPHY — FIXED LOCATION — 03310																	
HARRISON STEEL CASTINGS CO.	13-02141-01	5	2	-	-	-	-	-	-	-	-	-	-	7	2	0.034	0.017
METALTEK INTERNATIONAL	24-26136-01	-	4	1	-	-	-	-	-	-	-	-	-	**5**	**5**	**0.291**	**0.058**
Total	**2**	**5**	**6**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**12**	**7**	**0.325**	**0.046**
INDUSTRIAL RADIOGRAPHY — TEMPORARY JOB SITE — 03320																	
ACUREN INSPECTION, INC.	22-27593-01	32	34	15	22	8	11	14	2	-	-	-	-	138	106	50.092	0.473
ALASKA INDUSTRIAL X-RAY	50-16084-01	-	3	3	1	-	-	4	-	-	-	-	-	11	11	5.943	0.540
ALONSO & CARUS IRON WORKS, INC.	52-21350-01	1	2	-	-	-	-	-	-	-	-	-	-	3	2	0.178	0.089
AMERICAN ENGINEERING TESTING, INC.	22-20271-02	1	2	3	-	2	1	1	-	-	-	-	-	10	9	4.619	0.513
AMERICAN PIPING INSPECTION	35-35011-01	-	-	-	1	2	2	2	1	-	-	-	-	8	8	8.590	1.074
APPLIED TECHNICAL SERVICES, INC.	10-35278-01	37	91	57	34	23	11	24	9	-	-	-	-	286	249	101.172	0.406
APPLUS RTD USA WEST	04-29076-02	11	19	12	14	12	4	7	-	-	-	-	-	79	68	28.282	0.416
CALUMET TESTING SERVICES, INC.	13-16347-01	3	5	1	3	-	2	1	1	-	-	-	-	16	13	6.672	0.513
CLEARWATER ENVIRONMENTAL, INC.	11-27746-01	6	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-
CONCRETE IMAGING, INC.	47-31316-01	1	2	1	3	-	1	-	-	-	-	-	-	8	7	2.034	0.291
CONSUMERS POWER COMPANY	21-08606-03	19	4	9	6	1	1	-	-	-	-	-	-	40	21	5.318	0.253
DBI, INC	15-29301-02	6	16	5	13	15	12	29	10	2	1	-	-	109	103	102.999	1.000
DIAMOND TECHNICAL SERVICES, INC.	37-31259-01	2	16	12	14	4	4	15	2	1	-	-	-	70	68	42.142	0.620
DOMINION NDT SERVICES, INC.	45-35118-01	-	3	1	1	1	1	1	-	-	-	-	-	8	8	3.688	0.461
ELECTRIC BOAT CORPORATION	06-01781-08	2	24	1	-	-	-	-	-	-	-	-	-	27	25	0.759	0.030
ENGINEERING & INSPECTIONS - HAWAII	53-27731-01	1	2	4	1	7	1	6	1	-	-	-	-	23	22	17.987	0.818
GE INSPECTION SERVICE, INC.	04-24888-01	2	3	-	-	-	-	-	-	-	-	-	-	5	3	0.081	0.027
GENERAL TESTING & INSPECTION CO.	47-32191-01	-	-	2	-	-	-	-	-	-	-	-	-	2	2	0.322	0.161
H & H X-RAY SERVUCES, INC	17-19236-01	10	8	14	14	24	24	48	13	1	-	-	-	156	146	149.593	1.025
HIGH COUNTRY FABRICATION	49-29300-01	-	4	2	-	-	-	-	-	-	-	-	-	6	6	0.662	0.110
HIGH MOUNTAIN INSPECTION SERVICES	49-26808-02	4	8	5	7	11	6	17	13	7	4	-	-	82	78	113.364	1.453
HSI GROUP, INC.	53-35428-01	-	5	4	2	-	-	-	-	-	-	-	-	11	11	1.754	0.159
HUNTINGTON INGALLS, INC.	45-09428-02	7	26	2	5	-	-	-	-	-	-	-	-	40	33	2.067	0.063

NOTE: The data values shown bolded and in boxes represent the highest value in each category. These values have not been adjusted for the multiple counting of transient workers (see section 5).

* Dose values exactly equal to the values separating ranges are reported in the next higher range.

Table A1 Annual TEDE for Nonreactor NRC Licensees 2017 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE #	Number of Individuals with Whole Body Doses in the Ranges (rem)*												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE (person-rem)	Average Meas. TEDE (rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
INDUSTRIAL RADIOGRAPHY — TEMPORARY JOB SITE — 03320 (Continued)																	
INSPECTION SERVICES ORGANIZATION	41-06832-06	6	3	1	1	-	-	-	-	-	-	-	-	11	5	0.596	0.119
INTEGRITY TESTLAB	07-30791-01	8	11	6	9	7	6	10	-	-	-	-	-	57	49	27.443	0.560
INTERTEK	17-29308-01	-	37	9	19	5	7	3	-	-	-	-	-	80	80	22.906	0.286
J CORE DRIILING, INC.	45-30846-01	1	2	1	-	-	-	-	-	-	-	-	-	**4**	**3**	**0.239**	0.080
JANX INTEGRITY GROUP	21-16560-01	166	49	43	92	73	60	91	21	4	1	-	-	**600**	**434**	**335.665**	0.773
KAKIVIK ASSET MANAGEMENT	50-27667-01	12	43	35	27	23	11	2	-	-	-	-	-	153	141	43.779	0.310
LEHIGH TESTING LABORATORIES, INC.	07-01173-03	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
LKS INSPECTION SERVICES, LLC	53-27795-01	-	4	1	1	1	-	-	-	-	-	-	-	7	7	1.200	0.171
MAGNUM MIDSTREAM, LP	37-35141-01	-	1	4	2	6	3	2	4	-	-	-	-	22	22	19.318	0.878
MARYLAND Q.C. LABORATORIES, INC.	19-28683-01	8	6	3	2	-	-	-	-	-	-	-	-	19	11	1.439	0.131
MATERIALS INTEGRITY, INC.	50-27722-01	1	3	-	-	-	-	-	-	-	-	-	-	4	3	0.112	0.037
METALS TESTING SERVICES, INC.	37-29406-02	1	1	1	1	1	2	-	-	-	-	-	-	7	6	3.047	0.508
MID AMERICAN INSPECTION SERVICES	21-26060-01	-	1	1	6	2	-	3	1	-	-	-	-	14	14	8.970	0.641
MISTRAS GROUP, INC.	12-16559-02	29	83	32	30	16	20	22	-	-	-	-	-	232	203	72.866	0.359
NATIONAL INSPECTION SERVICES LLC	17-35438-01	-	-	-	1	1	2	2	-	-	-	-	-	6	6	5.627	0.938
NONDESTRUCTIVE & VISUAL INSPECTION	17-29410-01	-	3	2	3	4	10	18	6	3	1	-	-	50	50	67.733	1.355
POLE BROTHERS IMAGING, LLC.	45-25383-01	-	-	1	1	1	-	-	-	-	-	-	-	3	3	1.202	0.401
QCI TESTING LAB	11-29245-01	3	2	-	-	1	-	-	-	-	-	-	-	6	3	0.750	0.250
QUALITY INSPECTION & TESTING	50-29038-01	-	-	-	-	2	-	1	-	-	-	-	-	3	3	2.422	0.807
QUALITY TESTING SERVICES, INC.	24-32292-01	8	2	3	2	2	-	-	-	-	-	-	-	17	9	2.290	0.254
RNDT, INC.	37-30942-02	2	8	4	5	7	5	4	-	-	-	-	-	35	33	16.042	0.486
SCIENTIFIC TECHNICAL, INC.	45-24882-01	3	3	-	-	-	-	-	-	-	-	-	-	6	3	0.142	0.047
SGS NORTH AMERICA INC	35-29433-01	12	18	9	3	6	1	3	1	-	-	-	-	53	41	14.134	0.345
SHAW PIPELINE SERVICES, INC.	35-23193-03	18	46	45	45	24	19	28	5	2	-	-	-	232	214	114.145	0.533
SOUTHWEST X-RAY CORP	49-29277-01	-	-	-	2	-	1	-	-	-	-	-	-	3	3	1.564	0.521
STANLEY PIPELINE INSPECTION LLC	35-35301-01	2	21	34	44	26	9	10	-	-	-	-	-	146	144	60.248	0.418
SYSTEM ONE HOLDINGS, LLC.	37-27891-02	-	19	3	2	1	4	-	3	-	-	-	-	32	32	12.617	0.394

NOTE: The data values shown bolded and in boxes represent the highest value in each category. These values have not been adjusted for the multiple counting of transient workers (see section 5).

* Dose values exactly equal to the values separating ranges are reported in the next higher range.

Table A1 Annual TEDE for Nonreactor NRC Licensees 2017 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE #	Number of Individuals with Whole Body Doses in the Ranges (rem)*												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE (person-rem)	Average Meas. TEDE (rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
INDUSTRIAL RADIOGRAPHY — TEMPORARY JOB SITE — 03320 (Continued)																	
TEAM INDUSTRIAL SERVICES, INC.	42-32219-01	18	61	24	28	30	14	12	4	-	-	-	-	191	173	71.822	0.415
TECH CORR USA, LLC	42-29261-01	1	1	-	2	1	1	3	-	-	-	-	-	9	8	6.283	0.785
TEI ANALYTICAL SERVICE	37-28004-01	5	4	4	7	12	6	14	1	-	-	-	-	53	48	35.235	0.734
TERRACON CONSULTANTS	24-35241-01	-	-	-	1	-	-	1	-	-	-	-	-	2	2	1.609	0.805
TESTING TECHNOLOGIES, INC.	45-25007-01	2	4	2	4	3	6	-	-	-	-	-	-	21	19	8.913	0.469
THERMAL ENGINEERING INTERNATIONAL	24-19500-01	4	1	-	-		-	-	-	-	-	-	-	5	1	0.011	0.011
TUV RHEINLAND INDUSTRIAL SOLUTIONS	37-32340-02	-	1	-	2	1	1	1	-	-	-	-	-	6	6	3.080	0.513
VALLEY INSPECTION SERVICE INC	37-28385-01	1	1	1	-	2	-	1	1	1	1	2	-	11	10	23.133	**2.313**
VERSA INTEGRITY GROUP	17-35243-01	14	25	18	17	13	15	18	3	4	-	-	-	127	113	74.508	0.659
WR NON DESTRUCTIVE TESTING, INC.	52-25538-01	-	4	-	-	-	-	-	-	-	-	-	-	4	4	0.125	0.031
Total	**60**	**472**	**745**	**440**	**500**	**381**	**284**	**418**	**102**	**25**	**8**	**2**	**0**	**3,377**	**2,905**	**1,709.533**	**0.588**
MANUFACTURING AND DISTRIBUTION – NUCLEAR PHARMACIES – 02500																	
ADVANCED ISOTOPES OF IDAHO	11-29216-01MD	1	-	14	3	-	-	-	-	-	-	-	-	18	17	3.003	0.177
CARDINAL HEALTH	04-26507-01MD	3	12	1	1	-	-	-	-	-	-	-	-	17	14	0.708	0.051
CARDINAL HEALTH	11-27664-01MD	2	6	2	-	-	-	-	-	-	-	-	-	10	8	0.339	0.042
CARDINAL HEALTH	34-29200-01MD	84	193	22	1	1	1	1	2	1	-	-	-	**306**	**222**	**18.695**	0.084
CARDINAL HEALTH	47-25322-01MD	8	1	1	-	-	-	-	-	-	-	-	-	10	2	0.194	0.097
GE HEALTHCARE - KENTWOOD	21-26707-01MD	12	7	1	-	-	-	-	-	-	-	-	-	20	8	0.287	**0.036**
GE HEALTHCARE - LIVONIA	21-24828-01MD	8	8	3	1	-	-	-	-	-	-	-	-	20	12	1.210	0.101
GE HEALTHCARE - ST. LOUIS/OVERLAND	24-32462-01MD	5	4	1	-	-	-	-	-	-	-	-	-	10	5	0.244	0.049
LAKEVIEW DIAGNOSTIC, LLC	21-32817-01MD	1	3	1	-	-	-	-	-	-	-	-	-	5	4	0.294	0.074
LANTHEUS MI	52-25361-01MD	-	18	1	4	3	3	1	-	-	-	-	-	30	30	8.052	0.268
MID-AMERICA ISOTOPES, INC.	24-26241-01MD	30	1	1	2	-	-	-	-	-	-	-	-	34	4	0.920	0.230
PHARMALOGIC MT, INC.	09-29398-01MD	4	15	1	-	-	-	-	-	-	-	-	-	20	16	0.290	0.018
PHARMALOGIC WY, INC.	49-27629-01MD	7	8	-	-	-	-	-	-	-	-	-	-	15	8	0.119	0.015
RADIOPHARMACY OF INDIANAPOLIS	13-32637-01MD	20	-	3	2	1	-	-	-	-	-	-	-	26	6	1.772	**0.295**

NOTE: The data values shown bolded and in boxes represent the highest value in each category. These values have not been adjusted for the multiple counting of transient workers (see section 5).

* Dose values exactly equal to the values separating ranges are reported in the next higher range.

Table A1 Annual TEDE for Nonreactor NRC Licensees 2017 (continued)

PROGRAM CODE - LICENSEE NAME	LICENSE #	Number of Individuals with Whole Body Doses in the Ranges (rem)*												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE (person-rem)	Average Meas. TEDE (rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
MANUFACTURING AND DISTRIBUTION – NUCLEAR PHARMACIES – 02500																	
RADIOPHARMACY, INC.	13-26246-01MD	13	11	3	3	-	-	-	-	-	-	-	-	30	17	1.708	0.100
TRIAD ISOTOPES	09-32781-01MD	8	9	2	-	-	-	-	-	-	-	-	-	19	11	0.728	0.066
TRIAD ISOTOPES	09-32781-04MD	7	8	-	-	-		-	-	-	-	-	-	15	8	0.249	0.031
TRIAD ISOTOPES	24-04206-10MD	2	15	2	-	-	-	-	-	-	-	-	-	19	17	0.671	0.039
Total	**18**	**215**	**319**	**59**	**17**	**5**	**4**	**2**	**2**	**1**	**0**	**0**	**0**	**624**	**409**	**39.483**	**0.097**
MANUFACTURING AND DISTRIBUTION – TYPE "A" BROAD – 03211																	
INTERNATIONAL ISOTOPES IDAHO, INC.	11-27680-01	-	-	2	7	2	3	7	4	-	-	-	-	25	25	24.698	**0.988**
MALLINCKRODT, LLC	24-04206-01	110	65	35	27	21	11	16	5	-	-	-	-	**290**	**180**	**74.880**	0.416
Total	**2**	**110**	**65**	**37**	**34**	**23**	**14**	**23**	**9**	**0**	**0**	**0**	**0**	**315**	**205**	**99.578**	**0.486**
MANUFACTURING AND DISTRIBUTION – OTHER – 03214																	
BETACONTROL OF AMERICA, INC.	29-23394-01	-	1	-	-	-	-	-	-	-	-	-	-	**1**	**1**	**0.010**	**0.010**
Total	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0.010**	**0.010**
INDEPENDENT SPENT FUEL STORAGE INSTALLATION – 23200																	
GENERAL ELECTRIC - MORRIS ISFSI	SNM-2500	1	18	2	-	-	-	-	-	-	-	-	-	21	**20**	**0.631**	**0.032**
PORTLAND GENERAL ELECTRIC CO.	SNM-2509	46	-	-	-	-	-	-	-	-	-	-	-	**46**	-	-	-
Total	**2**	**47**	**18**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**67**	**20**	**0.631**	**0.032**
URANIUM HEXAFLUORIDE (UF_6) PROD UCTION PLANTS - 11400																	
HONEYWELL INTERNATIONAL, INC.	SUB-0526	31	437	100	44	1	-	1	-	-	-	-	-	**614**	**583**	**48.858**	**0.084**
Total	**1**	**31**	**437**	**100**	**44**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**614**	**583**	**48.858**	**0.084**
FUEL CYCLE URANIUM ENRICHMENT PLANTS – 21200																	
CENTRUS ENERGY	SNM-7003	184	4	-	-	-	-	-	-	-	-	-	-	**188**	**4**	**0.049**	**0.012**
Total	**1**	**184**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**188**	**4**	**0.049**	**0.012**
FUEL CYCLE FUEL FABRICATION FACILITIES – 21210																	
BWXT NUCLEAR OPERATIONS GROUP, INC	SNM-0042	44	188	31	3	1	-	1	1	-	-	-	-	269	225	16.964	0.075
FRAMATOME INC.	SNM-1227	796	510	66	69	15	1	-	-	-	-	-	-	**1,457**	**661**	56.295	0.085
GLOBAL NUCLEAR FUEL - AMERICAS, LLC	SNM-1097	225	336	91	35	2	-	-	-	-	-	-	-	689	464	36.785	0.079
NUCLEAR FUEL SERVICES, INC.	SNM-0124	628	458	32	-	-	-	-	-	-	-	-	-	1,118	490	8.380	0.017
WESTINGHOUSE ELECTRIC COMPANY	SNM-1107	220	199	167	115	21	1	-	-	-	-	-	-	723	503	**87.666**	**0.174**
Total	**5**	**1,913**	**1,691**	**387**	**222**	**39**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**4,256**	**2,343**	**206.090**	**0.088**

NOTE: The data values shown bolded and in boxes represent the highest value in each category. These values have not been adjusted for the multiple counting of transient workers (see section 5).

* Dose values exactly equal to the values separating ranges are reported in the next higher range.

Table A2 Other Facilities Reporting to the NRC 2017

PROGRAM CODE - LICENSEE NAME	LICENSE #	Number of Individuals with Whole Body Doses in the Ranges (rem)*												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE (person-rem)	Average Meas. TEDE (rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0				
MEDICAL INSTITUTION — QMP NOT REQUIRED — 02121																	
MINIDOKA MEMORIAL HOSPITAL	11-29085-01	-	1	-	-	-	-	-	-	-	-	-	-	**1**	**1**	**0.010**	**0.010**
Total	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0.010**	**0.010**
INSTRUMENT CALIBRATION SERVICE ONLY — SOURCE > 100 CURIES — 03222																	
ELECTRIC BOAT CORPORATION	06-01781-03	3	1	-	-	-	-	-	-	-	-	-	-	**4**	**1**	**0.001**	**0.001**
Total	**1**	**3**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**4**	**1**	**0.001**	**0.001**
RESEARCH AND DEVELOPMENT, TYPE A BROAD — 03610																	
MALLINCKRODT, INC.	24-17450-01	46	2	-	-	-	-	-	-	-	-	-	-	**48**	**2**	**0.026**	**0.013**
Total	**1**	**46**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**48**	**2**	**0.026**	**0.013**
MASTER MATERIALS — ISSUED TO GOVERNMENT AGENCIES — 03614																	
NAVY, DEPARTMENT OF THE	45-42158-A1NP	70	185	2	-	-	-	-	-	-	-	-	-	**257**	**187**	**2.916**	**0.016**
Total	**1**	**70**	**185**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**257**	**187**	**2.916**	**0.016**
RESEARCH AND DEVELOPMENT, OTHER — 03620																	
APS TECHNOLOGY	06-35157-01	7	-	-	-	-	-	-	-	-	-	-	-	**7**	**-**	**-**	**-**
HEALTH & HUMAN SERVICES, DEPT. OF	19-07538-05	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
Total	**2**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0.000**	**0**
ACCELERATOR-PRODUCED RADIONUCLIDES - 03210																	
CARDINAL HEALTH	34-32840-01	-	4	3	3	2	-	-	1	-	-	-	-	**13**	**13**	**4.886**	**0.376**
Total	**1**	**0**	**4**	**3**	**3**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**13**	**4.886**	**0.376**
WASTE DISPOSAL SERVICE PROCESSING AND/OR REPACKAGING - 03234																	
ENERGYSOLUTIONS	39-35044-01	28	8	-	-	-	-	-	-	-	-	-	-	**36**	**8**	**0.363**	**0.045**
Total	**1**	**28**	**8**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**36**	**8**	**0.363**	**0.045**
TEST REACTOR FACILITIES — 42140*																	
NAT'L INSTITUTE OF STANDARDS & TECH	TR-5	25	111	21	5	-	-	-	-	-	-	-	-	**162**	**137**	**9.208**	**0.067**
Total	**1**	**25**	**111**	**21**	**5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**162**	**137**	**9.208**	**0.067**
PROGRAM CODE — 42150																	
AEROTEST OPERATIONS, INC.	R-98	5	4	-	-	-	-	-	-	-	-	-	-	**9**	**4**	**0.218**	**0.055**
Total	**1**	**5**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**9**	**4**	**0.218**	**0.055**

NOTE: The data values shown bolded and in boxes represent the highest value in each category. These values have not been adjusted for the multiple counting of transient workers (see section 5).

* Dose values exactly equal to the values separating ranges are reported in the next higher range.

** Test reactor facilities are required to report to the NRC, but only two facilities report under this category and one of the facilities is in decommissioning.

APPENDIX B

ANNUAL DOSES AT LICENSED NUCLEAR POWER FACILITIES

2017

Annual Doses* at Licensed Nuclear Power Facilities
2017

PLANT NAME	TYPE	Number of Individuals with Annual Doses* in the Ranges (rem)**												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE per Site (person-rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0			
ARKANSAS 1, 2	PWR	1,489	1,512	214	28	3	-	-	-	-	-	-	-	3,246	1,757	86.504
BEAVER VALLEY 1, 2	PWR	1,630	614	136	25	1	-	-	-	-	-	-	-	2,406	776	53.706
BRAIDWOOD 1, 2	PWR	1,846	816	182	46	8	-	-	-	-	-	-	-	2,898	1,052	78.668
BROWNS FERRY 1, 2, 3	BWR	1,078	1,784	608	326	80	16	5	-	-	-	-	-	3,897	2,819	350.062
BRUNSWICK 1, 2	BWR	2,226	1,129	373	168	55	17	6	-	-	-	-	-	3,974	1,748	216.013
BYRON 1, 2	PWR	2,158	1,017	209	52	2	-	-	-	-	-	-	-	3,438	1,280	87.846
CALLAWAY 1	PWR	1,319	446	59	2	-	-	-	-	-	-	-	-	1,826	507	23.713
CALVERT CLIFFS 1, 2	PWR	1,714	517	134	34	1	-	-	-	-	-	-	-	2,400	686	49.283
CATAWBA 1, 2	PWR	2,035	549	89	4	-	-	-	-	-	-	-	-	2,677	642	32.236
CLINTON	BWR	1,619	825	359	120	26	10	1	-	-	-	-	-	2,960	1,341	154.579
COLUMBIA GENERATING	BWR	968	1,194	308	160	46	11	5	-	-	-	-	-	2,692	1,724	180.255
COMANCHE PEAK 1, 2	PWR	1,402	667	263	88	26	7	1	-	-	-	-	-	2,454	1,052	120.996
COOK 1, 2	PWR	2,252	658	133	33	6	-	-	-	-	-	-	-	3,082	830	57.999
COOPER STATION	BWR	631	297	76	18	3	-	-	-	-	-	-	-	1,025	394	30.193
DAVIS-BESSE 1	PWR	1,085	69	-	-	-	-	-	-	-	-	-	-	1,154	69	1.621
DIABLO CANYON 1, 2	PWR	1,755	630	139	17	1	-	-	-	-	-	-	-	2,542	787	47.910
DRESDEN 2, 3	BWR	1,574	1,525	356	42	4	1	-	-	-	-	-	-	3,502	1,928	129.266
DUANE ARNOLD	BWR	919	172	45	10	1	-	-	-	-	-	-	-	1,147	228	17.336
FARLEY 1, 2	PWR	1,716	486	86	3	-	-	-	-	-	-	-	-	2,291	575	31.351
FERMI 2	BWR	1,283	1,274	380	264	70	26	11	-	-	-	-	-	3,308	2,025	265.082
FITZPATRICK	BWR	1,481	648	291	139	46	10	5	-	-	-	-	-	2,620	1,139	162.196
GINNA	PWR	1,019	444	150	19	1	-	-	-	-	-	-	-	1,633	614	46.173
GRAND GULF	BWR	1,336	405	95	33	4	1	-	-	-	-	-	-	1,874	538	40.251
HARRIS 1	PWR	1,182	12	-	-	-	-	-	-	-	-	-	-	1,194	12	0.217
HATCH 1, 2	BWR	1,617	800	241	67	17	1	-	-	-	-	-	-	2,743	1,126	101.422
HOPE CREEK 1	BWR	324	312	65	30	5	-	-	-	-	-	-	-	736	412	31.919
INDIAN POINT 2, 3	PWR	754	1,637	173	64	17	6	2	-	-	-	-	-	2,653	1,899	102.735
LASALLE 1, 2	BWR	1,249	1,453	597	428	195	105	46	-	-	-	-	-	**4,073**	**2,824**	**570.389**
LIMERICK 1, 2	BWR	2,157	1,252	351	170	29	4	2	-	-	-	-	-	3,965	1,808	183.736
MCGUIRE 1, 2	PWR	1,963	1,132	346	115	13	1	-	-	-	-	-	-	3,570	1,607	147.589
MILLSTONE 2, 3	PWR	2,102	756	244	99	14	5	-	-	-	-	-	-	3,220	1,118	112.598
MONTICELLO	BWR	1,669	448	218	109	31	7	2	-	-	-	-	-	2,484	815	115.814
NINE MILE POINT 1, 2	BWR	1,475	946	317	119	10	7	2	-	-	-	-	-	2,876	1,401	141.150
NORTH ANNA 1, 2	PWR	2,439	560	85	31	2	-	-	-	-	-	-	-	3,117	678	44.884

NOTE: The data values shown bolded and in boxes represent the highest value in each category. Totals corrected for transients on page B-2.

* These doses are annual TEDE doses.
** Dose values exactly equal to the values separating ranges are reported in the next higher range.

Annual Doses* at Licensed Nuclear Power Facilities
2017 (continued)

PLANT NAME	TYPE	Number of Individuals with Annual Doses* in the Ranges (rem)**												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE per Site (person-rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0			
OCONEE 1, 2, 3	PWR	2,785	922	44	-	-	-	-	-	-	-	-	-	3,751	966	37.301
OYSTER CREEK	BWR	706	197	39	11	1	1	-	-	-	-	-	-	955	249	17.511
PALISADES	PWR	903	398	193	110	53	29	11	-	-	-	-	-	1,697	794	154.142
PALO VERDE 1, 2, 3	PWR	2,759	940	127	17	3	1	-	-	-	-	-	-	3,847	1,088	53.888
PEACH BOTTOM 2, 3	BWR	1,477	1,199	432	157	22	9	5	-	-	-	-	-	3,301	1,824	197.814
PERRY	BWR	1,275	630	349	279	123	40	28	-	-	-	-	-	2,724	1,449	327.717
PILGRIM 1	BWR	398	1,159	261	143	31	16	4	-	-	-	-	-	2,012	1,614	162.998
POINT BEACH 1, 2	PWR	1,145	464	192	81	17	1	-	-	-	-	-	-	1,900	755	87.479
PRAIRIE ISLAND 1, 2	PWR	1,326	457	86	13	2	-	-	-	-	-	-	-	1,884	558	34.322
QUAD CITIES 1, 2	BWR	1,297	1,321	431	118	16	1	1	-	-	-	-	-	3,185	1,888	173.167
RIVER BEND 1	BWR	1,504	817	309	211	107	41	15	-	-	-	-	-	3,004	1,500	273.004
ROBINSON 2	PWR	1,423	692	170	21	-	-	-	-	-	-	-	-	2,306	883	58.739
SALEM 1, 2	PWR	1,370	1,319	276	128	22	-	-	-	-	-	-	-	3,115	1,745	135.197
SEABROOK	PWR	1,294	432	81	6	-	-	-	-	-	-	-	-	1,813	519	29.191
SEQUOYAH 1, 2	PWR	1,883	710	99	17	5	-	-	-	-	-	-	-	2,714	831	47.200
SOUTH TEXAS 1, 2	PWR	1,863	432	146	38	4	-	-	-	-	-	-	-	2,483	620	55.025
ST LUCIE 1, 2	PWR	1,541	726	151	53	3	-	-	-	-	-	-	-	2,474	933	71.123
SUMMER 1	PWR	1,722	704	138	13	1	-	-	-	-	-	-	-	2,578	856	50.308
SURRY 1, 2	PWR	2,583	591	152	36	2	-	-	-	-	-	-	-	3,364	781	58.012
SUSQUEHANNA 1, 2	BWR	2,315	915	335	152	30	7	1	-	-	-	-	-	3,755	1,440	165.468
THREE MILE ISLAND 1	PWR	1,328	712	255	39	3	-	-	-	-	-	-	-	2,337	1,009	82.657
TURKEY POINT 3, 4	PWR	1,505	729	266	103	6	-	-	-	-	-	-	-	2,609	1,104	108.200
VOGTLE 1, 2	PWR	2,025	672	198	62	6	-	-	-	-	-	-	-	2,963	938	80.556
WATERFORD 3	PWR	1,403	721	130	36	7	-	-	-	-	-	-	-	2,297	894	60.728
WATTS BAR 1, 2	PWR	2,177	839	192	38	3	1	1	-	-	-	-	-	3,251	1,074	75.672
WOLF CREEK 1	PWR	838	236	2	-	-	-	-	-	-	-	-	-	1,076	238	3.437
Totals BWRs (34 Units)	**BWR**	**30,578**	**20,702**	**6,836**	**3,274**	**952**	**331**	**139**	**0**	**0**	**0**	**0**	**0**	**62,812**	**32,234**	**4,007.342**
Totals PWRs (65 Units)	**PWR**	**61,733**	**25,218**	**5,540**	**1,471**	**232**	**51**	**15**	**0**	**0**	**0**	**0**	**0**	**94,260**	**32,527**	**2,409.206**
Total LWRs (99 Units)	**LWRs**	**92,311**	**45,920**	**12,376**	**4,745**	**1,184**	**382**	**154**	**0**	**0**	**0**	**0**	**0**	**157,072**	**64,761**	**6,416.548**
Corrected for Transients †	**LWRs**	**62,882**	**29,448**	**9,210**	**4,695**	**1,666**	**671**	**532**	**11**	**0**	**0**	**0**	**0**	**109,115**	**46,233**	**6,416.548**

* These doses are annual TEDE doses.
** Dose values exactly equal to the values separating ranges are reported in the next higher range.
† Totals corrected for transients and include all LWRs in commercial operation for a full year.

Annual Doses* at Licensed Nuclear Power Facilities
2017 (continued)

PLANT NAME	TYPE	Number of Individuals with Annual Doses* in the Ranges (rem)**												Total Number Monitored	Number with Meas. Dose	Total Collective TEDE per Site (person-rem)
		No Meas. Exposure	Meas. <0.10	0.10-0.25	0.25-0.50	0.50-0.75	0.75-1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0	5.0-6.0	>6.0			
REACTORS NO LONGER IN COMMERCIAL OPERATION																
CRYSTAL RIVER 3	PWR	356	56	12	-	-	-	-	-	-	-	-	-	424	68	4.133
FERMI 1	FBR	79	-	-	-	-	-	-	-	-	-	-	-	79	-	-
FT CALHOUN	PWR	555	69	2	1	-	-	-	-	-	-	-	-	**627**	72	2.770
GE VALLECITOS	VBWR	93	81	11	8	5	1	-	-	-	-	-	-	199	106	9.823
GE ESADA VALLECITOS	EVESR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HUMBOLDT BAY	BWR	13	-	-	-	-	-	-	-	-	-	-	-	13	-	-
KEWAUNEE	PWR	195	39	20	5	-	-	-	-	-	-	-	-	259	64	6.167
LACROSSE	BWR	127	35	14	9	-	-	-	-	-	-	-	-	185	58	6.356
PEACH BOTTOM 1	HTGR	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SAN ONOFRE 1, 2, 3	PWR	580	1	-	-	-	-	-	-	-	-	-	-	580	1	0.005
SAVANNAH, NUCLEAR SHIP	NS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
VERMONT YANKEE	BWR	332	77	38	12	1	-	-	-	-	-	-	-	460	**128**	**13.698**
ZION 1, 2	PWR	347	63	9	3	-	-	-	-	-	-	-	-	422	75	4.542
Total Reporting* **	**13**	**2,677**	**421**	**106**	**38**	**6**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3,248**	**572**	**47.494**
REACTORS NO LONGER IN COMMERCIAL OPERATION, REPORTED WITH OTHER UNITS																
DRESDEN 1	BWR	Reported with Dresden 2, 3.														
INDIAN POINT 1	PWR	Reported with Indian Point 2, 3.														
MILLSTONE 1	BWR	Reported with Millstone 2, 3.														
THREE MILE ISLAND 2	PWR	Reported with Three Mile Island 1.														
REACTORS NO LONGER IN COMMERCIAL OPERATION, DECOMMISSIONED																
BIG ROCK POINT	BWR	28	-	-	-	-	-	-	-	-	-	-	-	28	-	-
HADDAM NECK	PWR	27	11	-	-	-	-	-	-	-	-	-	-	38	**11**	**0.182**
MAINE YANKEE	PWR	38	3	-	-	-	-	-	-	-	-	-	-	**41**	3	0.054
TROJAN	PWR	Reported as ISFSI (See Appendix A).														
YANKEE-ROWE	PWR	27	7	-	-	-	-	-	-	-	-	-	-	34	7	0.112
Total Reporting* **	**5**	**120**	**21**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**141**	**21**	**0.348**

NOTE: Totals corrected for transients on page B-2.

* These doses are annual TEDE doses.
** Dose values exactly equal to the values separating ranges are reported in the next higher range.
*** These numbers are for the reactors no longer in commercial operation that report their doses separately (i.e., do not report their doses with other units).

APPENDIX C

PERSONNEL, DOSE, AND POWER GENERATION SUMMARY

1969–2017

A discussion of the methods used to collect and calculate the information contained in this appendix is given in Sections 3.1 and 4.2.

APPENDIX C Personnel, Dose, and Power Generation Summary 1969-2017

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
ARKANSAS 1, 2	1975	588.0	76.5	147	21	0.14	0.04
Docket 50-313, 50-368;	1976	464.6	56.6	476	289	0.61	0.62
DPR-51; NPF-6	1977	610.3	76.8	601	256	0.43	0.42
1st commercial operation	1978	627.2	77.5	722	189	0.26	0.30
12/74, 3/80	1979	397.0	55.3	1,321	369	0.28	0.93
Type - PWRs	1980	452.8	63.7	1,233	342	0.28	0.76
Capacity - 836, 988 MWe	1981	1,104.7	68.3	2,225	1,102	0.50	1.00
	1982	905.4	58.6	1,608	803	0.50	0.89
	1983	915.0	54.7	2,109	1,397	0.66	1.53
	1984	1,289.1	77.4	1,742	806	0.46	0.63
	1985	1,192.3	73.6	1,262	286	0.23	0.24
	1986	1,070.3	66.9	2,135	1,141	0.53	1.07
	1987	1,366.1	88.9	1,123	382	0.34	0.28
	1988	1,070.3	69.4	2,421	1,387	0.57	1.30
	1989	1,066.3	72.0	2,063	711	0.34	0.67
	1990	1,351.9	84.2	2,493	762	0.31	0.56
	1991	1,515.8	88.4	2,064	351	0.17	0.23
	1992	1,352.1	77.4	3,114	876	0.28	0.65
	1993	1,606.0	91.3	1,981	268	0.14	0.17
	1994	1,662.8	93.6	1,361	172	0.13	0.10
	1995	1,397.0	82.7	2,259	386	0.17	0.28
	1996	1,596.0	89.5	1,441	203	0.14	0.13
	1997	1,621.9	95.9	1,195	119	0.10	0.07
	1998	1,494.6	88.1	1,249	166.599	0.13	0.11
	1999	1,477.3	86.9	1,463	183.997	0.13	0.12
	2000	1,329.2	79.5	1,977	242.326	0.12	0.18
	2001	1,684.0	95.8	1,082	106.040	0.10	0.06
	2002	1,659.0	91.8	1,581	265.337	0.17	0.16
	2003	1,675.8	93.1	973	99.003	0.10	0.06
	2004	1,759.5	95.0	1,227	106.172	0.09	0.06
	2005	1,560.0	84.5	2,335	475.784	0.20	0.30
	2006	1,739.8	95.0	1,184	143.296	0.12	0.08
	2007	1,769.3	96.0	1,387	105.310	0.08	0.06
	2008	1,614.8	89.7	1,791	196.047	0.11	0.12
	2009	1,733.7	95.5	1,139	102.732	0.09	0.06
	2010	1,716.6	93.7	1,388	99.376	0.07	0.06
	2011	1,621.9	90.5	1,526	116.884	0.08	0.07
	2012	1,764.5	96.2	931	43.908	0.05	0.02
	2013	1,366.6	74.3	1,098	50.041	0.05	0.04
	2014	1,654.6	92.3	1,372	71.561	0.05	0.04
	2015	1,582.0	87.5	1,881	136.727	0.07	0.09
	2016	1,535.7	84.0	1,674	111.105	0.07	0.07
	2017	1,451.4	83.4	1,757	86.504	0.05	0.06
BEAVER VALLEY 1, 2	1977	355.6	57.0	331	87	0.26	0.24
Docket 50-334, 50-412;	1978	304.2	40.8	646	190	0.29	0.62
DPR-66; NPF-73	1979	221.0	40.0	704	132	0.19	0.60
1st commercial operation	1980	39.8	6.8	1,817	553	0.30	13.89
10/76, 11/87	1981	573.4	73.6	1,237	229	0.19	0.40
Type - PWRs	1982	326.7	41.6	1,755	599	0.34	1.83
Capacity - 908, 905 MWe	1983	561.2	68.2	1,485	772	0.52	1.38
	1984	576.7	71.8	1,393	504	0.36	0.87
	1985	717.7	91.9	619	60	0.10	0.08
	1986	581.3	70.7	1,575	627	0.40	1.08
	1987	684.1	83.8	1,282	210	0.16	0.31
	1988	1,386.1	87.4	1,764	530	0.30	0.38
	1989	1,017.4	69.6	2,349	1,378	0.59	1.35
	1990	1,271.0	85.3	1,675	348	0.21	0.27
	1991	1,267.5	78.6	1,689	495	0.29	0.39
	1992	1,441.9	89.1	1,414	289	0.20	0.20
	1993	1,157.9	73.1	2,087	621	0.30	0.54
	1994	1,514.6	88.6	487	44	0.09	0.03
	1995	1,389.2	83.1	1,536	453	0.29	0.33
	1996	1,269.0	76.5	1,688	449	0.27	0.35

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
BEAVER VALLEY 1, 2 (continued)	1997	1,159.3	72.1	1,391	306	0.22	0.26
	1998	523.1	33.5	700	59.311	0.08	0.11
	1999	1,353.7	85.9	841	99.461	0.12	0.07
	2000	1,378.7	87.3	1,730	337.867	0.20	0.25
	2001	1,500.8	92.3	1,202	184.361	0.15	0.12
	2002	1,548.0	95.4	1,048	90.479	0.09	0.06
	2003	1,437.0	88.4	1,623	277.168	0.17	0.19
	2004	1,593.1	96.3	1,270	156.509	0.12	0.10
	2005	1,590.4	96.7	978	79.055	0.08	0.05
	2006	1,385.6	84.0	2,174	370.146	0.17	0.27
	2007	1,664.1	96.0	955	86.595	0.09	0.05
	2008	1,670.2	94.4	991	83.394	0.08	0.05
	2009	1,599.3	89.6	1,504	224.516	0.15	0.14
	2010	1,714.2	95.6	750	49.983	0.07	0.03
	2011	1,705.5	95.1	831	72.206	0.09	0.04
	2012	1,622.6	90.4	1,272	125.166	0.10	0.08
	2013	1,687.4	93.3	746	41.712	0.06	0.02
	2014	1,684.6	92.5	907	62.951	0.07	0.04
	2015	1,659.6	91.1	1,115	95.208	0.09	0.06
	2016	1,737.4	94.8	687	44.146	0.06	0.03
	2017	1,747.9	95.5	776	53.706	0.07	0.03
BIG ROCK POINT[1] Docket 50-155; DPR-6 1st commercial operation 3/63 Type - BWR Capacity - (67) MWe	1969	48.1	---	165	136	0.82	2.83
	1970	43.5	---	290	194	0.67	4.46
	1971	44.4	---	260	184	0.71	4.14
	1972	43.5	---	195	181	0.93	4.16
	1973	50.9	---	241	285	1.18	5.60
	1974	40.7	70.3	281	276	0.98	6.78
	1975	35.1	59.8	300	180	0.60	5.13
	1976	29.5	50.1	488	289	0.59	9.80
	1977	43.6	73.4	465	334	0.72	7.66
	1978	48.5	77.9	285	175	0.61	3.61
	1979	13.0	23.5	623	455	0.73	35.00
	1980	48.9	79.0	599	354	0.59	7.24
	1981	56.9	90.6	479	160	0.33	2.81
	1982	43.6	70.8	521	328	0.63	7.52
	1983	42.3	71.0	493	263	0.53	6.22
	1984	50.3	78.6	297	155	0.52	3.08
	1985	43.8	73.5	435	291	0.67	6.64
	1986	61.0	95.5	202	84	0.42	1.38
	1987	45.3	71.0	251	222	0.88	4.90
	1988	46.1	72.8	303	170	0.56	3.69
	1989	50.2	79.0	418	177	0.42	3.53
	1990	51.3	77.2	351	232	0.66	4.52
	1991	59.1	85.2	435	226	0.52	3.82
	1992	32.7	54.5	496	277	0.56	8.47
	1993	51.2	79.4	419	152	0.36	2.97
	1994	49.5	75.3	310	119	0.38	2.40
	1995	62.2	95.0	205	54	0.26	0.87
	1996	41.5	76.5	1,688	449	0.27	0.35
	1997	22.4	54.1	258	55	0.21	2.46
	1998	0.0	0.0	432	104.130	0.24	---
	1999	0.0	0.0	285	86.577	0.30	---
	2000	0.0	0.0	226	89.271	0.40	---
	2001	0.0	0.0	167	47.556	0.28	---
	2002	0.0	0.0	170	43.538	0.26	---
	2003	0.0	0.0	336	121.045	0.36	---
	2004	0.0	0.0	227	57.599	0.25	---
	2005	0.0	0.0	223	20.227	0.09	---
	2006	0.0	0.0	27	0.382	0.01	---
	2007	0.0	0.0	0	0.000	---	---

[1] Big Rock Point ceased operations in August 1997 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
BRAIDWOOD 1, 2	1989	1,381.8	75.4	1,460	296	0.20	0.21
Docket 50-456, 50-457;	1990	1,740.2	84.1	1,081	186	0.17	0.11
NPF-72, NPF-77	1991	1,377.2	68.9	1,641	550	0.34	0.40
1st commercial operation	1992	1,885.9	89.0	1,059	228	0.22	0.12
7/88, 10/88	1993	1,899.3	86.9	1,043	273	0.26	0.14
Type - PWRs	1994	1,666.1	77.2	1,237	298	0.24	0.18
Capacity - 1,166, 1,144 MWe	1995	1,914.7	85.4	1,134	236	0.21	0.12
	1996	1,854.9	82.1	1,356	334	0.25	0.18
	1997	1,863.3	85.4	1,693	321	0.19	0.17
	1998	1,979.1	88.9	1,869	259.236	0.14	0.13
	1999	2,161.6	95.8	1,153	145.976	0.13	0.07
	2000	2,142.8	94.9	1,562	194.126	0.12	0.09
	2001	2,186.4	95.8	881	100.570	0.11	0.05
	2002	2,284.0	96.8	975	90.716	0.09	0.04
	2003	2,279.9	95.6	1,572	244.860	0.16	0.11
	2004	2,277.8	97.3	986	94.942	0.10	0.04
	2005	2,253.7	96.6	926	88.084	0.10	0.04
	2006	2,234.1	95.0	1,624	199.168	0.12	0.09
	2007	2,244.0	96.0	1,258	98.040	0.08	0.04
	2008	2,252.5	96.3	1,235	103.180	0.08	0.05
	2009	2,195.0	93.8	1,397	142.066	0.10	0.06
	2010	2,111.9	94.0	870	63.856	0.07	0.03
	2011	2,257.5	96.8	1,071	70.165	0.07	0.03
	2012	2,141.0	92.1	1,818	167.655	0.09	0.08
	2013	2,244.2	96.2	633	31.847	0.05	0.01
	2014	2,313.9	97.3	866	42.493	0.05	0.02
	2015	2,250.0	94.9	986	52.468	0.05	0.02
	2016	2,265.9	96.0	733	39.695	0.05	0.02
	2017	2,281.4	96.4	1,052	78.668	0.07	0.03
BROWNS FERRY 1[2], 2, 3	1975	161.7	17.8	2,743	347	0.13	2.15
Docket 50-259, 50-260, 50-296;	1976	337.6	26.9	2,530	232	0.09	0.69
DPR-33, DPR-52, DPR-68	1977	1,327.5	73.7	1,985	876	0.44	0.66
1st commercial operation	1978	1,992.1	73.5	2,479	1,776	0.72	0.89
8/74, 3/75, 3/77	1979	2,393.0	79.1	2,869	1,593	0.56	0.67
Type - BWRs	1980	2,182.1	73.6	2,838	1,768	0.62	0.81
Capacity - 1,101, 1,104,	1981	2,132.9	69.5	3,497	2,398	0.69	1.12
1,105 MWe	1982	2,025.4	67.6	3,360	2,230	0.66	1.10
	1983	1,641.0	54.3	3,410	3,375	0.99	2.06
	1984	1,431.9	54.2	3,172	1,954	0.62	1.36
	1985	368.2	11.9	2,854	1,164	0.41	3.16
	1986	0.0	0.0	3,074	1,054	0.34	---
	1987	0.0	0.0	3,184	1,186	0.37	---
	1988	0.0	0.0	3,390	1,158	0.34	---
	1989	0.0	0.0	2,707	657	0.24	---
	1990	0.0	0.0	2,725	1,311	0.48	---
	1991	445.0	17.7	1,831	356	0.19	0.80
	1992	979.9	32.2	2,670	519	0.19	0.53
	1993	675.1	66.8	3,594	870	0.24	1.29
	1994	860.2	83.4	3,362	861	0.26	1.00
	1995	1,165.8	98.6	2,567	413	0.16	0.35
	1996	1,972.8	93.0	1,904	389	0.20	0.20
	1997	1,928.8	90.2	2,268	522	0.23	0.27
	1998	1,961.9	87.7	1,612	367.716	0.23	0.19
	1999	2,091.0	85.1	1,741	446.941	0.26	0.21
	2000	2,143.8	97.1	1,657	333.215	0.20	0.16
	2001	2,074.0	90.7	1,525	293.879	0.19	0.14
	2002	2,069.0	95.4	1,977	357.573	0.18	0.17
	2003	2,014.5	93.6	2,608	602.535	0.23	0.30
	2004	2,104.7	95.5	3,242	672.714	0.21	0.32
	2005	2,044.2	94.3	3,743	636.282	0.17	0.31
	2006	2,040.1	94.0	3,618	641.154	0.18	0.31

[2] All three Browns Ferry units were placed on administrative hold in 1985. Units 2 and 3 were restarted in 1991 and 1995, respectively. Browns Ferry Unit 1 was restarted during 2007.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
BROWNS FERRY 1[2], 2, 3	2007	2,420.2	90.0	3,027	554.314	0.18	0.23
(continued)	2008	2,837.4	88.5	2,633	482.127	0.18	0.17
	2009	2,933.1	91.2	2,188	348.257	0.16	0.12
	2010	2,828.0	92.3	2,825	556.749	0.20	0.20
	2011	2,845.8	87.9	2,079	296.642	0.14	0.10
	2012	2,969.2	91.2	3,139	464.325	0.15	0.16
	2013	3,050.0	93.5	2,543	382.609	0.15	0.13
	2014	3,052.3	94.0	2,401	389.854	0.16	0.13
	2015	3,158.6	96.4	2,282	288.063	0.13	0.09
	2016	2,992.6	93.3	3,077	404.585	0.13	0.14
	2017	3,179.0	96.9	2,819	350.062	0.12	0.11
BRUNSWICK 1, 2	1976	297.2	56.0	1,265	326	0.26	1.10
Docket 50-324, 50-325;	1977	291.1	55.7	1,512	1,120	0.74	3.85
DPR-62, DPR-71	1978	1,173.1	83.7	1,458	1,004	0.69	0.86
1st commercial operation	1979	810.0	60.1	2,891	2,602	0.90	3.21
3/77, 11/75	1980	687.2	52.2	3,788	3,870	1.02	5.63
Type - BWRs	1981	925.2	56.9	3,854	2,638	0.68	2.85
Capacity - 938, 932 MWe	1982	540.3	50.3	4,957	3,792	0.76	7.02
	1983	636.7	44.3	5,602	3,475	0.62	5.46
	1984	761.3	51.5	5,046	3,260	0.65	4.28
	1985	822.2	58.4	4,057	2,804	0.69	3.41
	1986	1,051.3	69.1	3,370	1,909	0.57	1.82
	1987	1,152.4	80.6	3,052	1,419	0.46	1.23
	1988	990.8	70.1	2,648	1,747	0.66	1.76
	1989	990.9	65.8	3,844	1,786	0.46	1.80
	1990	991.6	67.8	3,182	1,548	0.49	1.56
	1991	952.8	64.5	2,586	778	0.30	0.82
	1992	375.9	27.9	2,690	623	0.23	1.66
	1993	470.0	33.8	2,921	872	0.30	1.86
	1994	1,268.4	83.0	3,049	999	0.33	0.79
	1995	1,411.7	92.9	2,657	683	0.26	0.48
	1996	1,261.1	85.9	2,784	716	0.26	0.57
	1997	1,474.0	94.1	2,212	411	0.19	0.28
	1998	1,521.0	94.3	2,005	395.526	0.20	0.26
	1999	1,494.7	92.8	1,818	418.417	0.23	0.28
	2000	1,571.2	95.6	1,648	321.785	0.20	0.20
	2001	1,576.0	95.8	1,623	302.812	0.19	0.19
	2002	1,568.0	94.5	1,743	275.534	0.16	0.18
	2003	1,676.9	95.6	1,794	248.622	0.14	0.15
	2004	1,690.6	94.5	2,140	244.577	0.11	0.14
	2005	1,654.9	92.2	1,944	305.978	0.16	0.18
	2006	1,661.2	90.0	2,103	280.465	0.13	0.17
	2007	1,714.9	92.0	2,186	290.093	0.13	0.17
	2008	1,694.5	91.7	2,546	354.212	0.14	0.21
	2009	1,647.9	89.6	2,683	350.347	0.13	0.21
	2010	1,690.7	91.3	3,227	407.424	0.13	0.24
	2011	1,662.7	90.5	2,778	381.057	0.14	0.23
	2012	1,629.3	89.4	3,368	369.873	0.11	0.23
	2013	1,650.6	89.9	3,978	361.148	0.09	0.22
	2014	1,750.6	94.5	3,498	261.897	0.07	0.15
	2015	1,745.6	93.7	2,660	230.570	0.09	0.13
	2016	1,756.7	95.7	1,756	167.236	0.10	0.10
	2017	1,754.6	96.0	1,748	216.013	0.12	0.12
BYRON 1, 2	1986	894.5	88.6	1,081	76	0.07	0.08
Docket 50-454, 50-455;	1987	650.9	70.9	1,826	769	0.42	1.18
NPF-37, NPF-66	1988	1,534.7	86.3	1,222	459	0.38	0.30
1st commercial operation	1989	1,812.6	90.2	1,109	172	0.16	0.09
9/85, 8/87	1990	1,567.3	78.8	1,396	434	0.31	0.28
Type - PWRs	1991	1,816.3	89.9	1,077	268	0.25	0.15
Capacity - 1,157, 1,127 MWe	1992	1,888.4	90.1	1,021	199	0.19	0.11
	1993	1,785.6	83.5	1,370	432	0.32	0.24
	1994	1,953.3	90.7	962	280	0.29	0.14

[2] All three Browns Ferry units were placed on administrative hold in 1985. Units 2 and 3 were restarted in 1991 and 1995, respectively. Browns Ferry Unit 1 was restarted during 2007.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
BYRON 1, 2	1995	1,900.6	85.5	1,107	306	0.28	0.16
(continued)	1996	1,758.4	79.3	1,610	455	0.28	0.26
	1997	1,856.7	86.6	1,546	241	0.16	0.13
	1998	1,869.8	85.9	1,809	275.221	0.15	0.15
	1999	2,064.2	92.3	1,478	239.102	0.16	0.12
	2000	2,196.9	97.4	959	193.871	0.20	0.09
	2001	2,301.5	97.8	719	59.451	0.08	0.03
	2002	2,205.0	93.8	1,287	195.013	0.15	0.09
	2003	2,294.8	97.2	824	87.129	0.11	0.04
	2004	2,277.4	97.7	906	89.147	0.10	0.04
	2005	2,175.6	94.2	1,542	199.812	0.13	0.09
	2006	2,223.3	95.0	1,163	134.497	0.12	0.06
	2007	2,152.1	93.0	1,311	128.797	0.10	0.06
	2008	2,203.7	94.6	1,483	140.809	0.09	0.06
	2009	2,250.9	96.7	985	83.443	0.08	0.04
	2010	2,266.6	97.4	922	56.425	0.06	0.02
	2011	2,077.9	91.0	1,849	244.104	0.13	0.12
	2012	2,085.4	94.6	924	50.973	0.06	0.02
	2013	2,231.4	96.8	1,002	57.708	0.06	0.03
	2014	2,197.8	94.2	1,184	80.774	0.07	0.04
	2015	2,222.8	96.8	878	42.935	0.05	0.02
	2016	2,237.5	96.0	884	54.012	0.06	0.02
	2017	2,186.4	93.7	1,280	87.846	0.07	0.04
CALLAWAY 1	1985	967.4	90.0	964	36	0.04	0.04
Docket 50-483;	1986	865.2	81.3	1,052	225	0.21	0.26
NPF-30	1987	759.0	71.1	1,082	393	0.36	0.52
1st commercial operation 12/84	1988	1,069.2	93.4	353	27	0.08	0.03
Type - PWR	1989	1,000.3	85.4	1,055	283	0.27	0.28
Capacity - 1,190 MWe	1990	960.7	84.1	1,134	442	0.39	0.46
	1991	1,193.1	99.7	280	21	0.08	0.02
	1992	967.5	83.0	1,133	336	0.30	0.35
	1993	1,002.9	86.4	1,126	225	0.20	0.22
	1994	1,196.4	100.0	191	14	0.07	0.01
	1995	989.6	84.7	1,062	187	0.18	0.19
	1996	1,066.0	90.5	980	248	0.25	0.23
	1997	1,022.2	100.0	248	12	0.05	0.01
	1998	972.2	91.3	929	200.729	0.22	0.21
	1999	981.3	88.7	1,098	320.554	0.29	0.33
	2000	1,137.5	99.8	244	16.058	0.07	0.01
	2001	954.5	86.7	873	106.782	0.12	0.11
	2002	955.0	86.2	983	95.648	0.10	0.10
	2003	1,104.3	96.2	252	8.297	0.03	0.01
	2004	892.8	78.9	1,124	120.621	0.11	0.14
	2005	913.2	80.7	1,600	222.629	0.14	0.24
	2006	1,152.8	95.0	225	6.308	0.03	0.01
	2007	1,069.7	89.0	1,079	73.236	0.07	0.07
	2008	1,067.6	89.8	729	45.738	0.06	0.04
	2009	1,170.3	97.6	164	4.821	0.03	0.00
	2010	1,029.9	84.8	800	58.735	0.07	0.06
	2011	1,071.7	88.9	838	80.215	0.10	0.07
	2012	1,220.2	100.0	169	4.525	0.03	0.00
	2013	959.9	80.9	680	43.123	0.06	0.04
	2014	1,061.3	88.0	649	37.173	0.06	0.04
	2015	1,192.2	99.1	96	3.128	0.03	0.00
	2016	1,078.3	89.8	641	46.770	0.07	0.04
	2017	951.9	80.3	507	23.713	0.05	0.02
CALVERT CLIFFS 1, 2	1976	753.4	95.2	507	74	0.15	0.10
Docket 50-317, 50-318;	1977	583.0	72.1	2,265	547	0.24	0.94
DPR-53, DPR-69	1978	1,188.5	75.8	1,391	500	0.36	0.42
1st commercial operation	1979	1,161.0	74.0	1,428	805	0.56	0.69
5/75, 4/77	1980	1,309.9	84.1	1,496	677	0.45	0.52
Type - PWRs	1981	1,379.7	83.1	1,555	607	0.39	0.44
Capacity - 863, 855 MWe	1982	1,238.3	73.7	1,805	1,057	0.59	0.85

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
CALVERT CLIFFS 1, 2 (continued)	1983	1,397.2	81.6	1,915	668	0.35	0.48
	1984	1,389.4	79.3	1,369	479	0.35	0.34
	1985	1,189.8	68.4	1,598	694	0.43	0.58
	1986	1,530.0	87.2	1,296	347	0.27	0.23
	1987	1,207.3	71.8	1,384	412	0.30	0.34
	1988	1,397.7	81.0	1,296	291	0.22	0.21
	1989	333.6	20.1	1,786	346	0.19	1.04
	1990	161.1	11.0	2,019	304	0.15	1.89
	1991	1,085.0	64.7	1,974	132	0.07	0.12
	1992	1,271.2	73.9	1,979	330	0.17	0.26
	1993	1,462.1	83.9	1,462	405	0.28	0.28
	1994	1,342.1	79.4	1,482	454	0.31	0.34
	1995	1,542.8	89.9	1,203	235	0.20	0.15
	1996	1,438.5	82.4	1,167	239	0.20	0.17
	1997	1,499.6	89.1	1,091	229	0.21	0.15
	1998	1,523.1	89.3	1,042	186.887	0.18	0.12
	1999	1,521.4	90.1	1,134	191.778	0.17	0.13
	2000	1,575.7	92.7	912	134.689	0.15	0.09
	2001	1,554.7	91.7	895	166.864	0.19	0.11
	2002	1,380.0	81.7	1,582	245.075	0.16	0.18
	2003	1,558.4	90.9	1,671	265.164	0.16	0.17
	2004	1,653.7	95.7	1,205	143.944	0.12	0.09
	2005	1,678.1	97.2	942	168.390	0.18	0.10
	2006	1,581.8	92.0	1,215	203.790	0.17	0.13
	2007	1,641.6	95.0	1,191	153.335	0.13	0.09
	2008	1,670.7	97.4	745	74.149	0.10	0.04
	2009	1,660.9	96.6	891	95.756	0.11	0.06
	2010	1,597.3	93.5	834	128.581	0.15	0.08
	2011	1,635.9	95.7	703	95.233	0.14	0.06
	2012	1,545.6	89.9	725	115.525	0.16	0.07
	2013	1,632.6	94.0	580	61.079	0.11	0.04
	2014	1,638.3	94.9	586	62.065	0.11	0.04
	2015	1,672.4	95.6	583	45.624	0.08	0.03
	2016	1,685.6	96.3	904	85.891	0.10	0.05
	2017	1,725.0	97.2	686	49.283	0.07	0.03
CATAWBA 1, 2 Docket 50-413, 50-414; NPF-35, NPF-52 1st commercial operation 6/85, 8/86 Type - PWRs Capacity - 1,160, 1,150 MWe	1986	638.9	49.9	1,724	286	0.17	0.45
	1987	1,651.2	75.9	1,865	449	0.24	0.27
	1988	1,675.2	77.2	2,009	556	0.28	0.33
	1989	1,733.6	79.5	1,660	334	0.20	0.19
	1990	1,616.3	70.8	2,174	809	0.37	0.50
	1991	1,691.5	74.6	1,871	462	0.25	0.27
	1992	1,962.8	83.9	1,515	414	0.27	0.21
	1993	1,896.1	81.5	1,564	396	0.25	0.21
	1994	2,105.2	90.2	1,268	207	0.16	0.10
	1995	2,011.9	85.3	1,892	462	0.24	0.23
	1996	1,879.1	80.5	1,588	302	0.19	0.16
	1997	2,028.2	89.3	1,561	266	0.17	0.13
	1998	2,006.4	89.6	1,123	162.068	0.14	0.08
	1999	2,046.7	90.2	1,024	118.662	0.12	0.06
	2000	2,038.3	90.3	1,185	186.532	0.16	0.09
	2001	2,119.9	92.9	960	116.241	0.12	0.05
	2002	2,238.0	97.2	884	81.325	0.09	0.04
	2003	1,991.8	89.2	1,409	210.617	0.15	0.11
	2004	2,111.4	93.0	1,123	122.831	0.11	0.06
	2005	2,194.5	96.0	1,019	83.679	0.08	0.04
	2006	1,928.6	85.0	1,792	212.570	0.12	0.11
	2007	2,102.5	92.0	1,399	144.218	0.10	0.07
	2008	2,160.3	93.5	1,110	85.080	0.08	0.04
	2009	2,044.8	89.1	1,385	169.409	0.12	0.08
	2010	2,164.8	94.8	1,045	97.010	0.09	0.04
	2011	2,144.2	93.9	961	52.321	0.05	0.02
	2012	2,029.7	88.8	1,157	94.734	0.08	0.05
	2013	2,187.9	95.5	1,053	82.906	0.08	0.04
	2014	2,136.0	93.3	996	50.777	0.05	0.02

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
CATAWBA 1, 2	2015	2,098.6	92.2	1,299	97.678	0.08	0.05
(continued)	2016	2,232.7	96.1	1,000	77.097	0.08	0.03
	2017	2,249.6	96.8	642	32.236	0.05	0.01
CLINTON	1988	701.3	84.2	769	130	0.17	0.19
Docket 50-461;	1989	348.3	48.5	1,196	372	0.31	1.07
NPF-62	1990	435.8	55.1	1,390	553	0.40	1.27
1st commercial operation 11/87	1991	722.7	80.8	1,010	233	0.23	0.32
Type - BWR	1992	589.7	68.6	1,195	431	0.36	0.73
Capacity - 1,022 MWe	1993	701.5	79.6	1,253	498	0.40	0.71
	1994	883.3	94.8	409	63	0.15	0.07
	1995	731.1	83.0	1,182	316	0.27	0.43
	1996	634.7	66.7	1,154	350	0.30	0.55
	1997	0.0	0.0	738	172	0.23	---
	1998	0.0	0.0	866	144.140	0.17	---
	1999	537.0	63.5	637	87.489	0.14	0.16
	2000	784.2	87.8	1,248	253.382	0.20	0.32
	2001	896.8	98.5	329	33.770	0.10	0.04
	2002	872.0	90.5	1,418	208.094	0.15	0.24
	2003	990.5	99.1	372	57.118	0.15	0.06
	2004	910.8	92.6	1,622	282.833	0.17	0.31
	2005	989.1	97.4	298	36.019	0.12	0.04
	2006	939.9	92.0	1,649	295.720	0.18	0.32
	2007	1,049.2	100.0	310	30.618	0.10	0.03
	2008	973.0	93.3	1,381	205.086	0.15	0.21
	2009	1,014.6	96.6	435	48.009	0.11	0.05
	2010	983.1	93.5	1,540	219.954	0.14	0.22
	2011	989.9	94.4	1,683	228.447	0.14	0.23
	2012	1,067.1	100.0	215	14.250	0.07	0.01
	2013	950.2	91.9	1,182	128.781	0.11	0.14
	2014	1,038.6	98.8	186	17.866	0.10	0.02
	2015	922.9	94.1	1,197	97.634	0.08	0.11
	2016	1,017.8	97.2	480	33.218	0.07	0.03
	2017	954.1	91.9	1,341	154.579	0.12	0.16
COLUMBIA GENERATING[3]	1985	616.0	87.6	755	119	0.16	0.19
Docket 50-397;	1986	616.0	74.4	1,013	222	0.22	0.36
NPF-21	1987	639.0	70.8	1,201	406	0.34	0.64
1st commercial operation 12/84	1988	707.7	71.8	1,050	353	0.34	0.50
Type - BWR	1989	727.2	78.3	1,299	492	0.38	0.68
Capacity - 1,116 MWe	1990	684.7	67.5	1,348	536	0.40	0.78
	1991	508.5	50.3	1,088	387	0.36	0.76
	1992	682.3	65.6	1,489	612	0.41	0.90
	1993	849.6	79.5	1,385	469	0.34	0.55
	1994	803.8	75.2	1,870	866	0.46	1.08
	1995	824.7	83.8	1,694	456	0.27	0.55
	1996	662.9	82.2	1,453	373	0.26	0.56
	1997	697.0	72.7	1,218	251	0.21	0.36
	1998	789.5	75.3	1,220	286.020	0.23	0.36
	1999	694.7	70.0	1,022	155.109	0.15	0.22
	2000	979.6	96.3	706	53.152	0.08	0.05
	2001	939.3	88.1	1,515	226.675	0.15	0.24
	2002	1,023.0	97.5	647	46.650	0.07	0.05
	2003	866.9	81.8	1,618	205.225	0.13	0.24
	2004	1,022.5	94.6	716	66.130	0.09	0.06
	2005	938.3	87.3	1,718	325.025	0.19	0.35
	2006	1,064.9	98.0	623	55.817	0.09	0.05
	2007	925.6	87.0	2,147	306.443	0.14	0.33
	2008	1,055.3	98.3	715	54.957	0.08	0.05
	2009	757.2	76.3	1,958	305.163	0.16	0.40
	2010	1,054.9	100.0	733	54.712	0.07	0.05
	2011	548.7	54.4	2,309	335.657	0.15	0.61
	2012	1,062.6	97.6	1,155	45.462	0.04	0.04
	2013	965.9	88.4	1,787	223.809	0.13	0.23

[3] Energy Northwest changed the name of Washington Nuclear 2 to Columbia Generating Station in 2001.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
COLUMBIA GENERATING[3] (continued)	2014	1,084.2	100.0	775	33.771	0.04	0.03
	2015	931.6	87.0	2,088	289.135	0.14	0.31
	2016	1,098.8	97.8	586	26.825	0.05	0.02
	2017	927.9	87.7	1,724	180.255	0.10	0.19
COMANCHE PEAK 1, 2	1991	644.4	82.2	985	148	0.15	0.23
Docket 50-445, 50-446;	1992	830.8	84.0	1,128	188	0.17	0.23
NPF-87, NPF-89	1993	853.8	81.2	945	109	0.12	0.13
1st commercial operation	1994	1,750.0	93.7	970	90	0.09	0.05
8/90, 8/93	1995	2,022.6	92.5	951	179	0.19	0.09
Type - PWR	1996	1,804.8	81.4	1,462	288	0.20	0.16
Capacity - 1,205, 1,195 MWe	1997	2,002.4	93.4	870	146	0.17	0.07
	1998	2,037.8	94.9	967	232.026	0.24	0.11
	1999	1,981.5	90.9	1,316	251.276	0.19	0.13
	2000	2,104.7	95.3	759	77.679	0.10	0.04
	2001	2,085.9	94.7	853	114.968	0.13	0.06
	2002	1,887.0	86.9	1,106	225.317	0.20	0.12
	2003	2,020.6	91.6	639	66.313	0.10	0.03
	2004	2,169.5	95.1	864	135.388	0.16	0.06
	2005	2,099.6	91.5	1,365	242.481	0.18	0.12
	2006	2,271.3	97.0	686	59.959	0.09	0.03
	2007	2,151.3	93.0	1,616	219.799	0.14	0.10
	2008	2,189.7	94.3	1,037	168.836	0.16	0.08
	2009	2,299.3	96.7	938	51.420	0.05	0.02
	2010	2,316.8	96.3	1,037	70.807	0.07	0.03
	2011	2,216.8	92.6	1,580	154.716	0.10	0.07
	2012	2,279.9	94.6	1,001	66.742	0.07	0.03
	2013	2,353.5	96.8	745	45.237	0.06	0.02
	2014	2,141.7	88.6	1,123	139.246	0.12	0.07
	2015	2,294.6	94.7	641	42.889	0.07	0.02
	2016	2,340.7	96.0	624	36.648	0.06	0.02
	2017	1,947.3	81.5	1,052	120.996	0.12	0.06
COOK 1, 2	1976	807.4	83.1	395	116	0.29	0.14
Docket 50-315, 50-316;	1977	573.0	76.1	802	300	0.37	0.52
DPR-58, DPR-74	1978	744.8	73.6	778	336	0.43	0.45
1st commercial operation	1979	1,373.0	65.3	1,445	718	0.50	0.52
8/75, 7/78	1980	1,552.4	74.1	1,345	493	0.37	0.32
Type - PWRs	1981	1,557.3	73.4	1,341	656	0.49	0.42
Capacity - 1,030, 1,168 MWe	1982	1,461.6	69.8	1,527	699	0.46	0.48
	1983	1,456.5	71.2	1,418	658	0.46	0.45
	1984	1,526.0	75.3	1,559	762	0.49	0.50
	1985	925.4	47.6	1,984	945	0.48	1.02
	1986	1,307.1	73.4	1,774	745	0.42	0.57
	1987	1,199.5	70.2	1,696	666	0.39	0.56
	1988	1,160.4	63.5	2,266	867	0.38	0.75
	1989	1,433.1	72.8	1,575	493	0.31	0.34
	1990	1,318.5	67.9	1,851	580	0.31	0.44
	1991	1,837.4	90.2	815	69	0.08	0.04
	1992	760.9	50.8	1,954	492	0.25	0.65
	1993	1,927.7	98.5	587	44	0.07	0.02
	1994	1,105.2	65.2	1,748	479	0.27	0.43
	1995	1,656.0	82.1	1,310	203	0.15	0.12
	1996	1,938.9	92.7	1,114	214	0.19	0.11
	1997	1,189.7	59.7	1,864	550	0.30	0.46
	1998	0.0	0.0	1,155	104.638	0.09	---
	1999	0.0	0.0	1,662	171.479	0.10	---
	2000	560.1	28.1	2,506	337.584	0.13	0.60
	2001	1,794.3	89.2	423	27.290	0.06	0.02
	2002	1,756.0	87.3	1,624	278.001	0.17	0.16
	2003	1,557.6	75.7	1,408	209.526	0.15	0.13
	2004	1,909.2	91.4	1,015	156.213	0.15	0.08
	2005	1,989.0	95.0	852	91.192	0.11	0.05
	2006	1,790.5	86.0	1,780	312.214	0.18	0.17

[3] Energy Northwest changed the name of Washington Nuclear 2 to Columbia Generating Station in 2001.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
COOK 1, 2	2007	1,983.7	93.0	1,310	238.829	0.18	0.12
(continued)	2008	1,711.8	80.8	971	76.460	0.08	0.04
	2009	950.5	45.3	693	40.007	0.06	0.04
	2010	1,786.1	86.7	1,116	83.276	0.07	0.05
	2011	1,981.5	94.2	842	57.169	0.07	0.03
	2012	2,017.5	94.7	754	49.112	0.07	0.02
	2013	1,858.5	87.1	1,187	103.772	0.09	0.06
	2014	2,012.7	94.3	727	53.798	0.07	0.03
	2015	1,885.7	87.4	626	29.827	0.05	0.02
	2016	1,753.5	82.3	1,123	93.715	0.08	0.05
	2017	2,008.2	89.7	830	57.999	0.07	0.03
COOPER STATION	1975	456.4	83.6	579	117	0.20	0.26
Docket 50-298;	1976	433.3	75.5	763	350	0.46	0.81
DPR-46	1977	538.2	86.2	315	198	0.63	0.37
1st commercial operation 7/74	1978	576.0	91.0	297	158	0.53	0.27
Type - BWR	1979	591.0	87.6	426	221	0.52	0.37
Capacity - 769 MWe	1980	448.3	71.2	785	859	1.09	1.92
	1981	457.1	71.2	935	579	0.62	1.27
	1982	622.3	84.6	743	542	0.73	0.87
	1983	396.6	63.3	1,383	1,293	0.93	3.26
	1984	411.9	67.2	1,598	799	0.50	1.94
	1985	127.3	21.5	1,980	1,333	0.67	10.47
	1986	480.0	74.7	895	320	0.36	0.67
	1987	652.3	96.2	549	103	0.19	0.16
	1988	493.4	67.9	942	251	0.27	0.51
	1989	564.3	76.2	1,202	343	0.29	0.61
	1990	602.0	79.4	1,174	379	0.32	0.63
	1991	566.3	78.8	1,099	405	0.37	0.72
	1992	731.0	96.4	463	84	0.18	0.11
	1993	436.1	58.8	1,130	391	0.35	0.90
	1994	262.2	35.1	333	79	0.24	0.30
	1995	486.5	66.8	1,095	228	0.21	0.47
	1996	742.1	97.9	468	48	0.10	0.06
	1997	622.8	84.4	1,125	174	0.15	0.28
	1998	555.9	75.9	977	181.858	0.19	0.33
	1999	743.2	98.1	318	47.815	0.15	0.06
	2000	539.2	74.2	963	199.589	0.21	0.37
	2001	592.7	80.9	1,309	168.665	0.13	0.28
	2002	719.0	98.6	362	38.739	0.11	0.05
	2003	511.4	74.1	882	135.249	0.15	0.26
	2004	702.6	94.7	481	47.064	0.10	0.07
	2005	670.8	89.4	1,266	275.652	0.22	0.41
	2006	674.7	90.0	1,265	270.135	0.21	0.40
	2007	761.6	99.0	730	49.902	0.07	0.07
	2008	679.0	89.9	1,715	359.926	0.21	0.53
	2009	654.6	86.6	1,638	254.032	0.16	0.39
	2010	775.4	100.0	773	61.303	0.08	0.08
	2011	658.5	84.8	1,737	349.247	0.20	0.53
	2012	662.9	87.6	1,800	279.301	0.16	0.42
	2013	776.5	100.0	548	35.870	0.07	0.05
	2014	675.3	88.8	1,274	202.670	0.16	0.30
	2015	776.1	99.4	408	27.634	0.07	0.04
	2016	676.1	88.2	1,291	195.518	0.15	0.29
	2017	789.1	100.0	394	30.193	0.08	0.04
CRYSTAL RIVER 3[4]	1978	311.5	41.4	643	321	0.50	1.03
Docket 50-302;	1979	453.0	58.9	1,150	495	0.43	1.09
DPR-72	1980	404.1	53.2	1,053	625	0.59	1.55
1st commercial operation 3/77	1981	490.4	62.2	1,120	408	0.36	0.83
Type - PWR	1982	589.8	76.0	780	177	0.23	0.30
Capacity - (860) MWe	1983	452.1	58.8	1,720	552	0.32	1.22

[4] Crystal River ceased power generation in 2010 due to problems associated with containment building delamination. In June 2013, it was decided that it would not be put in commercial operation again and, therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
CRYSTAL RIVER 3[4] (continued)	1984	774.2	94.5	549	49	0.09	0.06
	1985	344.2	47.6	1,976	689	0.35	2.00
	1986	319.5	41.8	1,057	472	0.45	1.48
	1987	436.0	60.9	1,384	488	0.35	1.12
	1988	690.2	84.0	569	64	0.11	0.09
	1989	352.8	48.8	880	234	0.27	0.66
	1990	497.8	63.8	1,441	476	0.33	0.96
	1991	654.6	82.0	821	116	0.14	0.18
	1992	632.1	76.1	1,403	424	0.30	0.67
	1993	722.4	85.0	683	60	0.09	0.08
	1994	711.9	84.3	1,079	228	0.21	0.32
	1995	866.3	100.0	209	8	0.04	0.01
	1996	290.8	37.7	1,192	353	0.30	1.21
	1997	0.0	0.0	973	179	0.18	---
	1998	739.9	90.3	313	19.298	0.06	0.03
	1999	727.5	87.8	1,324	251.077	0.19	0.35
	2000	819.4	97.6	257	14.649	0.06	0.02
	2001	741.6	89.2	902	147.946	0.16	0.20
	2002	831.0	99.4	128	5.039	0.04	0.01
	2003	749.0	90.8	961	126.554	0.13	0.17
	2004	831.4	98.1	131	4.044	0.03	0.00
	2005	723.0	88.5	939	122.608	0.13	0.17
	2006	793.8	95.0	138	4.474	0.03	0.01
	2007	761.7	91.0	1,135	184.554	0.16	0.24
	2008	796.9	93.7	282	16.110	0.06	0.02
	2009	615.0	72.5	1,705	222.344	0.13	0.36
	2010	0.0	0.0	666	31.922	0.05	---
	2011	0.0	0.0	251	8.292	0.03	---
	2012	0.0	0.0	94	1.876	0.02	---
	2013	0.0	0.0	40	0.794	0.02	---
	2014	0.0	0.0	26	0.696	0.03	---
	2015	0.0	0.0	20	0.700	0.04	---
	2016	0.0	0.0	95	14.746	0.16	---
	2017	0.0	0.0	68	4.133	0.06	---
DAVIS-BESSE 1 Docket 50-346; NPF-3 1st commercial operation 7/78 Type - PWR Capacity - 894 MWe	1978	326.4	48.7	421	48	0.11	0.15
	1979	381.0	67.0	304	30	0.10	0.08
	1980	256.4	36.2	1,283	154	0.12	0.60
	1981	531.4	67.4	578	58	0.10	0.11
	1982	390.8	51.5	1,350	164	0.12	0.42
	1983	592.1	73.0	718	80	0.11	0.14
	1984	518.5	62.5	1,088	177	0.16	0.34
	1985	238.3	31.2	718	71	0.10	0.30
	1986	3.3	1.3	981	124	0.13	37.58
	1987	618.0	89.6	625	47	0.08	0.08
	1988	144.1	27.1	1,183	307	0.26	2.13
	1989	880.0	98.6	404	38	0.09	0.04
	1990	500.0	56.7	1,377	489	0.36	0.98
	1991	703.6	81.8	1,000	216	0.22	0.31
	1992	915.2	100.0	287	19	0.07	0.02
	1993	729.5	83.4	1,244	348	0.28	0.48
	1994	768.4	88.0	861	144	0.17	0.19
	1995	920.4	100.0	256	7	0.03	0.01
	1996	775.8	85.3	949	167	0.18	0.22
	1997	820.0	94.0	213	10	0.05	0.01
	1998	699.8	83.2	980	155.269	0.16	0.22
	1999	841.3	95.6	397	27.951	0.07	0.03
	2000	770.8	87.3	1,109	168.044	0.15	0.22
	2001	875.6	100.0	119	5.505	0.05	0.01
	2002	106.0	12.6	1,983	402.766	0.20	3.80
	2003	0.0	0.0	1,047	219.696	0.21	---
	2004	657.8	77.6	161	6.594	0.04	0.01

[4] Crystal River ceased power generation in 2010 due to problems associated with containment building delamination. In June 2013, it was decided that it would not be put in commercial operation again and, therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
DAVIS-BESSE 1	2005	817.1	93.3	577	51.332	0.09	0.06
(continued)	2006	727.8	84.0	1,331	204.201	0.15	0.28
	2007	879.7	100.0	189	7.088	0.04	0.01
	2008	777.5	89.4	985	106.603	0.11	0.14
	2009	868.7	95.7	115	3.621	0.03	0.00
	2010	598.0	67.1	1,649	464.095	0.28	0.78
	2011	723.7	80.7	1,182	73.360	0.06	0.10
	2012	808.5	90.0	659	43.071	0.07	0.05
	2013	876.6	96.6	92	2.558	0.03	0.00
	2014	681.8	74.1	2,029	200.466	0.10	0.29
	2015	901.1	99.5	32	0.995	0.03	0.00
	2016	730.0	84.7	996	118.472	0.12	0.16
	2017	899.1	100.0	69	1.621	0.02	0.00
DIABLO CANYON 1, 2	1986	641.5	80.6	1,260	304	0.24	0.47
Docket 50-275, 50-323;	1987	1,688.6	83.0	1,170	336	0.29	0.20
DPR-80, DPR-82	1988	1,386.1	67.6	1,826	877	0.48	0.63
1st commercial operation	1989	1,899.0	87.5	1,646	465	0.28	0.24
5/85, 3/86	1990	1,952.6	91.0	1,441	323	0.22	0.17
Type - PWRs	1991	1,809.6	83.8	2,040	546	0.27	0.30
Capacity - 1,122, 1,118 MWe	1992	1,995.7	90.9	1,850	459	0.25	0.23
	1993	2,008.6	91.4	1,508	281	0.19	0.14
	1994	1,832.6	83.3	2,317	590	0.25	0.32
	1995	1,950.3	90.0	1,615	286	0.18	0.15
	1996	2,003.6	90.7	1,462	176	0.12	0.09
	1997	1,948.7	92.7	1,331	219	0.16	0.11
	1998	1,955.1	92.8	1,313	173.238	0.13	0.09
	1999	1,902.8	90.1	1,566	448.634	0.29	0.24
	2000	1,940.1	92.0	1,057	180.792	0.17	0.09
	2001	2,067.7	96.4	1,074	117.804	0.11	0.06
	2002	1,860.0	88.4	1,016	148.690	0.15	0.08
	2003	1,970.7	91.6	1,004	135.482	0.13	0.07
	2004	1,736.3	83.5	1,230	254.367	0.21	0.15
	2005	2,022.4	94.8	955	124.469	0.13	0.06
	2006	2,109.0	94.0	1,086	82.248	0.08	0.04
	2007	2,131.4	95.0	1,269	111.866	0.09	0.05
	2008	1,952.1	87.7	2,121	235.034	0.11	0.12
	2009	1,873.0	85.3	2,534	337.831	0.13	0.18
	2010	2,115.2	94.7	1,367	125.457	0.09	0.06
	2011	2,131.1	94.6	747	31.625	0.04	0.01
	2012	2,023.0	91.8	894	43.531	0.05	0.02
	2013	2,064.1	92.4	760	28.767	0.04	0.01
	2014	1,947.1	88.8	979	67.599	0.07	0.03
	2015	2,116.8	94.9	807	57.244	0.07	0.03
	2016	2,162.2	95.7	794	37.734	0.05	0.02
	2017	2,051.4	92.0	787	47.910	0.06	0.02
DRESDEN 1[5], 2, 3	1969	99.7	---	---	286	---	2.87
Docket 50-010, 50-237, 50-249;	1970	163.1	---	---	143	---	0.88
DPR-2, DPR-19, DPR-25	1971	394.5	---	---	715	---	1.81
1st commercial operation 7/60,	1972	1,243.7	---	---	728	---	0.59
6/70, 11/71	1973	1,112.2	---	1,341	939	0.70	0.84
Type - BWRs	1974	842.5	54.9	1,594	1,662	1.04	1.97
Capacity - (197), 870, 869 MWe	1975	708.1	54.6	2,310	3,423	1.48	4.83
	1976	1,127.2	80.8	1,746	1,680	0.96	1.49
	1977	1,132.9	77.0	1,862	1,694	0.91	1.50
	1978	1,242.2	79.5	1,946	1,529	0.79	1.23
	1979	1,013.0	74.7	2,407	1,800	0.75	1.78
	1980	1,074.4	55.0	2,717	2,105	0.77	1.96
	1981	1,035.7	51.5	2,331	2,802	1.20	2.71
	1982	1,085.3	77.9	2,572	2,923	1.14	2.69
	1983	913.6	65.6	2,854	3,582	1.26	3.92
	1984	789.8	55.3	2,261	1,774	0.78	2.25

[5] Dresden 1 ceased power generation in 1978, and in 1985, it was decided that it would not be put in commercial operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
DRESDEN 1[5], 2, 3 (continued)	1985	903.0	64.5	2,817	1,686	0.60	1.87
	1986	740.5	52.6	3,111	2,668	0.86	3.60
	1987	933.9	74.0	2,052	1,145	0.56	1.23
	1988	1,014.7	75.8	2,414	1,409	0.58	1.39
	1989	1,184.2	83.1	2,259	1,131	0.50	0.96
	1990	1,107.8	76.6	2,235	1,400	0.63	1.26
	1991	675.2	60.7	2,044	1,005	0.49	1.49
	1992	872.4	75.4	1,812	619	0.34	0.71
	1993	960.1	68.5	2,751	1,655	0.60	1.72
	1994	690.2	51.7	2,336	833	0.36	1.21
	1995	643.1	49.8	2,482	875	0.35	1.36
	1996	612.6	47.7	1,788	456	0.26	0.74
	1997	1,096.2	79.5	2,747	467	0.17	0.43
	1998	1,354.7	90.6	2,311	426.918	0.18	0.32
	1999	1,410.9	92.5	3,243	591.443	0.18	0.42
	2000	1,506.4	97.3	2,341	261.684	0.11	0.17
	2001	1,427.4	94.5	2,769	400.702	0.14	0.28
	2002	1,547.0	95.7	2,819	355.011	0.13	0.23
	2003	1,555.9	93.5	2,098	356.572	0.17	0.23
	2004	1,405.5	84.8	2,044	381.054	0.19	0.27
	2005	1,550.8	92.0	2,006	258.799	0.13	0.17
	2006	1,649.0	96.0	2,042	289.167	0.14	0.18
	2007	1,658.8	97.0	2,310	275.697	0.12	0.17
	2008	1,638.0	95.9	2,307	198.153	0.09	0.12
	2009	1,628.7	95.4	1,932	231.688	0.12	0.14
	2010	1,665.9	96.3	2,152	213.825	0.10	0.13
	2011	1,679.7	96.7	2,382	236.427	0.10	0.14
	2012	1,685.5	96.3	2,084	139.615	0.07	0.08
	2013	1,759.9	96.8	1,823	136.942	0.08	0.08
	2014	1,727.8	95.9	1,782	116.933	0.07	0.07
	2015	1,734.4	95.8	1,900	138.864	0.07	0.08
	2016	1,763.2	97.8	1,878	141.827	0.08	0.08
	2017	1,763.3	97.5	1,928	129.266	0.07	0.07
DUANE ARNOLD Docket 50-331; DPR-49 1st commercial operation 2/75 Type - BWR Capacity - 602 MWe	1976	305.2	78.0	350	105	0.30	0.34
	1977	353.6	78.9	538	299	0.56	0.85
	1978	149.2	33.2	1,112	974	0.88	6.53
	1979	352.0	78.0	757	275	0.36	0.78
	1980	339.1	73.3	1,108	671	0.61	1.98
	1981	277.7	69.8	1,286	790	0.61	2.84
	1982	278.5	74.7	524	229	0.44	0.82
	1983	283.0	62.9	1,468	1,135	0.77	4.01
	1984	329.4	72.9	611	189	0.31	0.57
	1985	236.2	53.8	1,414	1,112	0.79	4.71
	1986	365.5	82.0	476	187	0.39	0.51
	1987	308.4	64.7	1,094	667	0.61	2.16
	1988	386.5	75.2	1,136	614	0.54	1.59
	1989	388.5	79.0	425	194	0.46	0.50
	1990	367.4	75.8	1,460	861	0.59	2.34
	1991	503.7	94.5	336	202	0.60	0.40
	1992	416.5	81.9	1,043	502	0.48	1.21
	1993	393.4	79.5	1,043	407	0.39	1.03
	1994	498.6	94.0	493	120	0.24	0.24
	1995	452.5	83.8	1,129	357	0.32	0.79
	1996	476.8	90.7	1,093	270	0.25	0.57
	1997	474.4	94.4	352	63	0.18	0.13
	1998	438.3	86.6	1,019	236.693	0.23	0.54
	1999	416.6	84.3	834	201.196	0.24	0.48
	2000	507.3	98.4	317	44.181	0.14	0.09
	2001	439.5	86.8	898	137.564	0.15	0.31
	2002	522.0	94.4	319	35.061	0.11	0.07
	2003	455.2	84.8	829	124.402	0.15	0.27

[5] Dresden 1 ceased power generation in 1978, and in 1985, it was decided that it would not be put in commercial operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
DUANE ARNOLD	2004	561.2	98.3	220	18.993	0.09	0.03
(continued)	2005	517.4	90.5	879	139.622	0.16	0.27
	2006	581.7	99.0	254	29.392	0.12	0.05
	2007	515.8	88.0	1,062	183.609	0.17	0.36
	2008	601.4	100.0	276	24.187	0.09	0.04
	2009	534.1	91.3	960	140.206	0.15	0.26
	2010	508.1	86.9	1,093	200.601	0.18	0.39
	2011	595.3	98.6	400	29.663	0.07	0.05
	2012	494.9	84.9	1,169	134.515	0.12	0.27
	2013	598.6	100.0	262	16.414	0.06	0.03
	2014	474.0	86.0	1,043	121.986	0.12	0.26
	2015	598.6	100.0	391	20.441	0.05	0.03
	2016	536.8	92.5	1,106	110.613	0.10	0.21
	2017	595.2	99.3	228	17.336	0.08	0.03
FARLEY 1, 2	1978	713.8	86.5	527	108	0.20	0.15
Docket 50-348, 50-364;	1979	211.0	28.6	1,227	643	0.52	3.05
NPF-2, NPF-8	1980	557.3	69.3	1,330	435	0.33	0.78
1st commercial operation	1981	310.2	41.4	1,331	512	0.38	1.65
12/77, 7/81	1982	1,271.5	79.2	1,453	484	0.33	0.38
Type - PWRs	1983	1,356.5	83.0	1,938	1,021	0.53	0.75
Capacity - 874, 883 MWe	1984	1,447.0	86.6	2,046	902	0.44	0.62
	1985	1,368.2	81.1	2,551	799	0.31	0.58
	1986	1,409.4	83.8	2,314	858	0.37	0.61
	1987	1,369.7	84.7	1,871	598	0.32	0.44
	1988	1,567.7	92.3	1,840	552	0.30	0.35
	1989	1,402.9	84.6	2,206	749	0.34	0.53
	1990	1,464.0	86.7	1,700	457	0.27	0.31
	1991	1,464.0	88.1	1,645	648	0.39	0.44
	1992	1,331.7	81.8	2,018	805	0.40	0.60
	1993	1,455.5	88.3	1,284	333	0.26	0.23
	1994	1,587.2	93.0	1,035	250	0.24	0.16
	1995	1,311.2	83.8	1,574	460	0.29	0.35
	1996	1,549.2	90.9	1,150	232	0.20	0.15
	1997	1,449.7	89.0	1,105	278	0.25	0.19
	1998	1,313.9	80.9	1,380	431.821	0.31	0.33
	1999	1,436.0	91.4	1,102	190.463	0.17	0.13
	2000	1,430.1	88.6	1,683	359.855	0.21	0.25
	2001	1,384.3	84.4	1,810	320.509	0.18	0.23
	2002	1,558.0	93.5	772	96.431	0.12	0.06
	2003	1,592.6	95.3	788	111.016	0.14	0.07
	2004	1,496.8	89.4	1,141	107.227	0.09	0.07
	2005	1,564.2	93.3	810	67.826	0.08	0.04
	2006	1,602.7	94.0	747	66.189	0.09	0.04
	2007	1,495.8	88.0	1,226	139.716	0.11	0.09
	2008	1,602.6	94.4	669	40.833	0.06	0.03
	2009	1,595.2	94.1	657	41.851	0.06	0.03
	2010	1,503.4	89.0	1,321	121.313	0.09	0.08
	2011	1,647.4	95.1	723	37.510	0.05	0.02
	2012	1,680.7	95.8	563	29.817	0.05	0.02
	2013	1,609.4	92.8	775	53.212	0.07	0.03
	2014	1,655.9	94.5	713	37.703	0.05	0.02
	2015	1,631.0	93.6	888	55.942	0.06	0.03
	2016	1,563.7	90.0	957	59.840	0.06	0.04
	2017	1,690.0	96.1	575	31.351	0.05	0.02
FERMI 2	1989	624.0	68.5	1,270	255	0.20	0.41
Docket 50-341;	1990	848.2	84.7	462	83	0.18	0.10
NPF-43	1991	739.0	77.0	1,223	228	0.19	0.31
1st commercial operation 1/88	1992	874.3	81.3	1,213	245	0.20	0.28
Type - BWR	1993	984.3	92.9	360	35	0.10	0.04
Capacity - 1,095 MWe	1994	0.0	2.2	1,130	213	0.19	---
	1995	618.3	86.9	390	28	0.07	0.05
	1996	577.5	69.1	1,402	157	0.11	0.27
	1997	637.0	66.6	623	49	0.08	0.08

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
FERMI 2	1998	815.8	79.9	1,362	207.593	0.15	0.25
(continued)	1999	1,082.7	99.5	461	36.152	0.08	0.03
	2000	939.6	87.6	1,266	145.964	0.12	0.16
	2001	975.0	90.9	1,202	168.689	0.14	0.17
	2002	1,059.0	98.7	463	38.235	0.08	0.04
	2003	925.3	86.9	1,207	168.138	0.14	0.18
	2004	962.3	90.0	1,302	145.090	0.11	0.15
	2005	998.1	91.7	538	61.626	0.11	0.06
	2006	855.9	83.0	1,430	181.300	0.13	0.21
	2007	950.2	87.0	1,484	194.039	0.13	0.20
	2008	1,094.5	99.5	460	35.186	0.08	0.03
	2009	847.8	79.3	1,497	148.846	0.10	0.18
	2010	885.0	86.4	1,625	146.490	0.09	0.17
	2011	1,017.9	95.7	387	24.080	0.06	0.02
	2012	589.3	65.2	1,420	144.973	0.10	0.25
	2013	754.5	93.0	704	26.179	0.04	0.03
	2014	891.5	85.9	1,806	199.698	0.11	0.22
	2015	838.6	75.8	1,866	234.853	0.13	0.28
	2016	1,045.0	96.2	779	54.761	0.07	0.05
	2017	993.0	91.2	2,025	265.082	0.13	0.27
FITZPATRICK	1976	489.0	71.6	600	202	0.34	0.41
Docket 50-333;	1977	460.5	68.4	1,380	1,080	0.78	2.35
DPR-59	1978	497.0	72.1	904	909	1.01	1.83
1st commercial operation 7/75	1979	349.0	50.8	850	859	1.01	2.46
Type - BWR	1980	509.5	70.3	2,056	2,040	0.99	4.00
Capacity - 813 MWe	1981	562.9	74.7	2,490	1,425	0.57	2.53
	1982	583.6	75.0	2,322	1,190	0.51	2.04
	1983	546.2	70.6	1,715	1,090	0.64	2.00
	1984	576.2	76.8	1,610	971	0.60	1.69
	1985	492.3	63.7	1,845	1,051	0.57	2.13
	1986	711.2	90.6	1,185	411	0.35	0.58
	1987	496.2	70.3	1,578	940	0.60	1.89
	1988	514.0	69.0	1,553	786	0.51	1.53
	1989	727.5	92.3	1,027	377	0.37	0.52
	1990	543.8	72.6	1,536	884	0.58	1.63
	1991	399.7	53.4	1,269	333	0.26	0.83
	1992	0.0	0.0	2,374	674	0.28	---
	1993	559.6	81.7	1,427	232	0.16	0.41
	1994	588.4	83.2	1,595	322	0.20	0.55
	1995	569.8	74.5	1,249	327	0.26	0.57
	1996	623.3	83.1	1,384	357	0.26	0.57
	1997	756.2	95.9	662	91	0.14	0.12
	1998	562.8	78.0	1,781	357.826	0.20	0.64
	1999	749.7	95.5	558	68.409	0.12	0.09
	2000	685.9	88.4	1,267	300.997	0.24	0.44
	2001	807.2	98.9	665	63.229	0.10	0.08
	2002	751.0	93.3	1,234	230.523	0.19	0.31
	2003	793.0	97.9	298	51.156	0.17	0.06
	2004	735.0	92.1	1,091	186.055	0.17	0.25
	2005	802.9	96.3	382	62.697	0.16	0.08
	2006	771.5	93.0	1,527	234.425	0.15	0.30
	2007	790.1	96.0	526	58.741	0.11	0.07
	2008	761.7	92.9	1,430	184.772	0.13	0.24
	2009	844.5	100.0	487	35.119	0.07	0.04
	2010	726.2	91.3	1,429	219.887	0.15	0.30
	2011	826.9	100.0	513	35.217	0.07	0.04
	2012	691.1	87.2	1,546	169.886	0.11	0.25
	2013	780.8	98.9	603	39.392	0.07	0.05
	2014	665.4	87.8	1,674	135.890	0.08	0.20
	2015	842.7	100.0	250	20.785	0.08	0.02
	2016	668.7	95.4	362	28.304	0.08	0.04
	2017	705.8	89.0	1,139	162.196	0.14	0.23

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
FORT CALHOUN[6]	1975	252.3	67.4	469	294	0.63	1.17
Docket 50-285;	1976	265.9	69.5	516	313	0.61	1.18
DPR-40	1977	351.8	79.4	535	297	0.56	0.84
1st commercial operation 6/74	1978	342.3	75.1	596	410	0.69	1.20
Type - PWR	1979	440.0	95.7	451	126	0.28	0.29
Capacity - (482) MWe	1980	242.3	60.4	891	668	0.75	2.76
	1981	260.9	72.3	822	458	0.56	1.76
	1982	418.0	89.7	604	217	0.36	0.52
	1983	330.4	73.1	860	433	0.50	1.31
	1984	279.2	59.9	913	563	0.62	2.02
	1985	367.0	73.7	982	373	0.38	1.02
	1986	431.8	94.3	756	75	0.10	0.17
	1987	366.0	75.4	1,247	388	0.31	1.06
	1988	315.5	74.1	1,594	272	0.17	0.86
	1989	395.7	89.2	1,210	93	0.08	0.24
	1990	290.0	64.2	760	290	0.38	1.00
	1991	391.1	91.7	284	57	0.20	0.15
	1992	303.4	65.9	802	272	0.34	0.90
	1993	369.7	80.8	713	157	0.22	0.42
	1994	492.8	99.6	211	23	0.11	0.05
	1995	402.8	83.2	627	139	0.22	0.35
	1996	374.9	79.5	740	226	0.31	0.60
	1997	435.9	93.6	258	41	0.16	0.09
	1998	387.7	82.5	788	223.847	0.28	0.58
	1999	409.2	89.2	676	158.843	0.23	0.39
	2000	443.8	93.5	249	35.215	0.14	0.08
	2001	401.2	88.3	770	225.891	0.29	0.56
	2002	434.0	92.3	742	163.806	0.22	0.38
	2003	399.6	87.0	914	212.422	0.23	0.53
	2004	463.5	97.0	215	21.574	0.10	0.05
	2005	332.4	72.2	1,069	272.876	0.26	0.82
	2006	353.9	75.0	1,591	289.100	0.18	0.82
	2007	499.9	100.0	100	3.990	0.04	0.01
	2008	400.4	82.2	839	96.155	0.11	0.24
	2009	422.7	87.0	870	110.918	0.13	0.26
	2010	486.5	98.5	171	9.763	0.06	0.02
	2011	134.4	26.8	1,042	79.226	0.08	0.59
	2012	0.0	0.0	494	39.377	0.08	---
	2013	10.9	3.6	678	63.853	0.09	5.86
	2014	477.7	97.7	159	5.053	0.03	0.01
	2015	402.5	81.5	747	75.987	0.10	0.19
	2016	0.0	0.0	166	11.255	0.07	0.00
	2017	0.0	0.0	72	2.770	0.04	---
GINNA	1971	327.8	---	340	430	1.26	1.31
Docket 50-244;	1972	293.6	---	677	1,032	1.52	3.51
DPR-18	1973	409.5	---	319	224	0.70	0.55
1st commercial operation 7/70	1974	253.7	62.4	884	1,225	1.39	4.83
Type - PWR	1975	365.2	76.7	685	538	0.79	1.47
Capacity - 560 MWe	1976	248.8	58.2	758	636	0.84	2.56
	1977	365.6	85.5	530	401	0.76	1.10
	1978	386.5	80.6	657	450	0.68	1.16
	1979	355.0	72.8	878	592	0.67	1.67
	1980	370.5	76.0	1,073	708	0.66	1.91
	1981	399.0	82.1	925	655	0.71	1.64
	1982	289.0	58.8	1,117	1,140	1.02	3.94
	1983	365.0	74.6	969	855	0.88	2.34
	1984	378.1	77.2	713	395	0.55	1.04
	1985	436.7	87.9	845	426	0.50	0.98
	1986	433.3	87.4	901	357	0.40	0.82
	1987	459.0	91.5	773	344	0.45	0.75
	1988	423.1	87.4	897	295	0.33	0.70
	1989	369.2	75.9	1,254	605	0.48	1.64

[6] Fort Calhoun ceased power generation in October 2016 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
GINNA (continued)	1990	414.3	84.4	991	347	0.35	0.84
	1991	418.6	86.7	947	328	0.35	0.78
	1992	417.6	86.9	832	261	0.31	0.63
	1993	419.6	86.3	856	193	0.23	0.46
	1994	405.3	83.2	679	138	0.20	0.34
	1995	437.0	89.6	738	136	0.18	0.31
	1996	347.9	71.1	976	168	0.17	0.48
	1997	444.6	91.8	533	81	0.15	0.18
	1998	491.8	100.0	161	14.892	0.09	0.03
	1999	403.4	85.6	641	175.173	0.27	0.43
	2000	434.2	91.6	429	76.435	0.18	0.18
	2001	488.0	100.0	140	10.156	0.07	0.02
	2002	438.0	91.3	535	80.432	0.15	0.18
	2003	440.4	91.1	510	74.533	0.15	0.17
	2004	490.5	99.5	111	7.486	0.07	0.02
	2005	455.0	93.9	564	72.841	0.13	0.16
	2006	470.2	94.0	514	44.580	0.09	0.09
	2007	564.4	99.0	111	4.412	0.04	0.01
	2008	540.1	94.5	976	101.996	0.10	0.19
	2009	529.2	94.3	633	41.809	0.07	0.08
	2010	564.9	98.9	75	3.168	0.04	0.01
	2011	492.1	86.4	931	100.711	0.11	0.20
	2012	523.9	92.1	654	54.636	0.08	0.10
	2013	570.0	99.1	104	3.434	0.03	0.01
	2014	532.2	93.5	621	58.380	0.09	0.11
	2015	544.5	95.1	415	24.163	0.06	0.04
	2016	575.6	100.0	79	1.882	0.02	0.00
	2017	536.3	94.5	614	46.173	0.08	0.09
GRAND GULF Docket 50-416; NPF-29 1st commercial operation 7/85 Type - BWR Capacity - 1,428 MWe	1986	494.7	60.9	1,486	436	0.29	0.88
	1987	920.7	82.2	1,358	420	0.31	0.46
	1988	1,136.6	96.7	692	147	0.21	0.13
	1989	932.6	80.0	1,972	498	0.25	0.53
	1990	883.5	78.9	1,765	482	0.27	0.55
	1991	1,085.2	94.0	699	94	0.13	0.09
	1992	969.0	83.7	2,032	484	0.24	0.50
	1993	936.4	81.5	1,807	332	0.18	0.35
	1994	1,143.2	96.6	455	56	0.12	0.05
	1995	952.9	80.4	1,589	342	0.22	0.36
	1996	1,096.2	88.7	1,564	357	0.23	0.33
	1997	1,234.9	100.0	514	105	0.20	0.09
	1998	1,049.2	88.9	1,410	303.695	0.22	0.29
	1999	962.1	81.3	1,180	226.277	0.19	0.23
	2000	1,217.5	99.4	289	34.877	0.12	0.03
	2001	1,129.8	93.0	1,109	185.214	0.17	0.16
	2002	1,145.0	93.6	1,060	176.396	0.17	0.15
	2003	1,241.2	98.6	290	31.250	0.11	0.03
	2004	1,165.2	92.2	1,243	158.112	0.13	0.14
	2005	1,147.3	91.9	1,326	167.914	0.13	0.15
	2006	1,233.7	98.0	1,016	59.935	0.06	0.05
	2007	1,070.5	88.0	1,750	177.884	0.10	0.17
	2008	1,072.1	89.5	1,843	167.859	0.09	0.16
	2009	1,255.5	100.0	521	30.721	0.06	0.02
	2010	1,102.0	91.5	1,822	188.370	0.10	0.17
	2011	1,180.0	100.0	530	21.084	0.04	0.02
	2012	835.2	67.8	2,446	276.378	0.11	0.33
	2013	1,231.1	92.2	396	35.449	0.09	0.03
	2014	1,173.5	89.5	1,726	181.746	0.11	0.15
	2015	1,337.8	98.2	587	25.241	0.04	0.02
	2016	682.8	52.4	1,443	194.755	0.13	0.29
	2017	849.1	75.4	538	40.251	0.07	0.05

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
HADDAM NECK[7]	1969	438.5	---	138	106	0.77	0.24
Docket 50-213;	1970	424.7	---	734	689	0.94	1.62
DPR-61	1971	502.2	---	289	342	1.18	0.68
1st commercial operation 1/68	1972	515.6	---	355	325	0.92	0.63
Type - PWR	1973	293.1	---	951	697	0.73	2.38
Capacity - (560) MWe	1974	521.4	91.2	550	201	0.37	0.39
	1975	494.3	89.9	795	703	0.88	1.42
	1976	482.9	82.5	644	449	0.70	0.93
	1977	480.7	83.9	894	641	0.72	1.33
	1978	563.4	98.6	216	117	0.54	0.21
	1979	493.0	87.5	1,226	1,162	0.95	2.36
	1980	426.8	75.0	1,860	1,353	0.73	3.17
	1981	487.5	84.3	1,554	1,036	0.67	2.13
	1982	543.9	93.4	559	126	0.23	0.23
	1983	453.7	77.8	1,645	1,384	0.84	3.05
	1984	404.0	71.7	1,430	1,216	0.85	3.01
	1985	556.1	98.4	384	101	0.26	0.18
	1986	294.8	53.6	1,945	1,567	0.81	5.32
	1987	304.6	54.0	1,763	750	0.43	2.46
	1988	397.4	70.3	735	237	0.32	0.60
	1989	356.4	67.2	1,455	596	0.41	1.67
	1990	142.7	32.2	979	421	0.43	2.95
	1991	444.4	76.4	1,168	590	0.51	1.33
	1992	465.2	80.1	797	202	0.25	0.43
	1993	448.6	81.6	1,004	408	0.41	0.91
	1994	455.6	77.7	463	135	0.29	0.30
	1995	439.4	77.7	1,006	442	0.44	1.01
	1996	331.8	55.7	673	175	0.26	0.53
	1997	-1.3	0.0	219	11	0.05	---
	1998	0.0	0.0	423	93.743	0.22	---
	1999	0.0	0.0	545	108.602	0.20	---
	2000	0.0	0.0	555	262.192	0.47	---
	2001	0.0	0.0	361	95.348	0.26	---
	2002	0.0	0.0	258	51.668	0.20	---
	2003	0.0	0.0	400	82.022	0.21	---
	2004	0.0	0.0	564	91.981	0.16	---
	2005	0.0	0.0	350	36.479	0.10	---
	2006	0.0	0.0	124	11.883	0.10	---
	2007	0.0	0.0	0	0.000	---	---
	2008	0.0	0.0	1	0.011	0.01	---
	2009	0.0	0.0	1	0.010	0.01	---
	2010	0.0	0.0	2	0.024	0.01	---
	2011	0.0	0.0	6	0.364	0.06	---
	2012	0.0	0.0	2	0.024	0.01	---
	2013	0.0	0.0	9	0.182	0.02	---
	2014	0.0	0.0	11	0.185	0.02	---
	2015	0.0	0.0	13	0.204	0.02	---
	2016	0.0	0.0	15	0.244	0.02	---
	2017	0.0	0.0	11	0.182	0.02	---
HARRIS 1	1988	652.9	75.0	721	169	0.23	0.26
Docket 50-400;	1989	690.6	79.5	929	156	0.17	0.23
NPF-63	1990	776.4	89.6	453	85	0.19	0.11
1st commercial operation 5/87	1991	724.8	81.5	872	226	0.26	0.31
Type - PWR	1992	661.8	74.9	930	213	0.23	0.32
Capacity - 928 MWe	1993	913.0	99.7	327	31	0.09	0.03
	1994	740.8	82.7	1,089	222	0.20	0.30
	1995	731.1	83.8	1,068	174	0.16	0.24
	1996	860.6	95.4	444	17	0.04	0.02
	1997	673.6	80.4	1,131	149	0.13	0.22
	1998	766.2	90.4	931	133.497	0.14	0.17
	1999	827.0	97.9	247	15.538	0.06	0.02
	2000	783.0	92.5	888	100.981	0.11	0.13

[7] Haddam Neck (also known as Connecticut Yankee) ceased operations on December 4, 1996, and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
HARRIS 1	2001	611.2	72.4	1,586	252.241	0.16	0.41
(continued)	2002	892.0	99.4	145	6.674	0.05	0.01
	2003	823.9	93.2	786	68.463	0.09	0.08
	2004	797.9	88.2	747	57.103	0.08	0.07
	2005	902.9	99.5	164	8.483	0.05	0.01
	2006	802.4	89.0	917	87.225	0.10	0.11
	2007	845.1	94.0	870	64.808	0.07	0.08
	2008	890.4	97.4	192	10.356	0.05	0.01
	2009	845.1	92.7	742	41.401	0.06	0.05
	2010	808.3	89.0	1,069	82.578	0.08	0.10
	2011	926.0	100.0	157	4.724	0.03	0.01
	2012	810.8	87.4	1,066	79.845	0.07	0.10
	2013	786.3	85.4	861	54.874	0.06	0.07
	2014	918.8	97.5	52	1.275	0.02	0.00
	2015	830.2	88.4	875	57.978	0.07	0.07
	2016	857.7	91.1	687	43.876	0.06	0.05
	2017	937.1	99.7	12	0.217	0.02	0.00
HATCH 1, 2	1976	496.3	83.8	630	134	0.21	0.27
Docket 50-321, 50-366;	1977	446.8	66.3	1,303	465	0.36	1.04
DPR-57; NPF-5	1978	513.0	72.8	1,304	248	0.19	0.48
1st commercial operation	1979	401.0	54.6	2,131	582	0.27	1.45
12/75, 9/79	1980	1,008.7	70.9	1,930	449	0.23	0.45
Type - BWRs	1981	870.9	64.3	2,899	1,337	0.46	1.54
Capacity - 876, 883 MWe	1982	768.0	56.6	3,418	1,460	0.43	1.90
	1983	934.7	68.6	3,428	1,299	0.38	1.39
	1984	658.6	47.3	4,110	2,218	0.54	3.37
	1985	1,211.0	79.6	2,841	818	0.29	0.68
	1986	872.0	64.8	3,486	1,497	0.43	1.72
	1987	1,295.4	89.7	2,202	816	0.37	0.63
	1988	1,001.4	70.4	2,509	1,401	0.56	1.40
	1989	1,271.1	87.1	1,350	556	0.41	0.44
	1990	1,268.0	83.5	2,902	1,455	0.50	1.15
	1991	1,152.4	77.4	2,508	1,161	0.46	1.01
	1992	1,293.8	88.6	1,615	550	0.34	0.43
	1993	1,189.6	85.5	1,733	669	0.39	0.56
	1994	1,289.0	87.1	2,243	864	0.39	0.67
	1995	1,376.3	90.6	1,458	488	0.33	0.35
	1996	1,519.6	94.0	1,495	441	0.29	0.29
	1997	1,374.7	88.1	1,945	722	0.37	0.53
	1998	1,458.4	91.7	1,610	320.469	0.20	0.22
	1999	1,487.4	90.0	1,866	328.583	0.18	0.22
	2000	1,515.0	88.7	1,913	401.891	0.21	0.27
	2001	1,603.0	93.5	1,407	230.242	0.16	0.14
	2002	1,600.0	94.0	1,299	214.441	0.17	0.13
	2003	1,606.3	94.5	1,295	168.281	0.13	0.10
	2004	1,641.3	95.3	1,209	180.129	0.15	0.11
	2005	1,562.1	91.3	1,288	207.295	0.16	0.13
	2006	1,604.9	94.0	1,405	259.313	0.18	0.16
	2007	1,626.5	94.0	1,341	137.273	0.10	0.08
	2008	1,584.0	92.7	1,397	189.433	0.14	0.12
	2009	1,416.5	83.2	1,310	186.013	0.14	0.13
	2010	1,586.9	93.0	1,734	245.797	0.14	0.15
	2011	1,550.4	93.1	1,681	176.976	0.11	0.11
	2012	1,637.5	94.5	1,592	191.189	0.12	0.12
	2013	1,578.1	92.1	1,348	140.994	0.10	0.09
	2014	1,656.4	95.6	1,608	189.428	0.12	0.11
	2015	1,654.9	95.6	1,584	83.419	0.05	0.05
	2016	1,672.1	95.8	1,669	222.865	0.13	0.13
	2017	1,658.8	95.7	1,126	101.422	0.09	0.06

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
HOPE CREEK 1	1987	869.2	86.4	589	117	0.20	0.13
Docket 50-354;	1988	832.7	80.7	1,734	287	0.17	0.34
NPF-57	1989	791.1	77.8	1,873	465	0.25	0.59
1st commercial operation 12/86	1990	966.4	91.6	1,394	196	0.14	0.20
Type - BWR	1991	882.5	84.2	1,700	373	0.22	0.42
Capacity - 1,172 MWe	1992	841.9	80.8	1,694	436	0.26	0.52
	1993	1,049.2	97.8	688	98	0.14	0.09
	1994	852.0	81.2	1,779	326	0.18	0.38
	1995	844.5	79.8	1,571	196	0.12	0.23
	1996	806.9	77.4	1,069	158	0.15	0.20
	1997	731.8	77.8	1,747	350	0.20	0.48
	1998	993.2	98.0	620	54.816	0.09	0.06
	1999	879.1	86.7	1,111	279.063	0.25	0.32
	2000	827.8	87.9	1,236	188.295	0.15	0.23
	2001	918.2	91.1	1,532	156.180	0.10	0.17
	2002	1,007.0	99.2	220	25.922	0.12	0.03
	2003	826.6	84.6	1,597	139.295	0.09	0.17
	2004	688.6	71.3	2,440	239.540	0.10	0.35
	2005	874.9	88.6	881	67.063	0.08	0.08
	2006	983.8	93.0	2,135	133.570	0.06	0.14
	2007	929.3	91.0	2,221	191.068	0.09	0.21
	2008	1,139.1	100.0	999	34.510	0.03	0.03
	2009	1,111.4	93.3	2,090	169.362	0.08	0.15
	2010	1,082.0	92.1	1,985	160.910	0.08	0.15
	2011	1,199.3	99.4	426	24.677	0.06	0.02
	2012	1,091.3	93.4	2,207	153.866	0.07	0.14
	2013	1,040.3	89.7	2,019	150.568	0.07	0.14
	2014	1,187.9	98.8	853	36.543	0.04	0.03
	2015	1,078.9	91.7	2,915	169.862	0.06	0.16
	2016	1,100.4	92.8	1,661	139.883	0.08	0.13
	2017	1,216.7	100.0	412	31.919	0.08	0.03
HUMBOLDT BAY[8]	1969	44.6	---	125	164	1.31	3.68
Docket 50-133;	1970	49.3	---	115	209	1.82	4.24
DPR-7	1971	39.6	---	140	292	2.09	7.37
1st commercial operation 8/63	1972	43.1	---	127	253	1.99	5.87
Type - BWR	1973	50.1	---	210	266	1.27	5.31
Capacity - (63) MWe	1974	43.4	83.8	296	318	1.07	7.33
	1975	45.3	83.9	265	339	1.28	7.48
	1976	23.5	46.4	523	683	1.31	29.06
	1977	0.0	0.0	1,063	1,905	1.79	---
	1978	0.0	0.0	320	335	1.05	---
	1979	0.0	0.0	135	31	0.23	---
	1980	0.0	0.0	142	22	0.15	---
	1981	0.0	0.0	75	9	0.12	---
	1982	0.0	0.0	71	19	0.27	---
	1983	0.0	0.0	84	17	0.20	---
	1984			"Data not available"			
	1985	0.0	0.0	178	51	0.29	---
	1986	0.0	0.0	115	50	0.43	---
	1987			"Data not available"			
	1988	0.0	0.0	10	1	0.10	---
	1989	0.0	0.0	0	0	0.00	---
	1990	0.0	0.0	0	0	0.00	---
	1991	0.0	0.0	0	0	0.00	---
	1992	0.0	0.0	8	0	0.00	---
	1993	0.0	0.0	24	1	0.04	---
	1994	0.0	0.0	21	1	0.05	---
	1995	0.0	0.0	42	2	0.05	---
	1996	0.0	0.0	66	5	0.08	---
	1997	0.0	0.0	105	16	0.15	---

[8] Humboldt Bay had been shut down since 1976, and in 1984, it was decided that it would not be placed in operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
HUMBOLDT BAY[8]	1998	0.0	0.0	38	0.929	0.02	---
(continued)	1999	0.0	0.0	28	0.720	0.03	---
	2000	0.0	0.0	20	0.911	0.05	---
	2001	0.0	0.0	10	0.360	0.04	---
	2002	0.0	0.0	18	1.504	0.08	---
	2003	0.0	0.0	14	0.351	0.03	---
	2004	0.0	0.0	11	0.454	0.04	---
	2005	0.0	0.0	11	0.547	0.05	---
	2006	0.0	0.0	40	4.086	0.10	---
	2007	0.0	0.0	45	3.271	0.07	---
	2008	0.0	0.0	56	2.051	0.04	---
	2009	0.0	0.0	30	0.631	0.02	---
	2010	0.0	0.0	136	7.691	0.06	---
	2011	0.0	0.0	158	6.709	0.04	---
	2012	0.0	0.0	156	15.859	0.10	---
	2013	0.0	0.0	172	24.121	0.14	---
	2014	0.0	0.0	125	12.381	0.10	---
	2015	0.0	0.0	54	4.391	0.08	---
	2016	0.0	0.0	0	0.000	---	---
	2017	0.0	0.0	0	0.000	---	---
INDIAN POINT 1[9]**, 2, 3**[10]	1969	206.2	---	---	298	---	1.45
Docket 50-3, 50-247, 50-286;	1970	43.3	---	---	1,639	---	37.85
DPR-5, DPR-26, DPR-64	1971	154.0	---	---	768	---	4.99
1st commercial operation	1972	142.3	---	---	967	---	6.80
10/62, 8/74, 8/76	1973	0.0	---	2,998	5,262	1.76	---
Type - PWRs	1974	556.1	59.4	1,019	910	0.89	1.64
Capacity - (265), 998, 1,030 MWe	1975	584.4	74.8	891	705	0.79	1.21
	1976	273.9	34.8	1,590	1,950	1.23	7.12
	1977	1,278.3	75.3	1,391	1,070	0.77	0.84
	1978	1,172.3	67.8	1,909	2,006	1.05	1.71
INDIAN POINT 1[9]**, 2**	1979	574.0	71.4	1,349	1,279	0.95	2.23
Docket 50-3, 50-247;	1980	510.8	64.8	1,577	971	0.62	1.90
DPR-5, DPR-26	1981	367.5	46.0	2,595	2,731	1.05	7.43
1st commercial operation	1982	532.4	65.4	2,144	1,635	0.76	3.07
10/62, 8/74	1983	702.6	84.0	1,057	486	0.46	0.69
Type - PWRs	1984	416.7	51.9	2,919	2,644	0.91	6.35
Capacity - (265), 998 MWe	1985	791.4	95.7	708	192	0.27	0.24
	1986	457.5	56.2	1,926	1,250	0.65	2.73
	1987	611.4	73.4	1,980	1,217	0.61	1.99
	1988	719.3	86.9	890	235	0.26	0.33
	1989	532.5	64.6	2,093	1,436	0.69	2.70
	1990	618.0	66.6	1,061	608	0.57	0.98
	1991	461.2	55.7	1,810	1,468	0.81	3.18
	1992	930.9	99.1	489	97	0.20	0.10
	1993	702.1	75.7	1,514	675	0.45	0.96
	1994	903.8	100.0	381	48	0.13	0.05
	1995	582.4	70.8	1,690	548	0.32	0.94
	1996	927.8	94.8	388	54	0.14	0.06
	1997	360.6	45.1	1,340	367	0.27	1.02
	1998	282.8	31.5	1,154	289.600	0.25	1.02
	1999	831.8	88.2	350	40.931	0.12	0.05
	2000	115.4	13.0	2,003	567.224	0.28	4.92
	2001	887.2	97.2	399	22.067	0.06	0.02
	2002	860.0	91.3	1,361	248.487	0.18	0.29
	2003	953.0	98.9	241	11.778	0.05	0.01
	2004	0.0	0.0	156	3	0.02	---

[8] Humboldt Bay had been shut down since 1976, and in 1984, it was decided that it would not be placed in operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[9] Indian Point 1 was defueled in 1975, and in 1984, it was decided that it would not be placed in operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[10] Indian Point 3 was purchased by a different utility in 1979 and subsequently reported its dose separately. Indian Point 1, 2, and 3 have been owned by the same utility since 2001 and report together.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
INDIAN POINT 1[9]	2005	0.0	0.0	151	6.692	0.04	---
Docket 50-3;	2006	0.0	0.0	193	7.670	0.04	---
DPR-05	2007	0.0	0.0	210	2.554	0.01	---
1st commercial operation 10/62	2008	0.0	0.0	234	4.322	0.02	---
Type - PWR	2009	0.0	0.0	140	0.404	0.00	---
Capacity - (265) MWe	2010	0.0	0.0	157	0.833	0.01	---
	2011	0.0	0.0	103	0.262	0.00	---
	2012	0.0	0.0	106	0.343	0.00	---
	2013	0.0	0.0	3	0.283	0.09	---
INDIAN POINT 3[10]	1979	574.0	66.5	808	636	0.79	1.11
Docket 50-286;	1980	367.3	53.2	977	308	0.32	0.84
DPR-64	1981	367.5	59.8	677	364	0.54	0.99
1st commercial operation 8/76	1982	171.5	22.5	1,477	1,226	0.83	7.15
Type - PWR	1983	7.8	2.6	941	607	0.65	77.82
Capacity - 1,030 MWe	1984	714.4	76.3	658	230	0.35	0.32
	1985	566.5	66.0	1,093	570	0.52	1.01
	1986	655.3	73.4	588	202	0.34	0.31
	1987	574.6	62.7	1,308	500	0.38	0.87
	1988	792.5	83.3	451	93	0.21	0.12
	1989	587.8	61.1	1,800	876	0.49	1.49
	1990	595.3	62.9	1,066	358	0.34	0.60
	1991	862.8	87.5	299	40	0.13	0.05
	1992	561.7	61.4	1,003	212	0.21	0.38
	1993	140.5	14.9	478	60	0.13	0.43
	1994	0.0	0.0	529	58	0.11	---
	1995	174.8	21.4	638	67	0.11	0.38
	1996	695.3	74.8	289	22	0.08	0.03
	1997	495.1	54.9	1,608	234	0.15	0.47
	1998	874.0	95.3	213	14.774	0.07	0.02
	1999	829.8	88.3	893	116.920	0.13	0.14
	2000	960.0	99.3	143	8.693	0.06	0.01
	2001	903.9	93.1	1,014	118.115	0.12	0.13
	2002	960.0	98.5	156	6.797	0.04	0.01
	2003	866.2	89.8	902	96.059	0.11	0.11
INDIAN POINT 2, 3[10]	2004	1,851.1	191.0	1,370	199.862	0.15	0.11
Docket 50-247, 50-286;	2005	1,922.2	191.7	1,363	85.280	0.06	0.04
DPR-26, DPR-64	2006	1,936.0	191.0	1,634	289.701	0.18	0.15
1st commercial operation	2007	1,899.3	188.0	1,971	109.969	0.06	0.06
8/74, 8/76	2008	1,977.2	192.6	1,456	142.728	0.10	0.07
Type - PWRs	2009	1,884.2	187.5	1,853	79.090	0.04	0.04
Capacity - 998, 1,030 MWe	2010	1,859.2	183.6	1,962	200.382	0.10	0.11
	2011	1,938.8	95.1	1,185	63.267	0.05	0.03
	2012	1,921.0	94.7	1,289	109.807	0.09	0.06
	2013	1,946.6	95.6	1,297	74.038	0.06	0.04
	2014	1,973.1	96.5	1,313	142.195	0.11	0.07
	2015	1,870.1	92.6	1,277	60.475	0.05	0.03
	2016	1,723.7	85.9	958	72.915	0.08	0.04
	2017	1,740.7	86.6	1,899	102.735	0.05	0.06
KEWAUNEE[11]	1975	401.9	88.2	104	28	0.27	0.07
Docket 50-305;	1976	405.9	78.9	381	270	0.71	0.67
DPR-43	1977	425.0	79.9	312	140	0.45	0.33
1st commercial operation 6/74	1978	466.6	89.5	335	154	0.46	0.33
Type - PWR	1979	412.0	79.0	343	127	0.37	0.31
Capacity - (556) MWe	1980	433.8	82.1	401	165	0.41	0.38
	1981	451.8	86.7	383	141	0.37	0.31
	1982	458.4	87.6	353	101	0.29	0.22

[9] Indian Point 1 was defueled in 1975, and in 1984, it was decided that it would not be placed in operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[10] Indian Point 3 was purchased by a different utility in 1979 and subsequently reported its dose separately. Indian Point 1, 2, and 3 have been owned by the same utility since 2001 and report together.

[11] Kewaunee ceased operations in May 2013 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
KEWAUNEE[11] (continued)	1983	444.1	83.7	445	165	0.37	0.37
	1984	455.3	85.7	482	139	0.29	0.31
	1985	443.1	82.4	519	176	0.34	0.40
	1986	461.7	85.8	502	169	0.34	0.37
	1987	480.0	89.7	755	226	0.30	0.47
	1988	467.5	88.3	705	210	0.30	0.45
	1989	449.1	84.9	570	239	0.42	0.53
	1990	468.8	87.9	490	145	0.30	0.31
	1991	441.8	83.4	495	221	0.45	0.50
	1992	471.4	88.0	450	122	0.27	0.26
	1993	457.1	86.8	436	106	0.24	0.23
	1994	475.6	88.8	364	72	0.20	0.15
	1995	455.6	87.8	415	109	0.26	0.24
	1996	380.4	71.8	474	126	0.27	0.33
	1997	269.8	56.0	278	56	0.20	0.21
	1998	423.0	87.2	384	88.205	0.23	0.21
	1999	505.1	100.0	103	5.055	0.05	0.01
	2000	432.6	88.8	394	99.864	0.25	0.23
	2001	394.1	80.8	1,110	200.245	0.18	0.51
	2002	509.0	97.4	102	4.449	0.04	0.01
	2003	473.5	90.5	439	73.108	0.17	0.15
	2004	441.0	81.0	565	91.168	0.16	0.21
	2005	346.4	62.7	97	4.000	0.04	0.01
	2006	419.4	77.0	539	74.734	0.14	0.18
	2007	528.0	95.0	145	11.126	0.08	0.02
	2008	499.5	88.9	598	92.951	0.16	0.19
	2009	515.4	92.0	595	56.215	0.09	0.11
	2010	569.7	100.0	135	4.690	0.03	0.01
	2011	524.5	92.3	757	79.396	0.10	0.15
	2012	514.1	90.9	585	39.093	0.07	0.08
	2013	0.0	0.0	114	4.915	0.04	---
	2014	0.0	0.0	57	1.964	0.03	---
	2015	0.0	0.0	7	0.156	0.02	---
	2016	0.0	0.0	5	0.092	0.02	---
	2017	0.0	0.0	64	6.167	0.10	---
LA CROSSE[12] Docket 50-409; DPR-45 1st commercial operation 11/69 Type - BWR Capacity - (48) MWe	1970	15.3	---	---	111	---	7.25
	1971	33.1	---	218	158	0.72	4.77
	1972	29.2	---	151	172	1.14	5.89
	1973	24.4	---	157	221	1.41	9.06
	1974	37.9	81.0	115	139	1.21	3.67
	1975	32.0	69.6	165	234	1.42	7.31
	1976	21.2	47.6	118	110	0.93	5.19
	1977	11.3	33.7	141	225	1.60	19.91
	1978	21.6	62.0	182	164	0.90	7.59
	1979	24.0	71.8	153	186	1.22	7.75
	1980	26.4	68.5	124	218	1.76	8.26
	1981	29.6	76.0	187	123	0.66	4.16
	1982	17.2	44.6	148	205	1.39	11.92
	1983	24.8	59.7	160	313	1.96	12.62
	1984	38.5	80.5	288	252	0.88	6.55
	1985	39.2	86.7	373	173	0.46	4.41
	1986	19.6	46.1	260	290	1.12	14.80
	1987	0.0	0.0	127	68	0.54	---
	1988	0.0	0.0	49	31	0.63	---
	1989	0.0	0.0	60	15	0.25	---
	1990	0.0	0.0	51	9	0.18	---
	1991	0.0	0.0	42	8	0.19	---
	1992	0.0	0.0	28	6	0.21	---
	1993	0.0	0.0	48	8	0.17	---

[11] Kewaunee ceased operations in May 2013 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[12] La Crosse ceased operations in 1987 and will not be put in commercial operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
LA CROSSE[12] (continued)	1994	0.0	0.0	65	8	0.12	---
	1995	0.0	0.0	31	3	0.10	---
	1996	0.0	0.0	25	4	0.16	---
	1997	0.0	0.0	23	2	0.09	---
	1998	0.0	0.0	27	1.530	0.06	---
	1999	0.0	0.0	66	3.725	0.06	---
	2000	0.0	0.0	37	3.548	0.10	---
	2001	0.0	0.0	45	2.782	0.06	---
	2002	0.0	0.0	47	2.314	0.05	---
	2003	0.0	0.0	65	1.836	0.03	---
	2004	0.0	0.0	56	0.918	0.02	---
	2005	0.0	0.0	51	8.139	0.16	---
	2006	0.0	0.0	0	0.000	---	---
	2007	0.0	0.0	86	37.092	0.43	---
	2008	0.0	0.0	40	1.759	0.04	---
	2009	0.0	0.0	48	1.307	0.03	---
	2010	0.0	0.0	78	2.971	0.04	---
	2011	0.0	0.0	110	5.296	0.05	---
	2012	0.0	0.0	100	7.652	0.08	---
	2013	0.0	0.0	51	3.411	0.07	---
	2014	0.0	0.0	59	5.499	0.09	---
	2015	0.0	0.0	22	1.587	0.07	---
	2016	0.0	0.0	34	3.904	0.11	---
	2017	0.0	0.0	58	6.356	0.11	---
LASALLE 1, 2 Docket 50-373, 50-374; NPF-11, NPF-18 1st commercial operation 1/84, 6/84 Type - BWRs Capacity - 1,111, 1,111 MWe	1984	677.8	77.8	1,245	252	0.20	0.37
	1985	987.9	53.0	1,635	685	0.42	0.69
	1986	929.5	50.6	1,614	898	0.56	0.97
	1987	1,030.0	59.3	1,744	1,396	0.80	1.36
	1988	1,317.6	71.6	2,737	2,471	0.90	1.88
	1989	1,503.5	73.1	2,475	1,386	0.56	0.92
	1990	1,754.3	84.6	1,830	948	0.52	0.54
	1991	1,837.0	86.7	1,985	806	0.41	0.44
	1992	1,447.4	72.0	2,418	1,167	0.48	0.81
	1993	1,542.0	76.0	1,701	854	0.50	0.55
	1994	1,580.0	77.6	1,812	726	0.40	0.46
	1995	1,696.6	82.1	1,623	512	0.32	0.30
	1996	1,053.8	54.3	2,782	819	0.29	0.78
	1997	0.0	0.0	1,661	316	0.19	---
	1998	380.9	19.3	2,099	422.249	0.20	1.11
	1999	1,671.9	81.8	2,689	576.354	0.21	0.34
	2000	2,138.6	97.1	1,831	260.320	0.14	0.12
	2001	2,223.8	98.9	535	82.721	0.15	0.04
	2002	2,040.0	92.1	2,012	449.587	0.22	0.22
	2003	2,100.2	94.8	2,253	464.427	0.21	0.22
	2004	2,162.1	96.0	2,366	359.470	0.15	0.17
	2005	2,130.4	95.0	2,097	334.558	0.16	0.16
	2006	2,181.3	97.0	2,006	248.454	0.12	0.11
	2007	2,166.7	98.0	1,953	228.373	0.12	0.11
	2008	2,145.8	96.4	2,402	217.567	0.09	0.10
	2009	2,141.0	95.7	1,986	296.659	0.15	0.14
	2010	2,184.1	96.5	2,386	384.434	0.16	0.18
	2011	2,198.2	96.1	2,805	340.529	0.12	0.15
	2012	2,230.8	96.9	1,973	224.711	0.11	0.10
	2013	2,141.6	94.1	1,960	383.622	0.20	0.18
	2014	2,141.0	94.0	2,151	366.524	0.17	0.17
	2015	2,132.9	95.7	2,492	501.666	0.20	0.24
	2016	2,185.5	96.0	2,653	338.985	0.13	0.16
	2017	2,158.5	94.5	2,824	570.389	0.20	0.26

[12] La Crosse ceased operations in 1987 and will not be put in commercial operation again. Therefore, it is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
LIMERICK 1, 2	1987	636.1	70.2	2,156	174	0.08	0.27
Docket 50-352, 50-353;	1988	794.9	96.5	950	52	0.05	0.07
NPF-39, NPF-85	1989	628.4	66.0	1,818	266	0.15	0.42
1st commercial operation	1990	1,527.7	78.2	1,422	175	0.12	0.11
2/86, 1/90	1991	1,810.9	86.8	1,151	106	0.09	0.06
Type - BWRs	1992	1,741.4	84.8	1,559	330	0.21	0.19
Capacity - 1,099, 1,108 MWe	1993	1,913.2	91.6	1,287	217	0.17	0.11
	1994	1,944.4	94.9	1,543	275	0.18	0.14
	1995	1,957.1	93.0	1,581	260	0.16	0.13
	1996	2,026.2	93.3	1,654	234	0.14	0.12
	1997	2,001.7	95.8	1,463	234	0.16	0.12
	1998	1,907.2	89.5	1,854	357.139	0.19	0.19
	1999	2,089.6	94.2	1,800	271.547	0.15	0.13
	2000	2,154.9	95.8	1,279	260.611	0.20	0.12
	2001	2,205.9	97.3	1,127	210.336	0.19	0.10
	2002	2,197.0	97.1	1,248	160.324	0.13	0.07
	2003	2,213.6	97.2	1,298	147.047	0.11	0.07
	2004	2,218.9	97.6	1,265	149.433	0.12	0.07
	2005	2,168.9	96.3	1,460	187.609	0.13	0.09
	2006	2,207.2	97.0	1,509	193.429	0.13	0.09
	2007	2,185.8	96.0	1,570	197.104	0.13	0.09
	2008	2,169.2	96.0	1,393	176.825	0.13	0.08
	2009	2,211.4	97.2	1,606	234.742	0.15	0.11
	2010	2,165.2	96.7	1,525	167.797	0.11	0.08
	2011	2,112.7	94.5	2,007	184.415	0.09	0.09
	2012	2,071.4	92.8	2,011	159.812	0.08	0.08
	2013	2,235.7	96.8	1,663	133.531	0.08	0.06
	2014	2,182.1	94.8	1,523	138.396	0.09	0.06
	2015	2,165.6	95.9	1,516	124.787	0.08	0.06
	2016	2,219.1	96.3	1,626	126.799	0.08	0.06
	2017	2,123.1	93.4	1,808	183.736	0.10	0.09
MAINE YANKEE[13]	1973	408.7	---	782	117	0.15	0.29
Docket 50-309;	1974	432.6	68.7	619	420	0.68	0.97
DPR-36	1975	542.9	79.9	440	319	0.73	0.59
1st commercial operation 12/72	1976	712.2	95.0	244	85	0.35	0.12
Type - PWR	1977	617.6	82.2	508	245	0.48	0.40
Capacity - (860) MWe	1978	642.7	84.1	638	420	0.66	0.65
	1979	537.0	68.4	393	154	0.39	0.29
	1980	527.0	72.2	735	462	0.63	0.88
	1981	624.2	78.2	868	424	0.49	0.68
	1982	542.5	69.1	1,295	619	0.48	1.14
	1983	677.1	83.6	592	165	0.28	0.24
	1984	605.7	74.4	1,262	884	0.70	1.46
	1985	635.4	79.2	1,009	700	0.69	1.10
	1986	737.6	87.8	495	100	0.20	0.14
	1987	478.1	65.3	1,100	722	0.66	1.51
	1988	591.9	79.1	1,058	725	0.69	1.22
	1989	819.2	93.7	375	99	0.26	0.12
	1990	573.0	71.0	1,359	682	0.50	1.19
	1991	738.1	86.6	426	105	0.25	0.14
	1992	631.7	79.1	1,189	461	0.39	0.73
	1993	674.8	79.8	1,016	377	0.37	0.56
	1994	782.8	90.9	297	84	0.28	0.11
	1995	23.6	3.7	1,167	653	0.56	27.67
	1996	602.9	78.1	408	56	0.14	0.09
	1997	0.0	0.0	991	153	0.15	---
	1998	0.0	0.0	438	163.008	0.37	---
	1999	0.0	0.0	365	135.057	0.37	---
	2000	0.0	0.0	490	121.133	0.25	---
	2001	0.0	0.0	412	68.121	0.17	---
	2002	0.0	0.0	452	66.226	0.15	---
	2003	0.0	0.0	342	43.775	0.13	---

[13] Maine Yankee ceased operations in August 1997 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
MAINE YANKEE[13]	2004	0.0	0.0	190	21.313	0.11	---
(continued)	2005	0.0	0.0	2	0.048	0.02	---
	2006	0.0	0.0	0	0.000	---	---
	2007	0.0	0.0	0	0.000	---	---
	2008	0.0	0.0	1	0.013	0.01	---
	2009	0.0	0.0	3	0.137	0.05	---
	2010	0.0	0.0	1	0.084	0.08	---
	2011	0.0	0.0	2	0.060	0.03	---
	2012	0.0	0.0	6	0.238	0.04	---
	2013	0.0	0.0	4	0.186	0.05	---
	2014	0.0	0.0	3	0.079	0.03	---
	2015	0.0	0.0	9	0.176	0.02	---
	2016	0.0	0.0	2	0.038	0.02	---
	2017	0.0	0.0	3	0.054	0.02	---
MCGUIRE 1, 2	1982	524.9	80.4	1,560	169	0.11	0.32
Docket 50-369, 50-370;	1983	558.3	55.4	1,751	521	0.30	0.93
NPF-9, NPF-17	1984	764.1	68.5	1,663	507	0.30	0.66
1st commercial operation	1985	808.4	77.0	2,217	771	0.35	0.95
12/81, 3/84	1986	1,360.0	60.1	2,326	1,015	0.44	0.75
Type - PWRs	1987	1,774.7	79.2	2,865	1,043	0.36	0.59
Capacity - 1,158, 1,158 MWe	1988	1,830.7	80.2	2,808	1,104	0.39	0.60
	1989	1,810.2	80.8	1,994	620	0.31	0.34
	1990	1,340.3	61.3	2,289	727	0.32	0.54
	1991	1,945.1	85.0	1,723	361	0.21	0.19
	1992	1,696.8	74.4	1,619	418	0.26	0.25
	1993	1,470.4	66.2	1,685	463	0.27	0.31
	1994	1,848.0	80.2	1,637	397	0.24	0.21
	1995	2,132.3	92.9	1,259	138	0.11	0.06
	1996	1,881.8	82.8	1,622	238	0.15	0.13
	1997	1,558.2	73.0	2,193	492	0.22	0.32
	1998	2,139.8	95.1	1,045	142.245	0.14	0.07
	1999	1,961.7	88.9	1,274	256.524	0.20	0.13
	2000	2,100.1	94.2	940	132.513	0.14	0.06
	2001	2,113.3	93.9	963	136.581	0.14	0.06
	2002	2,051.0	91.7	1,167	180.618	0.15	0.09
	2003	2,156.2	96.0	841	71.323	0.08	0.03
	2004	2,075.7	91.8	1,116	196.193	0.18	0.09
	2005	1,993.9	89.2	1,401	173.972	0.12	0.09
	2006	2,100.2	93.0	1,218	108.285	0.09	0.05
	2007	2,011.4	89.0	1,375	156.035	0.11	0.08
	2008	1,943.3	86.2	1,613	165.767	0.10	0.09
	2009	2,170.6	95.3	1,165	79.773	0.07	0.04
	2010	2,151.9	94.8	1,225	81.321	0.07	0.04
	2011	2,038.3	89.9	1,648	119.637	0.07	0.06
	2012	2,045.6	90.4	1,222	62.690	0.05	0.03
	2013	2,157.3	94.4	1,447	109.423	0.08	0.05
	2014	2,008.0	87.0	1,760	138.257	0.08	0.07
	2015	2,230.1	95.5	1,074	49.399	0.05	0.02
	2016	2,269.9	96.1	1,201	67.654	0.06	0.03
	2017	2,145.6	92.0	1,607	147.589	0.09	0.07
MILLSTONE 1[14]	1972	377.6	---	612	596	0.97	1.58
Docket 50-245;	1973	225.1	---	1,184	663	0.56	2.95
DPR-21	1974	430.3	79.1	2,477	1,430	0.58	3.32
1st commercial operation 3/71	1975	465.4	75.6	2,587	2,022	0.78	4.34
Type - BWR	1976	449.8	76.1	1,387	1,194	0.86	2.65
Capacity - (641) MWe	1977	575.7	89.6	1,075	394	0.37	0.68
	1978	556.6	87.6	1,391	1,416	1.02	2.54
	1979	505.0	77.3	2,001	1,795	0.90	3.55

[13] Maine Yankee ceased operations in August 1997 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[14] Millstone 1 ceased operations in 1998, and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational. Since 2008, Millstone 1 has voluntarily provided an estimate of the collective dose for Unit 1, but not the number of individuals with measurable dose.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
MILLSTONE 1[14] (continued)	1980	405.8	69.0	3,024	2,157	0.71	5.32
	1981	304.3	51.6	2,506	1,496	0.60	4.92
	1982	490.2	79.9	1,370	929	0.68	1.90
	1983	640.1	95.6	309	244	0.79	0.38
	1984	516.1	78.8	1,992	836	0.42	1.62
	1985	548.5	83.6	732	608	0.83	1.11
	1986	626.8	95.4	389	150	0.39	0.24
	1987	523.4	79.6	1,588	684	0.43	1.31
	1988	658.8	98.6	327	144	0.44	0.22
	1989	554.6	84.2	852	462	0.54	0.83
	1990	608.3	91.6	365	131	0.36	0.22
	1991	213.1	35.4	1,154	409	0.35	1.92
	1992	431.8	68.1	348	99	0.28	0.23
	1993	627.9	96.8	305	81	0.27	0.13
	1994	394.0	63.6	1,321	391	0.30	0.99
	1995	520.6	80.0	910	620	0.68	1.19
	1996	0.0	0.0	747	431	0.58	---
	1997	-2.9	0.0	1,053	195	0.19	---
	1998	-2.7	0.0	347	12.741	0.04	---
	1999	0.0	0.0	397	9.790	0.02	---
	2000	0.0	0.0	478	59.955	0.13	---
	2001	0.0	0.0	414	14.946	0.04	---
	2002	0.0	0.0	185	4.151	0.02	---
	2003	0.0	0.0	195	10.675	0.05	---
	2004	0.0	0.0	147	11.152	0.08	---
	2005	0.0	0.0	145	0.897	0.01	---
	2006	0.0	0.0	4	0.607	0.15	---
	2007	0.0	0.0	33	0.901	0.03	---
	2008	0.0	0.0	0	0.222	---	---
	2009	0.0	0.0	0	0.114	---	---
	2010	0.0	0.0	0	0.142	---	---
	2011	0.0	0.0	0	0.265	---	---
	2012	0.0	0.0	0	0.137	---	---
	2013	0.0	0.0	0	0.313	---	---
	2014	0.0	0.0	0	0.313	---	---
	2015	0.0	0.0	0	0.000	---	---
	2016	0.0	0.0	0	0.000	---	---
	2017	0.0	0.0	0	0.000	---	---
MILLSTONE 2, 3 Docket 50-336, 50-423; DPR-65; NPF-49 1st commercial operation 12/75, 4/86 Type - PWRs Capacity - 870, 1,210 MWe	1976	545.7	78.7	620	168	0.27	0.31
	1977	518.7	65.7	667	242	0.36	0.47
	1978	536.6	67.3	1,420	1,444	1.02	2.69
	1979	520.0	62.8	525	471	0.90	0.91
	1980	579.3	69.2	893	637	0.71	1.10
	1981	722.4	82.6	890	531	0.60	0.74
	1982	595.9	70.6	2,083	1,413	0.68	2.37
	1983	294.0	34.2	2,383	1,881	0.79	6.40
	1984	782.7	93.5	285	120	0.42	0.15
	1985	417.8	49.4	1,905	1,581	0.83	3.78
	1986	1,313.8	80.4	2,393	993	0.41	0.76
	1987	1,624.5	84.1	1,441	505	0.35	0.31
	1988	1,594.8	83.2	1,827	804	0.44	0.50
	1989	1,428.3	72.9	1,984	1,079	0.54	0.76
	1990	1,614.9	87.1	1,652	593	0.36	0.37
	1991	819.5	69.7	1,084	381	0.35	0.46
	1992	1,115.1	59.9	3,190	1,280	0.40	1.15
	1993	1,525.2	79.7	2,064	557	0.27	0.37
	1994	1,556.6	73.1	1,249	188	0.15	0.12
	1995	1,278.1	60.5	1,691	416	0.25	0.33
	1996	418.1	19.3	983	126	0.13	0.30
	1997	0.0	0.0	1,435	253	0.18	---

[14] Millstone 1 ceased operations in 1998 and is no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational. From 2008-2014, Millstone 1 voluntarily provided an estimate of the collective dose for Unit 1, but not the number of individuals with measurable dose.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
MILLSTONE 2, 3	1998	374.9	20.9	1,179	112.543	0.10	0.30
(continued)	1999	1,446.3	73.3	1,688	252.138	0.15	0.17
	2000	1,865.8	92.4	1,385	142.664	0.10	0.08
	2001	1,759.3	92.0	1,327	174.238	0.13	0.10
	2002	1,703.0	87.5	1,548	292.197	0.19	0.17
	2003	1,834.6	91.0	1,274	322.923	0.25	0.18
	2004	1,887.5	95.0	803	136.459	0.17	0.07
	2005	1,777.1	88.8	1,329	202.490	0.15	0.11
	2006	1,898.5	93.0	1,160	174.164	0.15	0.09
	2007	1,875.1	94.0	1,150	163.780	0.14	0.09
	2008	1,761.1	87.7	1,467	272.693	0.19	0.15
	2009	1,906.1	89.6	983	159.203	0.16	0.08
	2010	1,916.8	93.1	718	81.589	0.11	0.04
	2011	1,822.7	87.7	1,044	169.417	0.16	0.09
	2012	1,948.9	92.2	726	73.270	0.10	0.04
	2013	1,954.5	94.6	747	64.232	0.09	0.03
	2014	1,812.7	87.5	1,250	160.502	0.13	0.09
	2015	1,992.4	95.0	818	63.940	0.08	0.03
	2016	1,896.1	93.1	856	64.125	0.07	0.03
	2017	1,888.0	91.2	1,118	112.598	0.10	0.06
MONTICELLO	1972	424.4	---	99	61	0.62	0.14
Docket 50-263;	1973	389.5	---	401	176	0.44	0.45
DPR-22	1974	349.3	74.9	842	349	0.41	1.00
1st commercial operation 6/71	1975	344.8	72.2	1,353	1,353	1.00	3.92
Type - BWR	1976	476.4	91.5	325	263	0.81	0.55
Capacity - 628 MWe	1977	425.6	79.9	860	1,000	1.16	2.35
	1978	459.4	87.2	679	375	0.55	0.82
	1979	522.0	97.6	372	157	0.42	0.30
	1980	411.8	78.2	1,114	531	0.48	1.29
	1981	389.3	72.6	1,446	1,004	0.69	2.58
	1982	291.1	63.3	1,307	993	0.76	3.41
	1983	494.6	96.3	416	121	0.29	0.24
	1984	33.7	9.2	1,872	2,462	1.32	73.06
	1985	509.8	91.7	586	327	0.56	0.64
	1986	402.7	79.1	895	596	0.67	1.48
	1987	422.5	81.9	941	568	0.60	1.34
	1988	542.5	99.8	375	110	0.29	0.20
	1989	318.2	76.2	1,102	507	0.46	1.59
	1990	536.0	96.9	336	94	0.28	0.18
	1991	429.4	80.8	964	465	0.48	1.08
	1992	528.3	97.5	454	114	0.25	0.22
	1993	458.1	84.4	954	494	0.52	1.08
	1994	471.3	87.0	788	395	0.50	0.84
	1995	564.7	100.0	200	44	0.22	0.08
	1996	461.6	86.9	757	240	0.32	0.52
	1997	417.4	75.9	399	106	0.27	0.25
	1998	470.2	88.1	674	209.137	0.31	0.44
	1999	530.7	92.9	451	70.075	0.16	0.13
	2000	483.2	84.2	792	216.136	0.27	0.45
	2001	441.3	78.5	834	220.683	0.26	0.50
	2002	571.0	99.0	399	40.030	0.10	0.07
	2003	522.8	91.7	858	168.896	0.20	0.32
	2004	573.2	99.2	279	35.081	0.13	0.06
	2005	509.4	90.0	919	175.201	0.19	0.34
	2006	579.1	100.0	273	33.416	0.12	0.06
	2007	478.6	85.0	1,075	191.398	0.18	0.40
	2008	555.3	95.8	351	43.777	0.12	0.08
	2009	473.1	85.2	1,235	173.624	0.14	0.37
	2010	536.0	98.5	534	56.116	0.11	0.10
	2011	383.4	71.3	1,903	236.997	0.12	0.62
	2012	556.7	98.6	528	38.786	0.07	0.07
	2013	342.3	62.5	1,247	198.968	0.16	0.58

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
MONTICELLO	2014	493.6	95.0	282	35.306	0.13	0.07
(continued)	2015	532.4	85.5	846	130.057	0.15	0.24
	2016	639.0	100.0	313	28.547	0.09	0.04
	2017	589.0	92.2	815	115.814	0.14	0.20
NINE MILE POINT 1, 2	1970	227.0	---	821	44	0.05	0.19
Docket 50-220, 50-410;	1971	346.5	---	1,006	195	0.19	0.56
DPR-63; NPF-69	1972	381.8	---	735	285	0.39	0.75
1st commercial operation	1973	411.0	---	550	567	1.03	1.38
12/69, 4/88	1974	385.9	70.5	740	824	1.11	2.14
Type - BWRs	1975	359.0	72.1	649	681	1.05	1.90
Capacity - 565, 1,277 MWe	1976	484.6	88.2	392	428	1.09	0.88
	1977	347.4	59.2	1,093	1,383	1.27	3.98
	1978	527.7	95.1	561	314	0.56	0.60
	1979	354.0	66.1	1,326	1,497	1.13	4.23
	1980	533.9	92.3	1,174	591	0.50	1.11
	1981	385.2	66.0	2,029	1,592	0.78	4.13
	1982	133.5	21.4	1,352	1,264	0.93	9.47
	1983	329.8	56.2	1,405	860	0.61	2.61
	1984	426.8	71.9	1,530	890	0.58	2.09
	1985	580.9	96.4	1,007	265	0.26	0.46
	1986	371.0	65.3	1,878	1,275	0.68	3.44
	1987	542.6	93.3	1,190	141	0.12	0.26
	1988	0.0	0.0	2,626	854	0.33	---
	1989	527.5	29.7	2,737	564	0.21	1.07
	1990	656.2	46.6	2,405	699	0.29	1.07
	1991	1,250.8	79.7	1,543	292	0.19	0.23
	1992	965.9	61.8	1,800	563	0.31	0.58
	1993	1,380.2	84.6	2,352	633	0.27	0.46
	1994	1,589.6	95.9	800	149	0.19	0.09
	1995	1,382.2	82.5	2,304	759	0.33	0.55
	1996	1,598.6	91.6	1,596	290	0.18	0.18
	1997	1,321.5	74.8	1,425	429	0.30	0.32
	1998	1,387.3	87.0	1,744	378.484	0.22	0.27
	1999	1,409.5	81.3	1,709	446.699	0.26	0.32
	2000	1,443.9	88.1	1,783	282.838	0.16	0.20
	2001	1,506.9	88.9	1,371	343.197	0.25	0.23
	2002	1,517.0	90.4	2,449	516.663	0.21	0.34
	2003	1,585.6	91.4	1,501	374.775	0.25	0.24
	2004	1,551.9	92.0	1,362	448.509	0.33	0.29
	2005	1,656.5	94.5	1,366	401.719	0.29	0.24
	2006	1,647.1	96.0	1,130	229.551	0.20	0.14
	2007	1,598.3	93.0	1,826	329.307	0.18	0.21
	2008	1,642.1	95.8	1,391	301.824	0.22	0.18
	2009	1,706.2	97.1	1,456	237.552	0.16	0.14
	2010	1,627.1	95.2	1,703	375.424	0.22	0.23
	2011	1,616.8	92.5	1,362	244.395	0.18	0.15
	2012	1,504.6	87.3	1,764	407.900	0.23	0.27
	2013	1,804.9	95.0	1,411	217.056	0.15	0.12
	2014	1,737.8	94.7	1,483	263.710	0.18	0.15
	2015	1,823.7	95.7	1,604	160.380	0.10	0.09
	2016	1,765.5	95.1	1,679	256.794	0.15	0.15
	2017	1,827.3	97.2	1,401	141.150	0.10	0.08
NORTH ANNA 1, 2	1979	507.0	61.7	2,025	449	0.22	0.89
Docket 50-338, 50-339;	1980	681.8	86.5	2,086	218	0.10	0.32
NPF-4, NPF-7	1981	1,241.9	71.5	2,416	680	0.28	0.55
1st commercial operation	1982	777.7	45.8	2,872	1,915	0.67	2.46
6/78, 12/80	1983	1,338.4	76.1	2,228	665	0.30	0.50
Type - PWRs	1984	1,021.3	58.8	3,062	1,945	0.64	1.90
Capacity - 948, 944 MWe	1985	1,516.9	86.1	2,436	838	0.34	0.55
	1986	1,484.5	83.0	2,831	722	0.26	0.49
	1987	1,112.6	67.8	2,624	1,521	0.58	1.37
	1988	1,772.7	96.7	992	112	0.11	0.06
	1989	1,226.8	72.5	2,861	1,471	0.51	1.20

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
NORTH ANNA 1, 2 (continued)	1990	1,590.4	90.5	2,161	590	0.27	0.37
	1991	1,597.5	88.6	2,085	629	0.30	0.39
	1992	1,403.2	84.1	2,159	576	0.27	0.41
	1993	1,428.4	80.1	2,768	908	0.33	0.64
	1994	1,717.1	95.9	1,036	193	0.19	0.11
	1995	1,666.4	90.8	1,551	367	0.24	0.22
	1996	1,569.6	89.1	1,203	291	0.24	0.19
	1997	1,711.5	96.2	856	103	0.12	0.06
	1998	1,632.8	92.7	1,201	265.922	0.22	0.16
	1999	1,747.7	96.1	727	94.402	0.13	0.05
	2000	1,734.1	95.8	730	65.405	0.09	0.04
	2001	1,491.0	84.8	1,231	308.907	0.25	0.21
	2002	1,557.0	84.3	914	143.312	0.16	0.09
	2003	1,569.1	87.2	1,041	187.014	0.18	0.12
	2004	1,685.6	92.0	965	129.686	0.13	0.08
	2005	1,751.5	96.0	686	58.844	0.09	0.03
	2006	1,723.0	95.0	749	82.069	0.11	0.05
	2007	1,596.7	88.0	1,581	309.237	0.20	0.19
	2008	1,643.1	91.2	795	61.003	0.08	0.04
	2009	1,735.5	95.6	745	78.126	0.10	0.05
	2010	1,529.6	84.9	1,032	182.289	0.18	0.12
	2011	1,429.1	76.5	792	90.763	0.11	0.06
	2012	1,745.6	91.4	762	106.518	0.14	0.06
	2013	1,712.9	89.2	948	121.803	0.13	0.07
	2014	1,813.8	94.1	753	71.914	0.10	0.04
	2015	1,857.4	96.6	663	43.838	0.07	0.02
	2016	1,726.2	90.0	1,109	119.339	0.11	0.07
	2017	1,840.9	95.6	678	44.884	0.07	0.02
OCONEE 1, 2, 3 Docket 50-269, 50-270, 50-287; DPR-38, DPR-47, DPR-55 1st commercial operation 7/73, 9/74, 12/74 Type - PWRs Capacity - 847, 848, 859 MWe	1974	650.6	60.1	844	517	0.61	0.79
	1975	1,838.3	75.5	829	497	0.60	0.27
	1976	1,561.4	63.0	1,215	1,026	0.84	0.66
	1977	1,566.4	65.9	1,595	1,329	0.83	0.85
	1978	1,909.0	75.8	1,636	1,393	0.85	0.73
	1979	1,708.0	67.7	2,100	1,001	0.48	0.59
	1980	1,703.7	70.1	2,124	1,055	0.50	0.62
	1981	1,661.5	66.8	2,445	1,211	0.50	0.73
	1982	1,293.1	52.5	2,445	1,792	0.73	1.39
	1983	2,141.5	82.2	1,902	1,207	0.63	0.56
	1984	2,242.9	85.7	2,085	1,106	0.53	0.49
	1985	2,036.3	80.5	2,729	1,304	0.48	0.64
	1986	1,995.6	79.0	2,499	949	0.38	0.48
	1987	1,962.6	82.4	2,672	1,142	0.43	0.58
	1988	2,228.9	87.2	2,672	871	0.33	0.39
	1989	2,188.6	85.4	2,205	684	0.31	0.31
	1990	2,405.2	91.4	1,948	404	0.21	0.17
	1991	2,275.0	86.7	1,966	551	0.28	0.24
	1992	2,110.7	82.0	1,954	612	0.31	0.29
	1993	2,399.2	91.3	1,499	237	0.16	0.10
	1994	2,144.3	82.2	1,923	537	0.28	0.25
	1995	2,366.1	89.5	1,586	304	0.19	0.13
	1996	1,847.9	70.3	1,479	257	0.17	0.14
	1997	1,563.7	67.7	1,379	223	0.16	0.14
	1998	1,989.1	81.3	1,695	366.028	0.22	0.18
	1999	2,264.5	90.3	1,568	202.025	0.13	0.09
	2000	2,321.0	91.6	1,686	272.697	0.16	0.12
	2001	2,167.6	86.8	2,002	579.209	0.29	0.27
	2002	2,355.0	92.5	1,723	224.672	0.13	0.10
	2003	2,177.7	86.3	2,180	245.349	0.11	0.11
	2004	2,125.2	84.1	2,295	367.891	0.16	0.17
	2005	2,349.5	92.3	1,516	148.694	0.10	0.06
	2006	2,274.8	90.0	1,859	221.222	0.12	0.10
	2007	2,347.8	92.0	1,915	252.936	0.13	0.11
	2008	2298.5	90.9	1,924	186.335	0.10	0.08

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
OCONEE 1, 2, 3	2009	2,385.7	92.6	1,830	180.868	0.10	0.08
(continued)	2010	2,391.1	93.3	1,953	193.088	0.10	0.08
	2011	2,321.6	90.7	2,142	182.261	0.09	0.08
	2012	2,351.0	91.8	1,777	131.442	0.07	0.06
	2013	2,400.1	93.1	1,549	106.414	0.07	0.04
	2014	2,419.3	94.1	2,005	109.011	0.05	0.05
	2015	2,504.5	97.4	1,339	69.050	0.05	0.03
	2016	2,417.5	93.9	1,179	53.398	0.05	0.02
	2017	2,488.4	96.7	966	37.301	0.04	0.01
OYSTER CREEK	1970	413.6	---	95	63	0.66	0.15
Docket 50-219;	1971	448.9	---	249	240	0.96	0.53
DPR-16	1972	515.0	---	339	582	1.72	1.13
1st commercial operation 12/69	1973	424.6	---	782	1,236	1.58	2.91
Type - BWR	1974	434.5	70.4	935	984	1.05	2.26
Capacity - 619 MWe	1975	373.6	73.3	1,210	1,140	0.94	3.05
	1976	456.5	79.3	1,582	1,078	0.68	2.36
	1977	385.7	70.1	1,673	1,614	0.96	4.18
	1978	431.8	74.3	1,411	1,279	0.91	2.96
	1979	541.0	85.9	842	467	0.55	0.86
	1980	232.9	41.4	1,966	1,733	0.88	7.44
	1981	314.8	59.8	1,689	917	0.54	2.91
	1982	242.7	62.5	1,270	865	0.68	3.56
	1983	27.9	11.5	2,303	2,257	0.98	80.90
	1984	37.1	9.6	2,369	2,054	0.87	55.36
	1985	446.1	89.4	2,342	748	0.32	1.68
	1986	157.3	31.5	3,740	2,436	0.65	15.49
	1987	371.0	64.2	1,932	522	0.27	1.41
	1988	419.6	65.9	2,875	1,504	0.52	3.58
	1989	287.5	57.3	2,395	910	0.38	3.17
	1990	511.8	89.1	1,941	310	0.16	0.61
	1991	351.6	60.5	3,089	1,185	0.38	3.37
	1992	536.3	85.9	2,771	657	0.24	1.23
	1993	551.9	87.8	2,560	416	0.16	0.75
	1994	431.7	70.8	2,382	844	0.35	1.96
	1995	615.4	97.4	761	90	0.12	0.15
	1996	515.0	82.6	1,833	449	0.24	0.87
	1997	579.1	94.3	509	50	0.10	0.09
	1998	490.8	82.4	1,408	308.323	0.22	0.63
	1999	615.1	100.0	466	41.664	0.09	0.07
	2000	444.9	83.3	2,044	614.379	0.30	1.38
	2001	595.0	97.6	442	45.817	0.10	0.08
	2002	573.0	94.0	1,468	265.810	0.18	0.46
	2003	598.4	97.2	416	43.363	0.10	0.07
	2004	551.8	91.6	1,346	226.880	0.17	0.41
	2005	611.9	99.5	316	27.813	0.09	0.05
	2006	530.2	90.0	1,443	189.950	0.13	0.36
	2007	579.7	97.0	464	46.590	0.10	0.08
	2008	531.0	91.0	1,511	211.932	0.14	0.40
	2009	568.3	96.4	382	37.272	0.10	0.07
	2010	525.7	89.9	1,655	206.284	0.12	0.39
	2011	604.8	98.0	434	46.984	0.11	0.08
	2012	537.1	88.5	1,359	165.164	0.12	0.31
	2013	584.1	96.5	299	29.981	0.10	0.05
	2014	551.8	91.2	1,160	145.487	0.13	0.26
	2015	602.3	97.7	275	22.710	0.08	0.04
	2016	523.4	87.5	1,286	133.603	0.10	0.26
	2017	619.8	99.5	249	17.511	0.07	0.03
PALISADES	1972	216.8	---	---	78	---	0.36
Docket 50-255;	1973	286.8	---	975	1,133	1.16	3.95
DPR-20	1974	10.7	5.5	774	627	0.81	58.60
1st commercial operation 12/71	1975	302.0	64.5	495	306	0.62	1.01
Type - PWR	1976	346.9	55.2	742	696	0.94	2.01
Capacity - 777 MWe	1977	616.6	91.4	332	100	0.30	0.16

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
PALISADES (continued)	1978	320.2	49.7	849	764	0.90	2.39
	1979	415.0	59.9	1,599	854	0.53	2.06
	1980	288.3	42.9	1,307	424	0.32	1.47
	1981	418.2	57.2	2,151	902	0.42	2.16
	1982	404.3	54.7	1,554	330	0.21	0.82
	1983	454.4	60.3	2,167	977	0.45	2.15
	1984	98.7	15.2	1,344	573	0.43	5.81
	1985	639.2	83.8	1,355	507	0.37	0.79
	1986	102.3	15.1	1,438	672	0.47	6.57
	1987	319.2	48.2	1,122	456	0.41	1.43
	1988	413.4	56.8	1,472	730	0.50	1.77
	1989	442.8	69.1	1,026	314	0.31	0.71
	1990	366.7	58.7	2,414	766	0.32	2.09
	1991	587.0	78.1	1,315	211	0.16	0.36
	1992	581.9	76.1	1,267	295	0.23	0.51
	1993	424.4	53.7	908	289	0.32	0.68
	1994	541.8	67.0	397	60	0.15	0.11
	1995	583.5	75.8	1,230	462	0.38	0.79
	1996	638.2	81.4	1,109	318	0.29	0.50
	1997	662.5	89.9	338	48	0.14	0.07
	1998	615.4	83.5	895	216.563	0.24	0.35
	1999	585.4	80.2	939	218.451	0.23	0.37
	2000	654.4	88.0	255	26.305	0.10	0.04
	2001	268.2	36.3	1,032	362.723	0.35	1.35
	2002	725.0	94.8	224	24.380	0.11	0.03
	2003	701.1	90.7	822	202.571	0.25	0.29
	2004	608.6	82.3	974	370.895	0.38	0.61
	2005	756.6	98.0	156	10.459	0.07	0.01
	2006	675.5	86.0	882	239.652	0.27	0.35
	2007	665.6	85.0	1,065	256.632	0.24	0.39
	2008	778.4	98.2	272	23.478	0.09	0.03
	2009	698.5	89.0	975	267.295	0.27	0.38
	2010	712.5	90.8	908	219.873	0.24	0.31
	2011	758.1	96.5	340	21.654	0.06	0.03
	2012	589.5	77.1	1,096	245.129	0.22	0.42
	2013	689.7	86.7	339	15.830	0.05	0.02
	2014	665.6	83.4	1,231	486.062	0.39	0.73
	2015	721.3	90.9	940	230.687	0.25	0.32
	2016	803.8	100.0	161	5.667	0.04	0.01
	2017	696.1	91.3	794	154.142	0.19	0.22
PALO VERDE 1, 2, 3 Docket 50-528, 50-529, 50-530; NPF-41, NPF-51, NPF-74 1st commercial operation 1/86, 9/86, 1/88 Type - PWRs Capacity - 1,311, 1,314, 1,312 MWe	1987	1,638.1	66.1	1,792	669	0.37	0.41
	1988	1,700.9	65.5	2,173	688	0.32	0.40
	1989	965.3	26.5	2,615	720	0.28	0.75
	1990	2,500.9	67.5	2,236	499	0.22	0.20
	1991	3,043.9	78.9	2,242	605	0.27	0.20
	1992	3,102.3	82.0	1,981	541	0.27	0.17
	1993	2,677.1	74.3	2,124	592	0.28	0.22
	1994	2,827.6	79.1	2,048	462	0.23	0.16
	1995	3,265.2	85.6	1,875	482	0.26	0.15
	1996	3,482.7	90.0	1,717	302	0.18	0.09
	1997	3,369.2	92.2	1,585	246	0.16	0.07
	1998	3,454.4	93.2	1,410	192.425	0.14	0.06
	1999	3,471.2	93.2	1,275	146.328	0.11	0.04
	2000	3,458.6	93.0	1,279	158.105	0.12	0.05
	2001	3,280.2	88.6	1,361	182.043	0.13	0.06
	2002	3,513.0	94.0	1,343	140.057	0.10	0.04
	2003	3,254.4	88.6	1,943	210.842	0.11	0.06
	2004	3,201.4	86.3	1,324	199.016	0.15	0.06
	2005	2,937.6	80.4	2,014	200.300	0.10	0.07
	2006	2,741.1	79.0	1,585	151.516	0.10	0.06
	2007	3,058.5	81.0	2,372	148.660	0.06	0.05
	2008	3,330.0	86.1	1,706	159.913	0.09	0.05
	2009	3,500.2	89.6	1,695	97.902	0.06	0.03

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
PALO VERDE 1, 2, 3 (continued)	2010	3,561.6	90.9	1,655	112.612	0.07	0.03
	2011	3,570.5	91.9	1,248	61.374	0.05	0.02
	2012	3,635.5	93.6	1,126	59.593	0.05	0.02
	2013	3,588.0	91.8	1,164	93.713	0.08	0.03
	2014	3,689.9	94.1	1,085	60.002	0.06	0.02
	2015	3,711.7	94.1	1,142	57.996	0.05	0.02
	2016	3,680.7	93.6	1,177	64.796	0.06	0.02
	2017	3,691.8	94.1	1,088	53.888	0.05	0.01
PEACH BOTTOM 2, 3 Docket 50-277, 50-278; DPR-44, DPR-56 1st commercial operation 7/74, 12/74 Type - BWRs Capacity - 1,217, 1,234 MWe	1975	1,234.3	80.9	971	228	0.23	0.18
	1976	1,379.2	73.0	2,136	840	0.39	0.61
	1977	1,052.4	58.7	2,827	2,036	0.72	1.93
	1978	1,636.3	84.0	2,244	1,317	0.59	0.80
	1979	1,740.0	84.5	2,276	1,388	0.61	0.80
	1980	1,374.2	66.3	2,774	2,302	0.83	1.68
	1981	1,161.8	58.0	2,857	2,506	0.88	2.16
	1982	1,583.3	76.9	2,734	1,977	0.72	1.25
	1983	824.7	41.0	3,107	2,963	0.95	3.59
	1984	1,165.8	57.5	3,313	2,450	0.74	2.10
	1985	682.7	37.5	4,209	3,354	0.80	4.91
	1986	1,395.0	71.7	2,454	1,080	0.44	0.77
	1987	365.7	20.3	4,363	2,195	0.50	6.00
	1988	0.0	0.0	4,204	2,327	0.55	---
	1989	491.0	35.0	2,301	728	0.32	1.48
	1990	1,684.0	85.7	1,585	377	0.24	0.22
	1991	1,210.9	62.3	2,702	934	0.35	0.77
	1992	1,516.6	78.7	1,911	502	0.26	0.33
	1993	1,654.0	81.9	1,757	552	0.31	0.33
	1994	1,927.4	93.8	2,133	579	0.27	0.30
	1995	1,955.9	95.1	1,940	398	0.21	0.20
	1996	2,012.4	96.9	1,657	282	0.17	0.14
	1997	1,956.3	95.0	1,872	490	0.26	0.25
	1998	1,881.2	93.2	1,903	366.040	0.19	0.19
	1999	2,057.2	96.0	1,630	319.307	0.20	0.16
	2000	2,058.3	96.7	1,729	330.928	0.19	0.16
	2001	2,037.1	95.8	1,445	344.283	0.24	0.17
	2002	2,105.0	96.7	1,915	333.056	0.17	0.16
	2003	2,072.4	94.9	1,641	355.969	0.22	0.17
	2004	2,148.8	96.4	1,422	264.727	0.19	0.12
	2005	2,102.0	95.6	1,801	306.201	0.17	0.15
	2006	2,169.1	97.0	1,513	247.676	0.16	0.11
	2007	2,163.8	97.0	1,906	384.795	0.20	0.18
	2008	2,115.3	95.1	1,816	212.741	0.12	0.10
	2009	2,130.4	95.5	2,032	310.517	0.15	0.15
	2010	2,145.3	96.2	1,716	219.372	0.13	0.10
	2011	2,152.0	95.7	2,758	389.814	0.14	0.18
	2012	2,142.5	94.8	2,460	305.431	0.12	0.14
	2013	2,143.5	94.7	2,902	483.936	0.17	0.23
	2014	2,142.3	94.2	3,053	430.941	0.14	0.20
	2015	2,267.6	95.6	2,938	395.597	0.13	0.17
	2016	2,498.1	97.7	2,052	202.221	0.10	0.08
	2017	2,481.1	98.0	1,824	197.814	0.11	0.08
PERRY Docket 50-440; NPF-58 1st commercial operation 11/87 Type - BWR Capacity - 1,240 MWe	1988	869.3	79.0	782	105	0.13	0.12
	1989	642.2	57.0	1,883	767	0.41	1.19
	1990	792.7	67.1	1,537	638	0.42	0.80
	1991	1,074.2	91.9	600	146	0.24	0.14
	1992	856.2	75.5	1,487	571	0.38	0.67
	1993	479.2	48.2	1,235	278	0.23	0.58
	1994	550.8	50.2	2,098	691	0.33	1.25
	1995	1,090.9	95.6	587	64	0.11	0.06
	1996	895.6	77.2	1,622	307	0.19	0.34
	1997	930.6	84.7	1,524	272	0.18	0.29
	1998	1,163.1	99.3	385	41.945	0.11	0.04
	1999	1,041.7	89.9	1,758	326.014	0.19	0.31

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
PERRY	2000	1,148.2	97.1	501	55.827	0.11	0.05
(continued)	2001	885.9	79.6	1,392	258.268	0.19	0.29
	2002	1,136.0	95.0	436	70.258	0.16	0.06
	2003	973.7	83.8	1,880	607.384	0.32	0.62
	2004	1,164.3	95.9	496	73.481	0.15	0.06
	2005	872.9	73.8	1,734	416.608	0.24	0.48
	2006	1,195.8	99.0	488	65.152	0.13	0.05
	2007	919.7	79.0	1,650	505.121	0.31	0.55
	2008	1,215.9	97.9	528	52.058	0.10	0.04
	2009	869.2	73.3	1,818	614.959	0.34	0.71
	2010	1,213.3	98.5	278	32.186	0.12	0.03
	2011	978.2	82.4	1,640	307.866	0.19	0.31
	2012	1,194.3	98.6	408	43.374	0.11	0.04
	2013	964.5	82.1	1,630	373.747	0.23	0.39
	2014	1,193.5	97.4	442	84.578	0.19	0.07
	2015	1,082.5	87.5	1,644	386.778	0.24	0.36
	2016	1,189.5	96.9	351	36.389	0.10	0.03
	2017	1,120.1	92.2	1,449	327.717	0.23	0.29
PILGRIM 1	1973	484.0	---	230	126	0.55	0.26
Docket 50-293;	1974	234.1	39.2	454	415	0.91	1.77
DPR-35	1975	308.1	71.3	473	798	1.69	2.59
1st commercial operation 12/72	1976	287.8	60.7	1,317	2,648	2.01	9.20
Type - BWR	1977	316.6	61.4	1,875	3,142	1.68	9.92
Capacity - 685 MWe	1978	519.5	83.1	1,667	1,327	0.80	2.55
	1979	574.0	89.4	2,458	1,015	0.41	1.77
	1980	360.3	56.2	3,549	3,626	1.02	10.06
	1981	408.9	65.9	2,803	1,836	0.66	4.49
	1982	389.9	63.9	2,854	1,539	0.54	3.95
	1983	559.5	87.2	2,326	1,162	0.50	2.08
	1984	1.4	0.4	4,542	4,082	0.90	2,915.71
	1985	587.3	91.5	2,209	893	0.40	1.52
	1986	121.9	18.8	2,635	874	0.33	7.17
	1987	0.0	0.0	4,710	1,579	0.34	---
	1988	0.0	0.0	2,073	392	0.19	---
	1989	204.6	64.1	1,797	207	0.12	1.01
	1990	503.5	82.1	1,898	225	0.12	0.45
	1991	406.3	65.8	2,836	605	0.21	1.49
	1992	561.0	85.4	1,332	281	0.21	0.50
	1993	513.7	80.9	1,328	435	0.33	0.85
	1994	453.6	71.4	758	200	0.26	0.44
	1995	531.7	80.7	1,294	482	0.37	0.91
	1996	631.3	95.4	517	116	0.22	0.18
	1997	492.1	80.7	1,655	588	0.36	1.19
	1998	650.5	100.0	530	71.446	0.13	0.11
	1999	510.7	84.4	1,222	344.270	0.28	0.67
	2000	627.5	98.3	422	50.797	0.12	0.08
	2001	585.6	91.0	1,113	179.585	0.16	0.31
	2002	657.0	100.0	463	38.280	0.08	0.06
	2003	566.6	87.5	1,437	250.192	0.17	0.44
	2004	676.1	99.5	427	41.109	0.10	0.06
	2005	623.2	93.7	1,212	206.089	0.17	0.33
	2006	665.4	100.0	654	43.531	0.07	0.07
	2007	584.5	90.0	1,407	240.526	0.17	0.41
	2008	668.1	99.0	377	22.568	0.06	0.03
	2009	616.0	91.7	1,301	264.215	0.20	0.43
	2010	675.5	100.0	303	25.739	0.08	0.04
	2011	580.5	89.0	1,179	241.402	0.20	0.42
	2012	669.0	99.4	284	21.620	0.08	0.03
	2013	493.9	80.4	1,188	176.012	0.15	0.36
	2014	658.6	98.9	421	36.716	0.09	0.06
	2015	570.0	86.9	1,392	218.609	0.16	0.38
	2016	617.9	94.7	634	44.242	0.07	0.07
	2017	576.1	88.2	1,614	162.998	0.10	0.28

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
POINT BEACH 1, 2	1971	393.4	---	---	164	---	0.42
Docket 50-266, 50-301;	1972	378.3	---	---	580	---	1.53
DPR-24, DPR-27	1973	693.7	---	501	588	1.17	0.85
1st commercial operation	1974	760.2	81.3	400	295	0.74	0.39
12/70, 10/72	1975	801.2	82.9	339	459	1.35	0.57
Type - PWRs	1976	857.3	86.7	313	370	1.18	0.43
Capacity - 576, 578 MWe	1977	873.9	87.3	417	430	1.03	0.49
	1978	914.4	90.9	336	320	0.95	0.35
	1979	808.0	80.8	610	644	1.06	0.80
	1980	727.2	82.5	561	598	1.07	0.82
	1981	760.4	83.6	773	596	0.77	0.78
	1982	757.2	84.3	767	609	0.79	0.80
	1983	648.2	72.7	1,702	1,403	0.82	2.16
	1984	788.9	78.6	1,372	789	0.58	1.00
	1985	831.3	82.5	671	482	0.72	0.58
	1986	858.9	85.7	664	402	0.61	0.47
	1987	857.5	85.5	720	554	0.77	0.65
	1988	899.3	88.6	734	410	0.56	0.46
	1989	847.8	85.5	736	504	0.68	0.59
	1990	875.5	86.5	617	378	0.61	0.43
	1991	874.8	87.1	724	265	0.37	0.30
	1992	866.7	85.8	617	256	0.41	0.30
	1993	911.0	90.0	559	186	0.33	0.20
	1994	914.5	91.2	548	170	0.31	0.19
	1995	858.4	86.1	548	190	0.35	0.22
	1996	831.6	84.7	1,029	276	0.27	0.33
	1997	186.8	21.8	670	92	0.14	0.49
	1998	649.7	69.7	881	169.253	0.19	0.26
	1999	806.0	83.1	962	194.489	0.20	0.24
	2000	872.0	88.7	765	138.989	0.18	0.16
	2001	915.9	93.4	740	131.667	0.18	0.14
	2002	909.0	91.1	945	180.654	0.19	0.20
	2003	917.2	92.1	627	84.965	0.14	0.09
	2004	912.3	90.1	627	109.515	0.17	0.12
	2005	782.5	78.1	851	128.646	0.15	0.16
	2006	977.2	96.0	453	39.597	0.09	0.04
	2007	958.5	94.0	535	52.023	0.10	0.05
	2008	889.4	87.8	958	144.021	0.15	0.16
	2009	902.3	92.9	766	93.270	0.12	0.10
	2010	952.8	93.8	869	95.695	0.11	0.10
	2011	796.2	75.8	1,027	159.684	0.16	0.20
	2012	1,114.3	95.2	581	69.755	0.12	0.06
	2013	1,135.3	95.9	547	63.146	0.12	0.06
	2014	1,079.4	91.4	759	127.523	0.17	0.12
	2015	1,142.9	95.8	446	47.473	0.11	0.04
	2016	1,159.0	96.8	515	57.294	0.11	0.05
	2017	1,102.0	93.1	755	87.479	0.12	0.08
PRAIRIE ISLAND 1, 2	1974	181.9	43.9	150	18	0.12	0.10
Docket 50-282, 50-306;	1975	836.0	83.3	477	123	0.26	0.15
DPR-42, DPR-60	1976	725.2	76.6	818	447	0.55	0.62
1st commercial operation	1977	922.9	87.2	718	300	0.42	0.33
12/73, 12/74	1978	941.1	92.2	546	221	0.40	0.23
Type - PWRs	1979	865.0	86.0	594	180	0.30	0.21
Capacity - 522, 519 MWe	1980	800.7	79.9	983	353	0.36	0.44
	1981	844.9	80.5	836	329	0.39	0.39
	1982	944.9	90.4	645	229	0.36	0.24
	1983	921.1	86.8	654	233	0.36	0.25
	1984	972.4	91.7	546	147	0.27	0.15
	1985	882.6	84.0	1,082	416	0.38	0.47
	1986	930.6	90.3	818	255	0.31	0.27
	1987	969.6	91.6	593	135	0.23	0.14
	1988	932.0	89.1	732	199	0.27	0.21
	1989	1,001.8	94.7	476	99	0.21	0.10

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
PRAIRIE ISLAND 1, 2 (continued)	1990	925.4	89.2	737	188	0.26	0.20
	1991	1,023.3	95.6	586	98	0.17	0.10
	1992	811.6	76.2	845	211	0.25	0.26
	1993	978.3	90.7	532	106	0.20	0.11
	1994	996.9	91.5	478	109	0.23	0.11
	1995	1,023.2	93.9	499	107	0.21	0.10
	1996	992.1	91.4	558	112	0.20	0.11
	1997	817.6	81.4	753	174	0.23	0.21
	1998	860.3	83.4	582	116.649	0.20	0.14
	1999	989.3	93.8	542	72.496	0.13	0.07
	2000	992.2	93.1	632	106.091	0.17	0.11
	2001	900.8	85.8	691	124.708	0.18	0.14
	2002	987.0	93.6	969	127.713	0.13	0.13
	2003	1,006.1	96.4	594	61.137	0.10	0.06
	2004	940.4	89.9	1,186	143.806	0.12	0.15
	2005	952.5	90.8	782	84.337	0.11	0.09
	2006	926.4	89.0	1,103	137.352	0.12	0.15
	2007	1,014.8	98.0	130	6.276	0.05	0.01
	2008	924.3	88.9	1,060	126.723	0.12	0.14
	2009	942.2	89.9	560	53.590	0.10	0.06
	2010	1,002.6	94.9	661	54.933	0.08	0.05
	2011	982.4	92.0	678	58.029	0.09	0.06
	2012	803.8	76.7	909	119.166	0.13	0.15
	2013	881.8	86.0	1,383	129.989	0.09	0.15
	2014	957.0	91.1	768	70.860	0.09	0.07
	2015	842.2	81.2	802	62.441	0.08	0.07
	2016	944.5	87.9	705	48.078	0.07	0.05
	2017	998.3	95.0	558	34.322	0.06	0.03
QUAD CITIES 1, 2 Docket 50-254, 50-265; DPR-29, DPR-30 1st commercial operation 2/73, 3/73 Type - BWRs Capacity - 887, 888 MWe	1974	958.1	72.3	678	482	0.71	0.50
	1975	833.6	68.4	1,083	1,618	1.49	1.94
	1976	951.2	73.1	1,225	1,651	1.35	1.74
	1977	970.1	84.0	907	1,031	1.14	1.06
	1978	1,124.5	88.6	1,207	1,618	1.34	1.44
	1979	1,075.0	84.6	1,688	2,158	1.28	2.01
	1980	866.9	64.4	3,089	4,838	1.57	5.58
	1981	1,156.9	81.1	2,246	3,146	1.40	2.72
	1982	1,018.7	76.0	2,314	3,757	1.62	3.69
	1983	1,088.5	79.2	1,802	2,491	1.38	2.29
	1984	994.6	65.7	1,678	1,579	0.94	1.59
	1985	1,268.0	82.7	1,184	990	0.84	0.78
	1986	1,093.2	71.0	1,451	950	0.65	0.87
	1987	1,126.6	75.3	1,429	720	0.50	0.64
	1988	1,173.7	84.1	1,486	827	0.56	0.70
	1989	1,196.3	85.9	1,721	900	0.52	0.75
	1990	1,148.9	77.8	2,186	1,028	0.47	0.89
	1991	1,044.5	73.2	1,722	509	0.30	0.49
	1992	960.8	68.0	2,413	1,157	0.48	1.20
	1993	974.9	67.0	2,150	849	0.39	0.87
	1994	681.5	48.7	2,163	1,128	0.52	1.66
	1995	1,002.5	70.4	2,041	736	0.36	0.73
	1996	876.6	60.1	2,248	1,025	0.46	1.17
	1997	935.3	66.5	2,474	654	0.26	0.70
	1998	794.8	55.1	2,177	760.596	0.35	0.96
	1999	1,476.5	95.9	1,000	200.556	0.20	0.14
	2000	1,410.4	93.9	2,840	893.766	0.31	0.63
	2001	1,478.2	95.9	736	143.849	0.20	0.10
	2002	1,396.0	89.0	3,818	1,786.021	0.47	1.28
	2003	1,569.4	93.1	998	438.144	0.44	0.28
	2004	1,443.8	95.5	2,334	510.521	0.22	0.35
	2005	1,516.2	94.2	2,869	961.026	0.33	0.63
	2006	1,524.9	93.0	2,329	559.362	0.24	0.37
	2007	1,650.3	97.0	1,945	249.927	0.13	0.15
	2008	1,619.4	95.2	2,065	274.444	0.13	0.17

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
QUAD CITIES 1, 2	2009	1,662.6	95.4	2,366	318.418	0.13	0.19
(continued)	2010	1,688.9	95.0	2,267	241.444	0.11	0.14
	2011	1,735.3	95.9	2,453	288.618	0.12	0.17
	2012	1,765.3	95.9	2,173	194.311	0.09	0.11
	2013	1,776.0	96.3	2,210	192.059	0.09	0.11
	2014	1,756.7	95.2	2,068	156.168	0.08	0.09
	2015	1,776.5	96.9	1,860	170.123	0.09	0.10
	2016	1,787.1	97.6	1,875	142.607	0.08	0.08
	2017	1,758.2	96.8	1,888	173.167	0.09	0.10
RANCHO SECO[15]	1976	268.1	30.4	297	58	0.20	0.22
Docket 50-312;	1977	706.4	77.1	515	391	0.76	0.55
DPR-54	1978	607.7	80.5	508	323	0.64	0.53
1st commercial operation 4/75	1979	687.0	91.1	287	126	0.44	0.18
Type - PWR	1980	530.9	60.4	890	412	0.46	0.78
Capacity - (873) MWe	1981	321.2	40.2	772	402	0.52	1.25
	1982	409.5	53.3	766	337	0.44	0.82
	1983	347.9	46.8	1,338	787	0.59	2.26
	1984	460.0	58.3	802	222	0.28	0.48
	1985	238.7	30.8	1,764	756	0.43	3.17
	1986	0.0	0.0	1,513	402	0.27	---
	1987	0.0	0.0	1,533	300	0.20	---
	1988	355.8	63.1	693	78	0.11	0.22
	1989	179.9	54.7	603	81	0.13	0.45
	1990	0.0	0.0	111	13	0.12	---
	1991	0.0	0.0	101	9	0.09	---
	1992	0.0	0.0	70	7	0.10	---
	1993	0.0	0.0	35	4	0.11	---
	1994	0.0	0.0	18	1	0.06	---
	1995	0.0	0.0	16	1	0.06	---
	1996	0.0	0.0	16	1	0.06	---
	1997	0.0	0.0	16	0	0.00	---
	1998	0.0	0.0	61	2.661	0.04	---
	1999	0.0	0.0	302	11.191	0.04	---
	2000	0.0	0.0	219	25.795	0.12	---
	2001	0.0	0.0	210	18.432	0.09	---
	2002	0.0	0.0	193	27.346	0.14	---
	2003	0.0	0.0	121	18.300	0.15	---
	2004	0.0	0.0	122	14.890	0.12	---
	2005	0.0	0.0	157	33.444	0.21	---
	2006	0.0	0.0	143	31.793	0.22	---
	2007	0.0	0.0	129	12.524	0.10	---
	2008	0.0	0.0	84	2.434	0.03	---
RIVER BEND 1	1987	605.2	68.4	1,268	378	0.30	0.62
Docket 50-458;	1988	880.7	94.3	513	107	0.21	0.12
NPF-47	1989	584.5	69.1	1,566	558	0.36	0.95
1st commercial operation 6/86	1990	682.2	78.0	1,616	489	0.30	0.72
Type - BWR	1991	814.7	87.2	780	144	0.18	0.18
Capacity - 967 MWe	1992	336.1	39.7	2,022	710	0.35	2.11
	1993	640.0	71.6	847	180	0.21	0.28
	1994	595.7	64.9	2,209	519	0.23	0.87
	1995	967.1	99.6	667	85	0.13	0.09
	1996	836.1	85.3	2,093	473	0.23	0.57
	1997	778.8	86.3	1,671	347	0.21	0.45
	1998	894.2	96.2	466	57.749	0.12	0.06
	1999	651.2	75.2	1,327	343.858	0.26	0.53
	2000	837.1	89.7	1,104	216.053	0.20	0.26
	2001	889.3	93.6	1,249	207.614	0.17	0.23
	2002	965.0	98.5	373	35.145	0.09	0.04
	2003	871.3	92.7	1,296	216.950	0.17	0.25
	2004	845.6	90.1	1,378	235.749	0.17	0.28

[15] Rancho Seco ceased operations in June 1989 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
RIVER BEND 1	2005	890.5	94.4	498	55.816	0.11	0.06
(continued)	2006	853.7	92.0	1,494	214.409	0.14	0.25
	2007	823.0	92.0	1,131	131.373	0.12	0.16
	2008	724.8	78.7	1,809	311.697	0.17	0.43
	2009	895.6	92.6	1,978	219.446	0.11	0.25
	2010	955.1	98.9	888	40.356	0.05	0.04
	2011	878.6	91.9	1,880	211.212	0.11	0.24
	2012	890.2	94.5	648	34.178	0.05	0.04
	2013	867.6	90.8	1,915	188.331	0.10	0.22
	2014	935.8	98.1	343	16.138	0.05	0.02
	2015	791.6	87.9	888	128.492	0.14	0.16
	2016	811.5	86.6	532	71.142	0.13	0.09
	2017	804.5	87.7	1,500	273.004	0.18	0.34
ROBINSON 2	1972	580.0	---	245	215	0.88	0.37
Docket 50-261;	1973	455.1	---	831	695	0.84	1.53
DPR-23	1974	578.1	83.3	853	672	0.79	1.16
1st commercial operation 3/71	1975	501.8	72.7	849	1,142	1.35	2.28
Type - PWR	1976	585.5	84.7	597	715	1.20	1.22
Capacity - 741 MWe	1977	511.5	85.2	634	455	0.72	0.89
	1978	480.5	72.0	943	963	1.02	2.00
	1979	482.0	70.8	1,454	1,188	0.82	2.46
	1980	387.3	62.2	2,009	1,852	0.92	4.78
	1981	426.6	73.0	1,462	733	0.50	1.72
	1982	277.5	48.9	2,011	1,426	0.71	5.14
	1983	409.8	75.5	2,244	923	0.41	2.25
	1984	28.0	7.0	4,127	2,880	0.70	102.86
	1985	629.5	87.9	1,378	311	0.23	0.49
	1986	577.1	80.3	1,571	539	0.34	0.93
	1987	510.1	72.5	1,379	499	0.36	0.98
	1988	385.0	65.9	1,351	564	0.42	1.46
	1989	336.6	48.7	1,098	195	0.18	0.58
	1990	400.3	64.8	1,626	437	0.27	1.09
	1991	575.1	81.4	885	193	0.22	0.34
	1992	487.2	66.8	1,267	352	0.28	0.72
	1993	502.7	70.7	1,221	337	0.28	0.67
	1994	560.3	79.5	420	63	0.15	0.11
	1995	618.7	84.7	1,058	215	0.20	0.35
	1996	654.8	88.6	1,031	167	0.16	0.26
	1997	707.5	99.0	304	13	0.04	0.02
	1998	628.5	88.9	978	170.476	0.17	0.27
	1999	648.9	91.8	807	123.952	0.15	0.19
	2000	710.0	99.7	138	8.396	0.06	0.01
	2001	627.9	90.6	827	124.750	0.15	0.20
	2002	638.0	91.2	830	110.631	0.13	0.17
	2003	733.1	100.0	109	4.838	0.04	0.01
	2004	653.7	89.3	952	118.159	0.12	0.18
	2005	656.9	89.7	791	64.662	0.08	0.10
	2006	735.5	100.0	86	3.320	0.04	0.00
	2007	655.0	90.0	890	80.752	0.09	0.12
	2008	618.1	84.6	788	68.381	0.09	0.11
	2009	738.9	99.3	126	6.643	0.05	0.01
	2010	410.8	57.0	996	85.917	0.09	0.21
	2011	726.5	99.3	137	3.630	0.03	0.00
	2012	613.4	82.2	1,027	65.258	0.06	0.11
	2013	650.3	85.3	1,116	80.595	0.07	0.12
	2014	703.1	91.2	477	28.666	0.06	0.04
	2015	653.4	84.9	957	56.373	0.06	0.09
	2016	734.3	96.3	133	3.704	0.03	0.01
	2017	676.9	89.1	883	58.739	0.07	0.09

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
SALEM 1, 2	1978	546.4	55.6	574	122	0.21	0.22
Docket 50-272, 50-311;	1979	250.0	25.5	1,488	584	0.39	2.34
DPR-70, DPR-75	1980	680.6	69.2	1,704	449	0.26	0.66
1st commercial operation	1981	743.0	78.1	1,652	254	0.15	0.34
6/77, 10/81	1982	1,440.4	72.6	3,228	1,203	0.37	0.84
Type - PWRs	1983	742.0	30.5	2,383	581	0.24	0.78
Capacity - 1,116, 1,134 MWe	1984	650.1	31.8	1,395	681	0.49	1.05
	1985	1,657.7	75.8	1,112	204	0.18	0.12
	1986	1,484.3	70.4	3,554	599	0.17	0.40
	1987	1,478.2	73.3	2,543	600	0.24	0.41
	1988	1,591.6	73.6	1,609	503	0.31	0.32
	1989	1,675.4	79.5	2,944	338	0.11	0.20
	1990	1,362.6	65.1	3,636	272	0.07	0.20
	1991	1,726.4	79.3	4,201	458	0.11	0.27
	1992	1,200.9	61.1	4,376	431	0.10	0.36
	1993	1,366.3	65.4	3,559	408	0.11	0.30
	1994	1,367.4	73.8	950	188	0.20	0.14
	1995	558.1	29.3	1,195	218	0.18	0.39
	1996	0.0	0.0	1,671	300	0.18	---
	1997	279.3	17.8	894	175	0.20	0.63
	1998	1,629.3	79.1	408	41.100	0.10	0.03
	1999	1,821.8	86.8	1,200	317.545	0.27	0.17
	2000	1,973.4	93.0	1,191	198.068	0.17	0.10
	2001	1,961.2	91.1	1,274	153.088	0.12	0.08
	2002	1,934.0	89.4	2,460	292.692	0.12	0.15
	2003	1,957.2	90.7	1,301	124.042	0.10	0.06
	2004	1,850.2	85.8	1,496	148.694	0.10	0.08
	2005	2,086.4	91.7	3,162	240.567	0.08	0.12
	2006	2,211.8	97.0	1,446	90.541	0.06	0.04
	2007	2,158.2	96.0	1,365	117.604	0.09	0.05
	2008	1,998.6	87.8	3,362	328.761	0.10	0.16
	2009	2,252.9	96.2	1,249	101.186	0.08	0.04
	2010	2,147.3	93.9	964	77.828	0.08	0.04
	2011	2,054.6	91.4	2,180	126.716	0.06	0.06
	2012	2,123.8	93.4	674	47.003	0.07	0.02
	2013	2,213.1	94.7	797	59.430	0.07	0.03
	2014	1,870.1	81.7	2,558	109.633	0.04	0.06
	2015	2,131.3	93.8	580	33.810	0.06	0.02
	2016	1,800.9	84.2	1,108	93.255	0.08	0.05
	2017	2,060.5	89.7	1,745	135.197	0.08	0.07
SAN ONOFRE 1[16], 2, 3[17]	1969	314.1	---	123	42	0.34	0.13
Docket 50-206, 50-361, 50-362;	1970	365.9	---	251	155	0.62	0.42
DPR-13; NPF-10, NPF-15	1971	362.1	---	121	50	0.41	0.14
1st commercial operation	1972	338.5	---	326	256	0.79	0.76
1/68, 8/83, 4/84	1973	273.7	---	570	353	0.62	1.29
Type - PWRs	1974	377.8	86.1	219	71	0.32	0.19
Capacity - (436), (1,070),	1975	389.0	87.4	424	292	0.69	0.75
(1,080) MWe	1976	297.9	70.2	1,330	880	0.66	2.95
	1977	281.2	63.7	985	847	0.86	3.01
	1978	323.2	80.2	764	401	0.52	1.24
	1979	401.0	90.2	521	139	0.27	0.35
	1980	97.3	22.3	3,063	2,386	0.78	24.52
	1981	95.9	26.7	2,902	3,223	1.11	33.61
	1982	61.6	15.7	3,055	832	0.27	13.51
	1983	0.0	0.0	1,701	155	0.09	---
	1984	670.4	68.3	7,514	986	0.13	1.47
	1985	1,381.8	132.9	5,742	722	0.13	0.52

[16] San Onofre 1 ceased operations in November 1992 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[17] San Onofre 2, 3 ceased power generation in January 2012, and in June 2013, it was decided that they would not be placed into commercial operation again. Therefore, they are no longer included in the count of operating reactors. Parentheses indicate plant capacities when plants were operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
SAN ONOFRE 1[16], 2, 3[17] (continued)	1986	1,698.2	61.1	3,594	824	0.23	0.49
	1987	1,983.0	78.8	2,138	696	0.33	0.35
	1988	1,982.3	68.4	2,324	781	0.34	0.39
	1989	1,840.8	64.9	2,237	567	0.25	0.31
	1990	1,980.5	69.1	2,224	885	0.40	0.45
	1991	1,987.6	75.3	1,814	412	0.23	0.21
	1992	2,228.6	87.1	1,651	324	0.20	0.15
	1993	1,771.3	79.9	2,193	767	0.35	0.43
	1994	2,220.7	100.0	528	32	0.06	0.01
	1995	1,686.9	79.1	1,914	455	0.24	0.27
	1996	2,089.3	93.2	1,272	129	0.10	0.06
	1997	1,533.9	72.9	1,652	341	0.21	0.22
	1998	1,996.4	92.0	1,091	195.600	0.18	0.10
SAN ONOFRE 1[16] Docket 50-206; DPR-13 1st commercial operation 1/68 Type - PWR Capacity - (436) MWe	1999	0.0	0.0	241	15.863	0.07	---
	2000	0.0	0.0	416	71.214	0.17	---
	2001	0.0	0.0	338	57.785	0.17	---
	2002	0.0	0.0	308	61.214	0.20	---
	2003	0.0	0.0	226	35.596	0.16	---
	2004	0.0	0.0	169	14.899	0.09	---
	2005	0.0	0.0	198	20.624	0.10	---
	2006	0.0	0.0	183	22.490	0.12	---
	2007	0.0	0.0	20	0.417	0.02	---
	2008	0.0	0.0	2	0.043	0.02	---
SAN ONOFRE 2, 3[17] Docket 50-361, 50-362; NPF-10, NPF-15 1st commercial operation 8/83, 4/84 Type - PWRs Capacity - (1,070), (1,080) MWe	1999	1,901.4	86.9	1,477	353.765	0.24	0.19
	2000	2,067.2	94.7	1,073	115.499	0.11	0.06
	2001	1,727.2	78.9	1,083	131.384	0.12	0.08
	2002	2,056.0	93.4	1,140	136.443	0.12	0.07
	2003	2,084.3	94.0	1,275	163.804	0.13	0.08
	2004	1,713.8	79.1	1,761	407.063	0.23	0.24
	2005	2,094.7	96.0	305	11.332	0.04	0.01
	2006	1,552.2	73.0	1,632	315.087	0.19	0.20
	2007	1,964.6	89.0	1,065	91.545	0.09	0.05
	2008	1,753.0	82.7	1,014	125.320	0.12	0.07
SAN ONOFRE 1[16], 2, 3[17] Docket 50-206, 50-361, 50-362; DPR-13; NPF-10, NPF-15 1st commercial operation 1/68, 8/83, 4/84 Type - PWRs Capacity - (436), (1,070), (1,080) MWe	2009	1,774.5	79.9	1,575	178.131	0.11	0.10
	2010	1,578.9	75.3	1,642	199.399	0.12	0.13
	2011	2,067.1	93.0	641	29.658	0.05	0.01
	2012	115.2	5.4	2,150	221.463	0.10	1.92
	2013	0.0	0.0	210	5.701	0.03	---
	2014	0.0	0.0	68	1.369	0.02	---
	2015	0.0	0.0	136	1.202	0.01	---
	2016	0.0	0.0	87	1.787	0.02	---
	2017	0.0	0.0	1	0.005	0.01	---
SEABROOK Docket 50-443; NPF-86 1st commercial operation 8/90 Type - PWR Capacity - 1,246 MWe	1991	810.4	75.9	699	92	0.13	0.11
	1992	932.4	81.3	806	147	0.18	0.16
	1993	1,071.5	93.6	110	6	0.05	0.01
	1994	736.4	63.5	852	113	0.13	0.15
	1995	995.5	87.5	800	102	0.13	0.10
	1996	1,168.6	99.6	206	10	0.05	0.01
	1997	907.0	79.8	1,571	186	0.12	0.21
	1998	957.6	84.5	559	18.509	0.03	0.02
	1999	991.5	87.5	1,339	105.723	0.08	0.11
	2000	901.8	79.3	1,158	70.091	0.06	0.08
	2001	989.6	89.1	423	8.672	0.02	0.01
	2002	1,058.0	92.8	1,095	66.583	0.06	0.06
	2003	1,055.9	93.6	981	70.953	0.07	0.07
	2004	1,158.6	100.0	291	5.858	0.02	0.01

[16] San Onofre 1 ceased operations in November 1992 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[17] San Onofre 2, 3 ceased power generation in January 2012, and in June 2013 it was decided that they would not be put back into commercial operation. Therefore, they are no longer included in the count of operating reactors. Parentheses indicate plant capacities when plants were operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
SEABROOK	2005	1,076.4	91.5	1,034	52.216	0.05	0.05
(continued)	2006	1,072.8	89.0	1,246	76.583	0.06	0.07
	2007	1,228.7	100.0	349	4.332	0.01	0.00
	2008	1,064.4	86.9	1,297	74.992	0.06	0.07
	2009	1,006.4	86.5	1,233	87.372	0.07	0.09
	2010	1,245.4	100.0	335	4.488	0.01	0.00
	2011	954.5	80.5	1,156	65.593	0.06	0.07
	2012	932.2	87.8	1,092	53.636	0.05	0.06
	2013	1,247.3	100.0	291	2.442	0.01	0.00
	2014	1,160.7	93.8	1,056	39.983	0.04	0.03
	2015	1,082.6	88.3	1,219	96.053	0.08	0.09
	2016	1,228.4	98.8	59	1.672	0.03	0.00
	2017	1,140.4	92.0	519	29.191	0.06	0.03
SEQUOYAH 1, 2	1982	583.5	52.8	1,968	570	0.29	0.98
Docket 50-327, 50-328;	1983	1,663.7	75.1	1,769	491	0.28	0.30
DPR-77, DPR-79	1984	1,481.9	69.0	2,373	1,119	0.47	0.76
1st commercial operation	1985	1,151.3	51.3	1,853	1,072	0.58	0.93
7/81, 6/82	1986	0.0	0.0	1,738	527	0.30	---
Type - PWR	1987	0.0	0.0	2,080	420	0.20	---
Capacity - 1,152, 1,140 MWe	1988	490.8	31.8	2,441	678	0.28	1.38
	1989	1,851.7	85.7	2,007	657	0.33	0.35
	1990	1,662.6	77.2	2,935	1,687	0.57	1.01
	1991	1,965.4	88.0	1,933	700	0.36	0.36
	1992	1,849.0	85.4	1,714	465	0.27	0.25
	1993	405.7	21.8	1,631	373	0.23	0.92
	1994	1,418.7	66.3	1,702	295	0.17	0.21
	1995	1,864.2	86.1	1,650	368	0.22	0.20
	1996	2,003.9	87.9	1,444	269	0.19	0.13
	1997	1,946.1	89.0	1,962	420	0.21	0.22
	1998	2,135.3	95.3	1,530	265.980	0.17	0.12
	1999	2,165.1	97.0	1,346	164.569	0.12	0.08
	2000	1,910.0	86.8	2,039	357.220	0.18	0.19
	2001	2,158.3	95.7	1,292	145.066	0.11	0.07
	2002	2,106.0	94.1	1,257	108.252	0.09	0.05
	2003	1,776.4	80.0	2,484	430.889	0.17	0.24
	2004	2,135.2	93.9	1,161	85.941	0.07	0.04
	2005	2,162.9	94.9	1,125	95.133	0.08	0.04
	2006	2,054.9	91.0	1,752	242.016	0.14	0.12
	2007	2,129.1	94.0	1,197	123.540	0.10	0.06
	2008	2,153.6	94.3	960	83.730	0.09	0.04
	2009	2,026.8	90.1	1,415	166.776	0.12	0.08
	2010	2,054.9	92.2	828	56.956	0.07	0.03
	2011	2,133.3	95.3	1,354	109.417	0.08	0.05
	2012	1,888.2	84.6	2,555	290.840	0.11	0.15
	2013	2,108.1	94.2	666	44.478	0.07	0.02
	2014	2,156.7	95.5	842	77.569	0.09	0.04
	2015	1,884.9	87.0	1,484	136.826	0.09	0.07
	2016	1,971.4	88.8	1,133	105.764	0.09	0.05
	2017	2,080.7	94.0	831	47.200	0.06	0.02
SOUTH TEXAS 1, 2	1989	769.3	65.6	989	161	0.16	0.21
Docket 50-498, 50-499;	1990	1,504.1	65.9	1,136	206	0.18	0.14
NPF-76, NPF-80	1991	1,741.5	72.4	1,144	257	0.22	0.15
1st commercial operation	1992	2,096.0	83.8	923	147	0.16	0.07
8/88, 6/89	1993	163.1	8.3	1,138	251	0.22	1.54
Type - PWRs	1994	1,700.2	70.6	661	47	0.07	0.03
Capacity - 1,251, 1,251 MWe	1995	2,294.2	89.9	1,485	291	0.20	0.13
	1996	2,465.9	95.0	1,145	137	0.12	0.06
	1997	2,265.5	93.6	1,583	273	0.17	0.12
	1998	2,379.4	96.9	1,171	183.977	0.16	0.08
	1999	2,219.7	91.6	1,328	259.770	0.20	0.12
	2000	2,180.0	89.7	1,372	231.634	0.17	0.11
	2001	2,262.7	92.2	1,325	237.645	0.18	0.11
	2002	2,173.0	87.5	1,510	329.091	0.22	0.15

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
SOUTH TEXAS 1, 2	2003	1,796.3	72.1	909	143.495	0.16	0.08
(continued)	2004	2,437.1	96.0	842	119.834	0.14	0.05
	2005	2,258.5	90.0	1,268	247.655	0.20	0.11
	2006	2,439.6	95.0	1,078	150.323	0.14	0.06
	2007	2,527.3	96.0	881	91.613	0.10	0.04
	2008	2,452.1	92.3	1,181	187.295	0.16	0.08
	2009	2,444.5	91.9	1,138	79.687	0.07	0.03
	2010	2,418.7	91.5	867	79.159	0.09	0.03
	2011	2,333.3	87.7	1,153	139.274	0.12	0.06
	2012	2,122.4	79.8	611	49.104	0.08	0.02
	2013	2,062.4	78.4	832	59.736	0.07	0.03
	2014	2,363.4	90.0	422	34.576	0.08	0.01
	2015	2,224.5	85.5	900	83.993	0.09	0.04
	2016	2,481.9	94.9	426	32.837	0.08	0.01
	2017	2,467.1	94.6	620	55.025	0.09	0.02
ST. LUCIE 1, 2	1977	649.1	84.7	445	152	0.34	0.23
Docket 50-335, 50-389;	1978	606.4	76.5	797	337	0.42	0.56
DPR-67; NPF-16	1979	592.0	74.0	907	438	0.48	0.74
1st commercial operation	1980	627.9	77.5	1,074	532	0.50	0.85
12/76, 8/83	1981	599.1	72.7	1,473	929	0.63	1.55
Type - PWRs	1982	816.8	94.0	1,045	272	0.26	0.33
Capacity - 981, 987 MWe	1983	290.3	15.4	2,211	1,204	0.54	4.15
	1984	1,183.0	69.6	2,090	1,263	0.60	1.07
	1985	1,445.8	82.5	1,971	1,344	0.68	0.93
	1986	1,588.6	89.1	1,279	491	0.38	0.31
	1987	1,407.9	81.9	2,012	951	0.47	0.68
	1988	1,639.7	93.0	1,448	611	0.42	0.37
	1989	1,493.1	85.1	1,414	495	0.35	0.33
	1990	1,188.4	70.0	1,876	777	0.41	0.65
	1991	1,592.8	90.8	1,282	479	0.37	0.30
	1992	1,511.9	87.3	1,251	264	0.21	0.17
	1993	1,227.6	77.7	1,462	492	0.34	0.40
	1994	1,424.8	85.0	1,896	505	0.27	0.35
	1995	1,306.6	76.0	1,498	413	0.28	0.32
	1996	1,473.4	86.5	1,433	385	0.27	0.26
	1997	1,394.6	83.6	2,314	646	0.28	0.46
	1998	1,572.5	94.2	1,170	134.459	0.11	0.09
	1999	1,569.1	93.8	1,107	176.878	0.16	0.11
	2000	1,630.0	96.0	990	98.691	0.10	0.06
	2001	1,527.5	91.6	1,375	228.071	0.17	0.15
	2002	1,633.0	96.6	992	155.946	0.16	0.10
	2003	1,524.7	91.5	937	141.734	0.15	0.09
	2004	1,492.0	89.3	1,157	159.436	0.14	0.11
	2005	1,408.4	85.1	2,262	406.171	0.18	0.29
	2006	1,542.4	93.0	1,226	119.963	0.10	0.08
	2007	1,302.1	78.0	2,447	409.958	0.17	0.31
	2008	1,566.5	92.7	1,127	112.234	0.10	0.07
	2009	1,490.6	88.8	1,139	132.861	0.12	0.09
	2010	1,440.2	88.4	1,357	197.359	0.15	0.14
	2011	1,200.9	77.3	2,050	295.228	0.14	0.25
	2012	1,139.5	70.6	1,750	185.426	0.11	0.16
	2013	1,783.4	90.3	964	74.926	0.08	0.04
	2014	1,805.7	90.9	1,068	121.092	0.11	0.07
	2015	1,720.9	87.2	1,477	188.087	0.13	0.11
	2016	1,779.5	89.8	920	76.628	0.08	0.04
	2017	1,875.3	94.2	933	71.123	0.08	0.04
SUMMER 1	1984	504.6	61.1	1,120	295	0.26	0.58
Docket 50-395;	1985	627.7	71.6	1,201	379	0.32	0.60
NPF-12	1986	853.7	95.3	392	23	0.06	0.03
1st commercial operation 1/84	1987	618.7	71.0	1,075	560	0.52	0.91
Type - PWR	1988	605.3	69.1	1,127	511	0.45	0.84
Capacity - 966 MWe	1989	652.4	83.1	374	52	0.14	0.08
	1990	730.0	83.9	1,090	376	0.34	0.52
	1991	642.5	82.9	984	291	0.30	0.45

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
SUMMER 1 (continued)	1992	892.6	97.4	249	27	0.11	0.03
	1993	728.3	84.0	1,121	297	0.26	0.41
	1994	536.7	69.5	1,549	374	0.24	0.70
	1995	899.8	97.2	257	13	0.05	0.01
	1996	850.4	90.3	701	97	0.14	0.11
	1997	829.7	89.8	820	163	0.20	0.20
	1998	934.8	98.8	285	13.513	0.05	0.01
	1999	842.0	89.4	827	120.172	0.15	0.14
	2000	723.9	76.6	933	166.561	0.18	0.23
	2001	769.3	83.3	486	69.398	0.14	0.09
	2002	840.0	87.9	685	59.644	0.09	0.07
	2003	837.0	87.4	745	70.828	0.10	0.08
	2004	938.4	96.8	200	10.085	0.05	0.01
	2005	850.3	88.9	734	72.454	0.10	0.09
	2006	858.6	90.0	676	61.333	0.09	0.07
	2007	967.9	100.0	75	2.691	0.04	0.00
	2008	817.2	84.8	623	49.091	0.08	0.06
	2009	784.5	82.6	767	56.050	0.07	0.07
	2010	968.8	99.4	104	2.129	0.02	0.00
	2011	847.7	87.6	598	31.580	0.05	0.04
	2012	829.0	85.3	766	82.261	0.11	0.10
	2013	955.5	97.2	172	5.113	0.03	0.01
	2014	789.4	82.6	934	110.929	0.12	0.14
	2015	812.3	83.8	811	64.958	0.08	0.08
	2016	988.4	100.0	137	2.862	0.02	0.00
	2017	789.2	81.3	856	50.308	0.06	0.06
SURRY 1, 2 Docket 50-280, 50-281; DPR-32, DPR-37 1st commercial operation 12/72, 5/73 Type - PWRs Capacity - 838, 838 MWe	1973	420.6	---	936	152	0.16	0.36
	1974	717.4	49.8	1,715	884	0.52	1.23
	1975	1,079.0	70.8	1,948	1,649	0.85	1.53
	1976	930.7	60.4	2,753	3,165	1.15	3.40
	1977	1,139.0	72.2	1,860	2,307	1.24	2.03
	1978	1,210.6	77.2	2,203	1,837	0.83	1.52
	1979	343.0	42.3	5,065	3,584	0.71	10.45
	1980	568.2	40.3	5,317	3,836	0.72	6.75
	1981	907.6	59.3	3,753	4,244	1.13	4.68
	1982	1,323.3	88.5	1,878	1,490	0.79	1.13
	1983	916.2	61.3	2,754	3,220	1.17	3.51
	1984	1,026.7	71.0	3,198	2,247	0.70	2.19
	1985	1,166.4	78.2	3,206	1,815	0.57	1.56
	1986	1,080.5	69.0	3,763	2,356	0.63	2.18
	1987	1,132.7	72.7	2,675	712	0.27	0.63
	1988	750.4	50.0	3,184	1,542	0.48	2.05
	1989	489.3	33.0	3,100	836	0.27	1.71
	1990	1,276.4	83.9	1,947	575	0.30	0.45
	1991	1,271.9	84.5	1,547	510	0.33	0.40
	1992	1,396.3	88.9	1,660	539	0.32	0.39
	1993	1,283.1	84.6	1,402	383	0.27	0.30
	1994	1,320.9	85.2	1,530	378	0.25	0.29
	1995	1,333.0	84.2	1,883	406	0.22	0.30
	1996	1,562.9	93.1	983	209	0.21	0.13
	1997	1,380.3	87.1	1,335	320	0.24	0.23
	1998	1,476.2	91.6	1,165	188.831	0.16	0.13
	1999	1,483.0	93.5	995	137.891	0.14	0.09
	2000	1,490.0	92.7	1,197	193.169	0.16	0.13
	2001	1,441.5	89.5	1,243	328.650	0.26	0.23
	2002	1,557.0	96.0	799	87.778	0.11	0.06
	2003	1,255.9	79.7	1,628	325.729	0.20	0.26
	2004	1,537.9	94.6	1,028	119.654	0.12	0.08
	2005	1,506.7	94.2	877	87.717	0.10	0.06
	2006	1,427.0	90.0	1,227	234.978	0.19	0.16
	2007	1,516.2	94.0	1,111	207.130	0.19	0.14
	2008	1,536.6	95.7	1,069	150.269	0.14	0.10

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
SURRY 1, 2	2009	1,485.1	93.1	1,241	193.703	0.16	0.13
(continued)	2010	1,503.7	93.7	958	111.129	0.12	0.07
	2011	1,487.4	88.1	1,121	113.718	0.10	0.08
	2012	1,549.9	91.6	1,205	168.755	0.14	0.11
	2013	1,644.4	95.7	770	67.528	0.09	0.04
	2014	1,636.1	95.2	743	57.491	0.08	0.04
	2015	1,345.9	80.1	1,275	182.980	0.14	0.14
	2016	1,667.9	96.8	645	44.432	0.07	0.03
	2017	1,647.0	96.0	781	58.012	0.07	0.04
SUSQUEHANNA 1, 2	1984	719.9	72.6	2,827	308	0.11	0.43
Docket 50-387, 50-388;	1985	1,452.2	76.4	3,669	1,106	0.30	0.76
NPF-14; NPF-22	1986	1,344.8	67.0	2,996	828	0.28	0.62
1st commercial operation	1987	1,749.5	85.3	2,548	621	0.24	0.35
6/83, 2/85	1988	1,691.0	83.5	1,904	516	0.27	0.31
Type - BWRs	1989	1,572.5	77.1	2,063	704	0.34	0.45
Capacity - 1,257, 1,257 MWe	1990	1,746.9	85.4	1,691	440	0.26	0.25
	1991	1,878.0	89.8	1,844	507	0.27	0.27
	1992	1,604.2	79.7	1,885	724	0.38	0.45
	1993	1,602.1	77.3	1,488	335	0.23	0.21
	1994	1,814.4	85.4	1,580	442	0.28	0.24
	1995	1,850.8	85.3	1,773	476	0.27	0.26
	1996	1,998.7	90.7	1,430	289	0.20	0.14
	1997	1,918.9	89.6	1,646	433	0.26	0.23
	1998	1,879.6	88.3	1,575	360.778	0.23	0.19
	1999	1,896.0	89.6	1,787	431.397	0.24	0.23
	2000	1,994.6	92.6	1,812	331.163	0.18	0.17
	2001	2,027.6	94.2	1,807	288.413	0.16	0.14
	2002	1,973.0	91.6	1,890	259.968	0.14	0.13
	2003	2,050.8	93.4	1,934	250.096	0.13	0.12
	2004	2,058.8	92.7	2,144	272.202	0.13	0.13
	2005	2,086.6	93.5	1,898	181.360	0.10	0.09
	2006	2,040.4	91.0	1,873	184.901	0.10	0.09
	2007	2,089.2	93.0	2,303	263.021	0.11	0.13
	2008	2,174.1	94.2	1,895	192.892	0.10	0.09
	2009	2,231.1	94.7	1,956	266.597	0.14	0.12
	2010	2,121.6	90.4	1,950	176.161	0.09	0.08
	2011	1,992.0	82.2	1,847	168.968	0.09	0.08
	2012	1,936.5	81.4	2,140	175.881	0.08	0.09
	2013	2,166.2	88.6	1,861	233.532	0.13	0.11
	2014	2,153.1	87.3	1,956	214.467	0.11	0.10
	2015	2,354.3	93.3	1,763	206.154	0.12	0.09
	2016	2,217.2	89.4	2,210	237.336	0.11	0.11
	2017	2,375.6	95.1	1,440	165.468	0.11	0.07
THREE MILE ISLAND 1[18], 2[19]	1975	675.9	82.2	131	73	0.56	0.11
Docket 50-289, 50-320;	1976	530.0	65.4	819	286	0.35	0.54
DPR-50, DPR-73	1977	664.5	80.9	1,122	360	0.32	0.54
1st commercial operation	1978	690.0	85.1	1,929	504	0.26	0.73
9/74, 12/78	1979	266.0	21.9	3,975	1,392	0.35	5.23
Type - PWRs	1980	0.0	0.0	2,328	394	0.17	---
Capacity - 802, (880) MWe	1981	0.0	0.0	2,103	376	0.18	---
	1982	0.0	0.0	2,123	1,004	0.47	---
	1983	0.0	0.0	1,592	1,159	0.73	---
	1984	0.0	0.0	1,079	688	0.64	---
	1985	103.6	10.6	1,890	857	0.45	8.27

[18] Three Mile Island 1 resumed commercial power generation in October 1985 after being under regulatory restraint since 1979.

[19] Three Mile Island 2 has been shut down since the 1979 accident, but was still included in the count of reactors through 1988 since dose was still being accumulated to defuel and decontaminate the unit during this time period. Parentheses indicate plant capacity when plant was operational. Since 2001, TMI has voluntarily provided an estimate of the collective dose for Unit 2, but not the number of individuals with measurable dose.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
THREE MILE ISLAND 1[18]	1986	585.2	70.9	1,360	213	0.16	0.36
Docket 50-289;	1987	610.7	73.6	1,259	149	0.12	0.24
DPR-50	1988	661.0	77.8	1,012	210	0.21	0.32
1st commercial operation 9/74	1989	871.3	100.0	670	54	0.08	0.06
Type - PWR	1990	645.5	84.6	1,319	264	0.20	0.41
Capacity - 802 MWe	1991	688.7	86.4	1,542	198	0.13	0.29
	1992	836.8	100.0	558	34	0.06	0.04
	1993	722.0	88.5	1,835	206	0.11	0.29
	1994	798.7	95.5	434	40	0.09	0.05
	1995	772.9	90.8	1,220	213	0.17	0.28
	1996	857.4	100.0	267	16	0.06	0.02
	1997	675.7	84.3	1,049	204	0.19	0.30
	1998	805.8	100.0	280	16.722	0.06	0.02
	1999	722.4	89.7	1,171	154.936	0.13	0.21
	2000	813.4	100.0	183	8.689	0.05	0.01
	2001	616.7	84.2	1,196	196.699	0.16	0.32
	2002	833.0	100.0	172	6.533	0.04	0.01
	2003	706.4	87.1	1,230	155.101	0.13	0.22
	2004	828.0	100.0	105	3.573	0.03	0.00
	2005	769.1	93.2	955	65.576	0.07	0.09
	2006	825.0	99.0	125	5.155	0.04	0.01
	2007	758.6	92.0	1,266	114.203	0.09	0.15
	2008	838.5	100.0	64	2.219	0.03	0.00
	2009	672.6	81.7	2,019	241.780	0.12	0.36
	2010	757.3	93.1	790	38.994	0.05	0.05
	2011	744.2	91.4	1,224	129.775	0.11	0.17
	2012	820.7	96.3	280	13.073	0.05	0.02
	2013	762.5	92.2	1,294	125.803	0.10	0.16
	2014	834.3	100.0	204	12.518	0.06	0.02
	2015	753.2	92.1	1,454	171.431	0.12	0.23
	2016	808.5	97.0	309	16.843	0.05	0.02
	2017	783.3	94.4	1,009	82.657	0.08	0.11
THREE MILE ISLAND 2[19]	1986	0.0	0.0	1,497	915	0.61	---
Docket 50-320;	1987	0.0	0.0	1,378	977	0.71	---
DPR-73	1988	0.0	0.0	1,247	917	0.74	---
1st commercial operation 12/78	1989	0.0	0.0	1,014	639	0.63	---
Type - PWR	1990	0.0	0.0	484	136	0.28	---
Capacity - (880) MWe	1991	0.0	0.0	153	37	0.24	---
	1992	0.0	0.0	315	157	0.50	---
	1993	0.0	0.0	167	33	0.20	---
	1994	0.0	0.0	259	7	0.03	---
	1995	0.0	0.0	191	2	0.01	---
	1996	0.0	0.0	122	2	0.02	---
	1997	0.0	0.0	232	1	0.00	---
	1998	0.0	0.0	105	0.697	0.01	---
	1999	0.0	0.0	203	0.512	0.00	---
	2000	0.0	0.0	70	0.401	0.01	---
	2001	0.0	0.0	0	0.228	---	---
	2002	0.0	0.0	0	---	---	---
	2003	0.0	0.0	0	0.260	---	---
	2004	0.0	0.0	0	0.216	---	---
	2005	0.0	0.0	0	---	---	---
	2006	0.0	0.0	0	0.372	---	---
	2007	0.0	0.0	0	0.082	---	---
	2008	0.0	0.0	0	0.138	---	---
	2009	0.0	0.0	0	0.113	---	---
	2010	0.0	0.0	0	0.359	---	---

[18] Three Mile Island 1 resumed commercial power generation in October 1985 after being under regulatory restraint since 1979.

[19] Three Mile Island 2 has been shut down since the 1979 accident, but was still included in the count of reactors through 1988 since dose was still being accumulated to defuel and decontaminate the unit during this time period. Parentheses indicate plant capacity when plant was operational. From 2001-2015, TMI voluntarily provided an estimate of the collective dose for Unit 2, but not the number of individuals with measurable dose.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
THREE MILE ISLAND 2[19]	2011	0.0	0.0	0	0.291	---	---
(continued)	2012	0.0	0.0	0	0.194	---	---
	2013	0.0	0.0	0	0.229	---	---
	2014	0.0	0.0	0	0.188	---	---
	2015	0.0	0.0	0	0.255	---	---
TROJAN[20]	1977	792.0	92.6	591	174	0.29	0.22
Docket 50-344;	1978	205.5	20.6	711	319	0.45	1.55
NPF-1	1979	631.0	58.1	736	258	0.35	0.41
1st commercial operation 5/76	1980	727.5	72.5	1,159	421	0.36	0.58
Type - PWR	1981	775.6	74.1	1,311	609	0.46	0.79
Capacity - (1,080) MWe	1982	579.5	60.8	977	419	0.43	0.72
	1983	494.2	62.4	969	307	0.32	0.62
	1984	567.0	54.4	1,042	433	0.42	0.76
	1985	829.1	76.7	852	363	0.43	0.44
	1986	852.4	79.7	1,321	381	0.29	0.45
	1987	525.5	54.0	1,209	363	0.30	0.69
	1988	758.6	67.5	1,408	401	0.28	0.53
	1989	666.8	61.9	1,360	421	0.31	0.63
	1990	732.4	66.3	1,169	258	0.22	0.35
	1991	181.6	16.1	1,496	567	0.38	3.12
	1992	553.9	68.4	567	84	0.15	0.15
	1993	0.0	68.4	54	21	0.39	---
	1994	0.0	0.0	51	9	0.18	---
	1995	0.0	0.0	141	44	0.31	---
	1996	0.0	0.0	112	41	0.37	---
	1997	0.0	0.0	227	41	0.18	---
	1998	0.0	0.0	283	46.417	0.16	---
	1999	0.0	0.0	274	51.504	0.19	---
	2000	0.0	0.0	127	17.631	0.14	---
	2001	0.0	0.0	14	1.091	0.08	---
	2002	0.0	0.0	13	0.536	0.04	---
	2003	0.0	0.0	105	23.996	0.23	---
	2004	0.0	0.0	5	0.079	0.02	---
TURKEY POINT 3, 4	1973	401.9	---	444	78	0.18	0.19
Docket 50-250, 50-251;	1974	953.6	---	794	454	0.57	0.48
DPR-31, DPR-41	1975	1,003.7	74.9	1,176	876	0.74	0.87
1st commercial operation	1976	974.2	71.2	1,647	1,184	0.72	1.22
12/72, 9/73	1977	979.5	72.1	1,319	1,036	0.79	1.06
Type - PWRs	1978	1,000.2	78.8	1,336	1,032	0.77	1.03
Capacity - 811, 821 MWe	1979	811.0	62.4	2,002	1,680	0.84	2.07
	1980	990.6	73.6	1,803	1,651	0.92	1.67
	1981	654.0	46.8	2,932	2,251	0.77	3.44
	1982	915.7	65.2	2,956	2,119	0.72	2.31
	1983	878.4	62.8	2,930	2,681	0.92	3.05
	1984	946.7	68.5	2,010	1,255	0.62	1.33
	1985	1,034.9	74.7	1,905	1,253	0.66	1.21
	1986	754.1	54.9	1,808	946	0.52	1.25
	1987	431.3	36.6	1,980	1,371	0.69	3.18
	1988	809.8	59.5	1,841	738	0.40	0.91
	1989	689.9	56.8	1,625	433	0.27	0.63
	1990	933.1	69.0	2,099	730	0.35	0.78
	1991	258.2	21.0	2,087	939	0.45	3.64
	1992	968.9	75.5	1,374	325	0.24	0.34
	1993	1,244.8	91.0	1,271	275	0.22	0.22
	1994	1,172.9	87.2	1,489	476	0.32	0.41
	1995	1,320.3	94.6	1,142	215	0.19	0.16

[19] Three Mile Island 2 has been shut down since the 1979 accident, but was still included in the count of reactors through 1988 since dose was still being accumulated to defuel and decontaminate the unit during this time period. Parentheses indicate plant capacity when plant was operational. From 2001-2015, TMI voluntarily provided an estimate of the collective dose for Unit 2, but not the number of individuals with measurable dose.

[20] Trojan ceased operations in 1992 and will not be put in commercial operation again. It is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational. As of 2005, Trojan no longer reports under its reactor license, but does report under its ISFSI license (see Appendix A).

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
TURKEY POINT 3, 4 (continued)	1996	1,307.8	94.0	1,157	187	0.16	0.14
	1997	1,220.9	88.6	1,581	414	0.26	0.34
	1998	1,323.0	94.5	1,045	156.415	0.15	0.12
	1999	1,352.5	96.5	919	127.567	0.14	0.09
	2000	1,283.7	92.2	1,292	219.852	0.17	0.17
	2001	1,324.1	95.0	827	101.575	0.12	0.08
	2002	1,374.0	97.9	793	73.764	0.09	0.05
	2003	1,253.2	91.6	1,442	247.053	0.17	0.20
	2004	1,231.0	89.9	1,089	117.404	0.11	0.10
	2005	1,143.0	84.9	1,136	109.996	0.10	0.10
	2006	1,251.8	90.0	1,321	149.208	0.11	0.12
	2007	1,281.5	91.0	1,085	107.601	0.10	0.08
	2008	1,294.9	92.0	1,067	97.357	0.09	0.08
	2009	1,219.7	87.6	1,359	166.217	0.12	0.14
	2010	1,290.9	91.9	1,025	86.749	0.08	0.07
	2011	1,245.7	89.6	921	62.326	0.07	0.05
	2012	878.0	67.9	2,024	241.151	0.12	0.27
	2013	1,245.9	82.7	882	82.215	0.09	0.07
	2014	1,375.7	89.4	1,271	114.326	0.09	0.08
	2015	1,489.7	92.7	933	79.124	0.08	0.05
	2016	1,567.7	95.6	892	76.269	0.09	0.05
	2017	1,451.9	88.8	1,104	108.200	0.10	0.07
VERMONT YANKEE[21] Docket 50-271; DPR-28 1st commercial operation 11/72 Type - BWR Capacity - (605) MWe	1973	222.1	---	244	85	0.35	0.38
	1974	303.5	---	357	216	0.61	0.71
	1975	429.0	87.8	282	153	0.54	0.36
	1976	389.6	77.1	815	411	0.50	1.05
	1977	423.5	85.1	641	258	0.40	0.61
	1978	387.5	75.9	934	339	0.36	0.87
	1979	414.0	82.1	1,220	1,170	0.96	2.83
	1980	357.8	71.5	1,443	1,338	0.93	3.74
	1981	429.1	84.6	1,264	731	0.58	1.70
	1982	501.0	96.0	481	205	0.43	0.41
	1983	346.1	69.3	1,316	1,527	1.16	4.41
	1984	398.1	79.0	954	626	0.66	1.57
	1985	361.4	71.8	1,392	1,051	0.76	2.91
	1986	248.1	48.9	1,389	1,188	0.86	4.79
	1987	423.6	84.2	827	303	0.37	0.72
	1988	492.1	95.7	379	124	0.33	0.25
	1989	432.8	84.7	832	288	0.35	0.67
	1990	433.1	85.9	849	307	0.36	0.71
	1991	492.3	94.3	310	118	0.38	0.24
	1992	446.8	88.1	921	381	0.41	0.85
	1993	402.3	80.1	833	217	0.26	0.54
	1994	515.8	98.7	220	38	0.17	0.07
	1995	462.1	87.0	737	182	0.25	0.39
	1996	452.7	85.2	951	231	0.24	0.51
	1997	487.1	96.0	260	57	0.22	0.12
	1998	383.4	77.9	944	199.399	0.21	0.52
	1999	463.4	91.0	854	175.795	0.21	0.38
	2000	517.8	99.6	198	37.846	0.19	0.07
	2001	474.9	93.5	863	143.010	0.17	0.30
	2002	451.0	91.7	946	150.446	0.16	0.33
	2003	505.9	98.8	359	54.348	0.15	0.11
	2004	439.2	87.2	1,379	211.529	0.15	0.48
	2005	467.5	94.2	1,105	198.003	0.18	0.42
	2006	582.9	100.0	380	49.537	0.13	0.08
	2007	537.0	93.0	1,191	171.200	0.14	0.32
	2008	557.3	94.1	1,402	213.680	0.15	0.38
	2009	611.9	100.0	392	61.105	0.16	0.10
	2010	548.6	91.2	1,071	206.321	0.19	0.38
	2011	562.1	93.3	1,029	176.129	0.17	0.31
	2012	571.1	100.0	275	45.480	0.17	0.08

[21] Vermont Yankee ceased operations in November 2014 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
VERMONT YANKEE[21]	2013	555.5	92.9	1,034	170.340	0.16	0.31
(continued)	2014	580.4	99.3	196	21.350	0.11	0.04
	2015	0.0	0.0	413	49.557	0.12	---
	2016	0.0	0.0	128	12.513	0.10	---
	2017	0.0	0.0	128	13.698	0.11	---
VOGTLE 1, 2	1988	820.4	77.7	1,108	138	0.12	0.17
Docket 50-424; 50-425;	1989	1,045.8	96.0	427	32	0.07	0.03
NPF-68, NPF-81	1990	1,710.9	82.7	1,602	466	0.29	0.27
1st commercial operation	1991	1,966.5	89.2	1,357	362	0.27	0.18
6/87, 5/89	1992	2,047.9	90.0	1,262	426	0.34	0.21
Type - PWRs	1993	2,060.4	88.3	1,338	367	0.27	0.18
Capacity - 1,150, 1,152 MWe	1994	2,170.1	91.3	1,048	217	0.21	0.10
	1995	2,285.4	95.2	953	199	0.21	0.09
	1996	2,056.8	86.5	1,395	452	0.32	0.22
	1997	2,121.1	91.4	994	158	0.16	0.07
	1998	2,123.9	92.3	994	162.210	0.16	0.08
	1999	2,106.0	91.5	1,359	228.942	0.17	0.11
	2000	2,223.9	95.6	899	121.312	0.14	0.05
	2001	2,231.5	96.2	870	129.270	0.15	0.06
	2002	1,942.0	85.3	1,152	243.957	0.21	0.13
	2003	2,179.9	94.8	806	84.344	0.10	0.04
	2004	2,200.7	95.7	765	80.763	0.11	0.04
	2005	2,027.9	88.6	1,099	151.096	0.14	0.07
	2006	2,048.8	89.0	892	115.509	0.13	0.06
	2007	2,089.9	92.0	951	120.515	0.13	0.06
	2008	2,023.9	89.3	1,185	137.620	0.12	0.07
	2009	2,201.6	95.7	931	79.681	0.09	0.04
	2010	2,238.6	95.8	924	89.182	0.10	0.04
	2011	2,138.0	92.6	1,179	118.931	0.10	0.06
	2012	2,226.6	95.7	776	59.317	0.08	0.03
	2013	2,178.4	95.3	857	78.298	0.09	0.04
	2014	2,065.8	91.6	1,404	156.744	0.11	0.08
	2015	2,210.0	95.3	843	60.565	0.07	0.03
	2016	2,267.1	97.0	778	58.472	0.08	0.03
	2017	2,189.0	94.3	938	80.556	0.09	0.04
WATERFORD 3	1986	875.7	79.1	1,244	223	0.18	0.25
Docket 50-382;	1987	891.8	82.5	959	156	0.16	0.17
NPF-38	1988	784.3	75.4	1,246	259	0.21	0.33
1st commercial operation 9/85	1989	909.8	82.6	1,306	265	0.20	0.29
Type - PWR	1990	1,027.9	92.8	432	47	0.11	0.05
Capacity - 1,152 MWe	1991	870.6	79.8	1,301	364	0.28	0.42
	1992	909.6	83.2	1,213	226	0.19	0.25
	1993	1,088.3	99.4	195	15	0.08	0.01
	1994	949.1	87.0	1,167	191	0.16	0.20
	1995	927.4	83.4	1,092	153	0.14	0.16
	1996	1,064.8	94.2	342	27	0.08	0.03
	1997	767.2	71.2	1,186	148	0.13	0.19
	1998	984.1	91.9	282	24.032	0.09	0.02
	1999	849.5	79.6	833	123.198	0.15	0.15
	2000	965.1	88.8	825	131.701	0.16	0.14
	2001	1,086.0	99.6	91	4.677	0.05	0.00
	2002	1,007.0	93.2	811	109.439	0.13	0.11
	2003	968.0	90.9	710	95.332	0.13	0.10
	2004	1,099.1	100.0	60	2.517	0.04	0.00
	2005	900.9	80.2	902	136.318	0.15	0.15
	2006	1,059.3	92.0	1,190	109.682	0.09	0.10
	2007	1,130.2	96.0	469	20.125	0.04	0.02
	2008	1,030.7	88.0	1,268	134.221	0.11	0.13
	2009	1,023.4	88.0	1,479	255.088	0.17	0.25
	2010	1,173.1	100.0	216	4.913	0.02	0.00
	2011	1,020.8	90.4	1,144	100.053	0.09	0.10
	2012	897.1	78.0	1,919	260.202	0.14	0.29

[21] Vermont Yankee ceased operations in November 2014 and is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
WATERFORD 3	2013	1,071.6	93.7	130	3.129	0.02	0.00
(continued)	2014	1,046.4	91.5	965	69.462	0.07	0.07
	2015	959.5	85.1	979	65.826	0.07	0.07
	2016	1,152.5	98.4	248	3.392	0.01	0.00
	2017	959.1	83.8	894	60.728	0.07	0.06
WATTS BAR 1, 2	1997	867.6	83.8	1,103	113	0.10	0.13
Docket 50-390, 50-391;	1998	1,105.1	99.1	96	3.106	0.03	0.00
NPF-90, NPF-96	1999	943.1	87.2	975	98.946	0.10	0.10
1st commercial operation	2000	1,033.3	92.8	1,053	122.453	0.12	0.12
5/96, 10/16	2001	1,095.9	96.5	197	5.912	0.03	0.01
Type - PWR	2002	1,034.0	92.1	909	93.598	0.10	0.09
Capacity - 1,037, 1,135 MWe	2003	973.3	86.7	1,392	165.741	0.12	0.17
	2004	1,122.1	99.1	220	5.893	0.03	0.01
	2005	1,003.7	90.0	1,244	143.506	0.12	0.14
	2006	764.5	70.0	2,070	322.682	0.16	0.42
	2007	1,150.6	100.0	128	4.414	0.03	0.00
	2008	923.5	83.2	887	70.648	0.08	0.08
	2009	1,051.1	92.1	853	63.846	0.07	0.06
	2010	1,111.7	98.3	129	6.193	0.05	0.01
	2011	939.6	85.4	900	51.021	0.06	0.05
	2012	969.5	86.5	1,002	62.779	0.06	0.06
	2013	1,137.9	99.5	85	2.616	0.03	0.00
	2014	1,003.4	89.0	600	28.268	0.05	0.03
	2015	964.5	87.5	976	64.320	0.07	0.07
	2016	1,284.1	97.8	189	4.489	0.02	0.00
	2017	1,558.2	69.6	1,074	75.672	0.07	0.05
WOLF CREEK 1	1986	832.8	73.3	682	143	0.21	0.17
Docket 50-482;	1987	778.8	71.1	675	138	0.20	0.18
NPF-42	1988	794.7	70.7	1,010	297	0.29	0.37
1st commercial operation 9/85	1989	1,108.4	99.5	186	18	0.10	0.02
Type - PWR	1990	940.2	81.0	798	195	0.24	0.21
Capacity - 1,164 MWe	1991	707.6	71.9	1,010	331	0.33	0.47
	1992	1,010.8	86.7	446	78	0.17	0.08
	1993	940.5	80.6	975	183	0.19	0.19
	1994	1,017.2	86.8	1,082	235	0.22	0.23
	1995	1,198.0	98.7	242	14	0.06	0.01
	1996	980.6	81.2	986	171	0.17	0.17
	1997	964.3	83.8	989	265	0.27	0.27
	1998	1,187.3	100.0	184	10.382	0.06	0.01
	1999	1,045.3	90.1	812	147.704	0.18	0.14
	2000	1,032.7	89.5	861	143.417	0.17	0.14
	2001	1,177.9	100.0	105	5.176	0.05	0.00
	2002	1,029.0	88.7	816	99.987	0.12	0.10
	2003	1,013.5	87.2	820	88.941	0.11	0.09
	2004	1,153.5	98.8	93	3.388	0.04	0.00
	2005	1,004.2	86.7	856	106.870	0.12	0.11
	2006	1,067.4	91.0	789	96.788	0.12	0.09
	2007	1,183.7	100.0	91	4.307	0.05	0.00
	2008	968.3	83.1	911	94.997	0.10	0.10
	2009	1,001.0	86.9	1,504	73.637	0.05	0.07
	2010	1,090.8	94.2	463	10.516	0.02	0.01
	2011	839.1	73.0	1,266	133.960	0.11	0.16
	2012	944.4	80.0	306	7.888	0.03	0.01
	2013	819.2	72.5	1,452	111.257	0.08	0.14
	2014	978.2	81.9	709	27.500	0.04	0.03
	2015	987.9	82.5	1,190	74.804	0.06	0.08
	2016	942.0	78.5	1,267	90.631	0.07	0.10
	2017	1,215.5	100.0	238	3.437	0.01	0.00

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
YANKEE ROWE[22]	1969	138.3	---	193	215	1.11	1.55
Docket 50-29;	1970	146.1	---	355	255	0.72	1.75
DPR-3	1971	173.5	---	155	90	0.58	0.52
1st commercial operation 7/61	1972	78.7	---	282	255	0.90	3.24
Type - PWR	1973	127.1	---	133	99	0.74	0.78
Capacity - (175) MWe	1974	111.3	---	243	205	0.84	1.84
	1975	145.1	82.4	249	116	0.47	0.80
	1976	152.2	89.8	152	59	0.39	0.39
	1977	124.6	73.9	725	356	0.49	2.86
	1978	145.0	81.0	565	282	0.50	1.94
	1979	149.0	81.6	441	127	0.29	0.85
	1980	35.6	22.0	502	213	0.42	5.98
	1981	109.0	74.4	515	302	0.59	2.77
	1982	108.6	73.4	814	474	0.58	4.36
	1983	163.5	91.4	395	68	0.17	0.42
	1984	124.8	71.4	654	348	0.53	2.79
	1985	144.3	85.3	653	211	0.32	1.46
	1986	169.7	95.0	384	45	0.12	0.27
	1987	138.7	82.7	593	217	0.37	1.56
	1988	136.4	85.2	738	227	0.31	1.66
	1989	159.4	92.9	496	62	0.13	0.39
	1990	101.1	61.5	702	246	0.35	2.43
	1991	121.2	72.3	162	40	0.25	0.33
	1992	0.0	0.0	324	94	0.29	---
	1993	0.0	0.0	313	163	0.52	---
	1994	0.0	0.0	222	156	0.70	---
	1995	0.0	0.0	191	78	0.41	---
	1996	0.0	0.0	239	95	0.40	---
	1997	0.0	0.0	323	65	0.20	---
	1998	0.0	0.0	125	4.603	0.04	---
	1999	0.0	0.0	83	2.291	0.02	---
	2000	0.0	0.0	38	2.406	0.06	---
	2001	0.0	0.0	48	3.969	0.08	---
	2002	0.0	0.0	128	20.024	0.16	---
	2003	0.0	0.0	136	30.934	0.23	---
	2004	0.0	0.0	70	6.502	0.09	---
	2005	0.0	0.0	63	1.456	0.02	---
	2006	0.0	0.0	45	0.975	0.02	---
	2007	0.0	0.0	0	0.000	---	---
	2008	0.0	0.0	1	0.019	0.02	---
	2009	0.0	0.0	5	0.114	0.02	---
	2010	0.0	0.0	3	0.083	0.03	---
	2011	0.0	0.0	8	0.113	0.01	---
	2012	0.0	0.0	1	0.013	0.01	---
	2013	0.0	0.0	2	0.043	0.02	---
	2014	0.0	0.0	10	0.145	0.01	---
	2015	0.0	0.0	25	0.463	0.02	---
	2016	0.0	0.0	5	0.073	0.01	---
	2017	0.0	0.0	7	0.112	0.02	---
ZION 1, 2[23]	1974	425.3	71.1	306	56	0.18	0.13
Docket 50-295; 50-304;	1975	1,181.5	74.9	436	127	0.29	0.11
DPR-39, DPR-48	1976	1,134.9	61.9	774	571	0.74	0.50
1st commercial operation	1977	1,358.6	75.0	784	1,003	1.28	0.74
12/73, 9/74	1978	1,613.5	80.2	1,104	1,017	0.92	0.63
Type - PWRs	1979	1,238.0	67.6	1,472	1,274	0.87	1.03
Capacity - (1,040), (1,040) MWe	1980	1,411.2	74.1	1,363	920	0.67	0.65
	1981	1,366.9	72.3	1,754	1,720	0.98	1.26
	1982	1,186.4	64.3	1,575	2,103	1.34	1.77

[22] Yankee Rowe ceased operations as of October 1991 and will not be put in commercial operation again. It is no longer in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

[23] Zion 1, 2 ceased operations in 1997 and 1996, respectively, and are no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

Reporting Organization	Year	Megawatt Years (MW-yr)	Unit Availability Factor	Total Personnel with Measurable Doses	Collective Dose per Site (person-rem)	Average Measurable Dose (rem)	Collective Dose/ MW-yr
ZION 1, 2[23] (continued)	1983	1,222.3	69.4	1,285	1,311	1.02	1.07
	1984	1,389.9	69.6	1,110	786	0.71	0.57
	1985	1,187.9	62.9	1,498	1,166	0.78	0.98
	1986	1,462.0	73.2	967	474	0.49	0.32
	1987	1,337.0	71.0	1,046	653	0.62	0.49
	1988	1,549.1	78.3	1,926	1,260	0.65	0.81
	1989	1,514.1	77.6	1,282	624	0.49	0.41
	1990	860.4	46.9	1,385	696	0.50	0.81
	1991	1,125.7	58.2	902	173	0.19	0.15
	1992	1,128.8	59.0	1,732	1,043	0.60	0.92
	1993	1,458.2	70.9	1,772	643	0.36	0.44
	1994	1,224.9	59.9	1,176	306	0.26	0.25
	1995	1,471.6	72.4	1,807	797	0.44	0.54
	1996	1,538.4	75.8	1,567	437	0.28	0.28
	1997	123.2	7.1	924	119	0.13	0.97
	1998	0.0	0.0	246	12.417	0.05	---
	1999	0.0	0.0	67	4.194	0.06	---
	2000	0.0	0.0	26	3.015	0.12	---
	2001	0.0	0.0	6	0.274	0.05	---
	2002	0.0	0.0	12	0.276	0.02	---
	2003	0.0	0.0	2	0.049	0.02	---
	2004	0.0	0.0	6	0.167	0.03	---
	2005	0.0	0.0	5	0.109	0.02	---
	2006	0.0	0.0	7	0.109	0.02	---
	2007	0.0	0.0	8	0.224	0.03	---
	2008	0.0	0.0	7	0.147	0.02	---
	2009	0.0	0.0	0	0.000	---	---
	2010	0.0	0.0	17	0.562	0.03	---
	2011	0.0	0.0	128	28.794	0.22	---
	2012	0.0	0.0	183	75.801	0.41	---
	2013	0.0	0.0	218	44.689	0.20	---
	2014	0.0	0.0	358	78.730	0.22	---
	2015	0.0	0.0	340	142.605	0.42	---
	2016	0.0	0.0	194	45.788	0.24	---
	2017	0.0	0.0	75	4.542	0.06	---

[23] Zion 1, 2 ceased operations in 1997 and 1996, respectively, and are no longer included in the count of operating reactors. Parentheses indicate plant capacity when plant was operational.

APPENDIX D

DOSE PERFORMANCE TRENDS BY REACTOR SITE

1973–2017

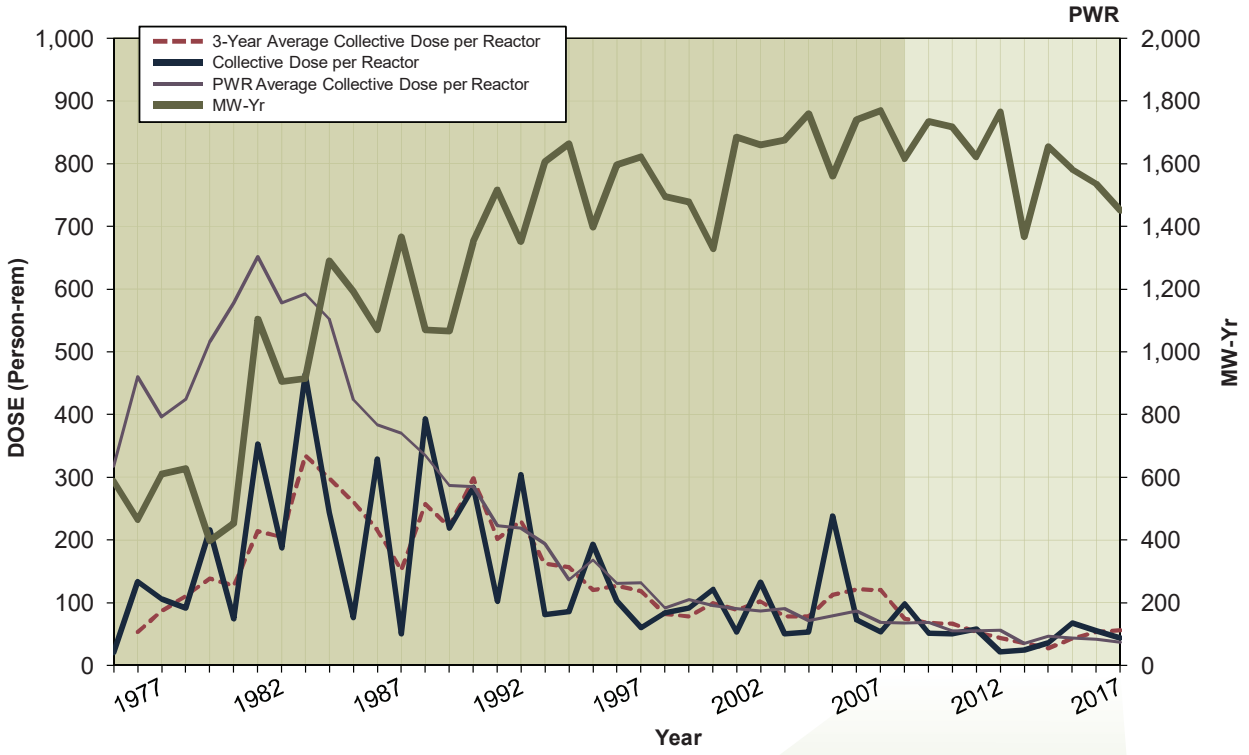
Appendix D only contains data on plants still operating in 2017.

GRAPHICAL REPRESENTATION OF DOSE TRENDS IN APPENDIX D

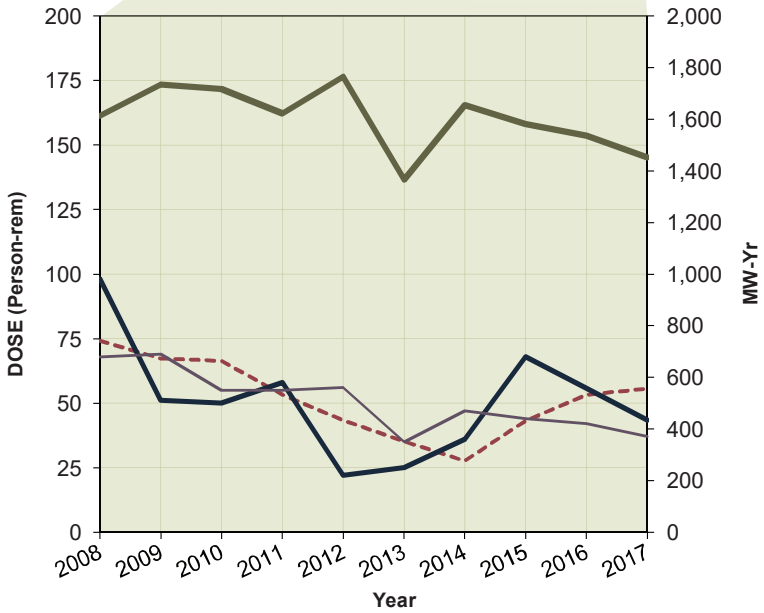
Each page of Appendix D presents a graph of selected dose performance trends from 1973 through 2017. The graphs illustrate the history of the collective dose per reactor for the site, the rolling 3-year average collective dose per reactor, and the electricity generated at the site. These data are plotted, beginning with each plant's first full year of commercial operation and continuing through 2017. Data for years when a plant was not in commercial operation have been included when available; however, any data reported before 1973 are not included. The 3-year average collective dose per reactor data are included because the data provide an overall indication of each plant's general trend in collective dose.

The 3-year average collective dose per reactor is also one of the metrics used by the NRC in the Reactor Oversight Program to evaluate a licensee's as low as is reasonably achievable program. This average is determined by summing the collective dose per reactor for the current year and the previous 2 years and then dividing this sum by 3, which is the number of years considered. Depicting dose trends by using a 3-year average reduces the sporadic effects on annual doses of refueling operations (usually an 18- to 24-month cycle) and occasional high-dose maintenance activities and provides a more representative depiction of collective dose trends over the life of a plant. The annual average collective dose per reactor for all reactors of the same type is also shown on the graph.

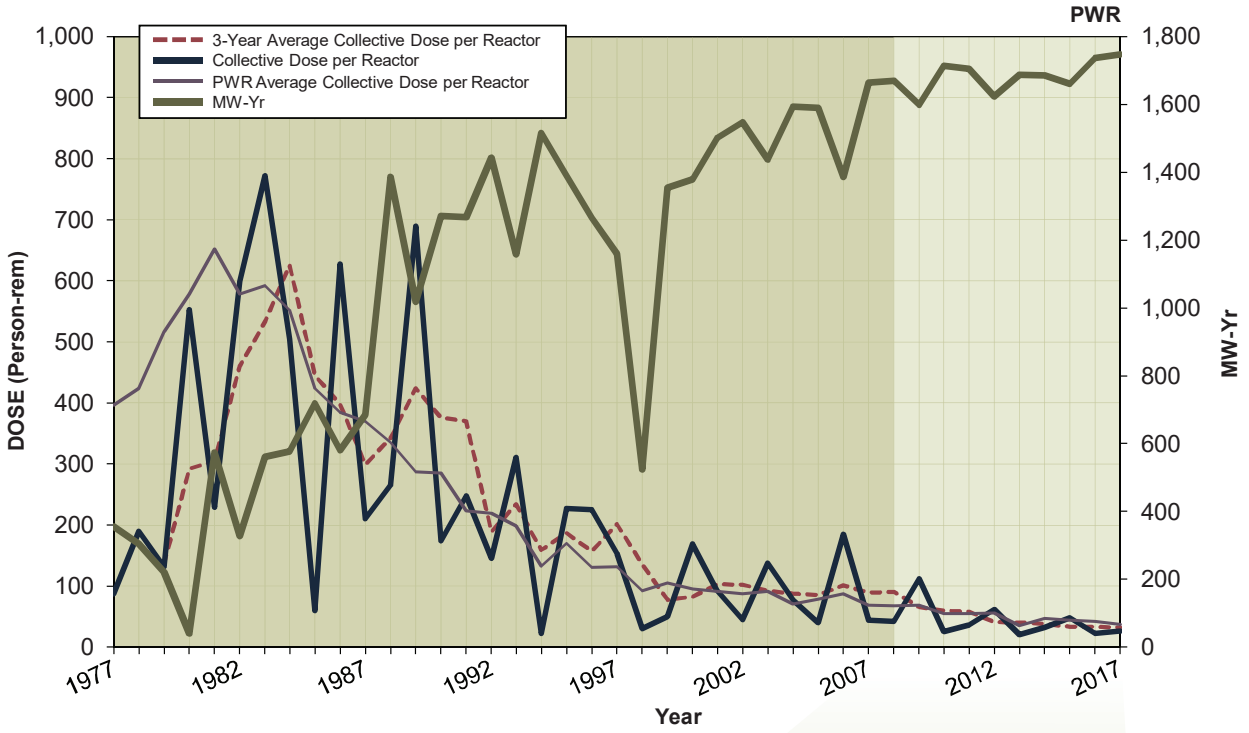
ARKANSAS 1, 2
Dose Performance Trends



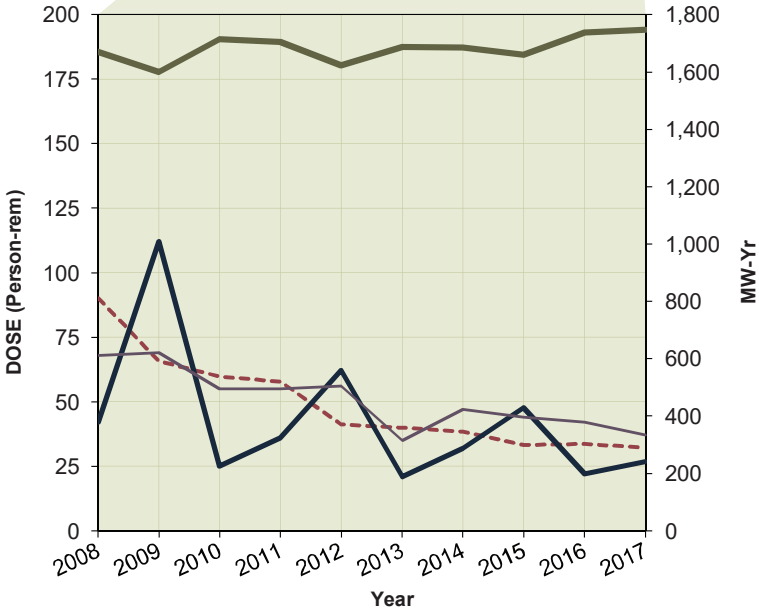
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	74.100	98.000	1,614.8
2009	67.355	51.000	1,733.7
2010	66.351	50.000	1,716.6
2011	53.165	58.000	1,621.9
2012	43.361	22.000	1,764.5
2013	35.139	25.000	1,366.6
2014	27.585	36.000	1,654.6
2015	43.055	68.000	1,582.0
2016	53.232	55.553	1,535.7
2017	55.723	43.250	1,451.4



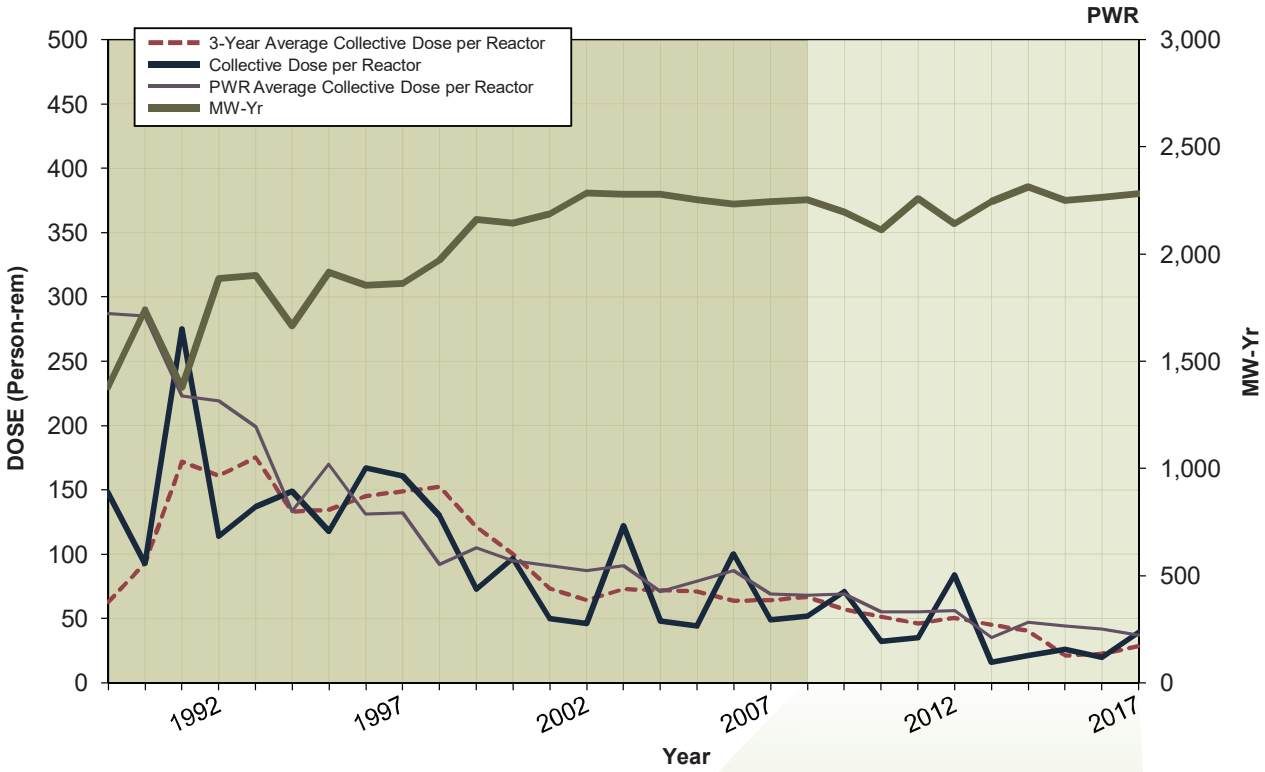
BEAVER VALLEY 1, 2
Dose Performance Trends



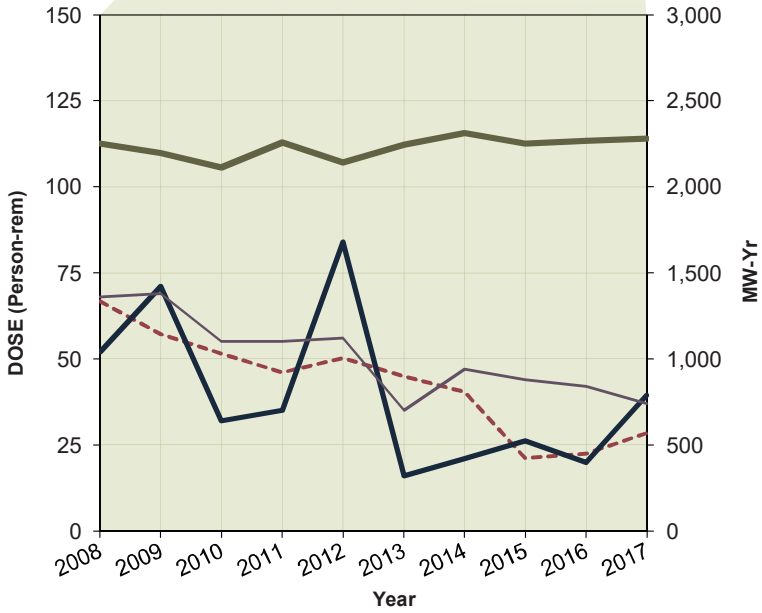
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	90.000	42.000	1,670.2
2009	65.753	112.000	1,599.3
2010	59.650	25.000	1,714.2
2011	57.784	36.000	1,705.5
2012	41.226	62.000	1,622.6
2013	39.847	21.000	1,687.4
2014	38.305	32.000	1,684.6
2015	33.312	47.604	1,659.6
2016	33.718	22.073	1,737.4
2017	32.177	26.853	1,747.9



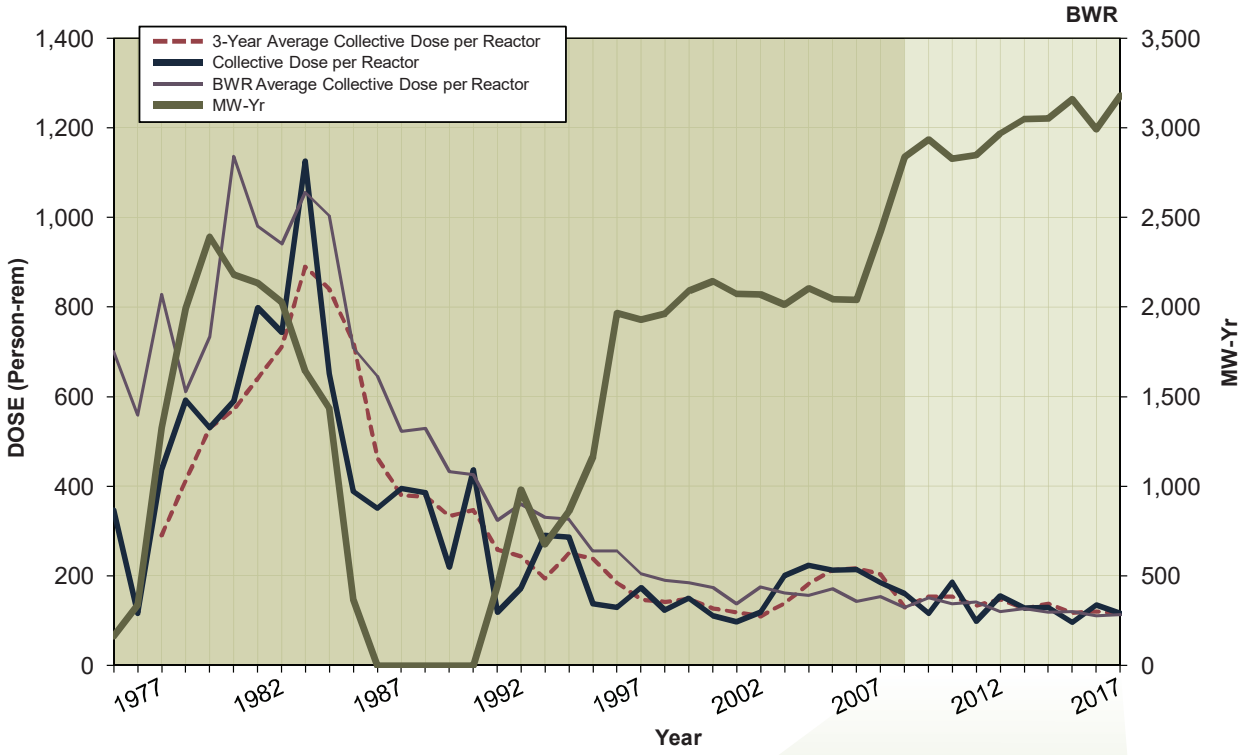
BRAIDWOOD 1, 2
Dose Performance Trends



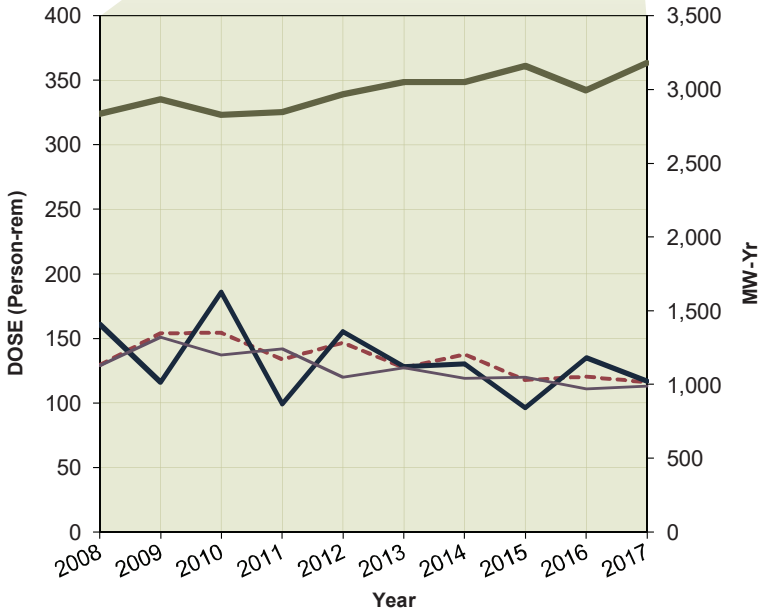
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	66.700	52.000	2,252.5
2009	57.211	71.000	2,195.0
2010	51.520	32.000	2,111.9
2011	46.014	35.000	2,257.5
2012	50.279	84.000	2,141.0
2013	44.944	16.000	2,244.2
2014	40.333	21.000	2,313.9
2015	21.135	26.234	2,250.0
2016	22.443	19.848	2,265.9
2017	28.472	39.334	2,281.4



BROWNS FERRY 1, 2, 3
Dose Performance Trends

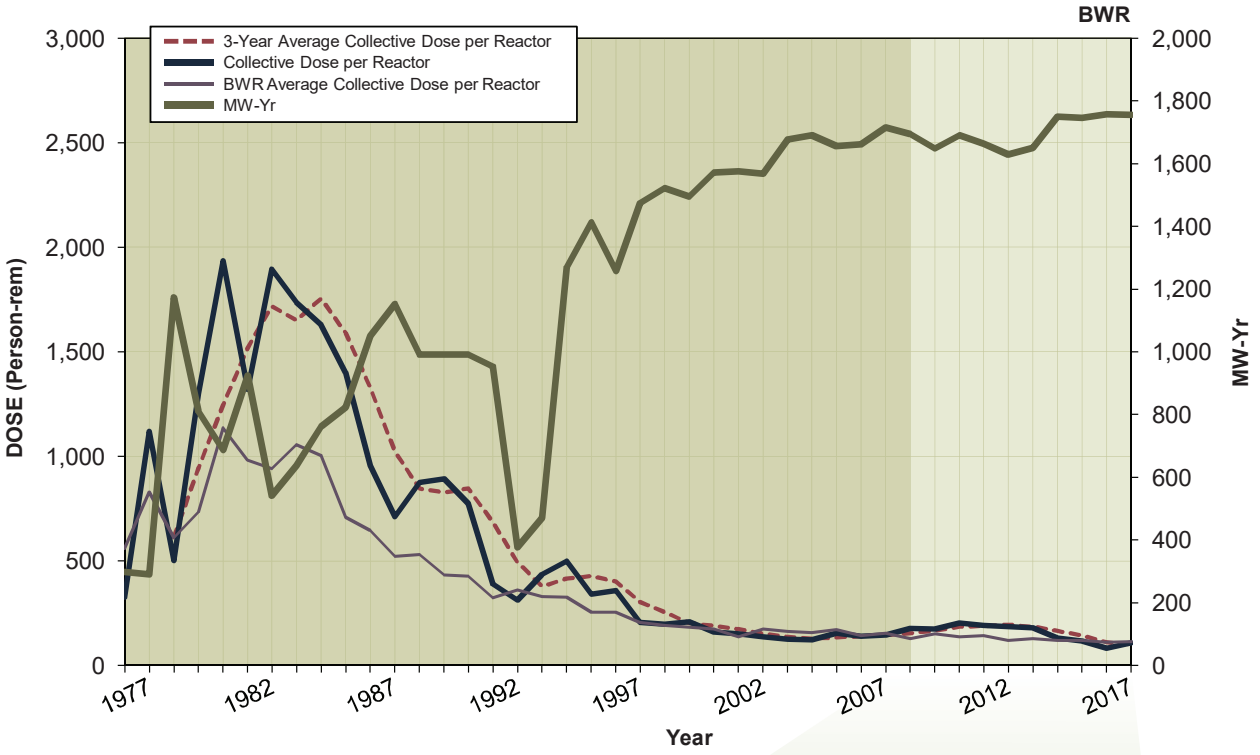


Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	129.200	161.000	2,837.4
2009	153.862	116.000	2,933.1
2010	154.123	186.000	2,828.0
2011	133.516	99.000	2,845.8
2012	146.413	155.000	2,969.2
2013	127.064	128.000	3,050.0
2014	137.421	130.000	3,052.3
2015	117.836	96.021	3,158.6
2016	120.278	134.862	2,992.6
2017	115.857	116.687	3,179.0

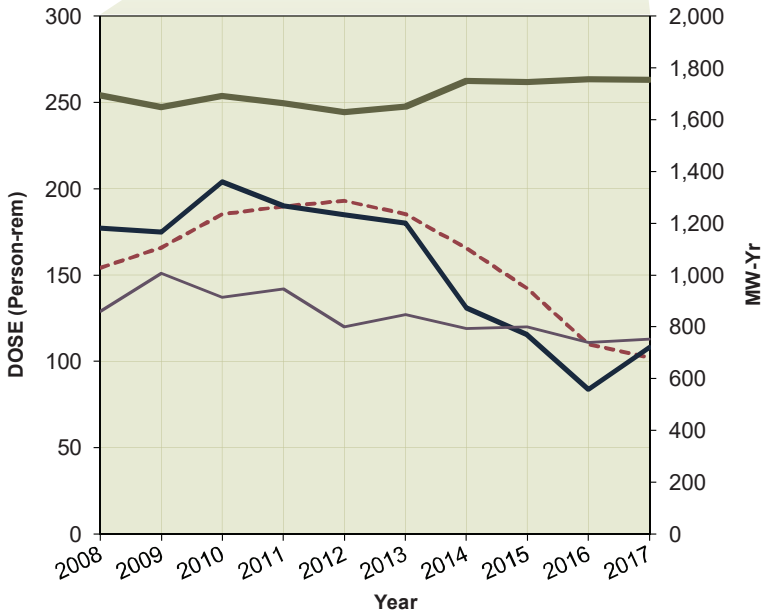


NOTE: Browns Ferry Unit 1 resumed power generation in 2007.

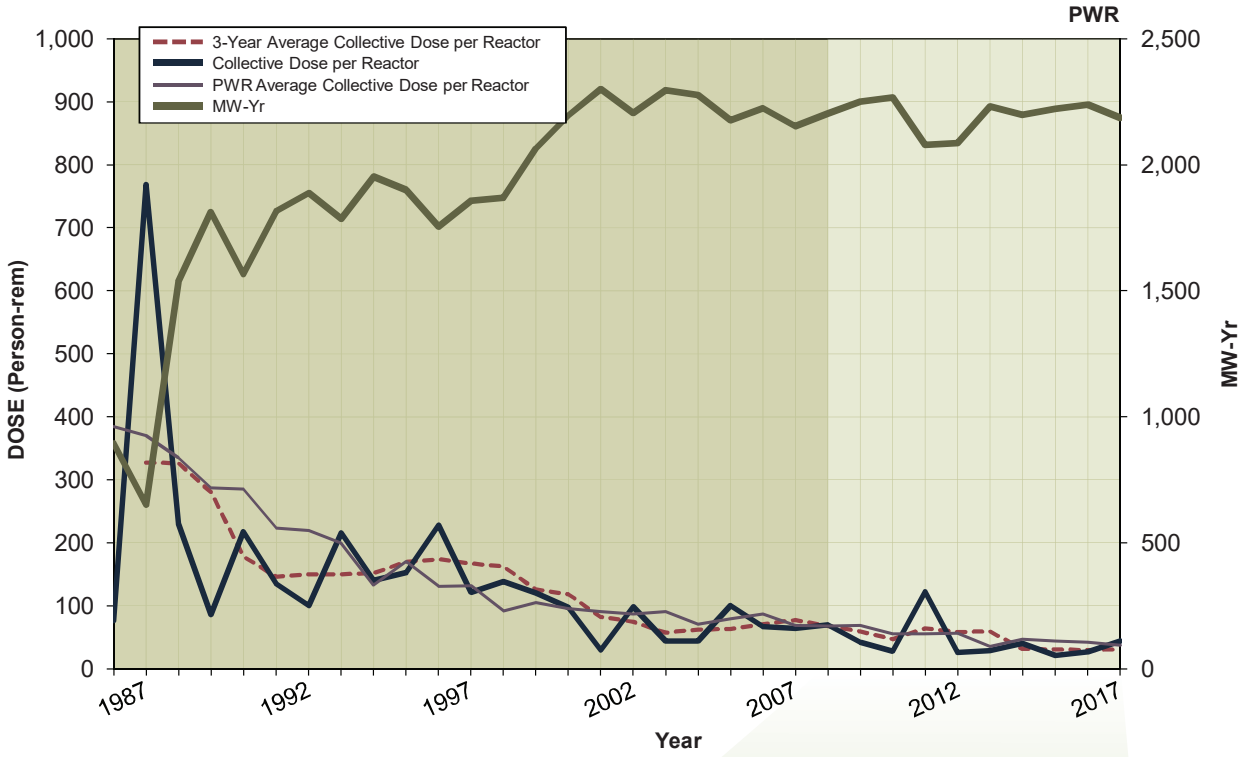
BRUNSWICK 1, 2
Dose Performance Trends



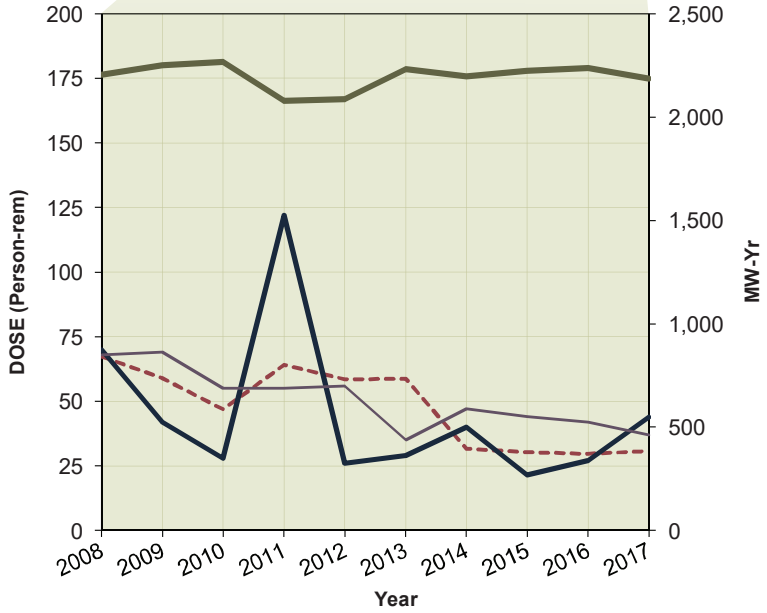
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	154.100	177.000	1,694.5
2009	165.758	175.000	1,647.9
2010	185.329	204.000	1,690.7
2011	189.805	190.000	1,662.7
2012	193.059	185.000	1,629.3
2013	185.346	180.000	1,650.6
2014	165.487	130.952	1,750.6
2015	142.270	115.285	1,745.6
2016	109.952	83.618	1,756.7
2017	102.303	108.007	1,754.6



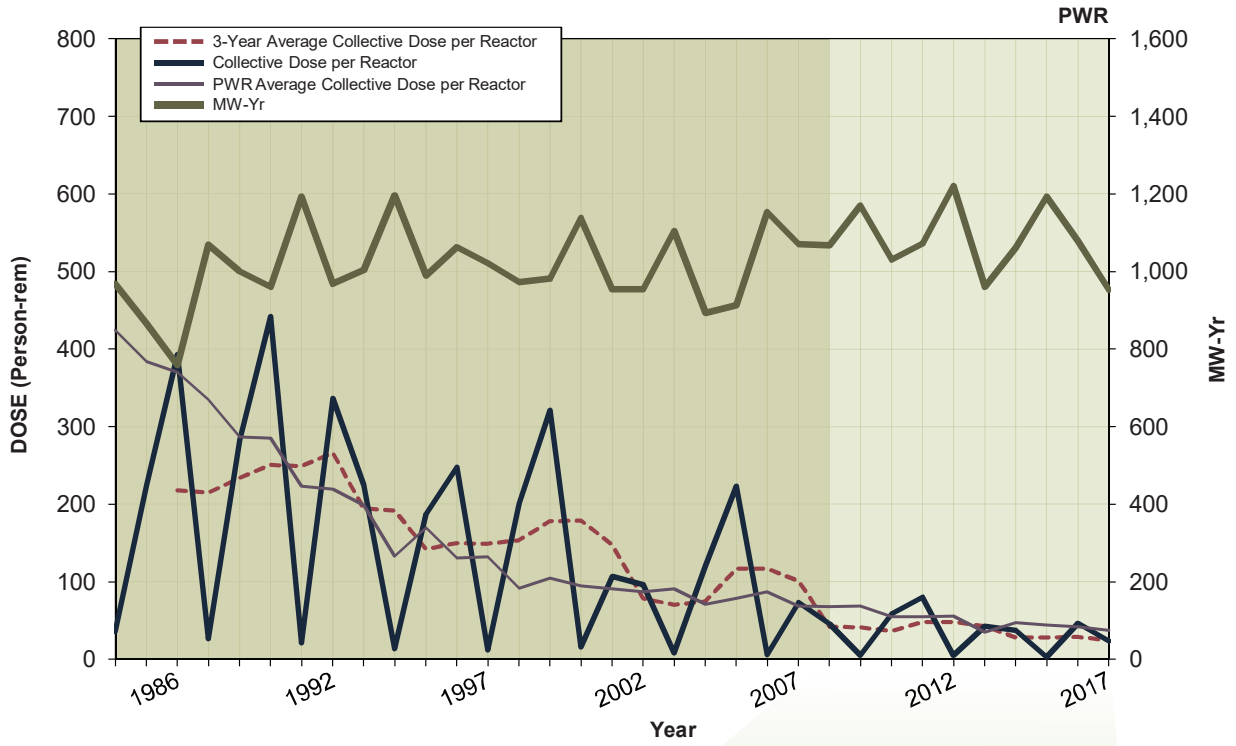
BYRON 1, 2
Dose Performance Trends



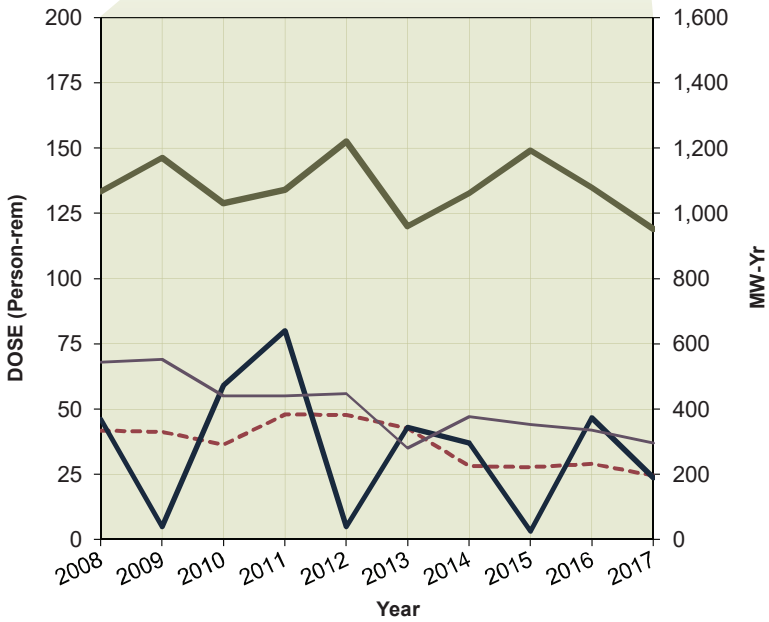
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	67.400	70.000	2,203.7
2009	58.841	42.000	2,250.9
2010	46.778	28.000	2,266.6
2011	63.996	122.000	2,077.9
2012	58.584	26.000	2,085.4
2013	58.798	29.000	2,231.4
2014	31.567	40.000	2,197.8
2015	30.236	21.468	2,222.8
2016	29.620	27.006	2,237.5
2017	30.799	43.923	2,186.4



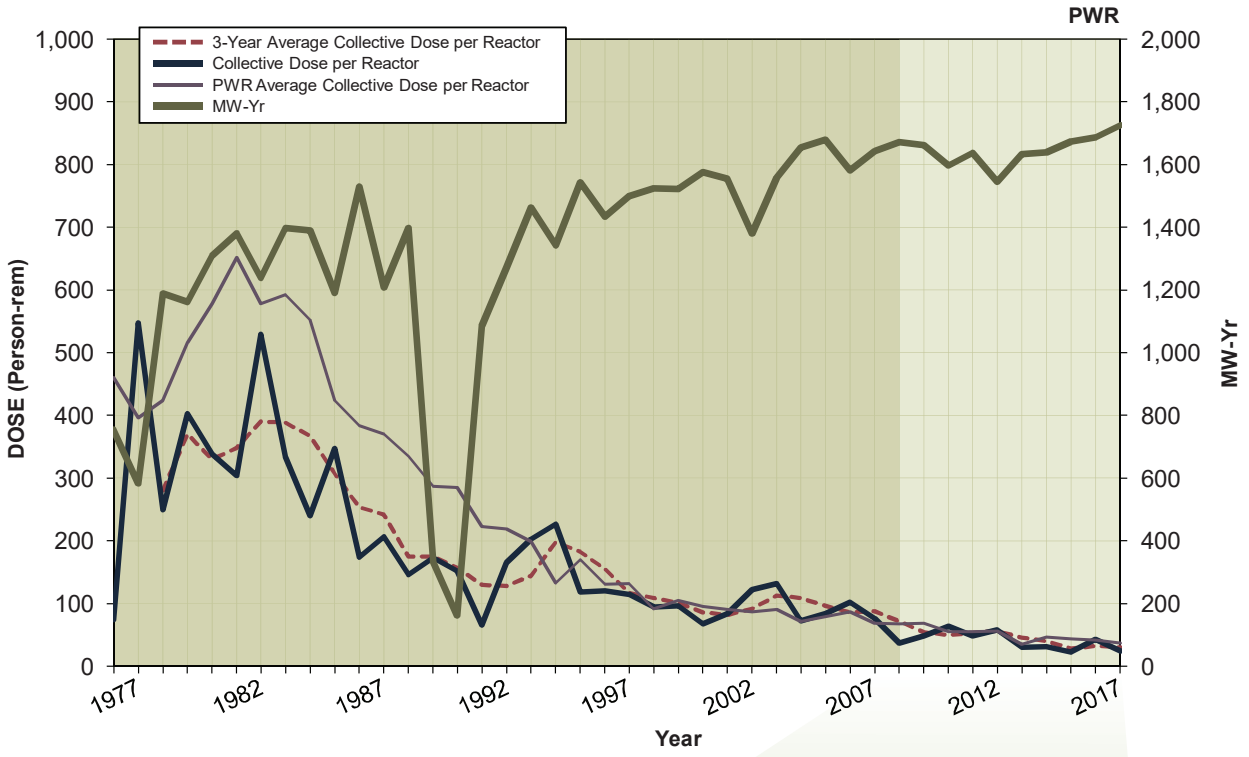
CALLAWAY 1
Dose Performance Trends



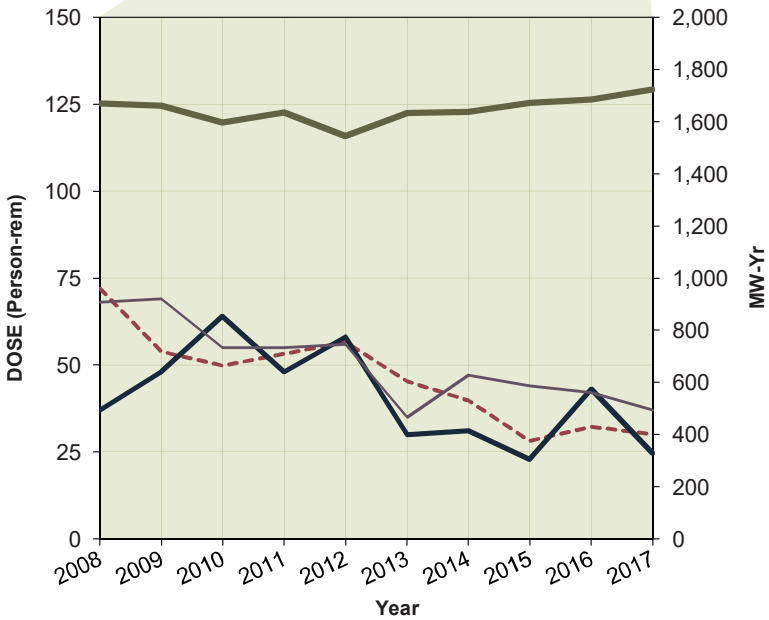
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	41.800	46.000	1,067.6
2009	41.252	5.000	1,170.3
2010	36.419	59.000	1,029.9
2011	47.927	80.000	1,071.7
2012	47.829	5.000	1,220.2
2013	42.621	43.000	959.9
2014	28.274	37.000	1,061.3
2015	27.808	3.128	1,192.2
2016	29.024	46.770	1,078.3
2017	24.537	23.713	951.9



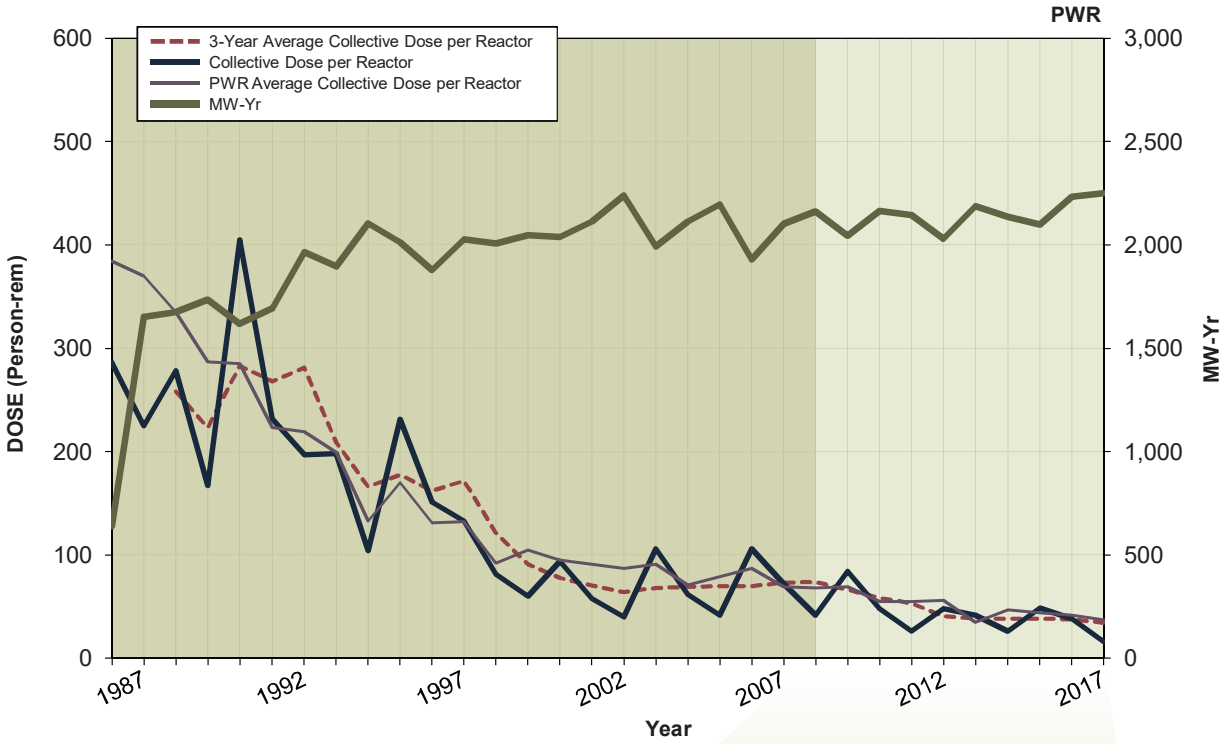
CALVERT CLIFFS 1, 2
Dose Performance Trends



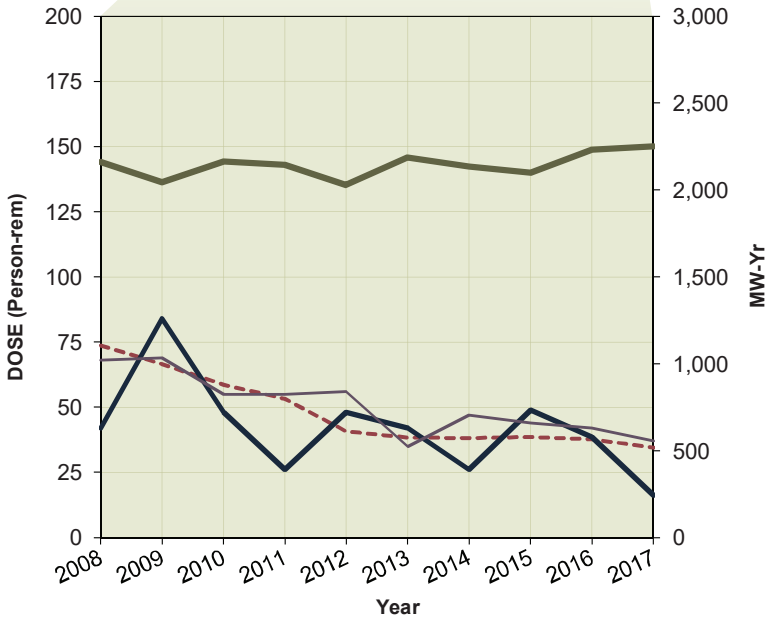
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	71.900	37.000	1,670.7
2009	53.893	48.000	1,660.9
2010	49.756	64.000	1,597.3
2011	53.262	48.000	1,635.9
2012	56.557	58.000	1,545.6
2013	45.306	30.000	1,632.6
2014	39.778	31.000	1,638.3
2015	28.128	22.812	1,672.4
2016	32.263	42.946	1,685.6
2017	30.133	24.642	1,725.0



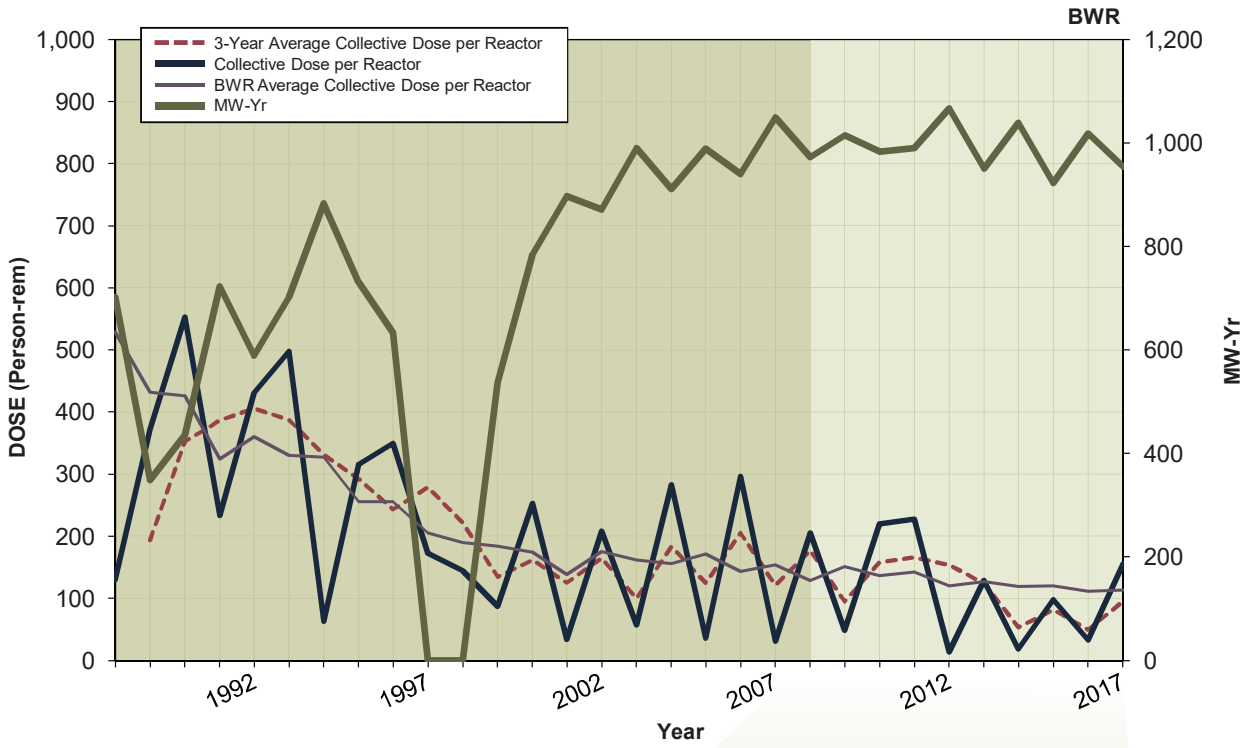
CATAWBA 1, 2
Dose Performance Trends



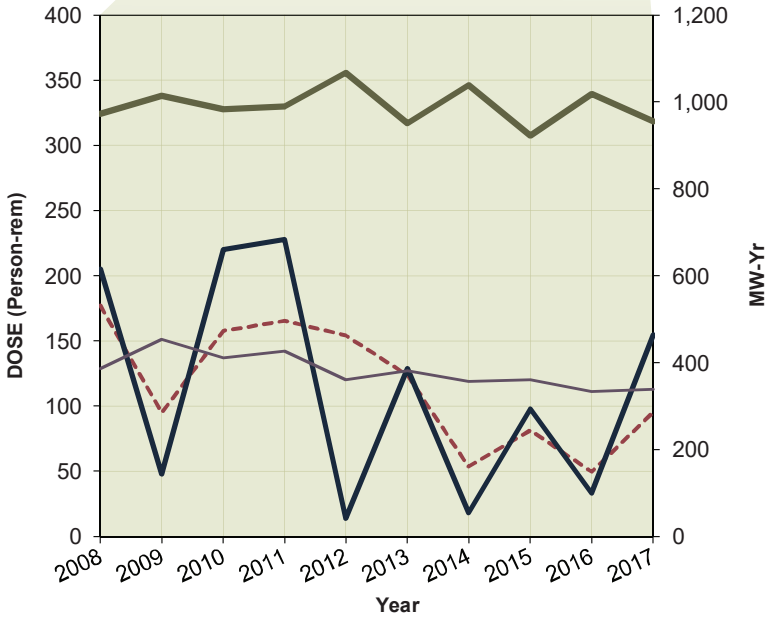
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	73.600	42.000	2,160.3
2009	66.435	84.000	2,044.8
2010	58.570	48.000	2,164.8
2011	53.124	26.000	2,144.2
2012	40.678	48.000	2,029.7
2013	38.327	42.000	2,187.9
2014	38.070	26.000	2,136.0
2015	38.560	48.839	2,098.6
2016	37.592	38.549	2,232.7
2017	34.502	16.118	2,249.6



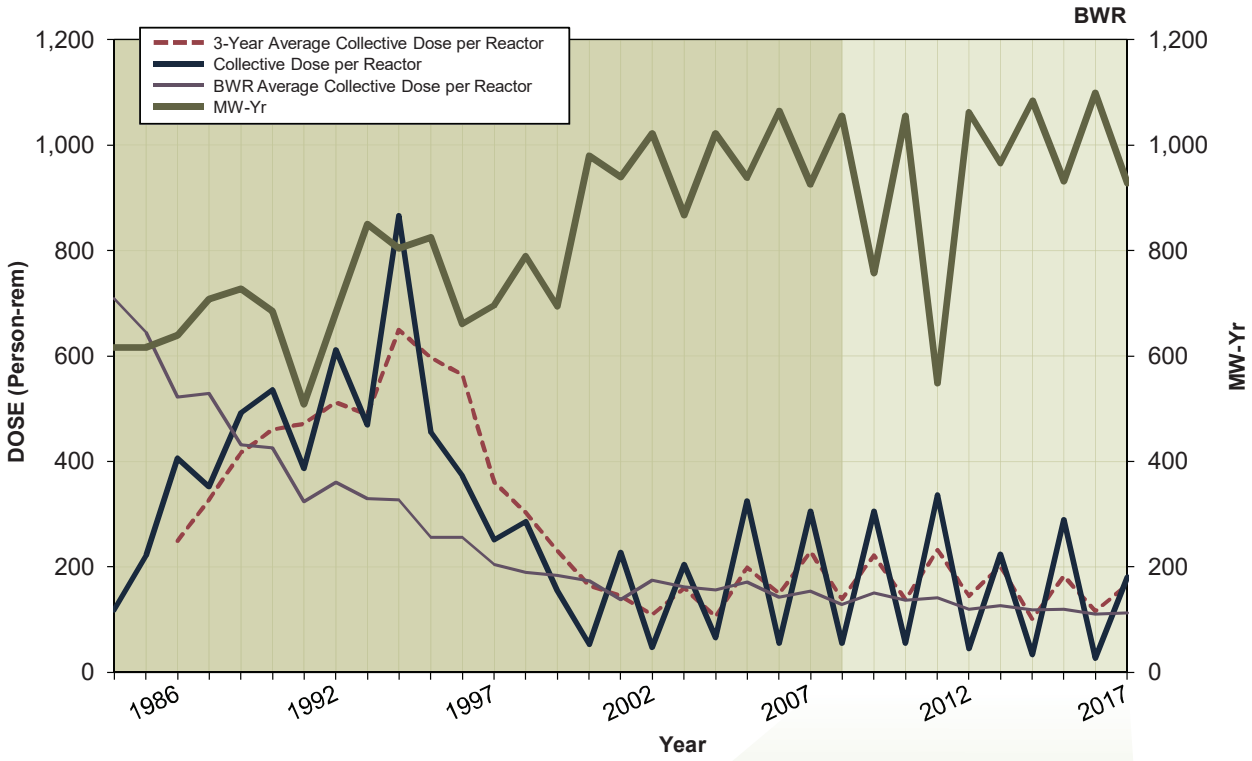
CLINTON
Dose Performance Trends



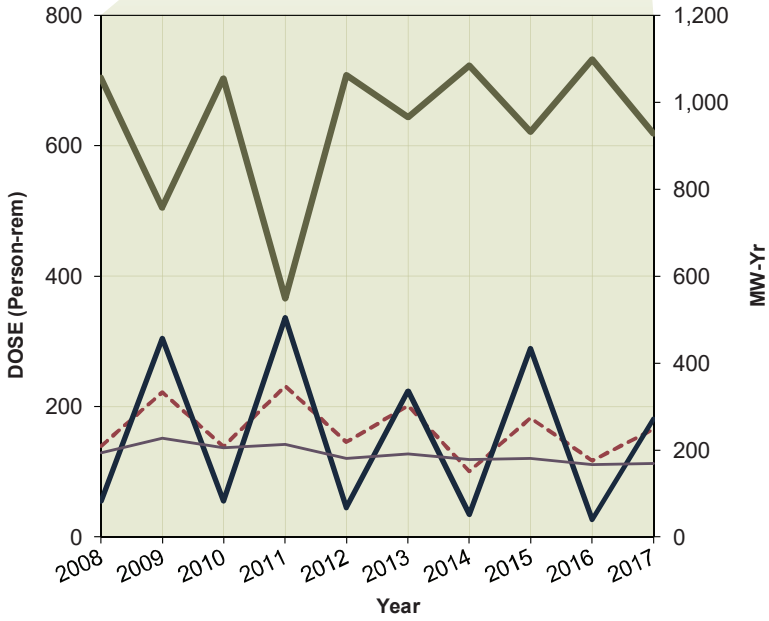
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	177.100	205.000	973.0
2009	94.576	48.000	1,014.6
2010	157.688	220.000	983.1
2011	165.470	228.000	989.9
2012	154.217	14.000	1,067.1
2013	123.826	129.000	950.2
2014	53.632	18.000	1,038.6
2015	81.427	97.634	922.9
2016	49.573	33.218	1,017.8
2017	95.144	154.579	954.1



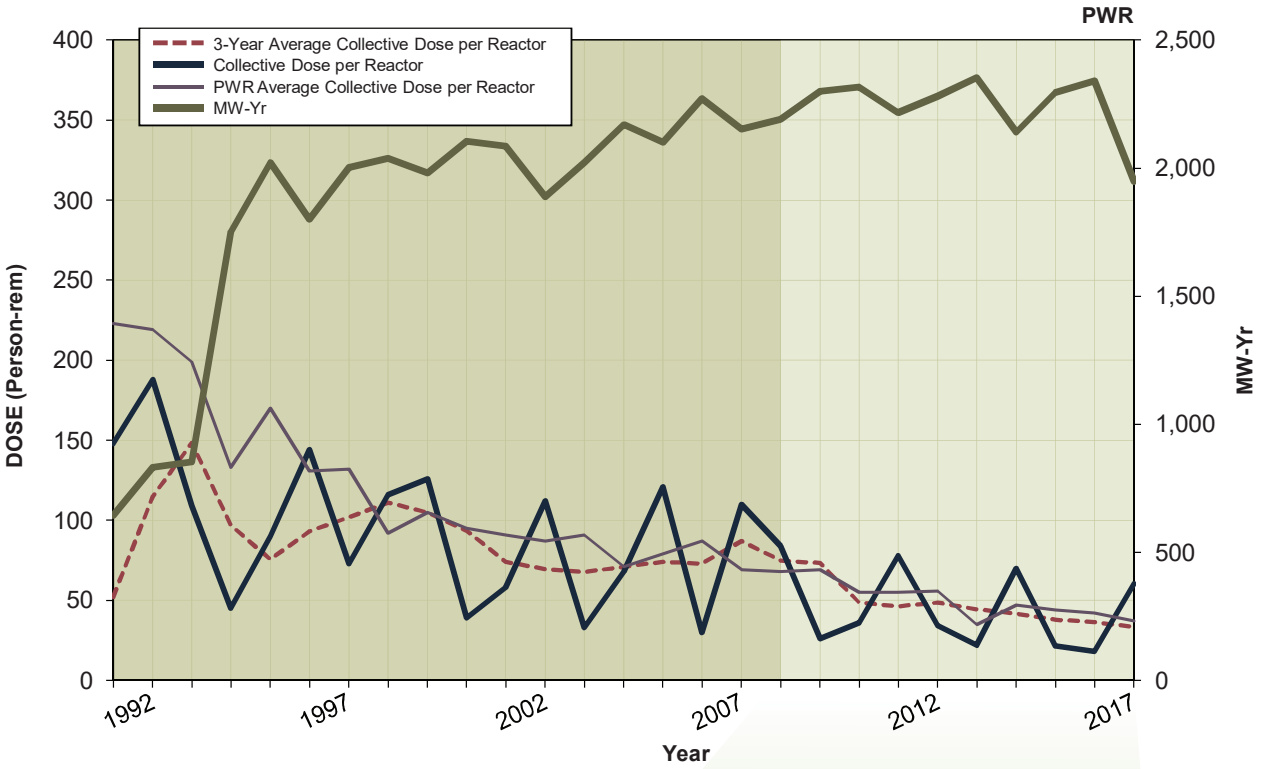
COLUMBIA GENERATING
Dose Performance Trends



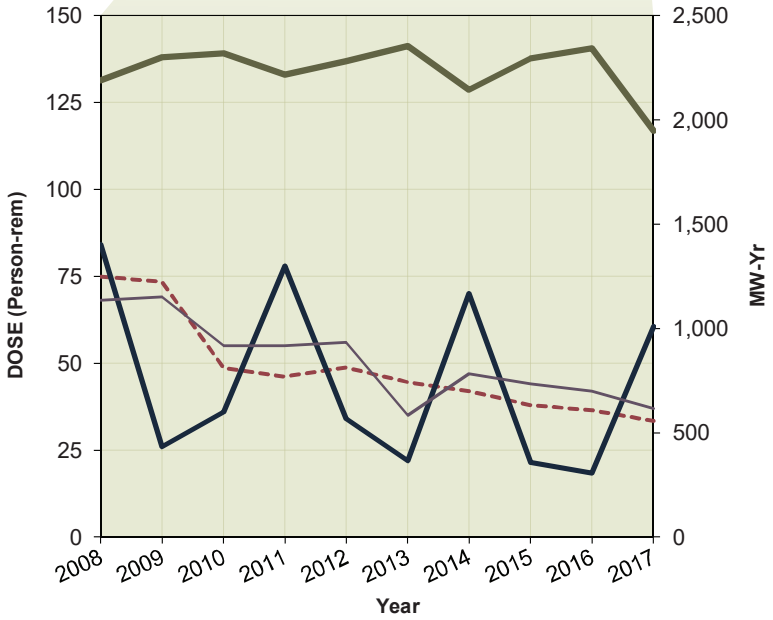
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	139.100	55.000	1,055.3
2009	222.202	305.000	757.2
2010	138.292	55.000	1,054.9
2011	231.844	336.000	548.7
2012	145.277	45.000	1,062.6
2013	201.662	224.000	965.9
2014	101.033	34.000	1,084.2
2015	182.257	289.135	931.6
2016	116.577	26.825	1,098.8
2017	165.405	180.255	927.9



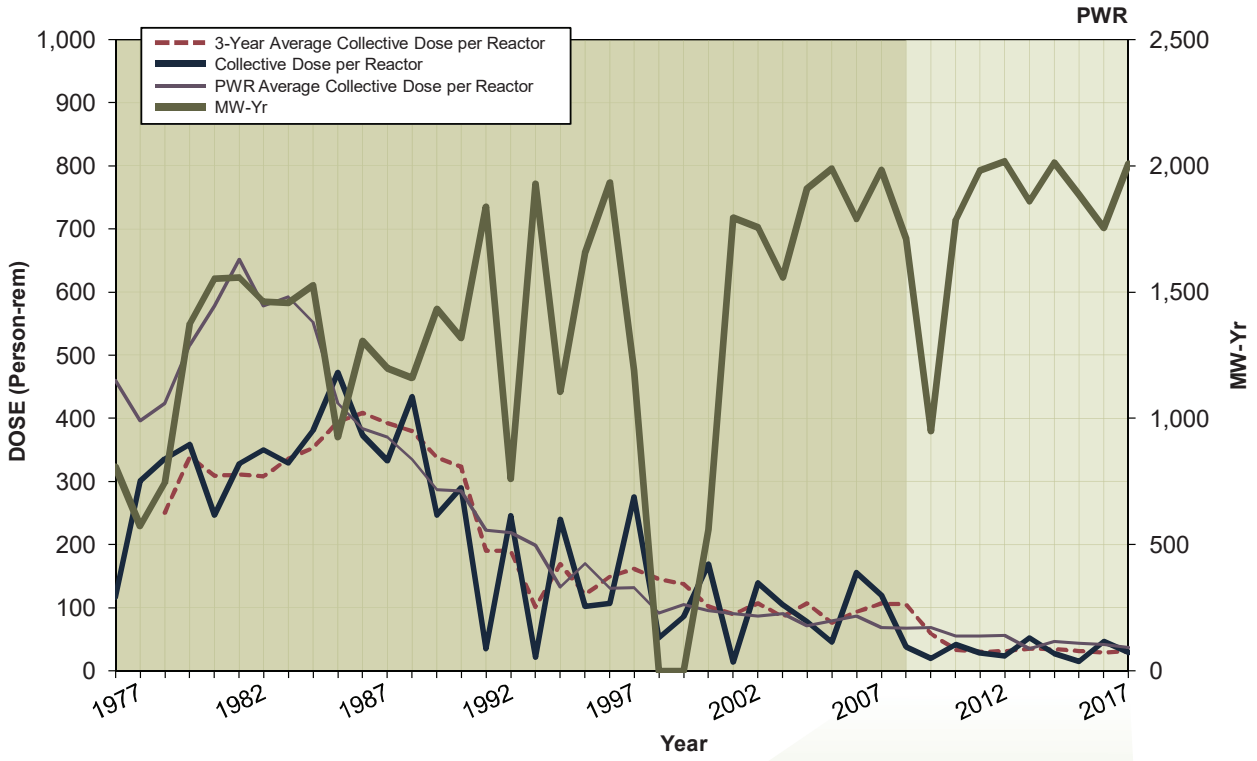
COMANCHE PEAK 1, 2
Dose Performance Trends



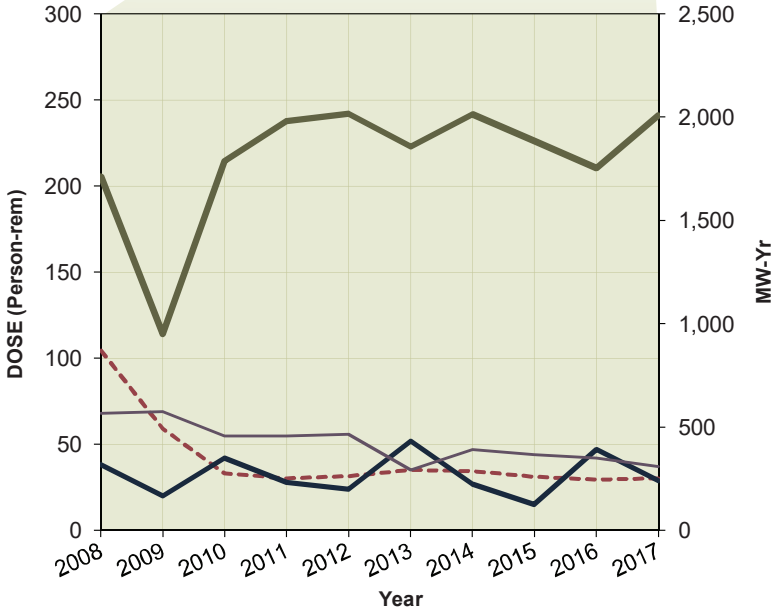
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	74.800	84.000	2,189.7
2009	73.337	26.000	2,299.3
2010	48.505	36.000	2,316.8
2011	46.157	78.000	2,216.8
2012	48.711	34.000	2,279.9
2013	44.449	22.000	2,353.5
2014	41.871	70.000	2,141.7
2015	37.895	21.445	2,294.6
2016	36.464	18.324	2,340.7
2017	33.422	60.498	1,947.3



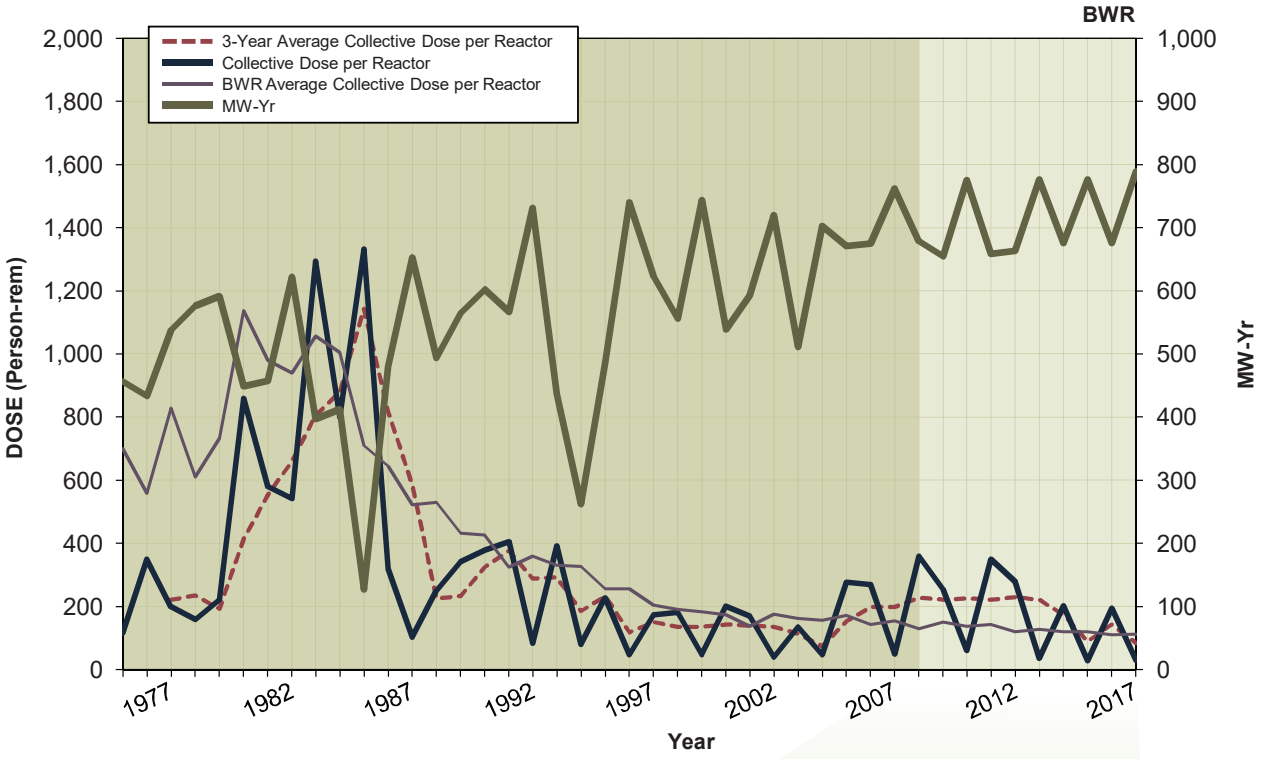
COOK 1, 2
Dose Performance Trends



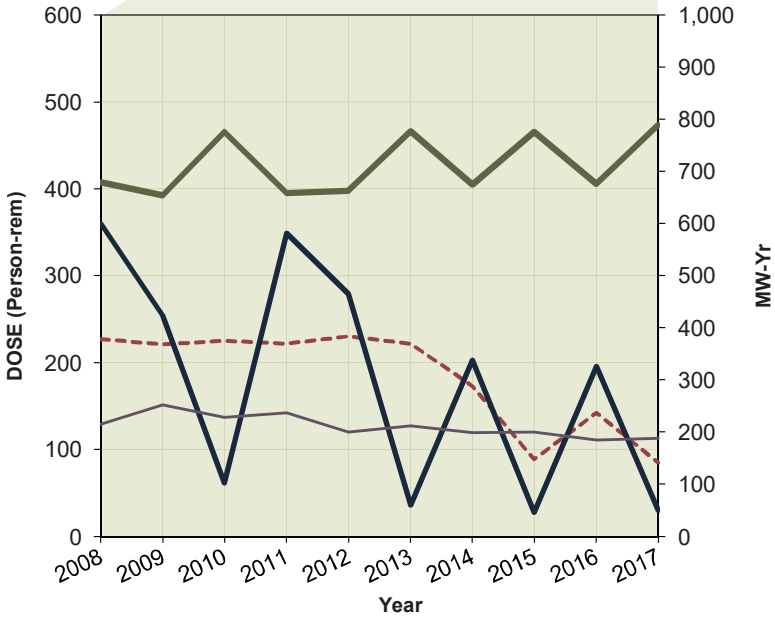
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	104.600	38.000	1,711.8
2009	59.201	20.000	950.5
2010	33.281	42.000	1,786.1
2011	30.075	28.000	1,981.5
2012	31.593	24.000	2,017.5
2013	35.009	52.000	1,858.5
2014	34.447	27.000	2,012.7
2015	31.233	14.914	1,885.7
2016	29.557	46.858	1,753.5
2017	30.257	29.000	2,008.2



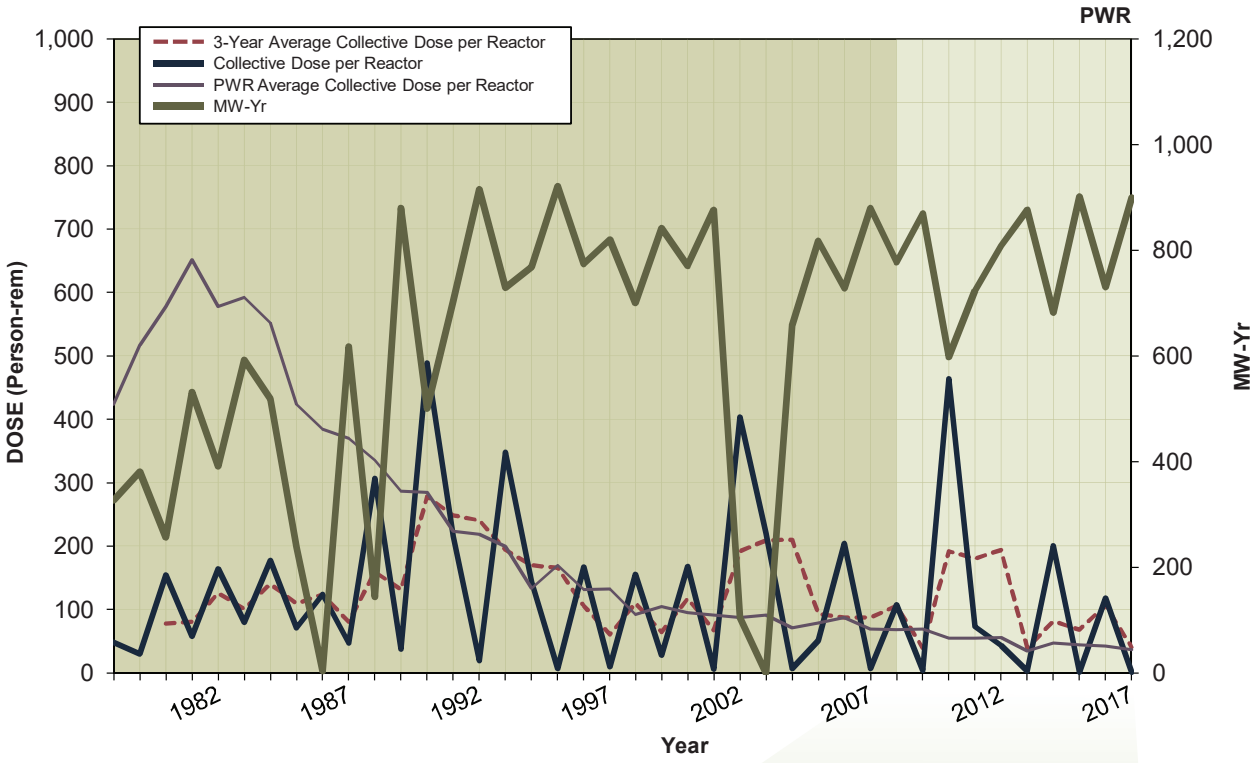
COOPER STATION
Dose Performance Trends



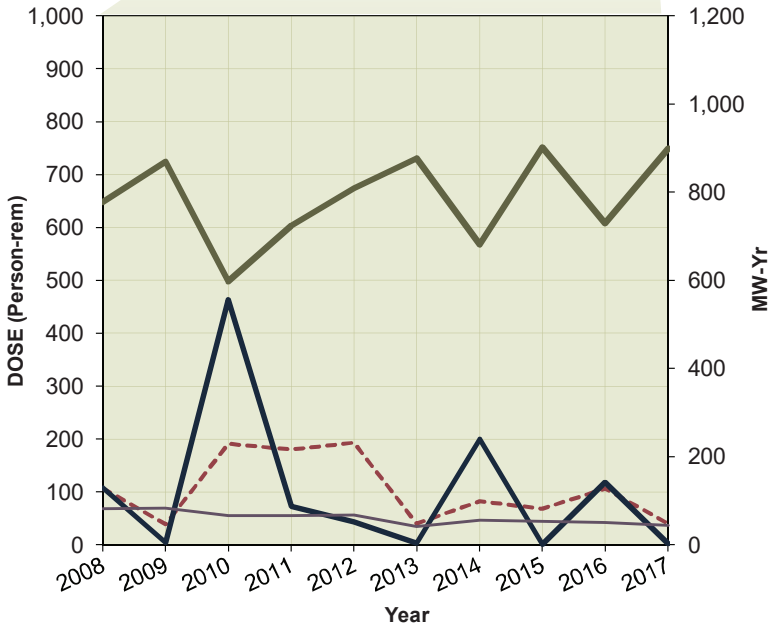
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	226.700	360.000	679.0
2009	221.278	254.000	654.6
2010	225.078	61.000	775.4
2011	221.527	349.000	658.5
2012	229.950	279.000	662.9
2013	221.473	36.000	776.5
2014	172.614	203.000	675.3
2015	88.725	27.634	776.1
2016	141.941	195.518	676.1
2017	84.448	30.193	789.1



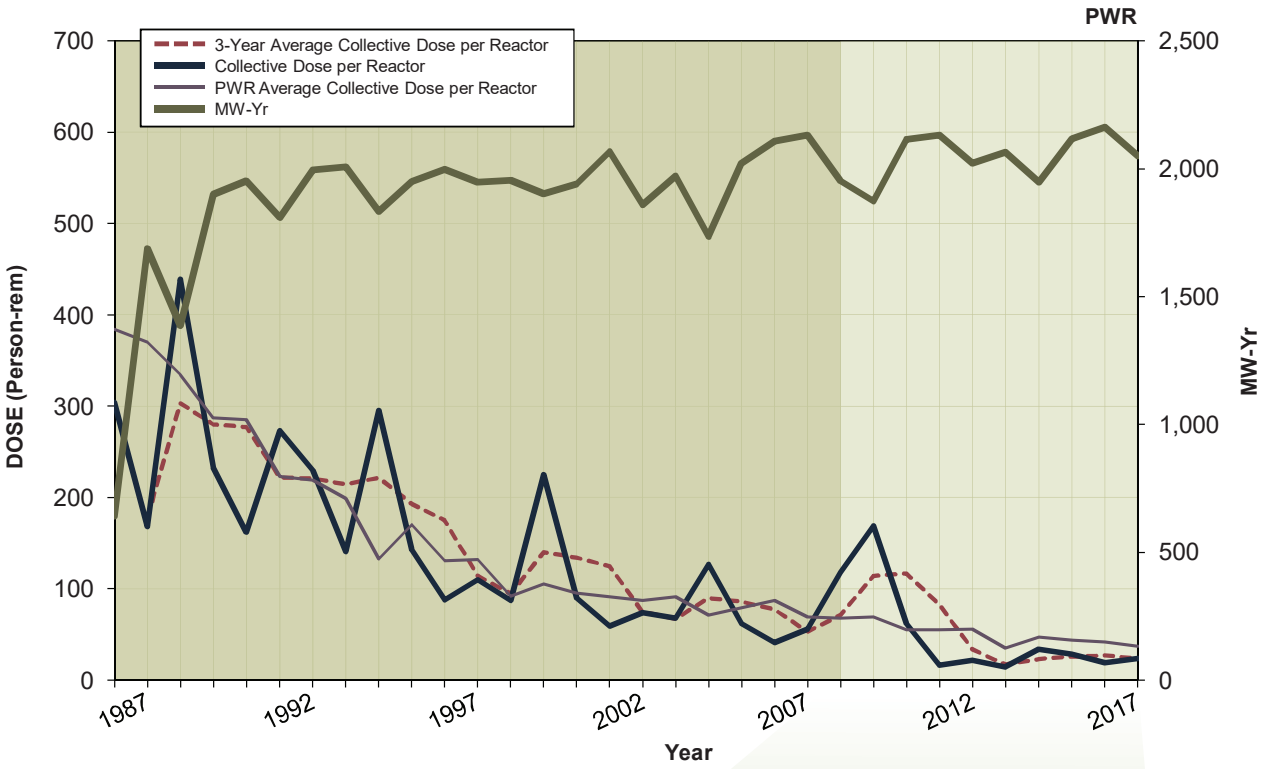
DAVIS-BESSE 1
Dose Performance Trends



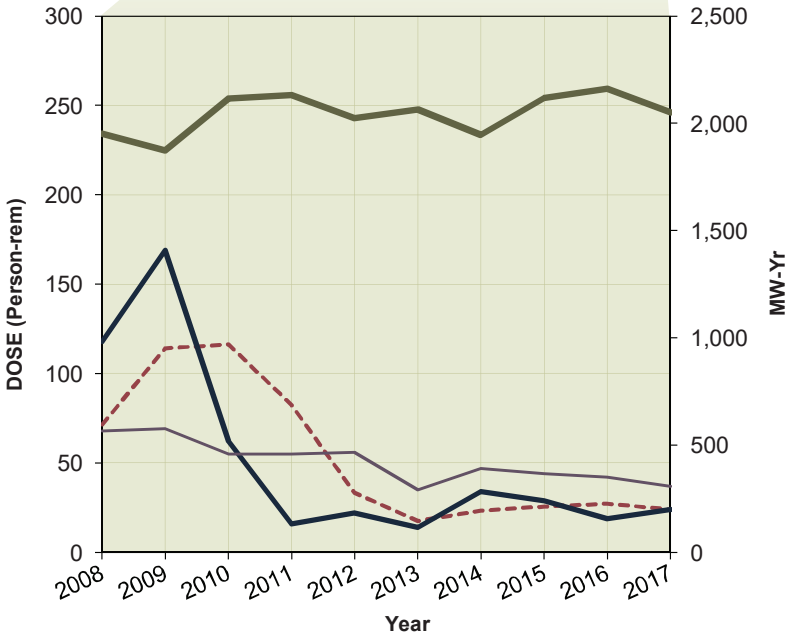
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	106.000	107.000	777.5
2009	39.103	4.000	868.7
2010	191.439	464.000	598.0
2011	180.359	73.000	723.7
2012	193.509	43.000	808.5
2013	39.663	3.000	876.6
2014	82.032	200.000	681.8
2015	68.006	0.995	901.1
2016	106.644	118.472	730.0
2017	40.363	1.621	899.1



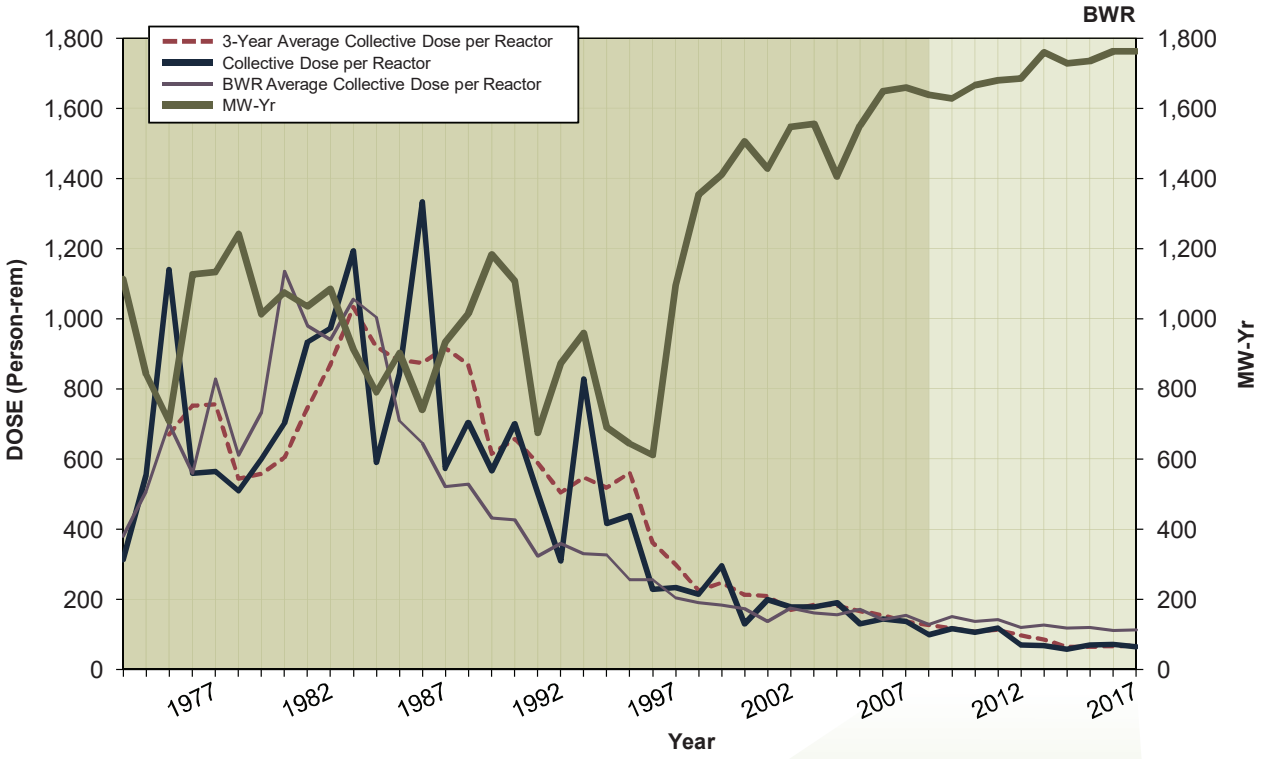
DIABLO CANYON 1, 2
Dose Performance Trends



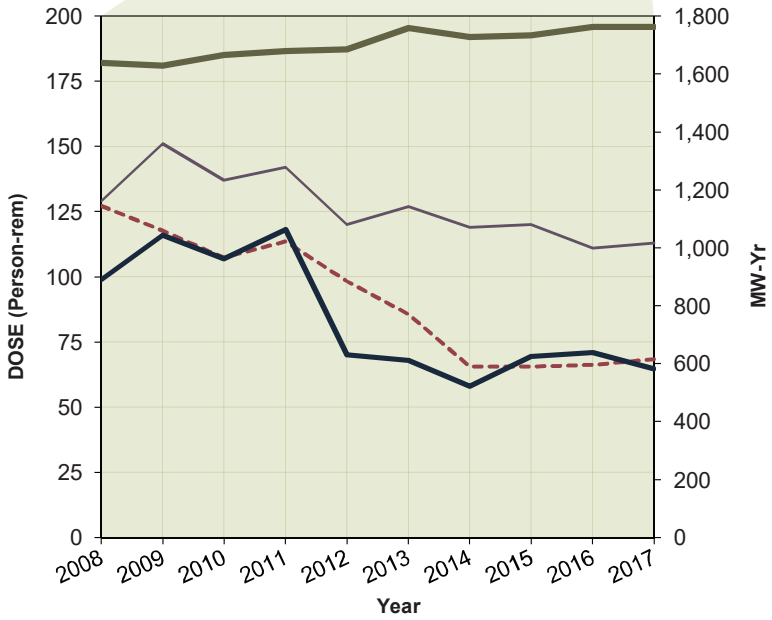
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	71.500	118.000	1,952.1
2009	114.105	169.000	1,873.0
2010	116.382	62.000	2,115.2
2011	82.486	16.000	2,131.1
2012	33.436	22.000	2,023.0
2013	17.321	14.000	2,064.1
2014	23.316	34.000	1,947.1
2015	25.602	28.622	2,116.8
2016	27.096	18.867	2,162.2
2017	23.815	23.955	2,051.4



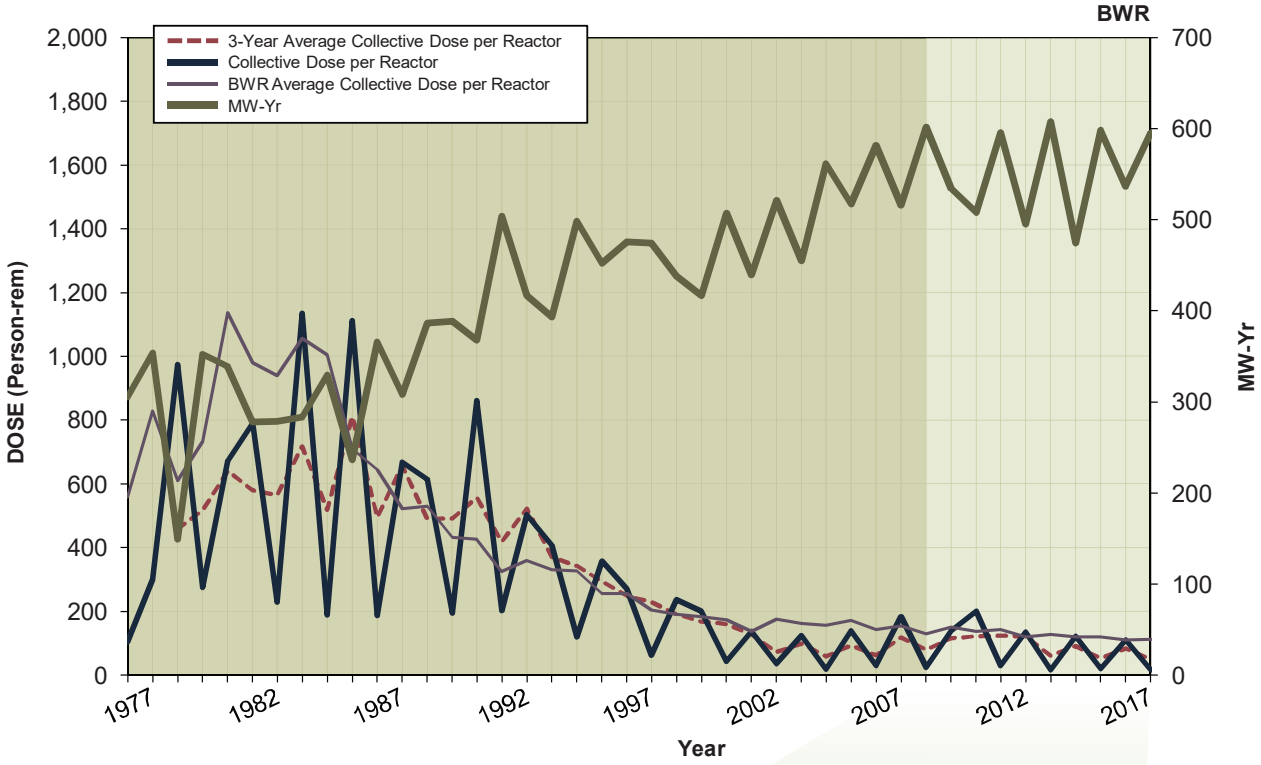
DRESDEN 2, 3
Dose Performance Trends



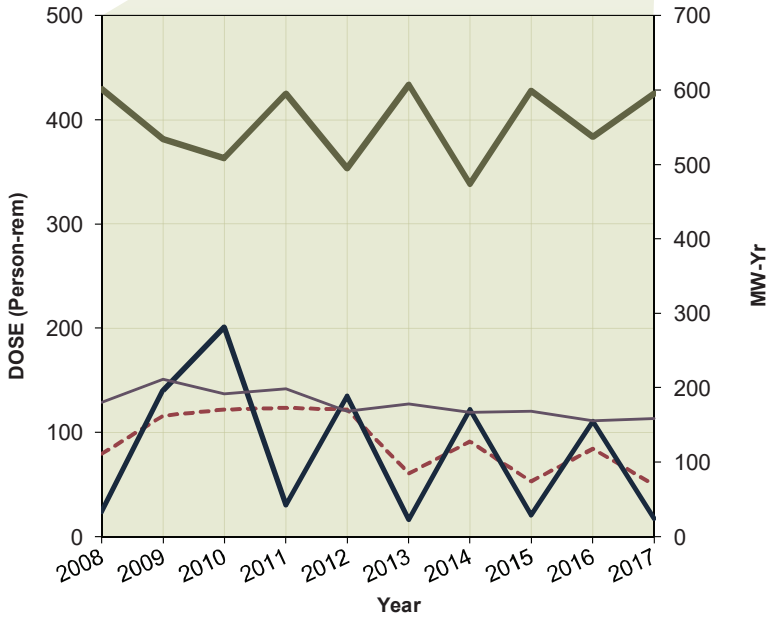
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	127.200	99.000	1,638.0
2009	117.581	116.000	1,628.7
2010	107.286	107.000	1,665.9
2011	113.657	118.000	1,679.7
2012	98.311	70.000	1,685.5
2013	85.497	68.000	1,759.9
2014	65.582	58.000	1,727.8
2015	65.457	69.432	1,734.4
2016	66.271	70.914	1,763.2
2017	68.326	64.633	1,763.3



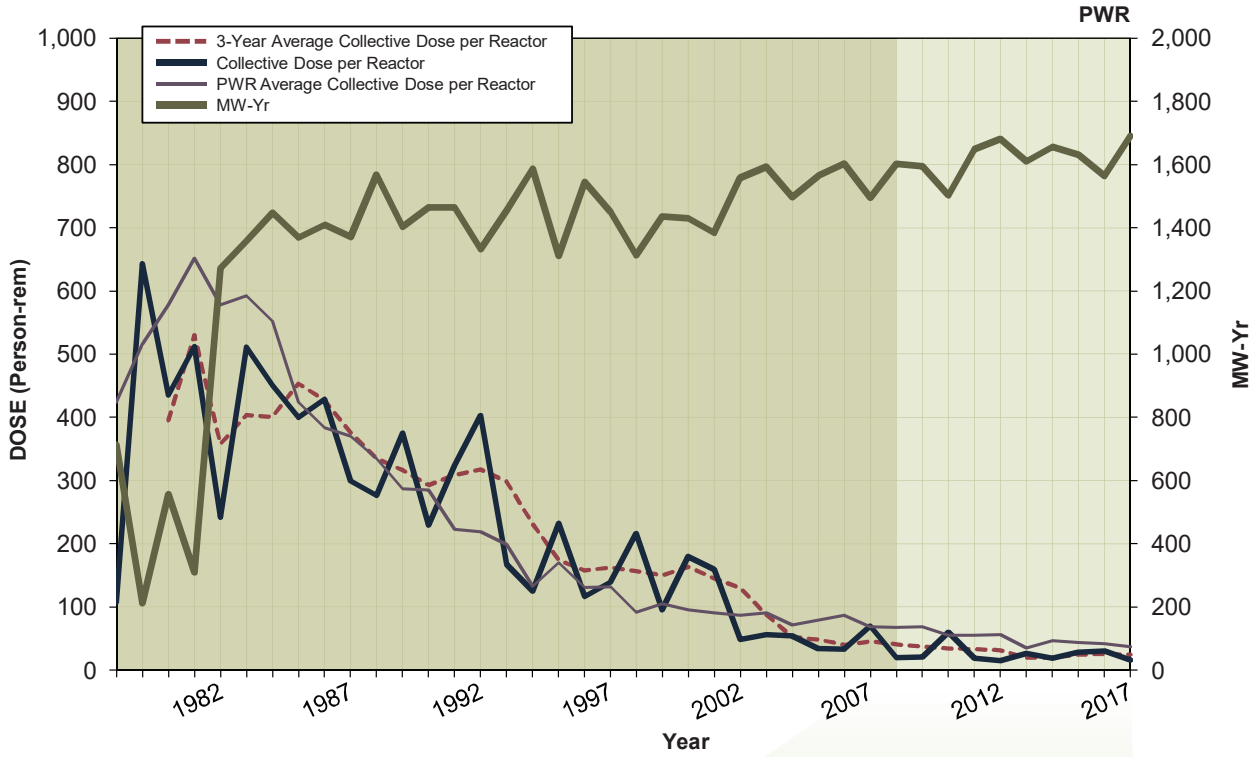
DUANE ARNOLD
Dose Performance Trends



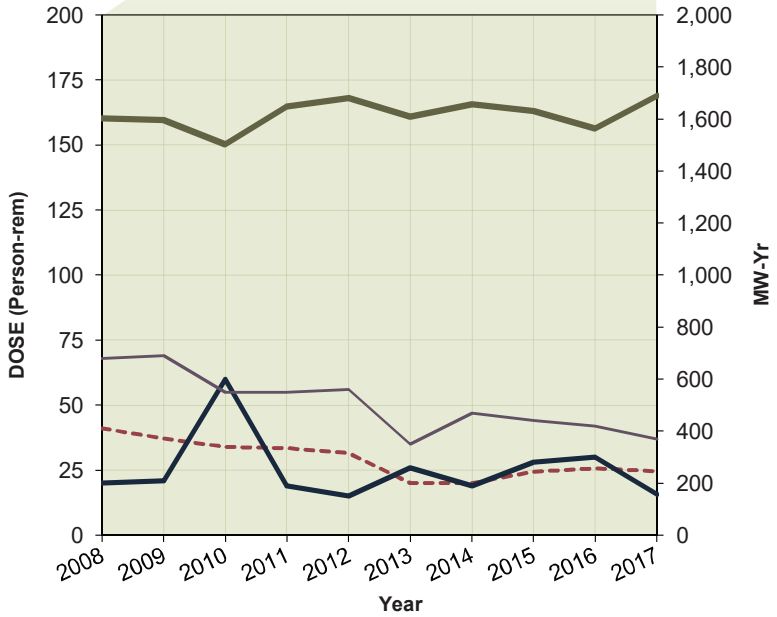
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	79.100	24.000	601.4
2009	116.005	140.000	534.1
2010	121.669	201.000	508.1
2011	123.460	30.000	595.3
2012	121.593	135.000	494.9
2013	60.197	16.000	607.4
2014	90.972	122.000	474.0
2015	52.947	20.441	598.6
2016	84.347	110.613	536.8
2017	49.463	17.336	595.2



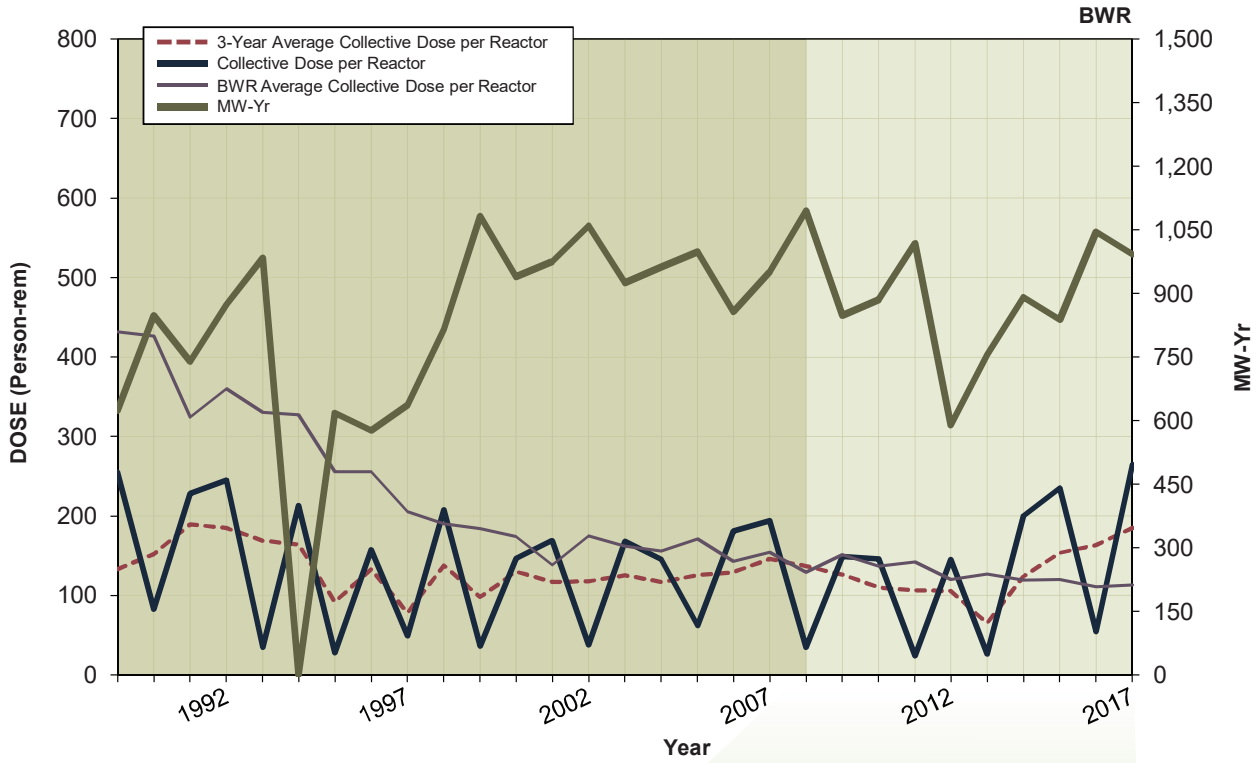
FARLEY 1, 2
Dose Performance Trends



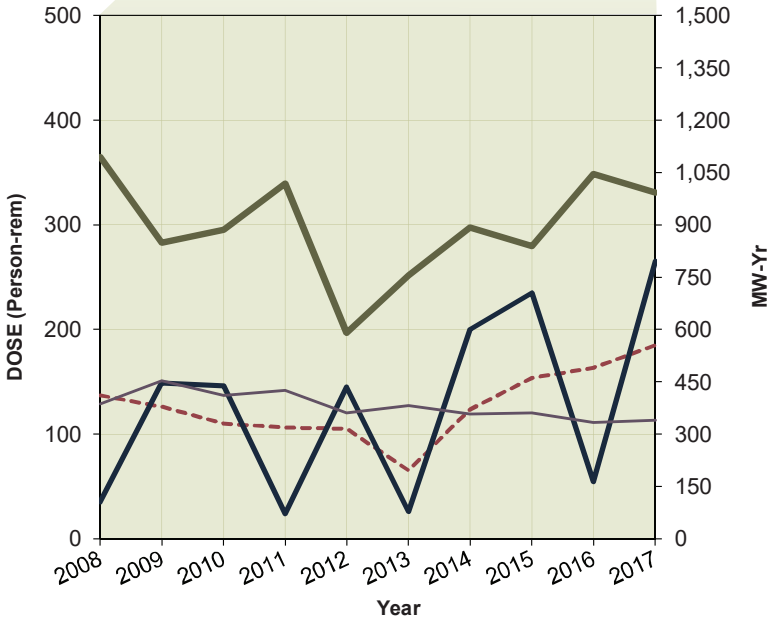
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	41.100	20.000	1,602.6
2009	37.075	21.000	1,595.2
2010	33.994	60.000	1,503.4
2011	33.446	19.000	1,647.4
2012	31.440	15.000	1,680.7
2013	20.090	26.000	1,609.4
2014	20.122	19.000	1,655.9
2015	24.476	27.971	1,631.0
2016	25.581	29.920	1,563.7
2017	24.522	15.676	1,690.0



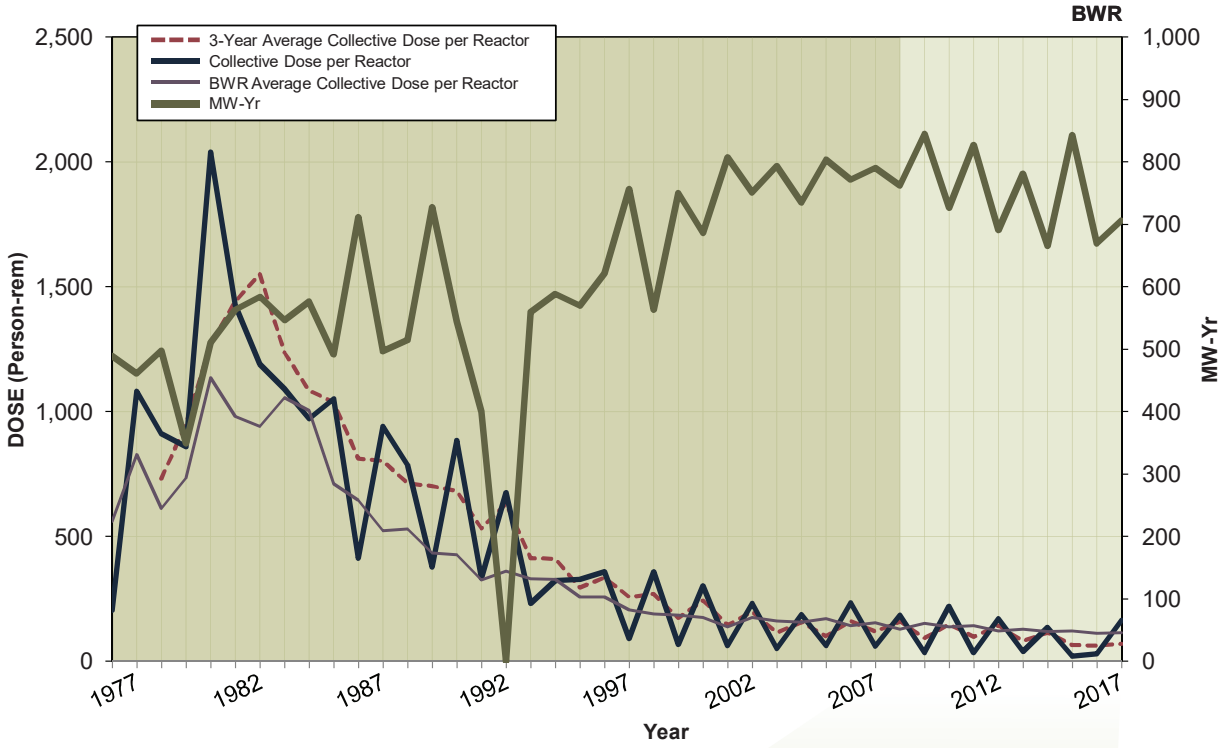
FERMI 2
Dose Performance Trends



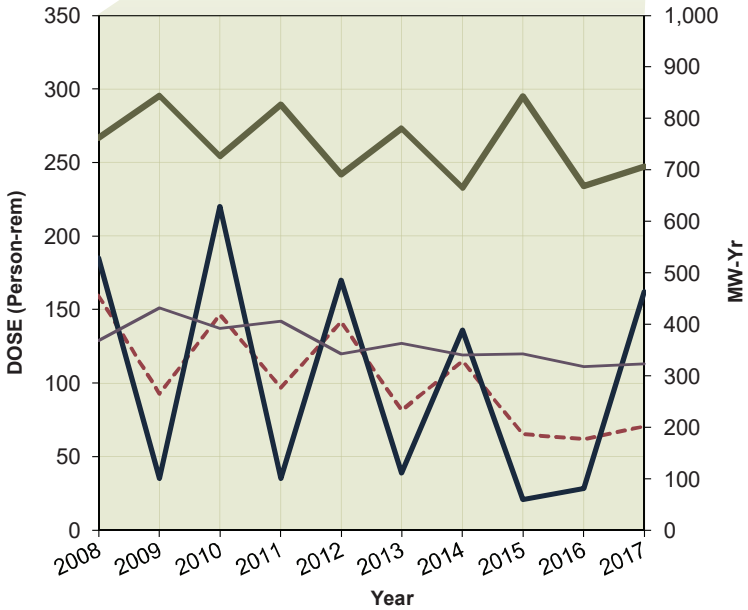
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	136.800	35.000	1,094.5
2009	126.028	149.000	847.8
2010	110.179	146.000	885.0
2011	106.472	24.000	1,017.9
2012	105.181	145.000	589.3
2013	65.077	26.000	754.5
2014	123.617	200.000	891.5
2015	153.577	234.853	838.6
2016	163.104	54.761	1,045.0
2017	184.899	265.082	993.0



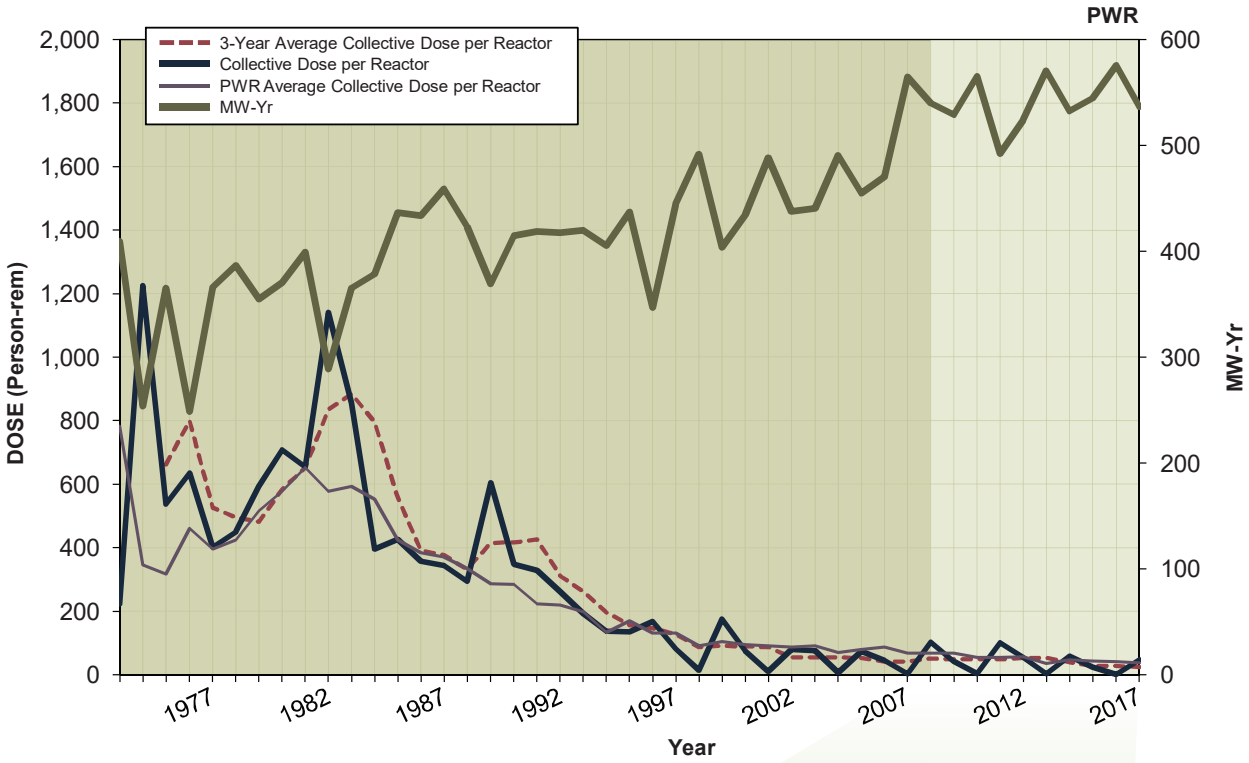
FITZPATRICK
Dose Performance Trends



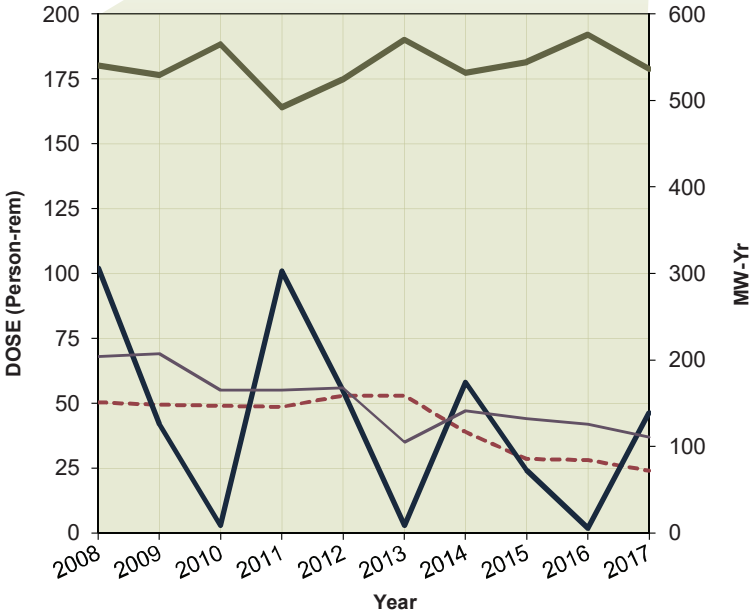
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	159.200	185.000	761.7
2009	92.887	35.000	844.5
2010	146.602	220.000	726.2
2011	96.741	35.000	826.9
2012	141.663	170.000	691.1
2013	81.498	39.000	780.8
2014	115.056	136.000	665.4
2015	65.356	20.785	842.7
2016	61.660	28.304	668.7
2017	70.428	162.196	705.8



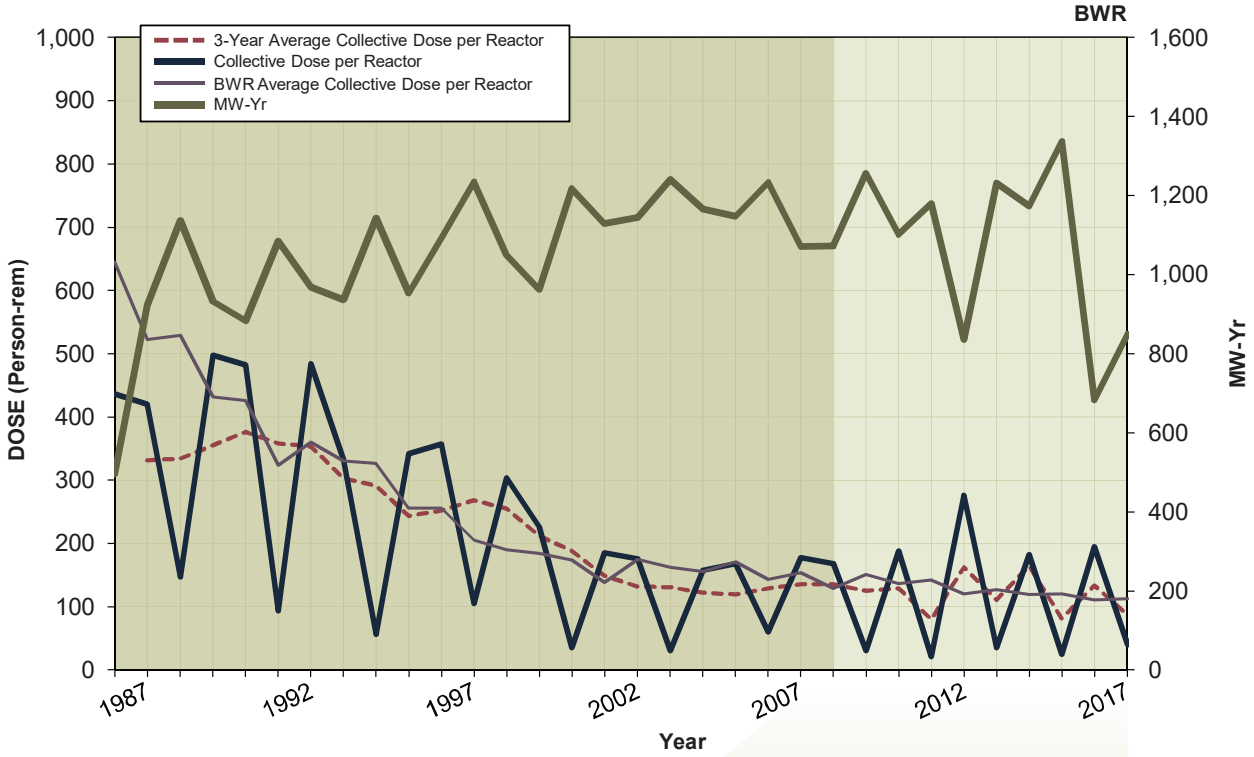
GINNA
Dose Performance Trends



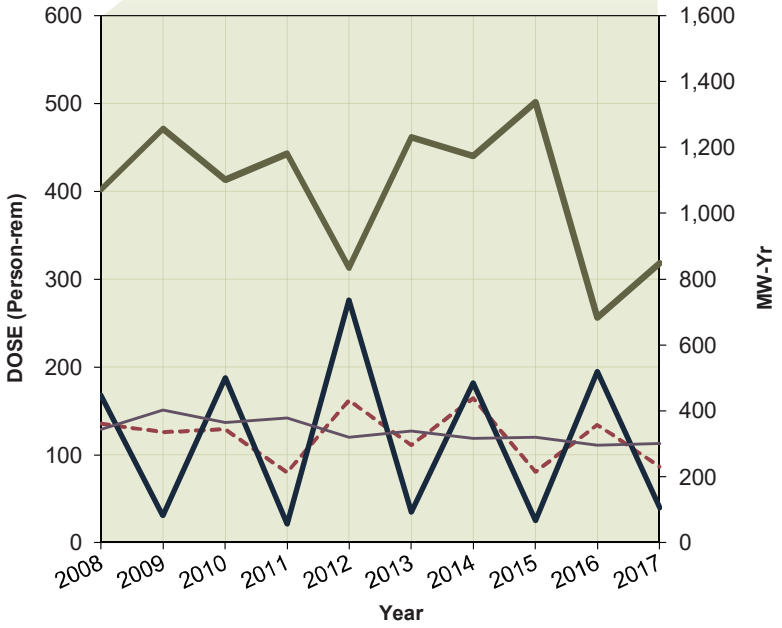
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	50.300	102.000	540.1
2009	49.407	42.000	529.2
2010	48.992	3.000	564.9
2011	48.563	101.000	492.1
2012	52.838	55.000	523.9
2013	52.927	3.000	570.0
2014	38.817	58.000	532.2
2015	28.659	24.163	544.5
2016	28.142	1.882	575.6
2017	24.073	46.173	536.3



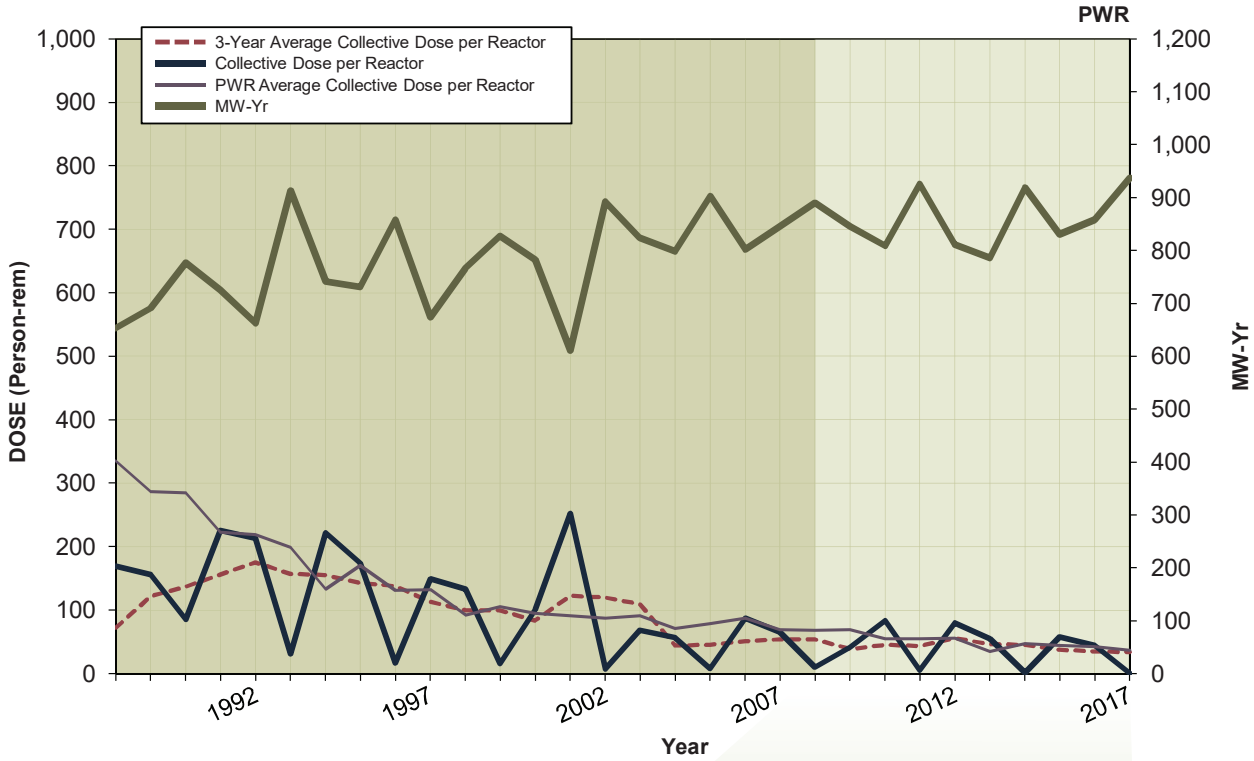
GRAND GULF
Dose Performance Trends



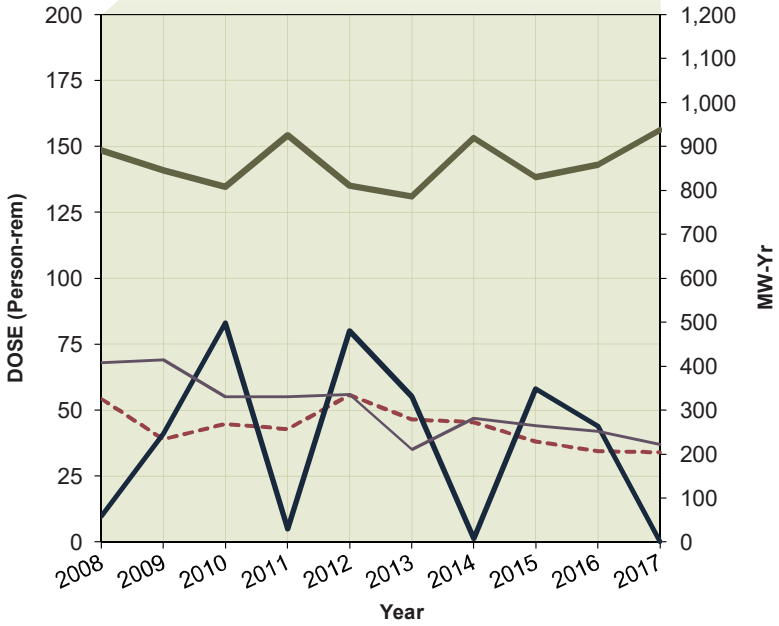
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	135.200	168.000	1,072.1
2009	125.502	31.000	1,255.5
2010	128.997	188.000	1,102.0
2011	80.058	21.000	1,180.0
2012	161.944	276.000	835.2
2013	110.970	35.000	1,231.1
2014	164.524	182.000	1,173.5
2015	80.812	25.241	1,337.8
2016	133.914	194.755	682.8
2017	86.749	40.251	849.1



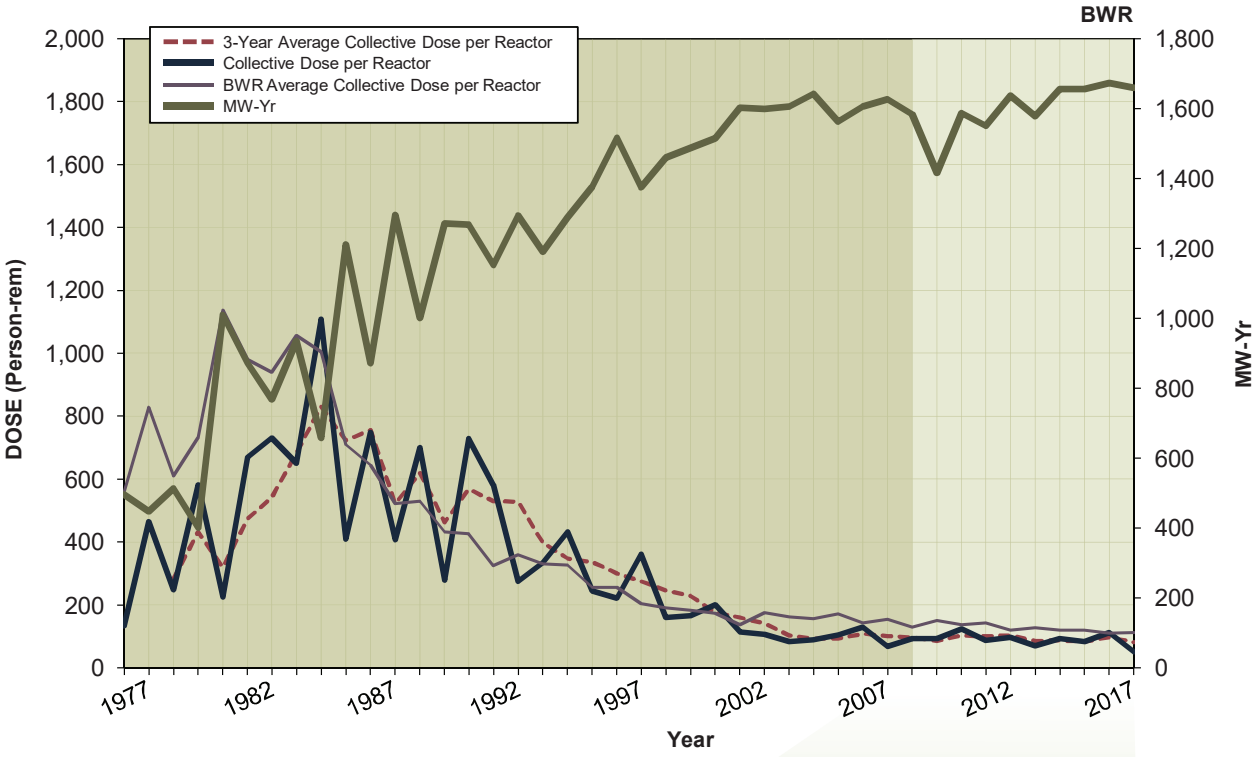
HARRIS 1
Dose Performance Trends



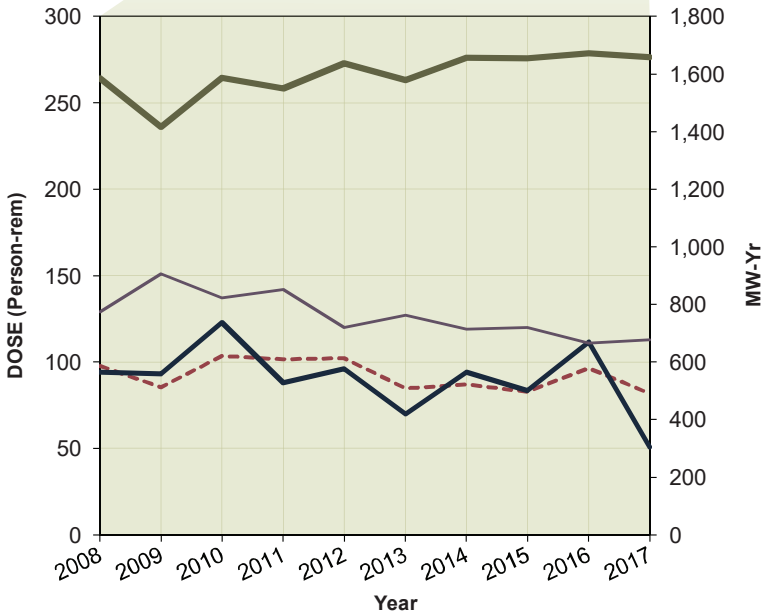
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	54.100	10.000	890.4
2009	38.870	41.000	845.1
2010	44.793	83.000	808.3
2011	42.901	5.000	926.0
2012	55.716	80.000	810.8
2013	46.481	55.000	786.3
2014	45.336	1.289	918.8
2015	38.047	57.978	830.2
2016	34.381	43.876	857.7
2017	34.024	0.217	937.1



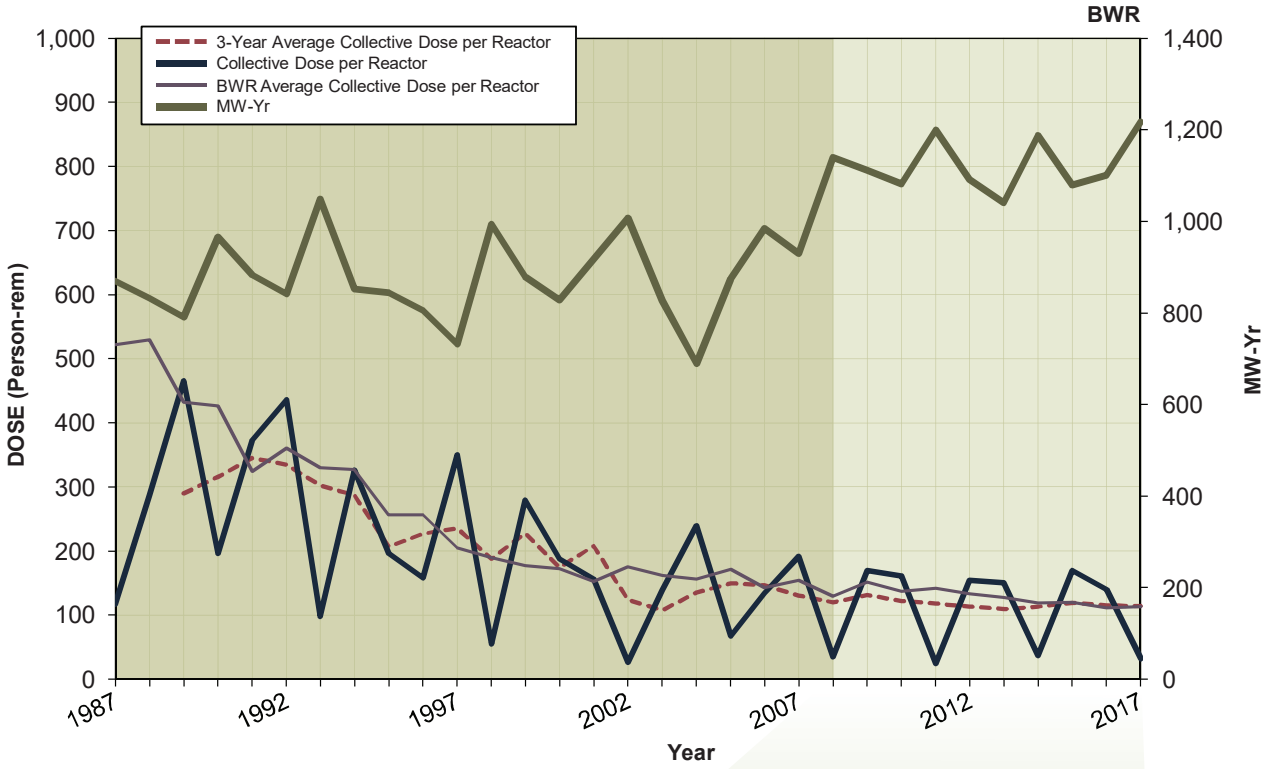
HATCH 1, 2
Dose Performance Trends



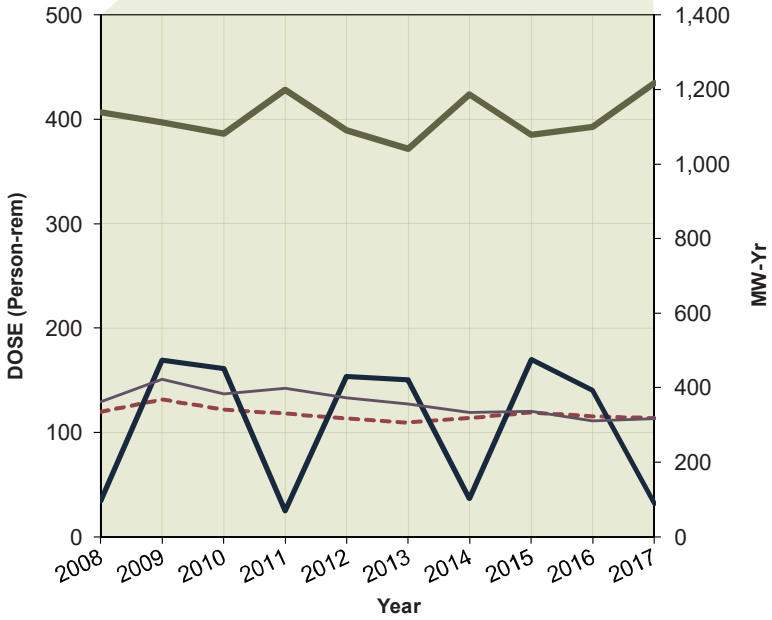
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	97.700	94.000	1,584.0
2009	85.436	93.000	1,416.5
2010	103.535	123.000	1,586.9
2011	101.464	88.000	1,550.4
2012	102.327	96.000	1,637.5
2013	84.860	70.000	1,578.1
2014	86.935	94.000	1,656.4
2015	82.877	83.500	1,654.9
2016	96.522	111.433	1,672.1
2017	81.854	50.711	1,658.8



HOPE CREEK 1
Dose Performance Trends

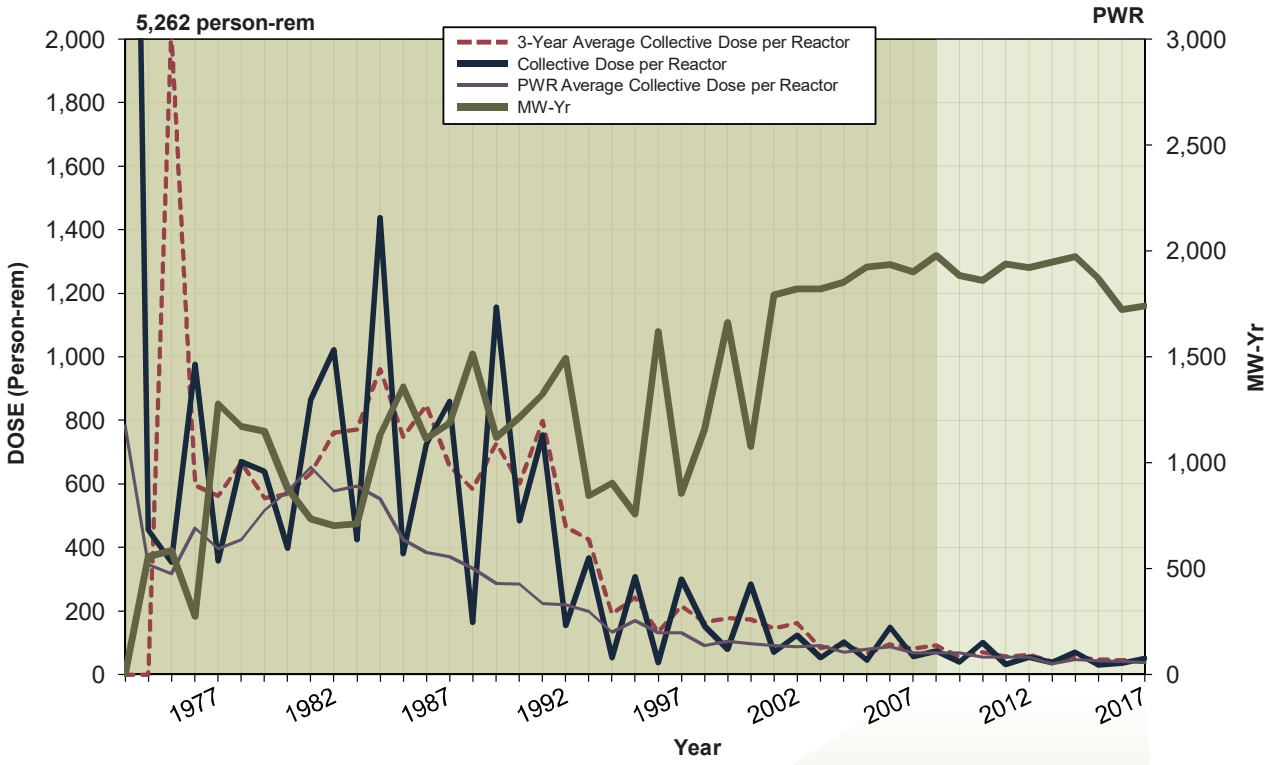


Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	119.700	34.500	1,139.1
2009	131.643	169.362	1,111.4
2010	121.591	160.910	1,082.0
2011	118.316	24.677	1,199.3
2012	113.151	153.866	1,091.3
2013	109.704	150.568	1,040.3
2014	113.659	36.543	1,187.9
2015	118.991	169.862	1,078.9
2016	115.429	139.883	1,100.4
2017	113.888	31.919	1,216.7

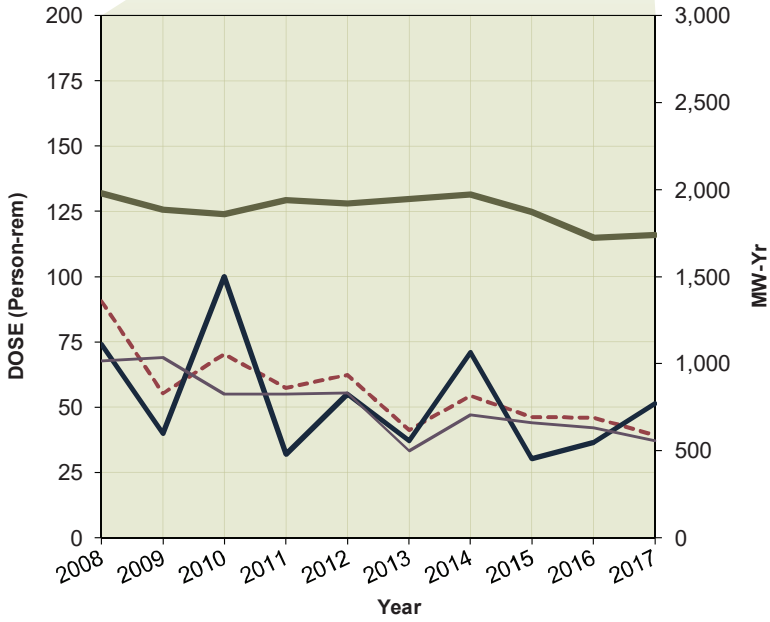


INDIAN POINT 2,3

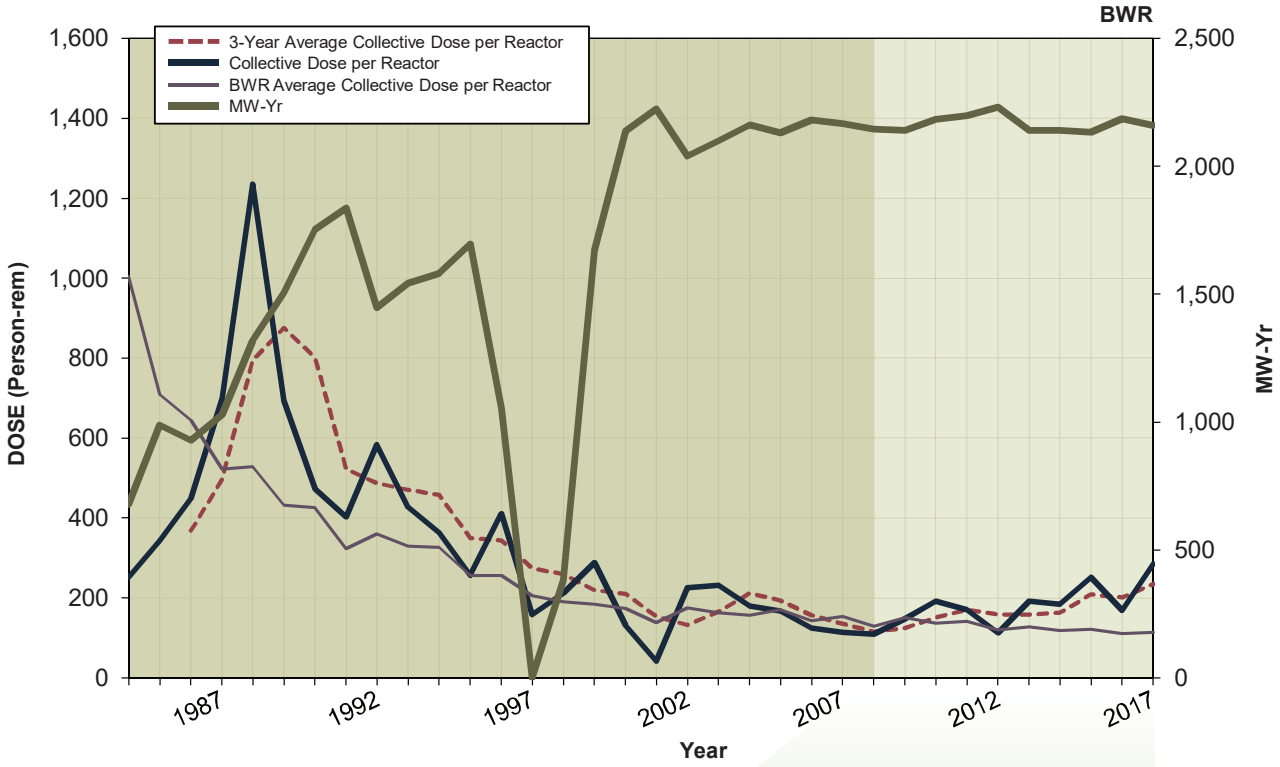
Dose Performance Trends



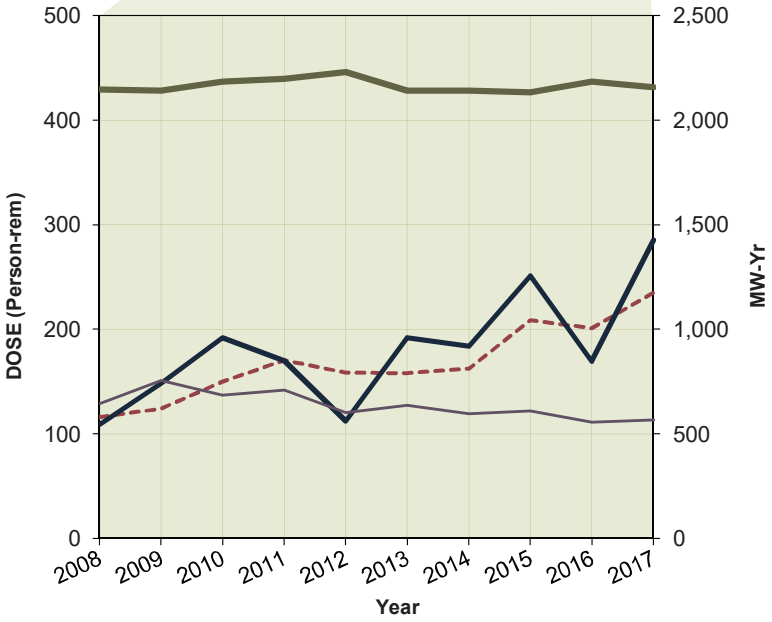
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	90.445	74.000	1,977.2
2009	55.292	40.000	1,884.2
2010	70.361	100.000	1,859.2
2011	57.326	32.000	1,938.8
2012	62.379	55.000	1,921.0
2013	41.230	37.000	1,946.6
2014	54.387	71.000	1,973.1
2015	46.165	30.238	1,870.1
2016	45.931	36.458	1,723.7
2017	39.354	51.368	1,740.7



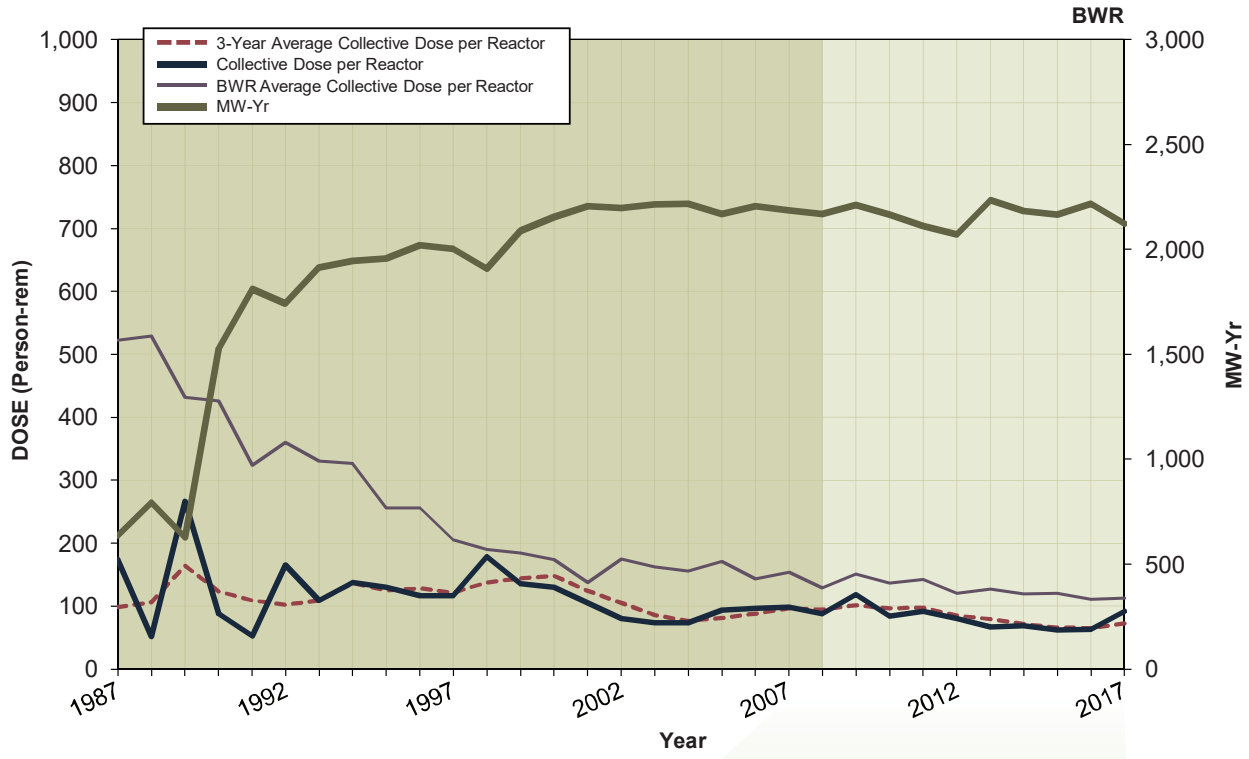
LASALLE 1, 2
Dose Performance Trends



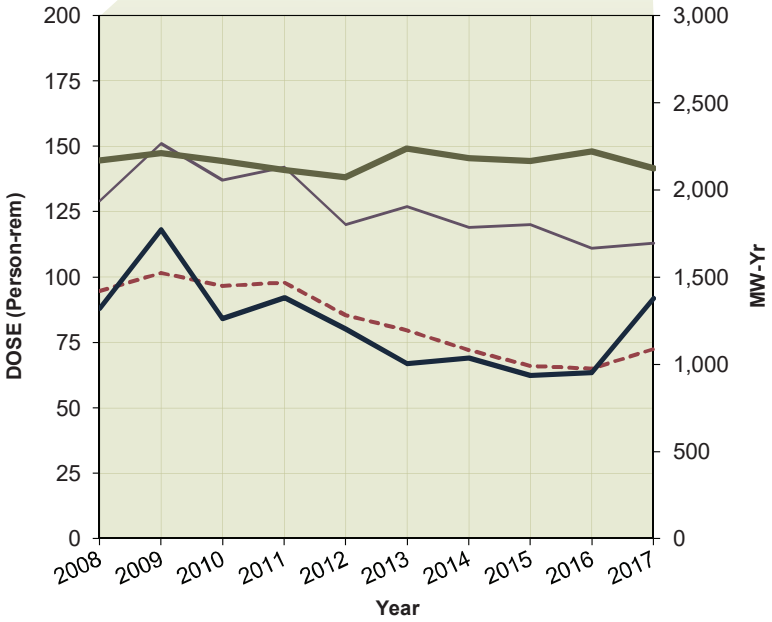
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	115.700	109.000	2,145.8
2009	123.777	148.000	2,141.0
2010	149.782	192.000	2,184.1
2011	170.270	170.000	2,198.2
2012	158.279	112.000	2,230.8
2013	158.144	192.000	2,141.6
2014	162.476	184.000	2,141.0
2015	208.635	250.833	2,132.9
2016	201.196	169.493	2,185.5
2017	235.173	285.195	2,158.5



LIMERICK 1, 2
Dose Performance Trends

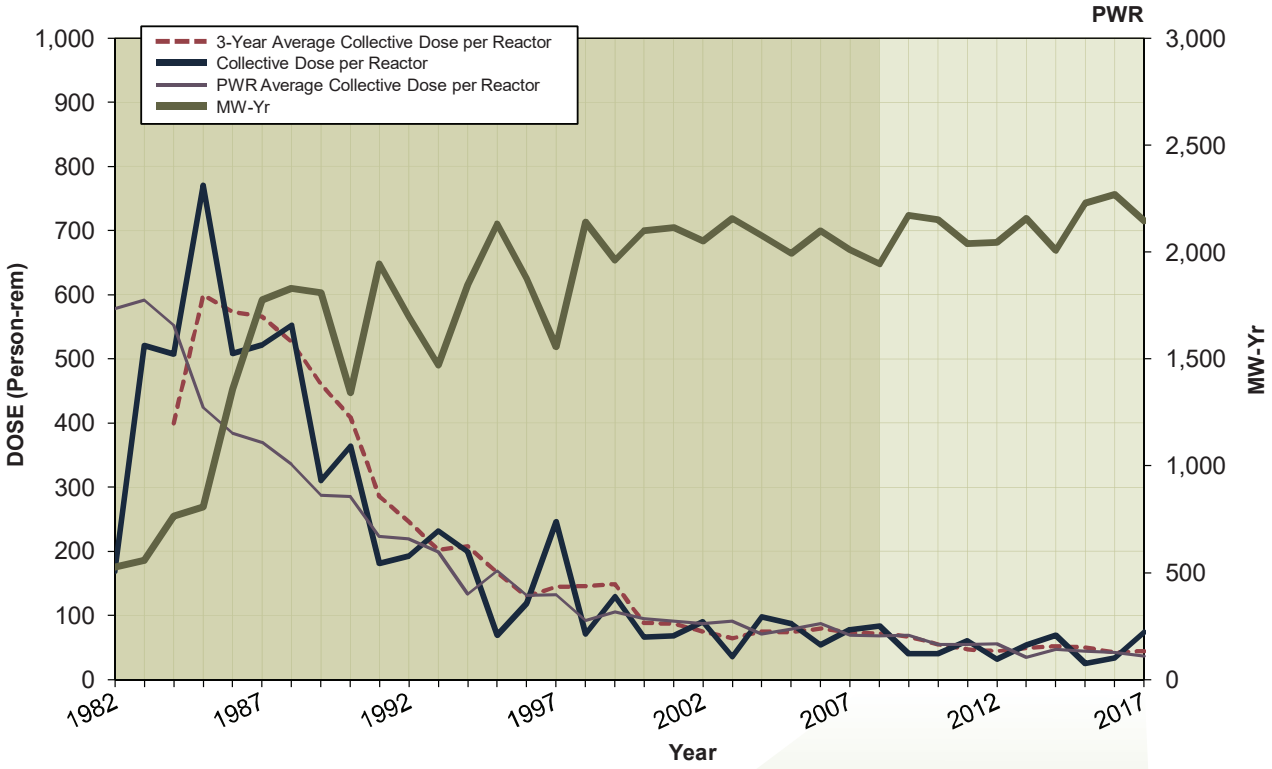


Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	94.600	88.000	2,169.2
2009	101.457	118.000	2,211.4
2010	96.557	84.000	2,165.2
2011	97.826	92.000	2,112.7
2012	85.337	80.000	2,071.4
2013	79.626	67.000	2,235.7
2014	71.957	69.000	2,182.1
2015	66.119	62.394	2,165.6
2016	64.997	63.400	2,219.1
2017	72.554	91.868	2,123.1

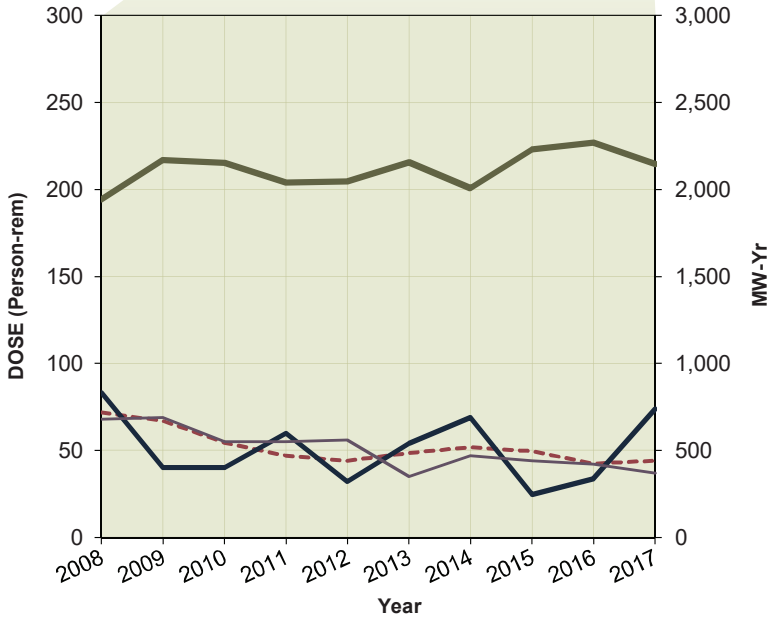


MCGUIRE 1, 2

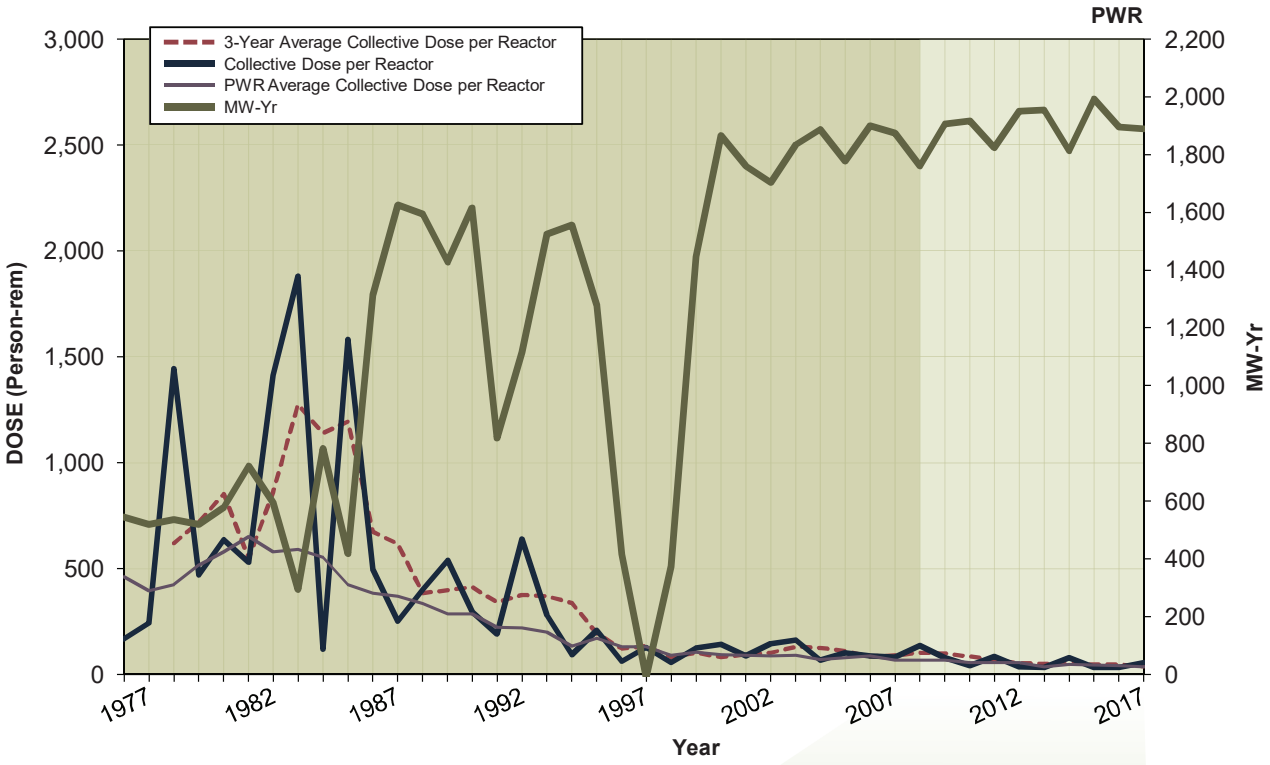
Dose Performance Trends



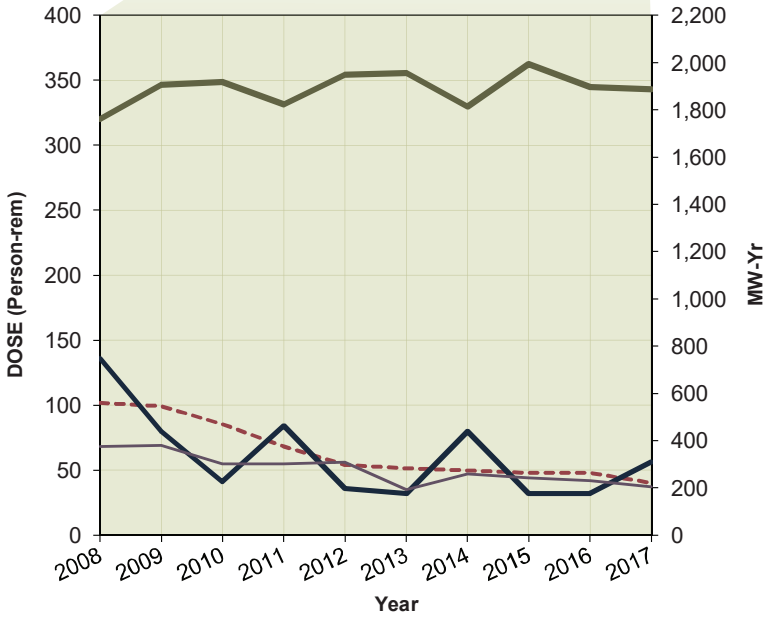
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	71.700	83.000	1,943.3
2009	66.929	40.000	2,170.6
2010	54.483	40.000	2,151.9
2011	46.789	60.000	2,038.3
2012	43.941	32.000	2,045.6
2013	48.625	54.000	2,157.3
2014	51.728	69.000	2,008.0
2015	49.513	24.700	2,230.1
2016	42.552	33.827	2,269.9
2017	44.107	73.795	2,145.6



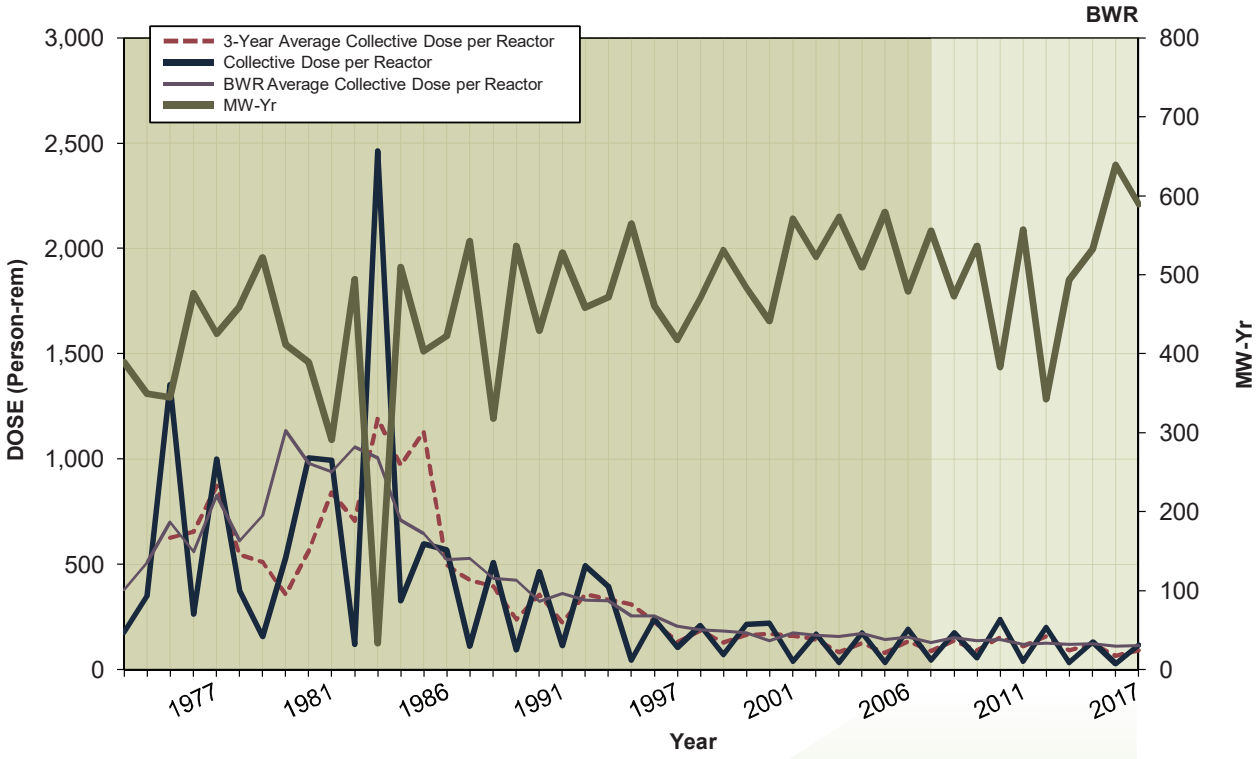
MILLSTONE 2, 3
Dose Performance Trends



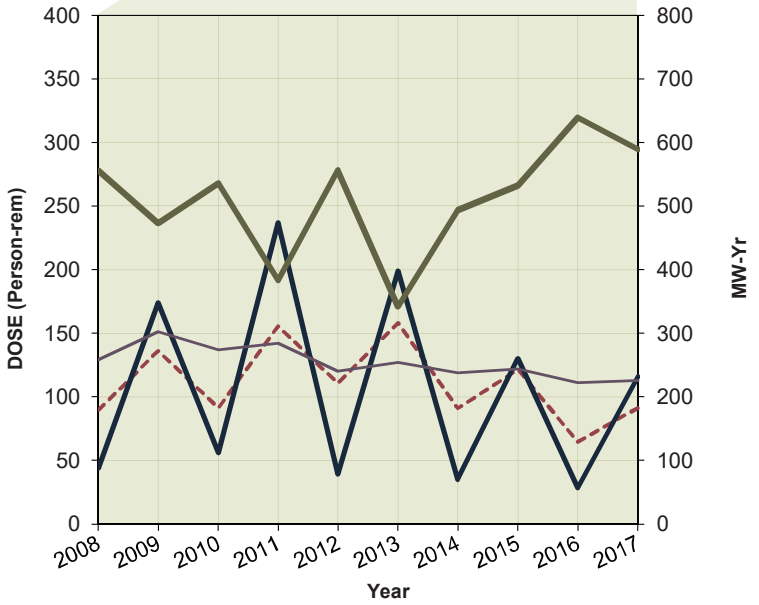
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	101.800	136.000	1,761.1
2009	99.301	80.000	1,906.1
2010	85.599	41.000	1,916.8
2011	68.368	84.000	1,822.7
2012	54.046	36.000	1,948.9
2013	51.153	32.000	1,954.5
2014	49.667	80.000	1,812.7
2015	48.112	31.970	1,992.4
2016	48.095	32.063	1,896.1
2017	40.111	56.299	1,888.0



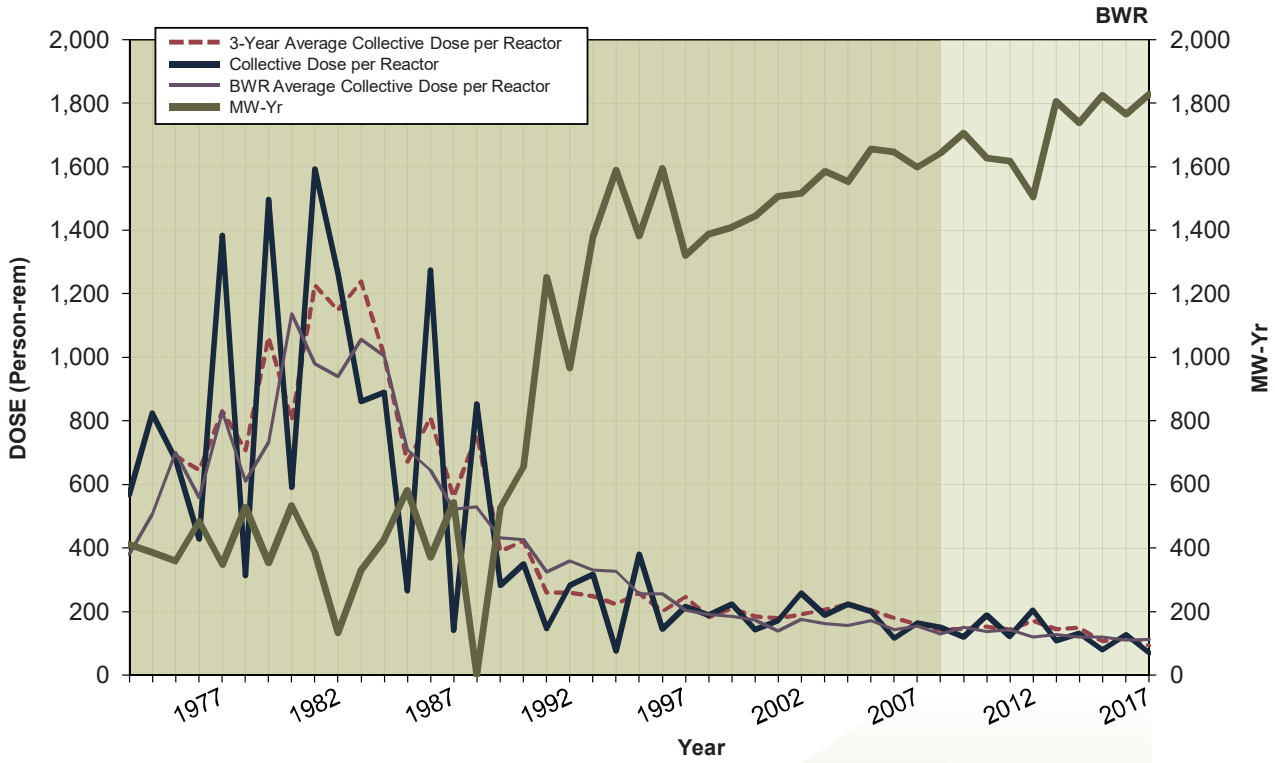
MONTICELLO
Dose Performance Trends



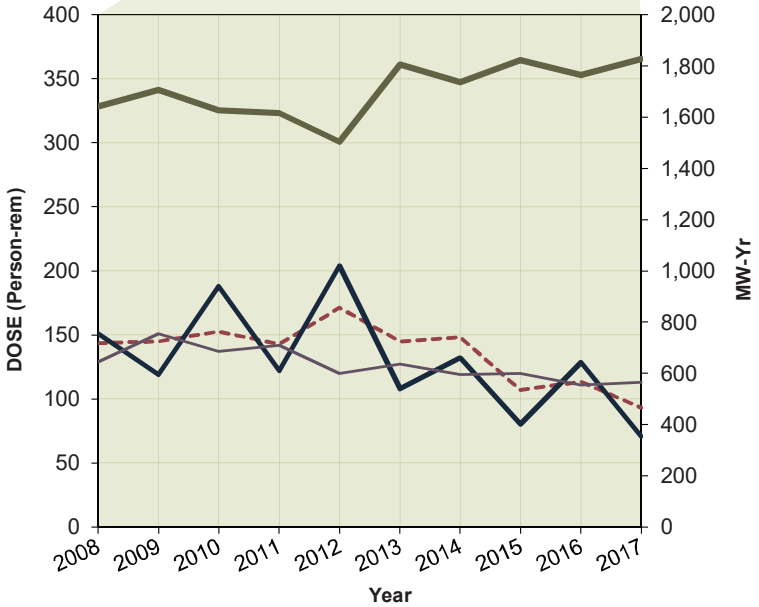
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	89.500	44.000	555.3
2009	136.274	174.000	473.1
2010	91.180	56.000	536.0
2011	155.579	237.000	383.4
2012	110.633	39.000	556.7
2013	158.250	199.000	342.3
2014	91.020	35.000	493.6
2015	121.444	130.057	532.4
2016	64.637	28.547	639.0
2017	91.473	115.814	589.0



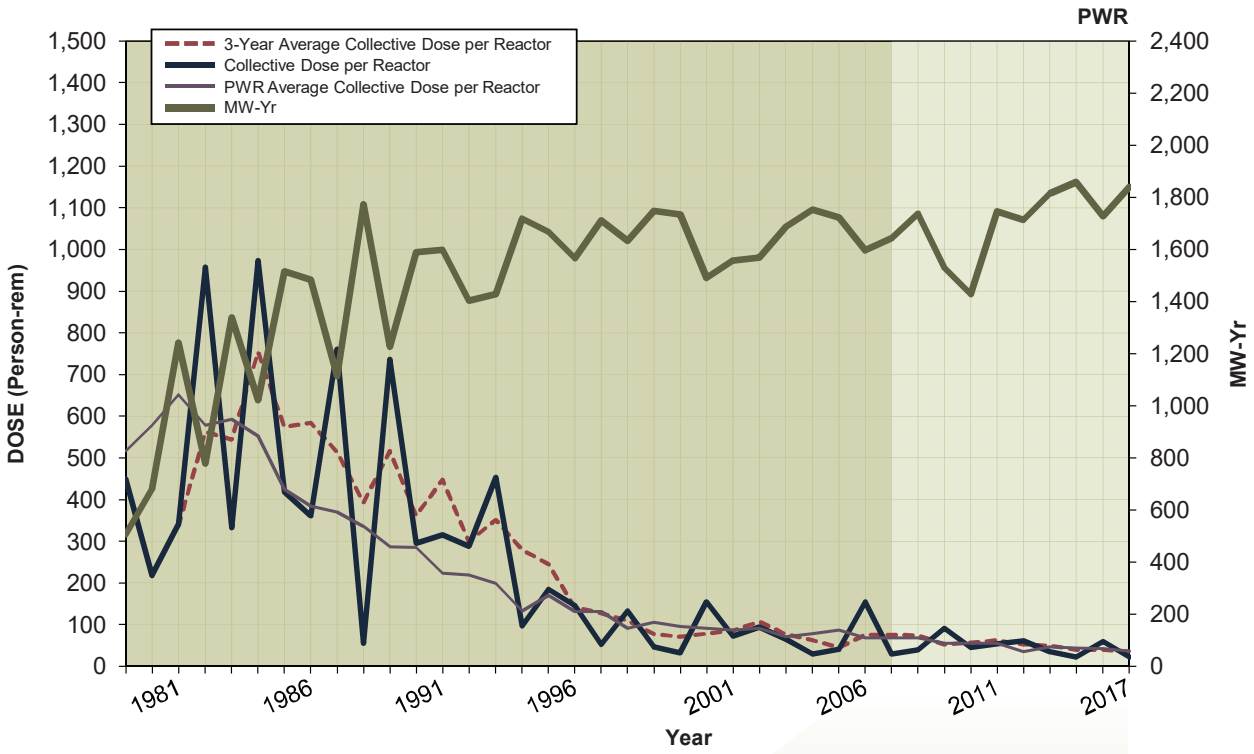
NINE MILE POINT 1, 2
Dose Performance Trends



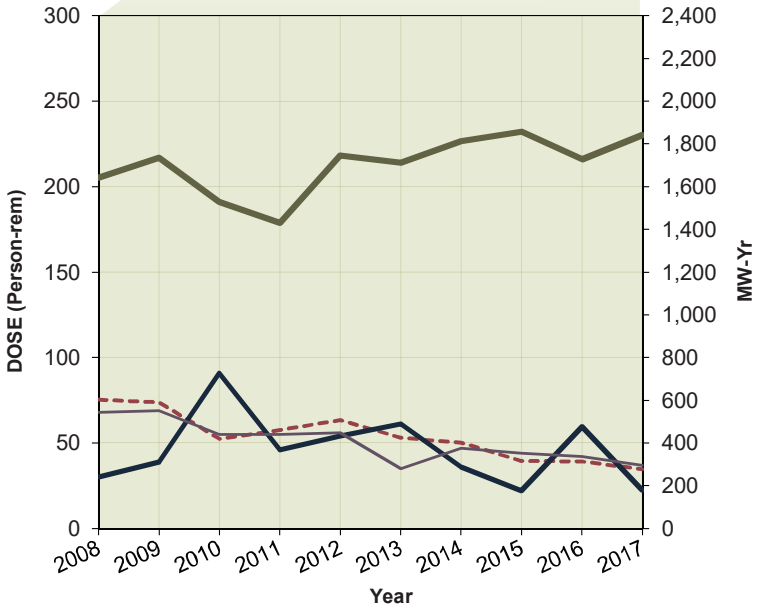
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	143.400	151.000	1,642.1
2009	144.792	119.000	1,706.2
2010	152.463	188.000	1,627.1
2011	142.895	122.000	1,616.8
2012	171.287	204.000	1,504.6
2013	144.892	108.000	1,804.9
2014	148.111	132.000	1,737.8
2015	106.858	80.190	1,823.7
2016	113.481	128.397	1,765.5
2017	93.054	70.575	1,827.3



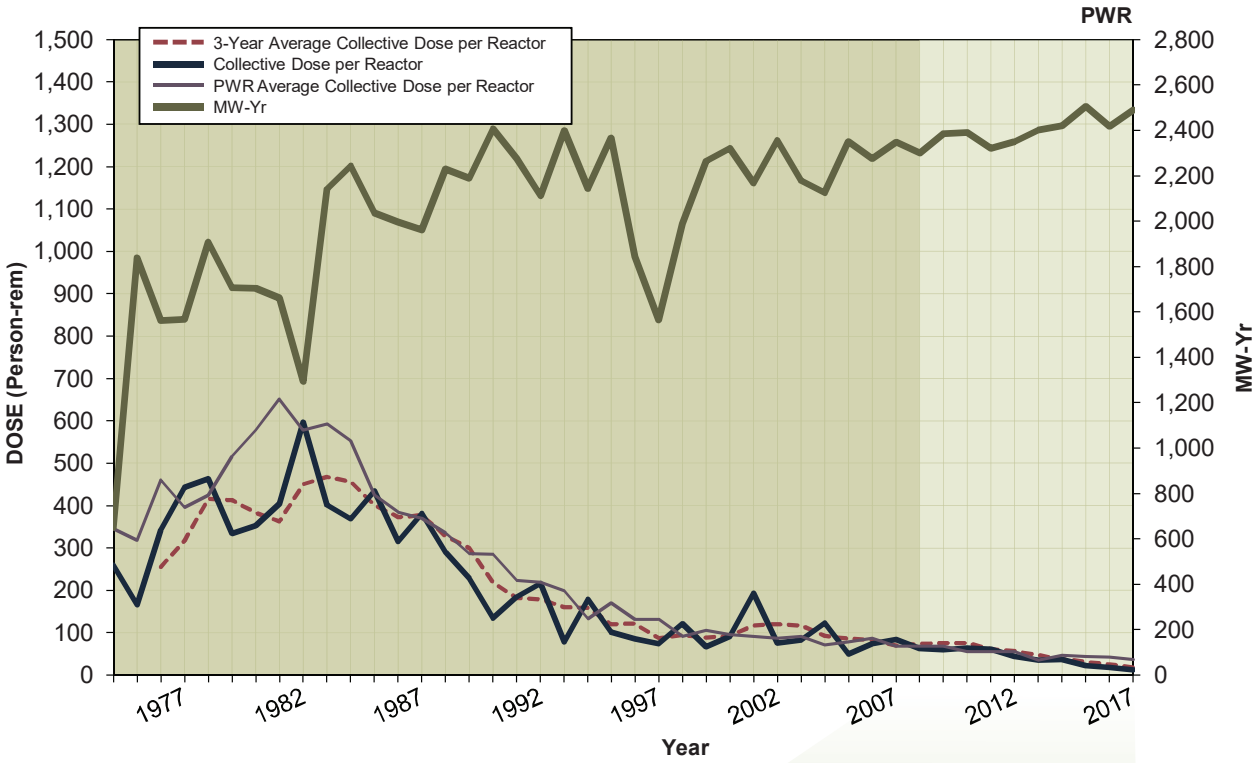
NORTH ANNA 1, 2
Dose Performance Trends



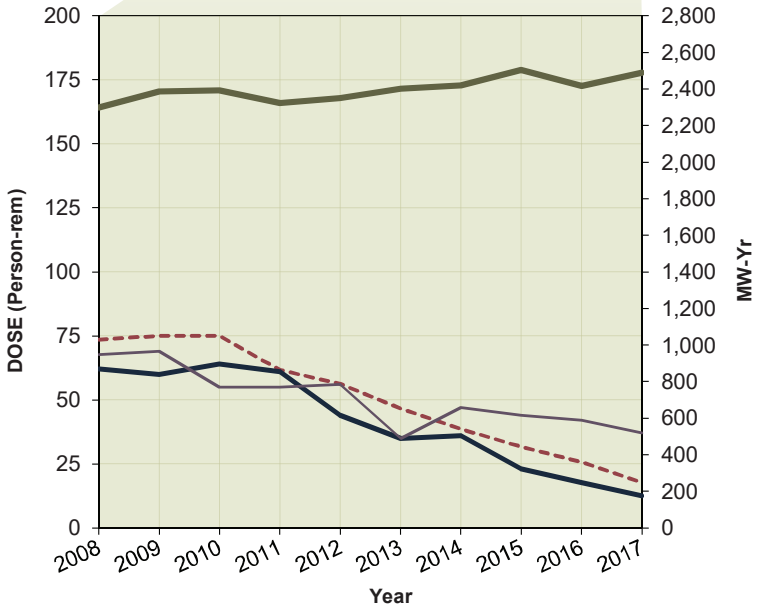
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	75.400	30.000	1,643.1
2009	73.721	39.000	1,735.5
2010	52.569	91.000	1,529.6
2011	57.530	46.000	1,429.1
2012	63.262	54.000	1,745.6
2013	53.181	61.000	1,712.9
2014	50.039	36.000	1,813.8
2015	39.593	21.919	1,857.4
2016	39.182	59.670	1,726.2
2017	34.677	22.442	1,840.9



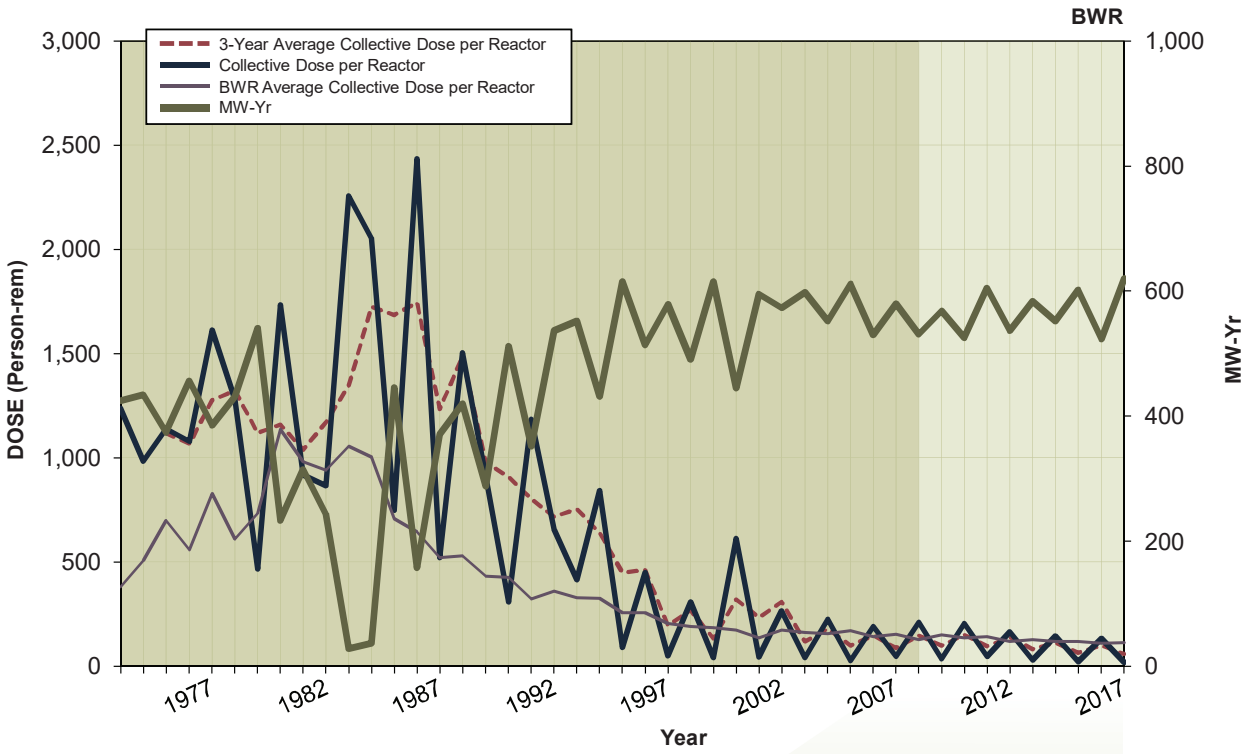
OCONEE 1, 2, 3
Dose Performance Trends



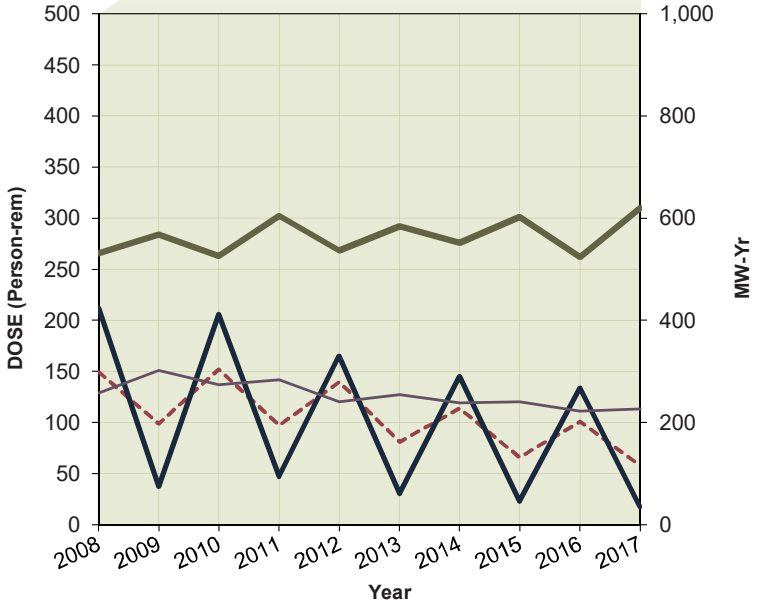
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	73.400	62.000	2,298.5
2009	74.970	60.000	2,385.7
2010	74.979	64.000	2,391.1
2011	61.667	61.000	2,321.6
2012	56.310	44.000	2,351.0
2013	46.680	35.000	2,400.1
2014	38.541	36.000	2,419.3
2015	31.608	23.017	2,504.5
2016	25.718	17.799	2,417.5
2017	17.750	12.434	2,488.4



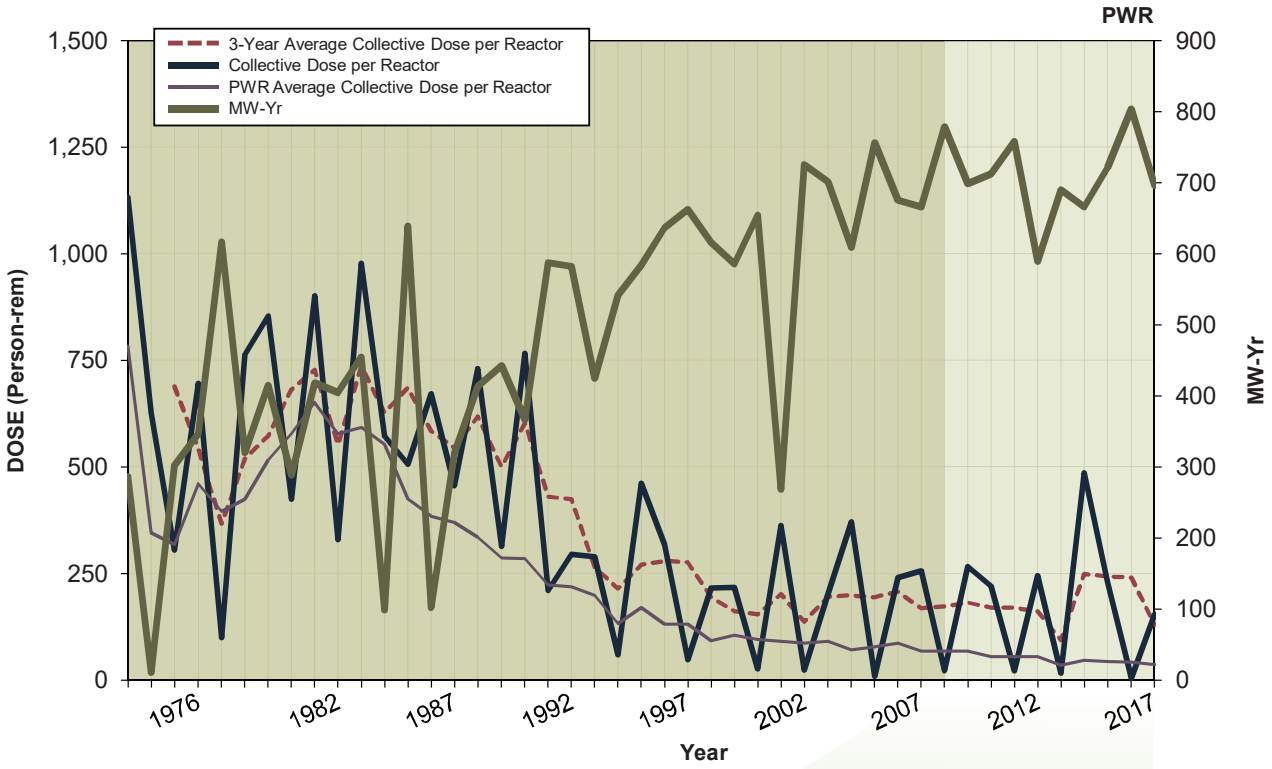
OYSTER CREEK
Dose Performance Trends



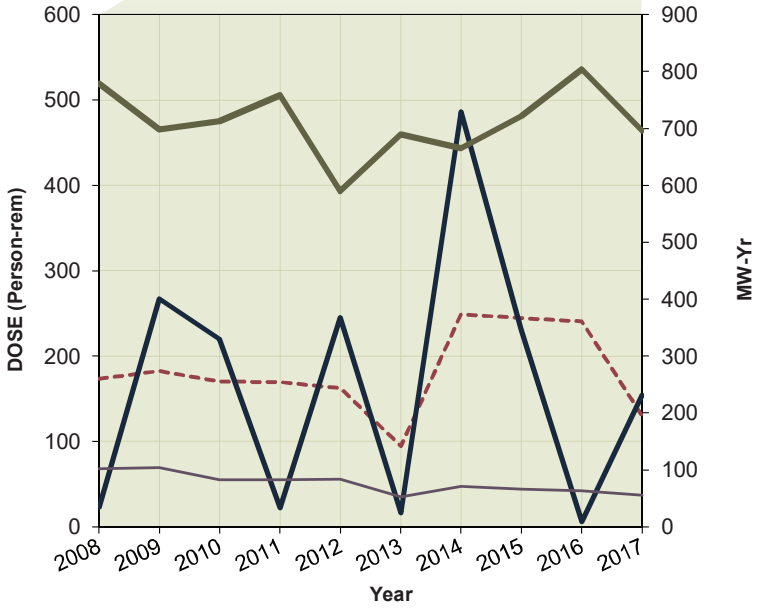
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	149.500	212.000	531.0
2009	98.587	37.000	568.3
2010	151.819	206.000	525.7
2011	96.847	47.000	604.8
2012	139.477	165.000	537.1
2013	80.710	30.000	584.1
2014	113.544	145.000	551.8
2015	66.059	22.710	602.3
2016	100.600	133.603	523.4
2017	57.941	17.511	619.8



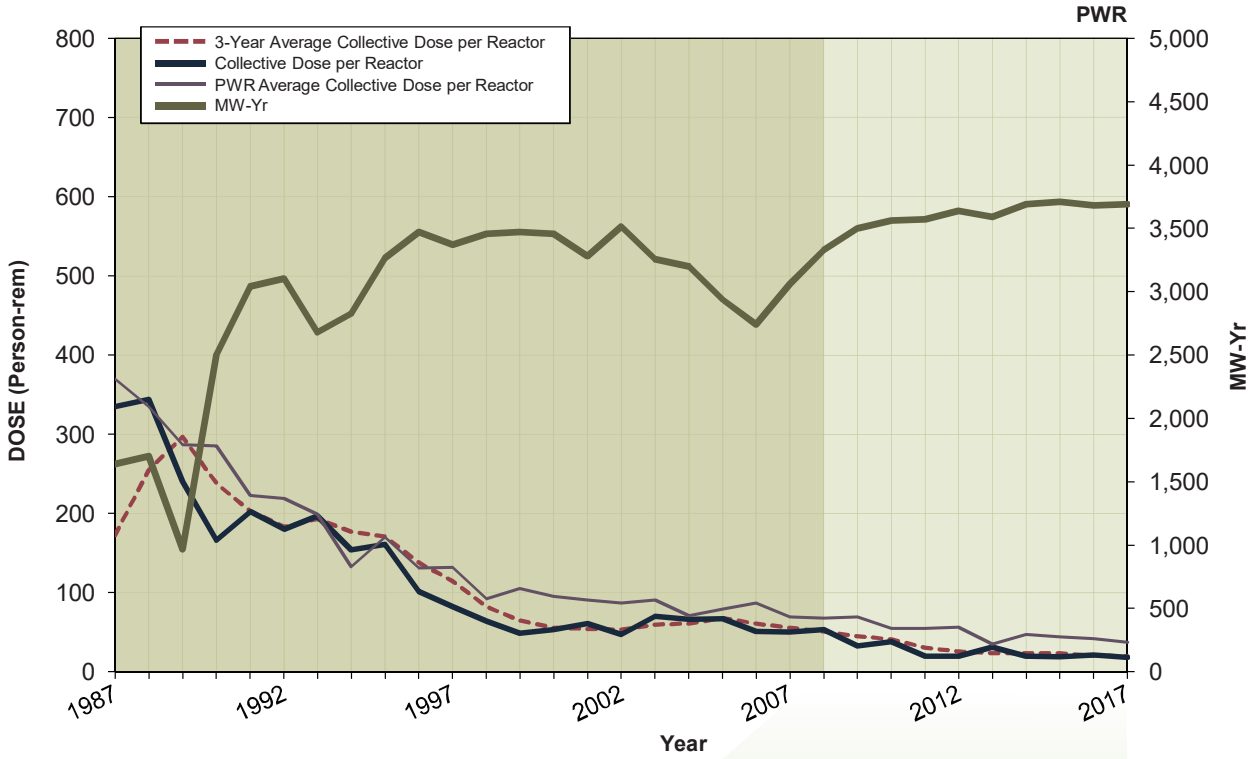
PALISADES
Dose Performance Trends



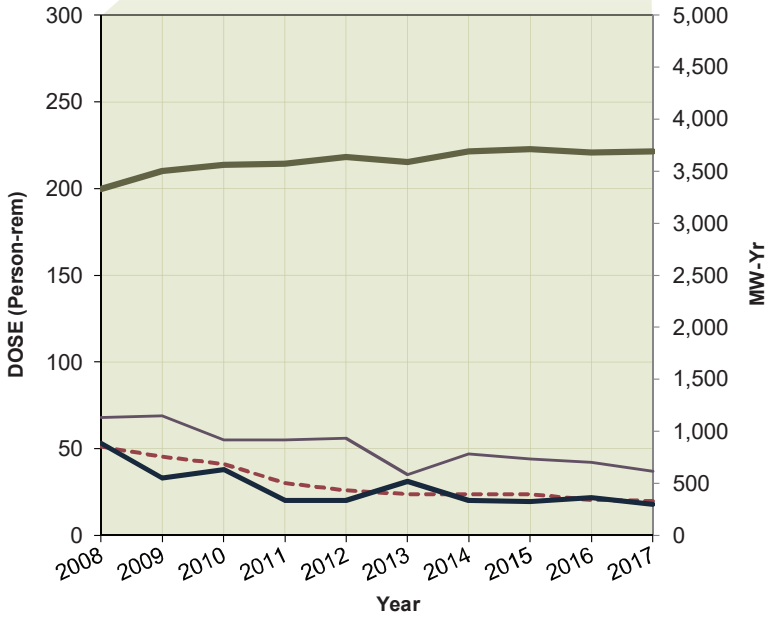
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	173.300	23.000	778.4
2009	182.476	267.000	698.5
2010	170.223	220.000	712.5
2011	169.607	22.000	758.1
2012	162.219	245.000	589.5
2013	94.204	16.000	689.7
2014	249.007	486.000	665.6
2015	244.193	230.687	721.3
2016	240.805	5.667	803.8
2017	130.165	154.142	696.1



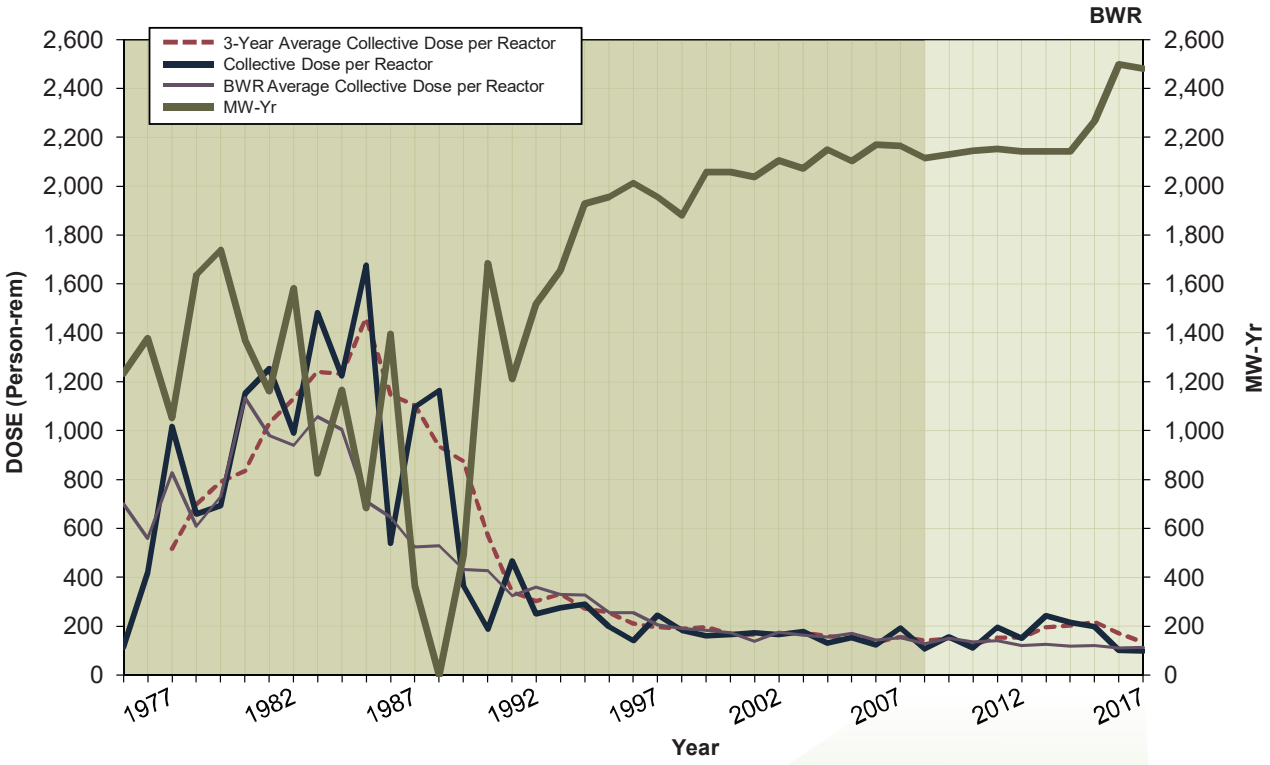
PALO VERDE 1, 2, 3
Dose Performance Trends



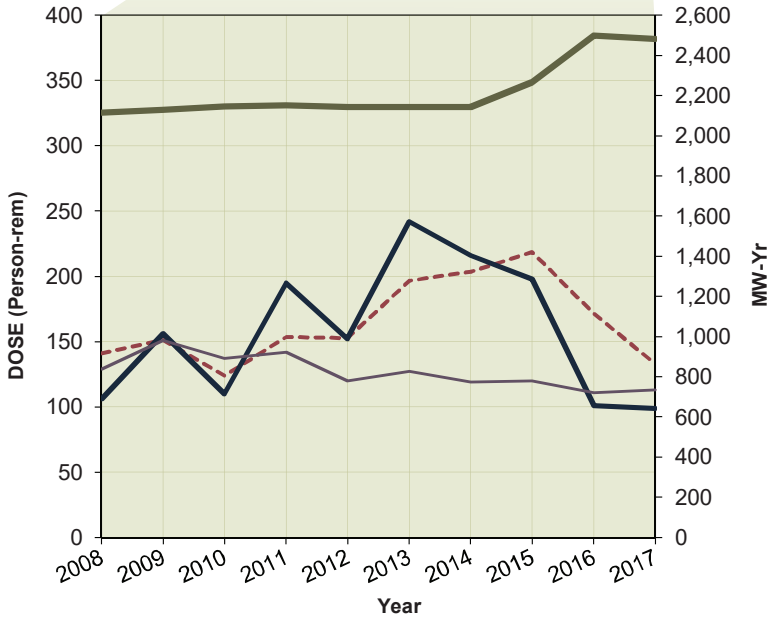
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	51.100	53.000	3,330.0
2009	45.178	33.000	3,500.2
2010	41.157	38.000	3,561.6
2011	30.210	20.000	3,570.5
2012	25.953	20.000	3,635.5
2013	23.583	31.000	3,588.0
2014	23.701	20.000	3,689.9
2015	23.523	19.332	3,711.7
2016	20.310	21.599	3,680.7
2017	19.631	17.963	3,691.8



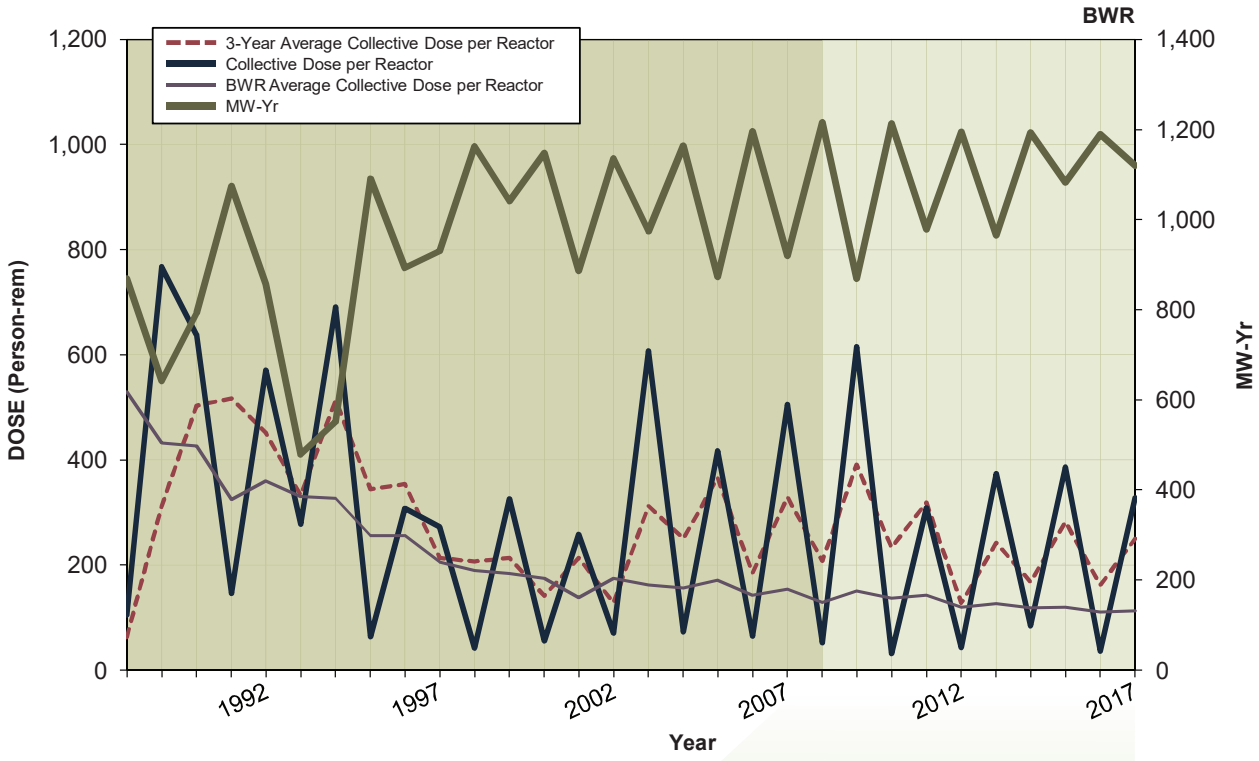
PEACH BOTTOM 2, 3
Dose Performance Trends



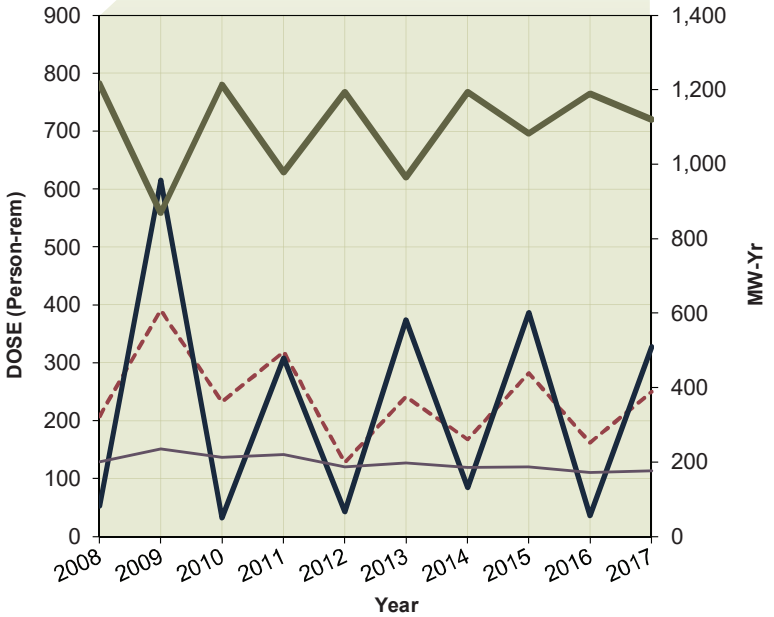
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	140.900	106.000	2,115.3
2009	151.353	156.000	2,130.4
2010	123.782	110.000	2,145.3
2011	153.284	195.000	2,152.0
2012	152.436	152.000	2,142.5
2013	196.530	242.000	2,143.5
2014	203.385	216.000	2,142.3
2015	218.412	197.799	2,267.6
2016	171.460	101.111	2,498.1
2017	132.605	98.907	2,481.1



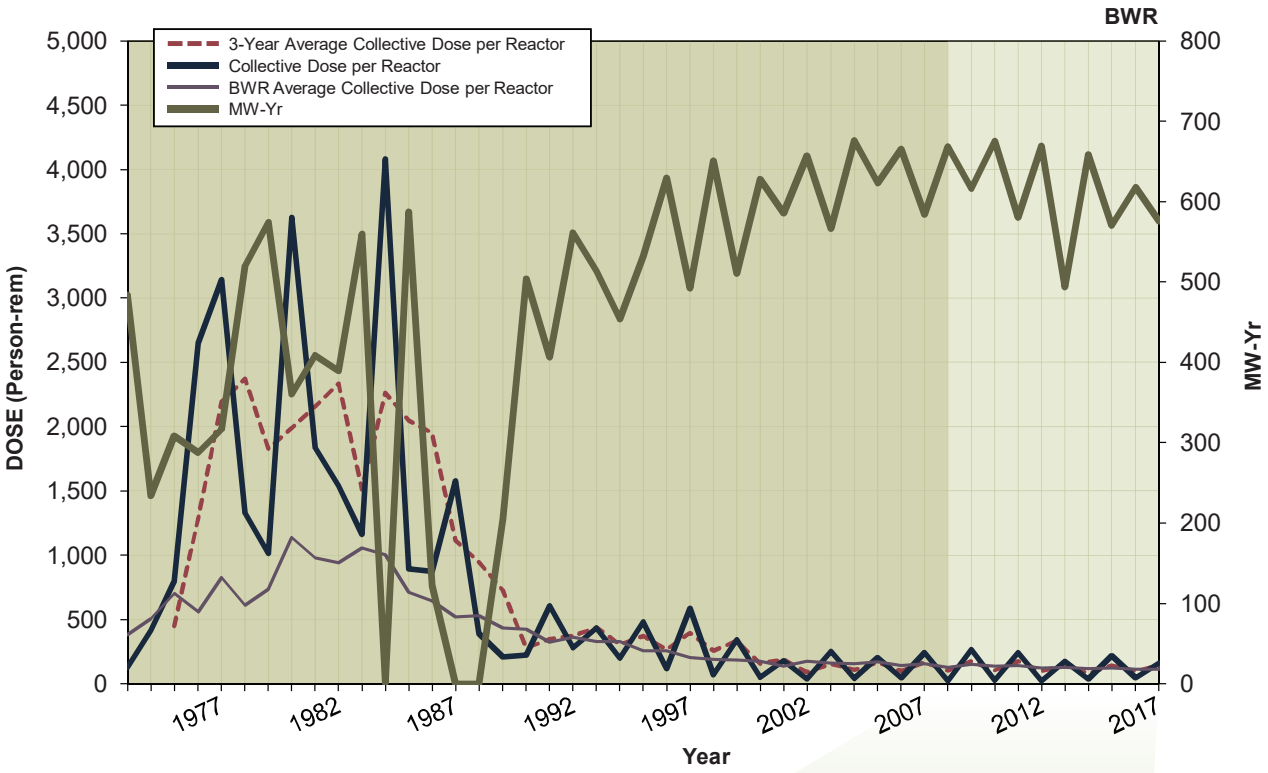
PERRY
Dose Performance Trends



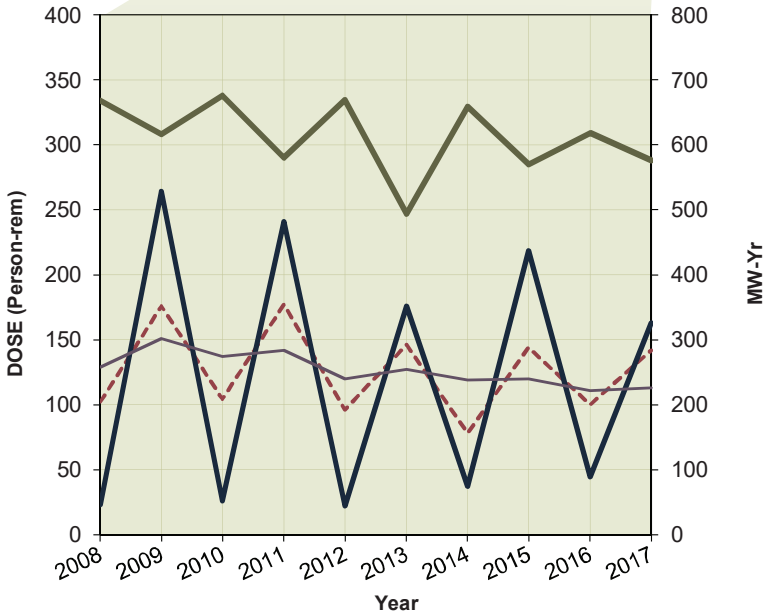
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	207.400	52.000	1,215.9
2009	390.727	615.000	869.2
2010	233.082	32.000	1,213.3
2011	318.350	308.000	978.2
2012	127.822	43.000	1,194.3
2013	241.675	374.000	964.5
2014	167.246	84.617	1,193.5
2015	281.714	386.778	1,082.5
2016	162.261	36.389	1,189.5
2017	250.295	327.717	1,120.1



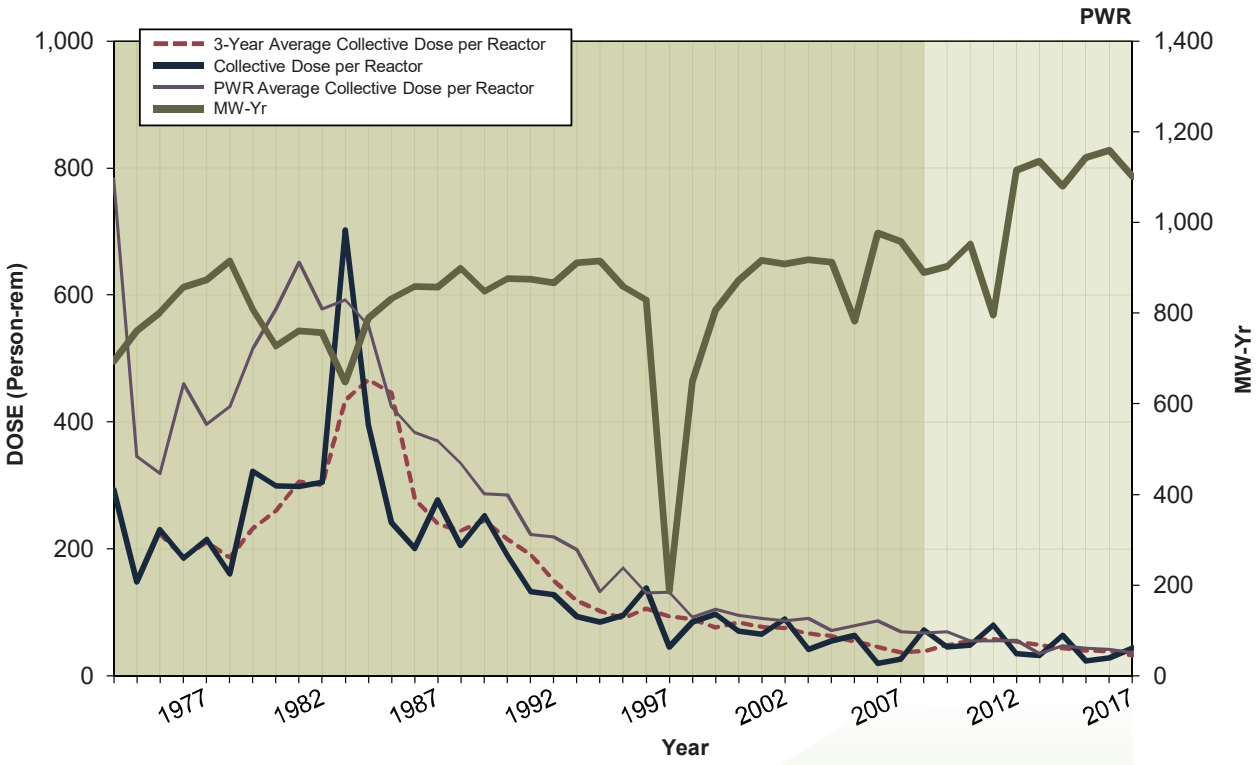
PILGRIM 1
Dose Performance Trends



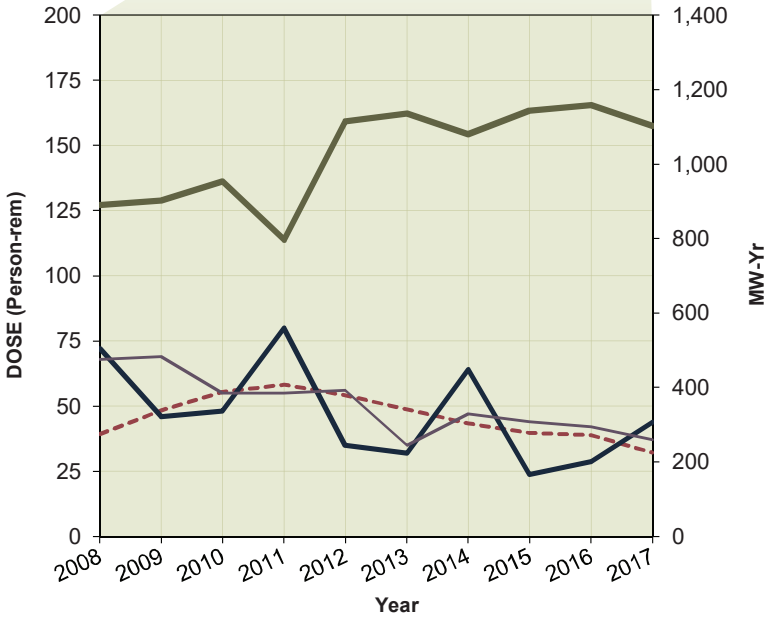
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	102.200	23.000	668.1
2009	175.780	264.000	616.0
2010	104.185	26.000	675.5
2011	177.119	241.000	580.5
2012	96.254	22.000	669.0
2013	146.345	176.000	493.9
2014	78.116	37.000	658.6
2015	143.779	218.609	570.0
2016	99.856	44.242	617.9
2017	141.950	162.998	576.1



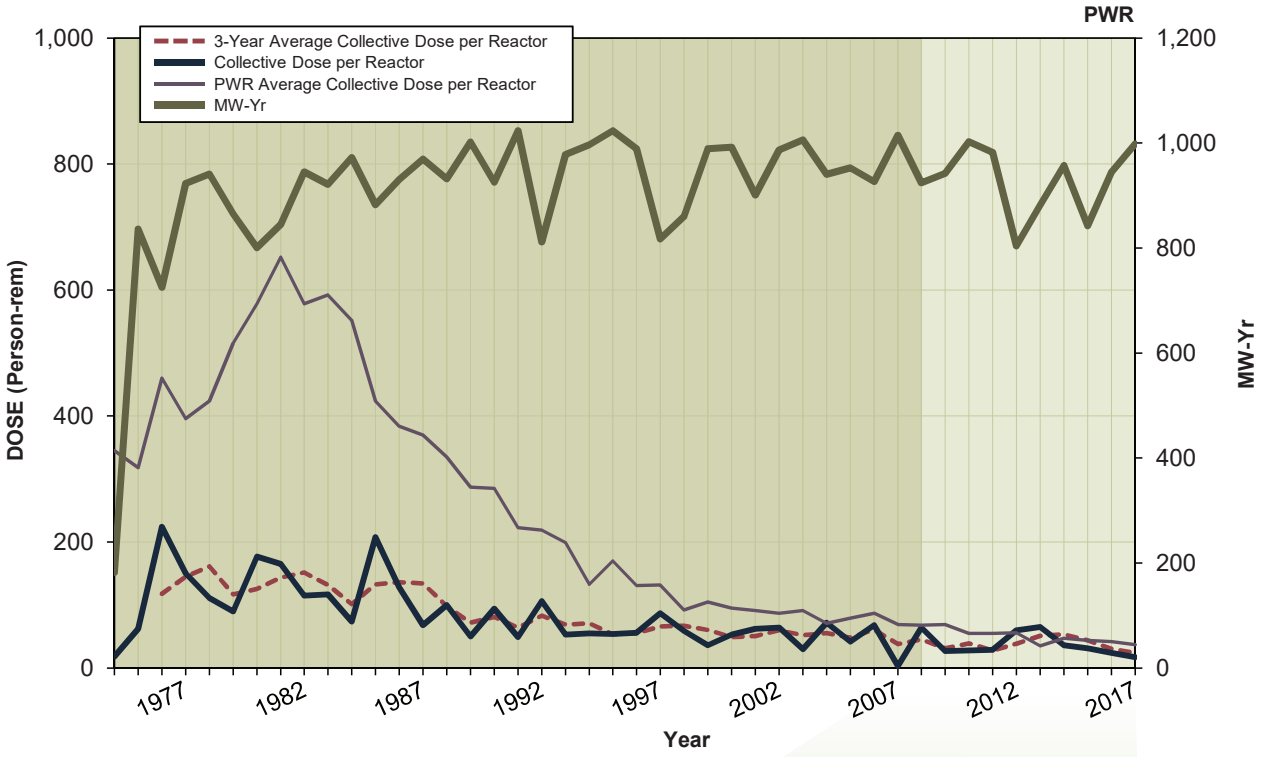
POINT BEACH 1, 2
Dose Performance Trends



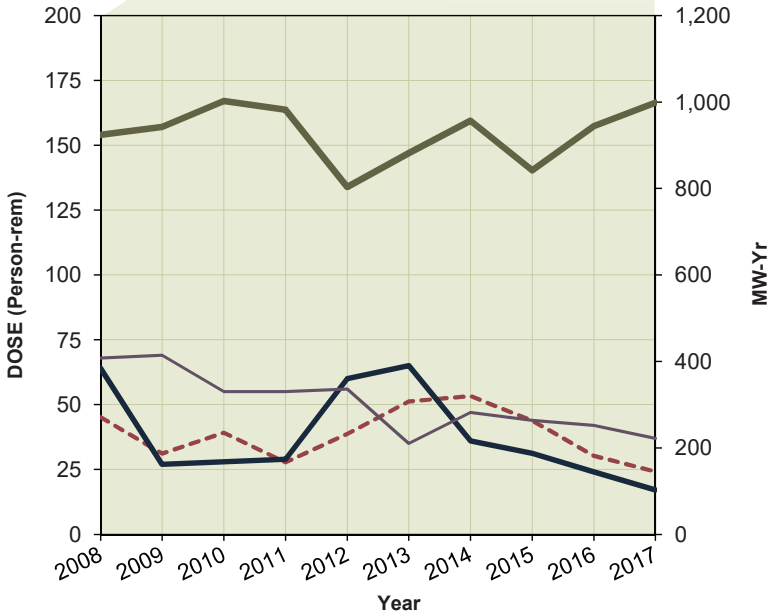
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	39.300	72.000	889.4
2009	48.212	46.000	902.3
2010	55.494	48.000	952.8
2011	58.108	80.000	796.2
2012	54.189	35.000	1,114.3
2013	48.764	32.000	1,135.3
2014	43.404	64.000	1,079.4
2015	39.690	23.737	1,142.9
2016	38.715	28.647	1,159.0
2017	32.041	43.740	1,102.0



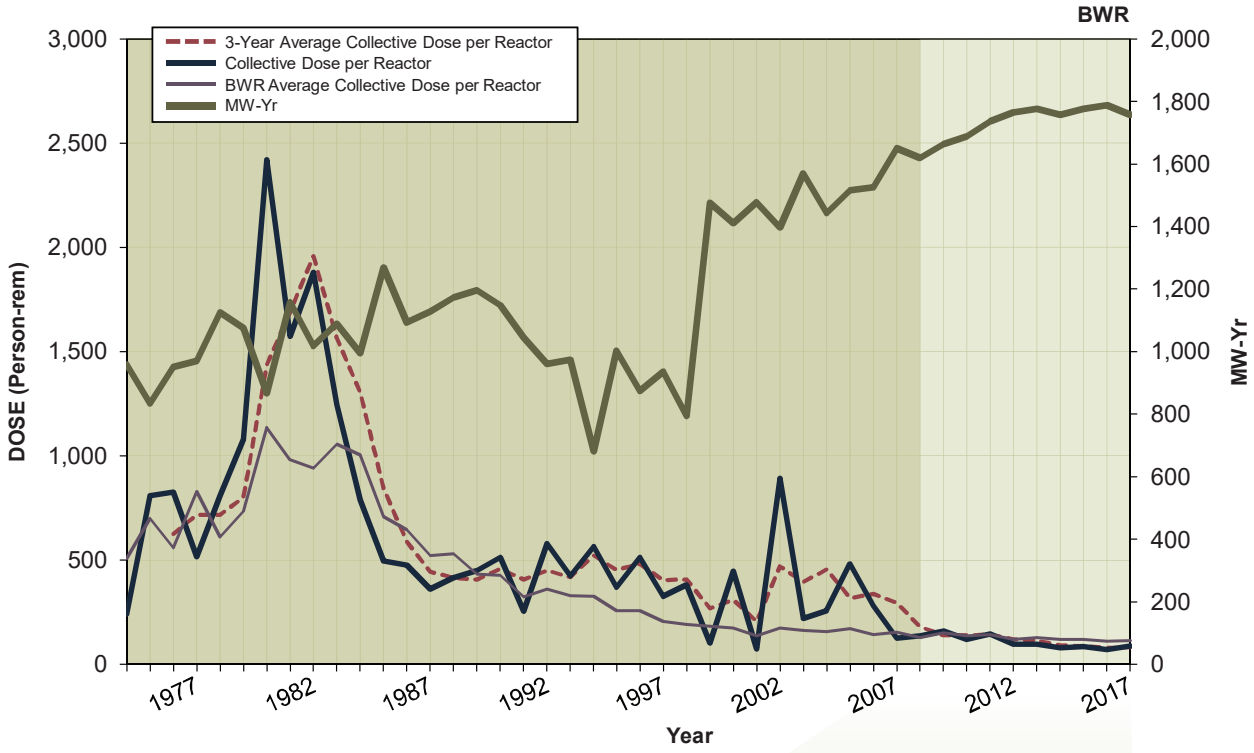
PRAIRIE ISLAND 1, 2
Dose Performance Trends



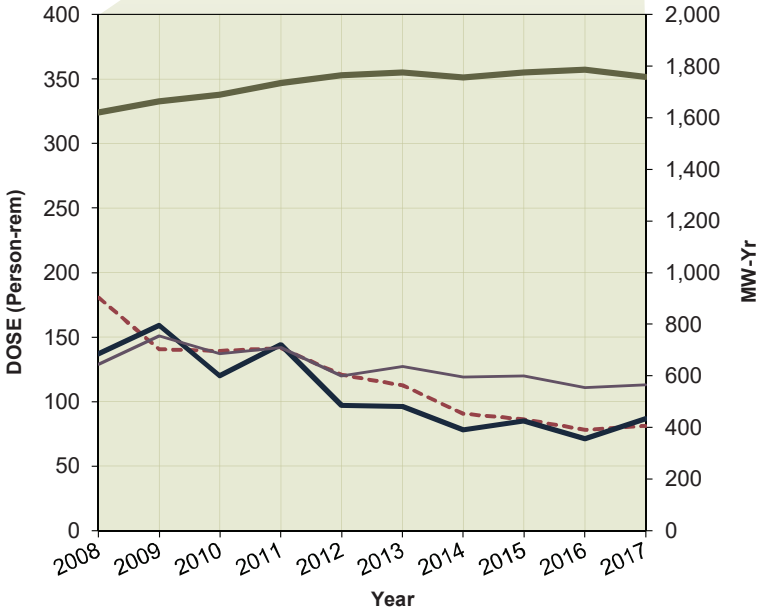
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	45.100	64.000	924.3
2009	31.098	27.000	942.2
2010	39.221	28.000	1,002.6
2011	27.759	29.000	982.4
2012	38.688	60.000	803.8
2013	51.197	65.000	881.8
2014	53.336	36.000	957.0
2015	43.882	31.221	842.2
2016	30.230	24.039	944.5
2017	24.140	17.161	998.3



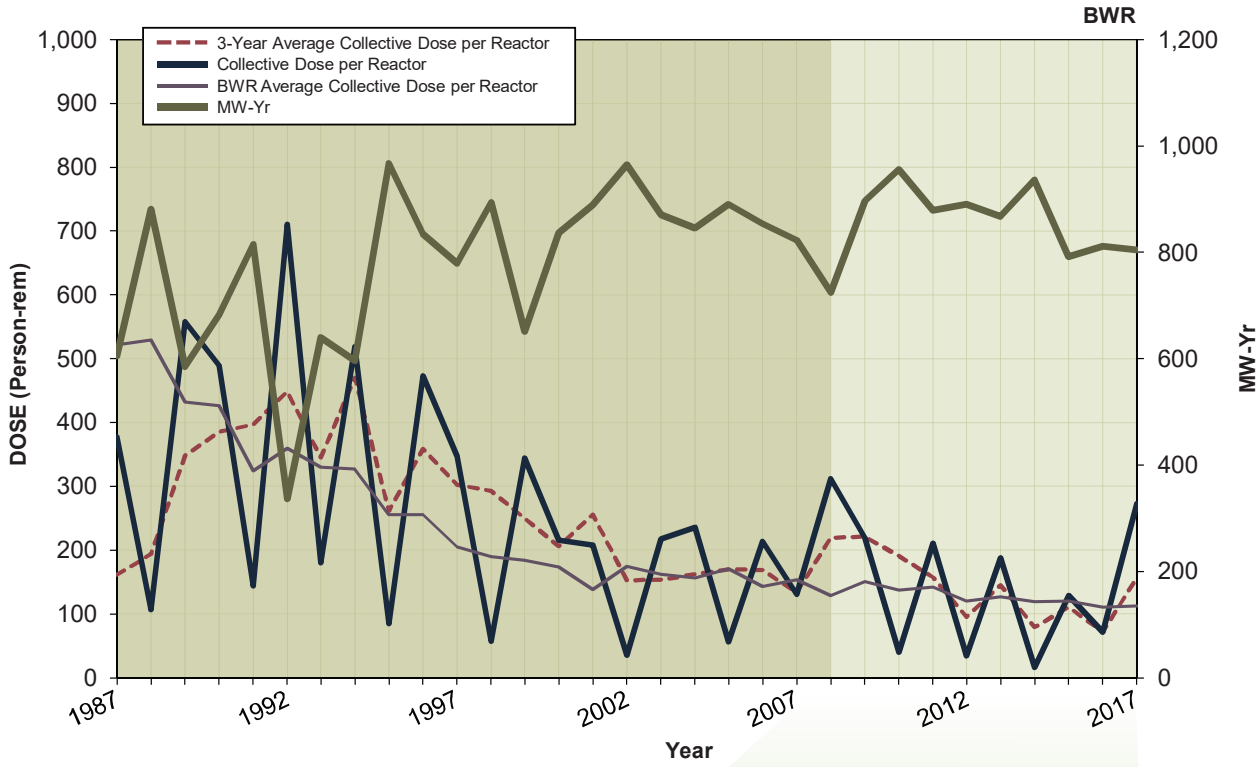
QUAD CITIES 1, 2
Dose Performance Trends



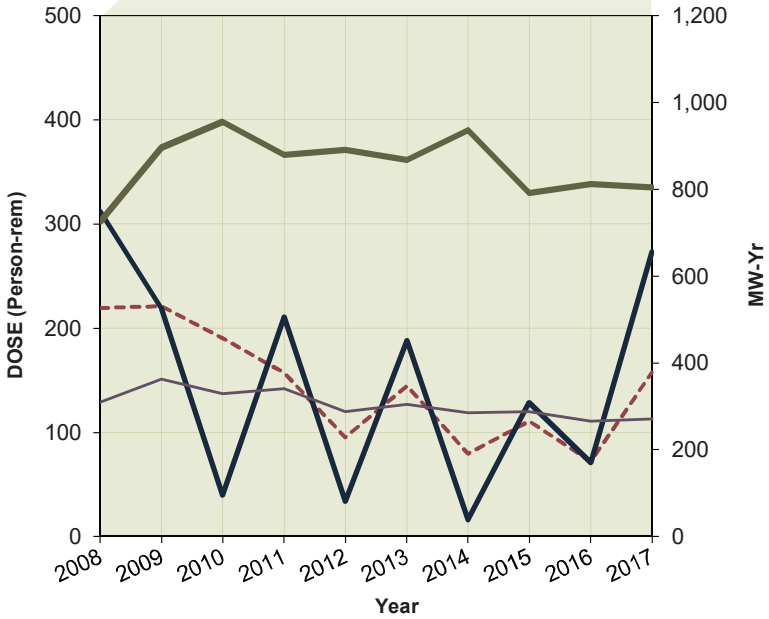
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	180.600	137.000	1,619.4
2009	140.470	159.000	1,662.6
2010	139.044	120.000	1,688.9
2011	141.413	144.000	1,735.3
2012	120.729	97.000	1,765.3
2013	112.498	96.000	1,776.0
2014	90.423	78.000	1,756.7
2015	86.392	85.062	1,776.5
2016	78.150	71.304	1,787.1
2017	80.983	86.584	1,758.2



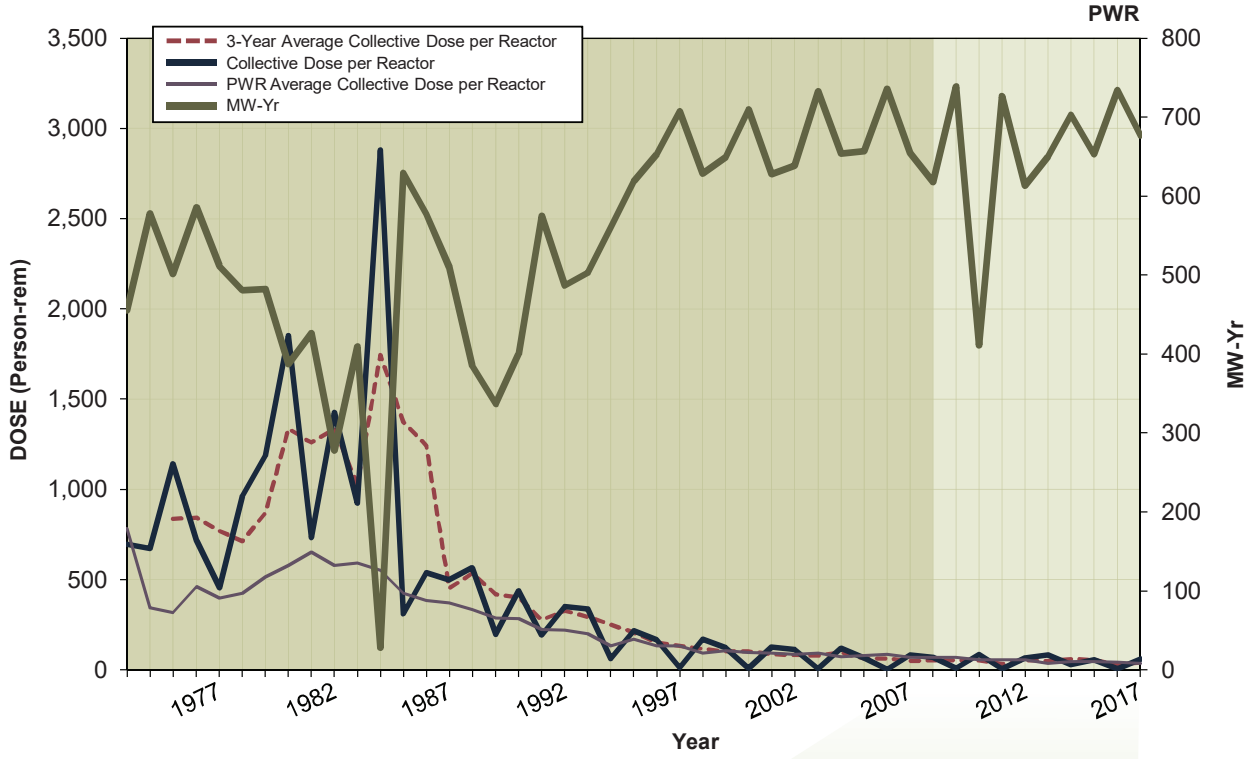
RIVER BEND 1
Dose Performance Trends



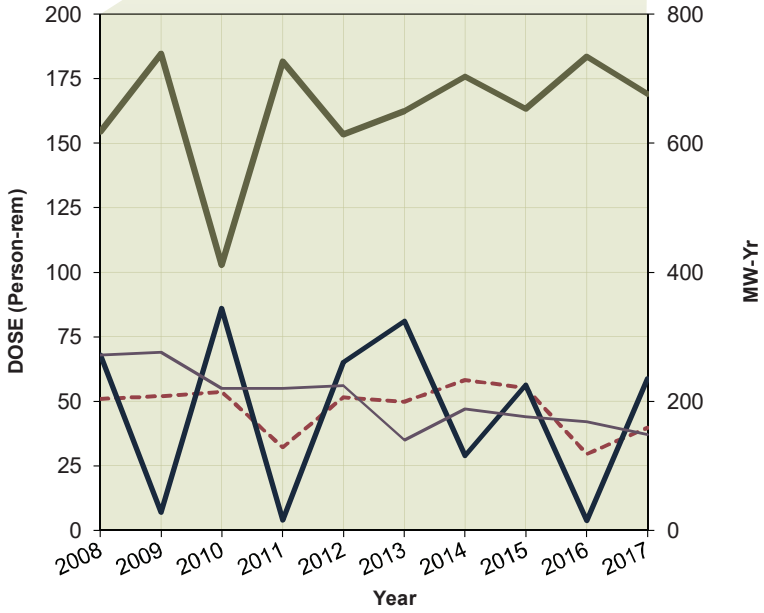
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	219.200	312.000	724.8
2009	220.840	219.000	895.6
2010	190.501	40.000	955.1
2011	157.005	211.000	878.6
2012	95.249	34.000	890.2
2013	144.574	188.000	867.6
2014	79.549	16.000	935.8
2015	110.99	128.492	791.6
2016	71.924	71.142	811.5
2017	157.546	273.004	804.5



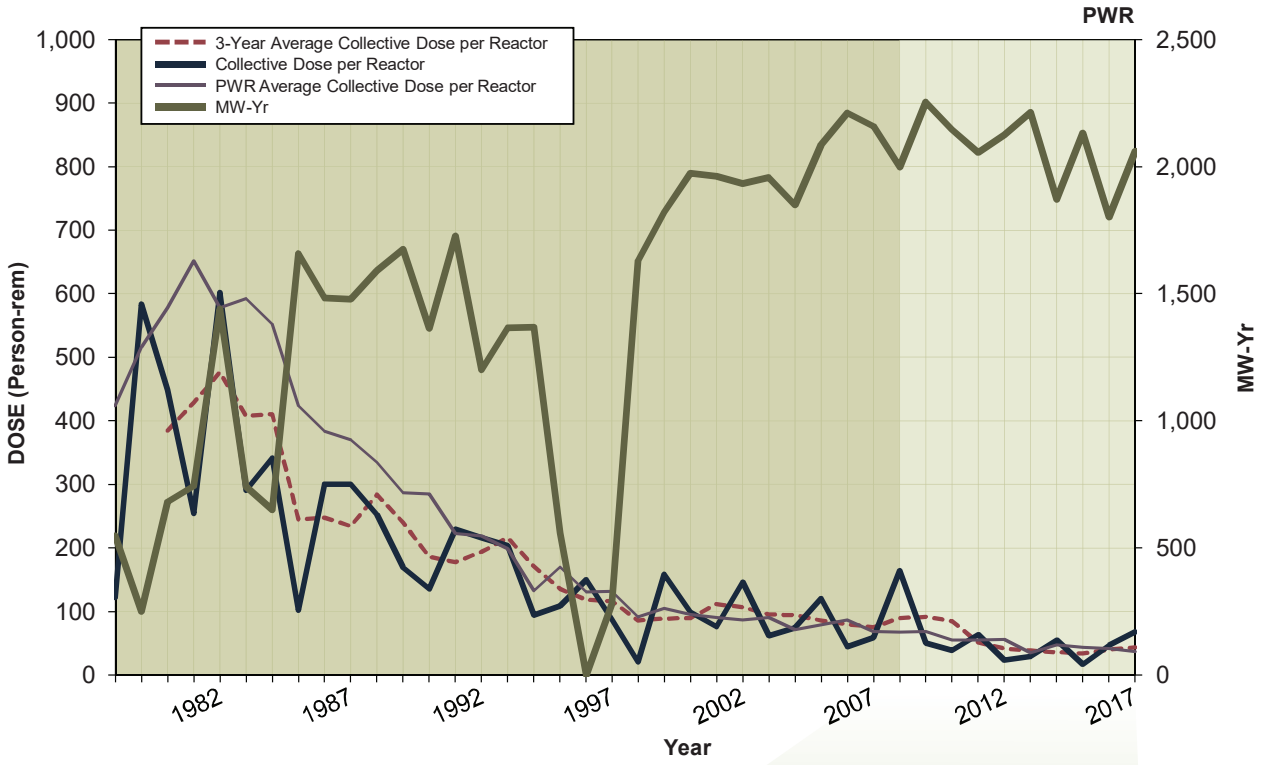
ROBINSON 2
Dose Performance Trends



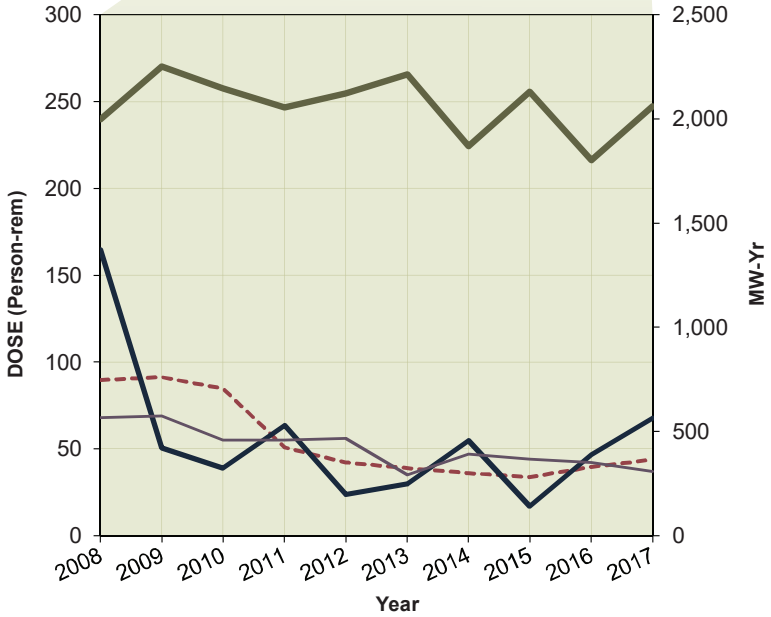
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	50.800	68.000	618.1
2009	51.932	7.000	738.9
2010	53.653	86.000	410.8
2011	32.063	4.000	726.5
2012	51.602	65.000	613.4
2013	49.828	81.000	650.3
2014	58.173	29.000	703.1
2015	55.211	56.373	653.4
2016	29.581	3.704	734.3
2017	39.605	58.739	676.9



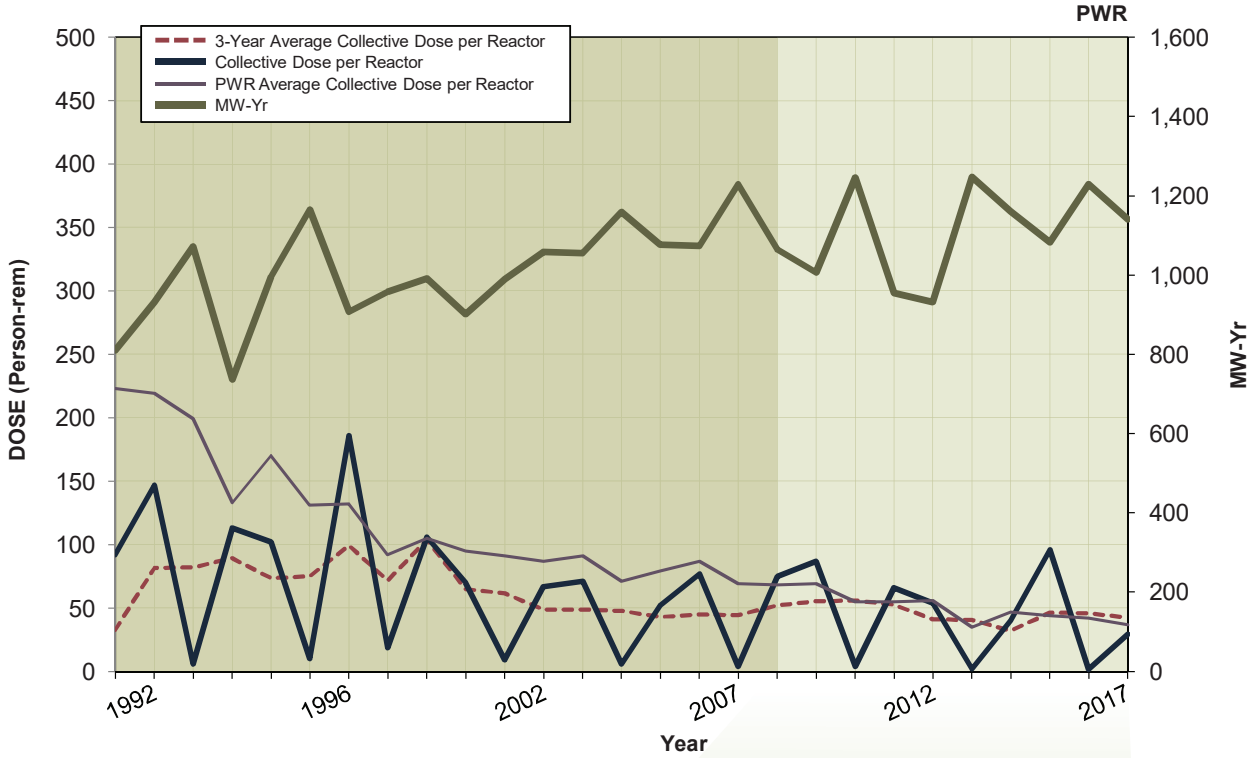
SALEM 1, 2
Dose Performance Trends



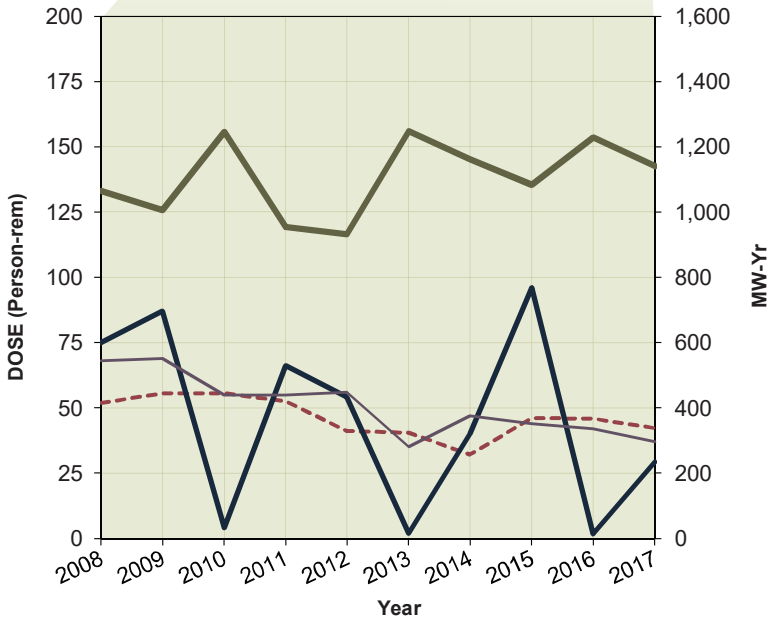
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	89.500	164.400	1,998.6
2009	91.264	50.593	2,252.9
2010	84.636	38.914	2,147.3
2011	50.955	63.358	2,054.6
2012	41.925	23.502	2,123.8
2013	38.858	29.715	2,213.1
2014	36.011	54.817	1,870.1
2015	33.812	16.905	2,131.3
2016	39.450	46.628	1,800.9
2017	43.710	67.599	2,060.5



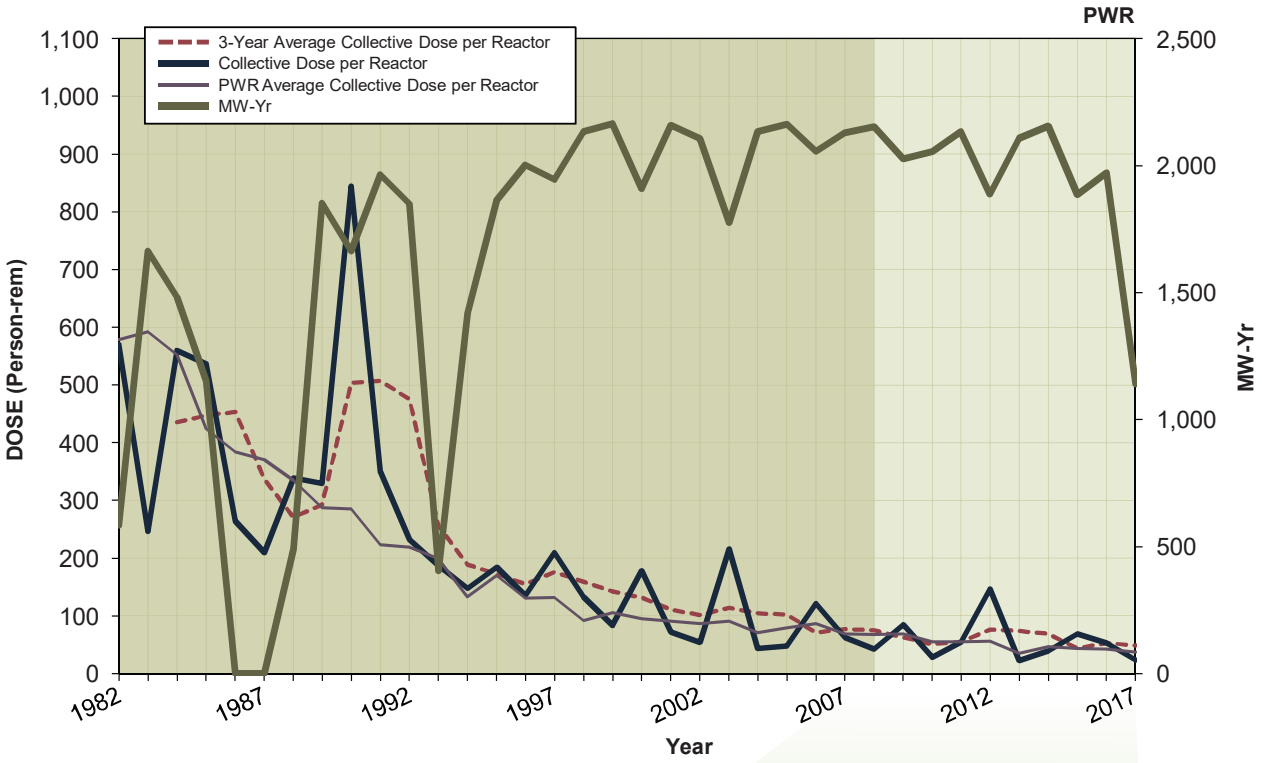
SEABROOK
Dose Performance Trends



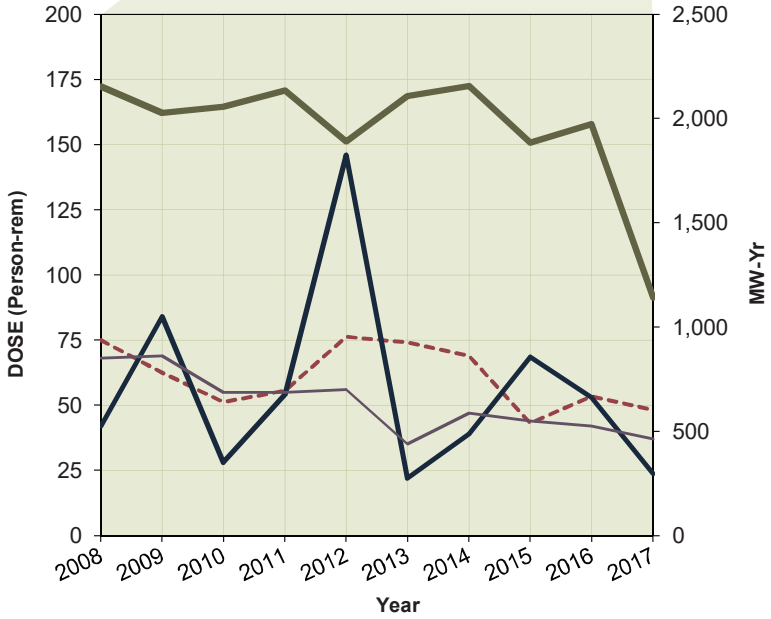
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	52.000	75.000	1,064.4
2009	55.568	87.000	1,006.4
2010	55.620	4.000	1,245.4
2011	52.484	66.000	954.5
2012	41.239	54.000	932.2
2013	40.557	2.000	1,247.3
2014	32.020	40.000	1,160.7
2015	46.159	96.053	1,082.6
2016	45.903	1.672	1,228.4
2017	42.305	29.191	1,140.4



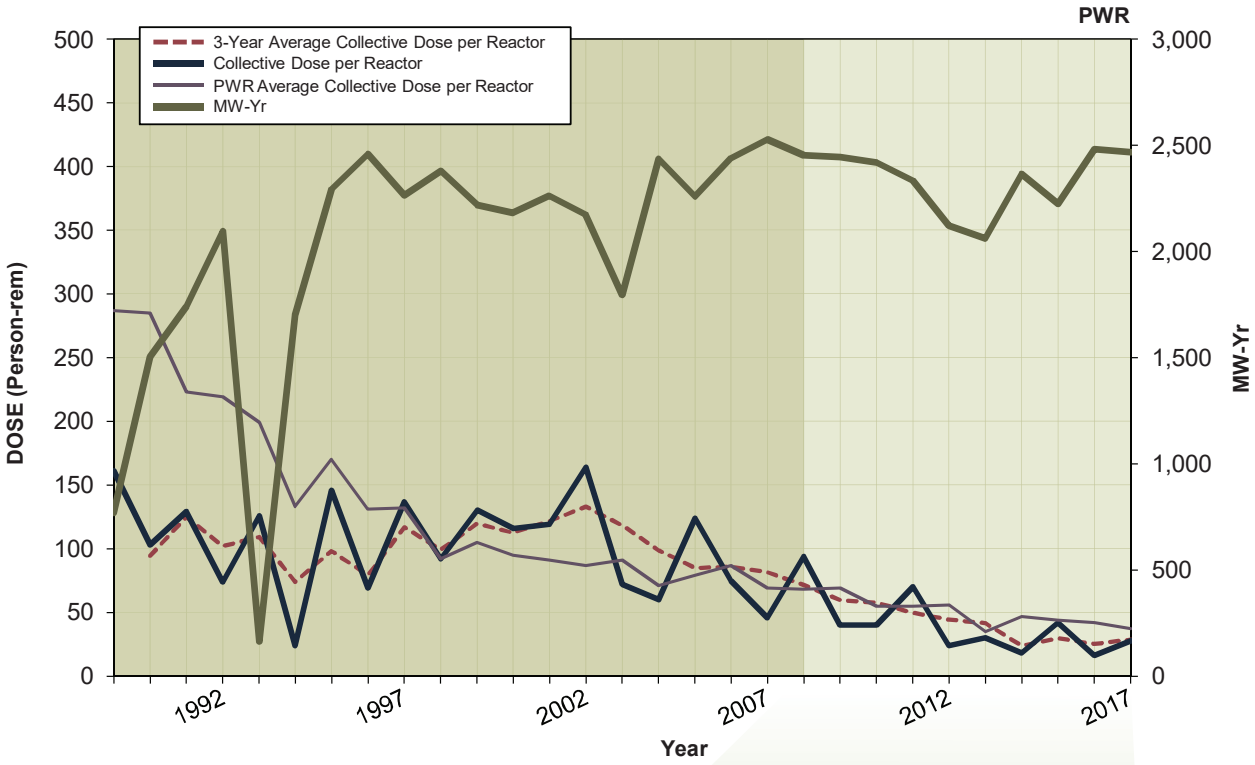
SEQUOYAH 1, 2
Dose Performance Trends



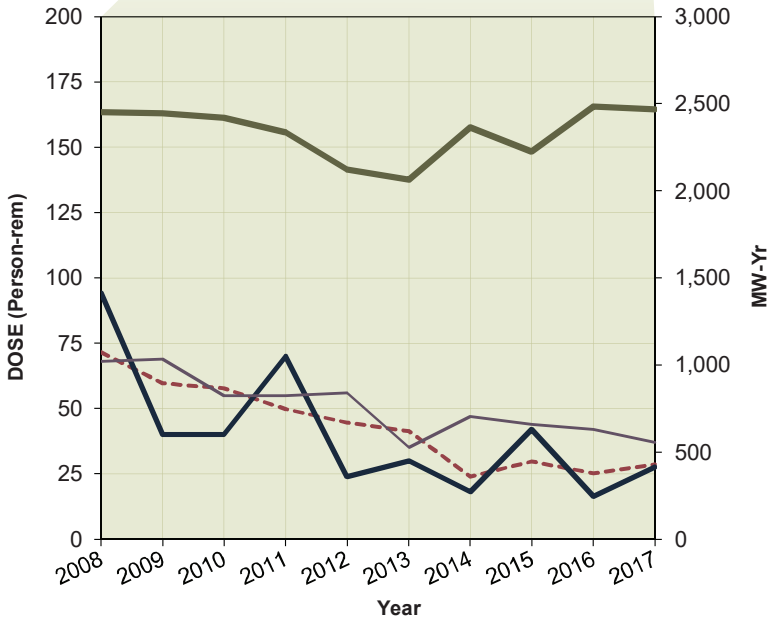
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	74.900	42.000	2,153.6
2009	62.363	84.000	2,026.8
2010	51.255	28.000	2,054.9
2011	55.525	54.000	2,133.3
2012	76.202	146.000	1,888.2
2013	74.123	22.000	2,108.1
2014	68.817	39.000	2,156.7
2015	43.148	68.413	1,884.9
2016	53.360	52.882	1,971.4
2017	48.298	23.600	1,140.4



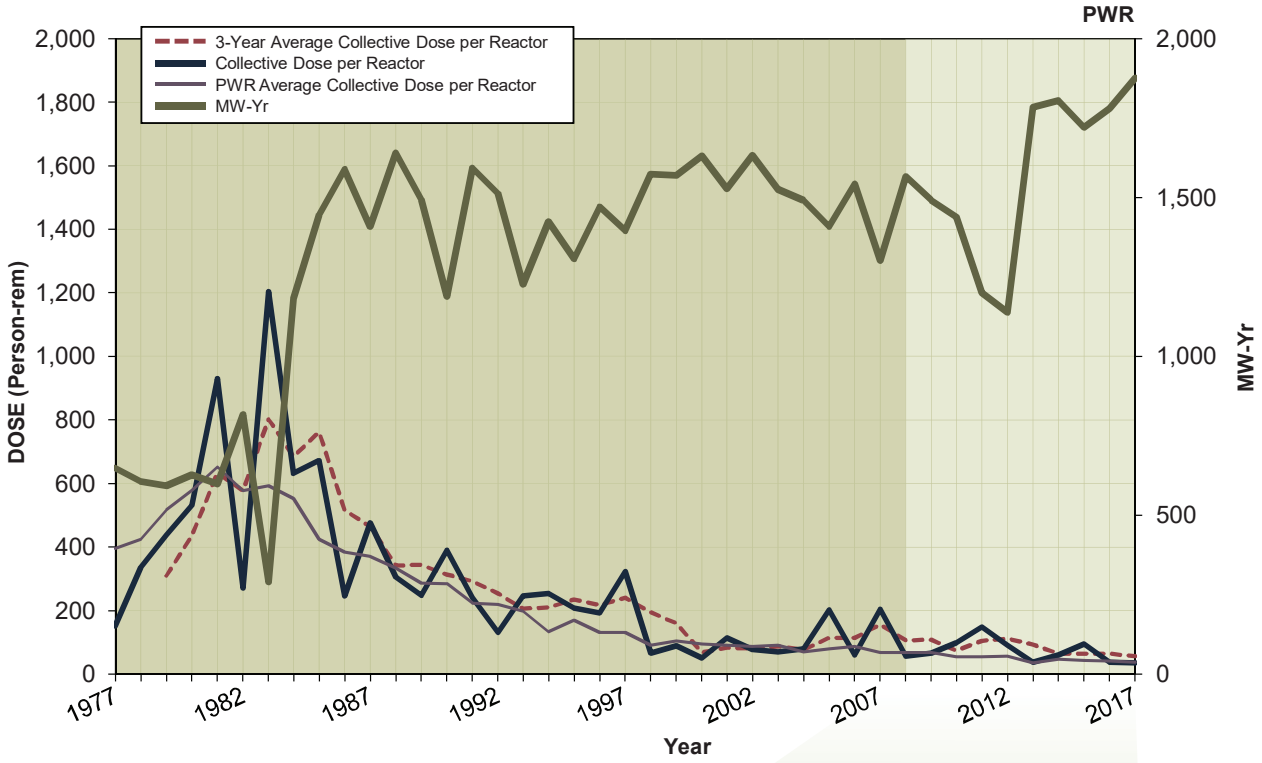
SOUTH TEXAS 1, 2
Dose Performance Trends



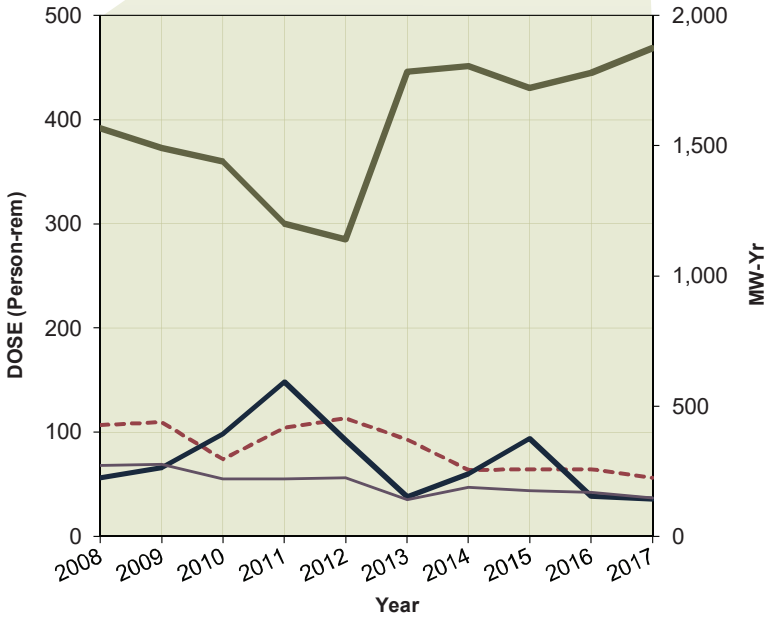
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	71.500	94.000	2,452.1
2009	59.748	40.000	2,444.5
2010	57.675	40.000	2,418.7
2011	49.687	70.000	2,333.3
2012	44.590	24.000	2,122.4
2013	41.352	30.000	2,062.4
2014	23.903	18.000	2,363.4
2015	29.718	41.997	2,224.5
2016	25.234	16.419	2,481.9
2017	28.643	27.513	2,467.1



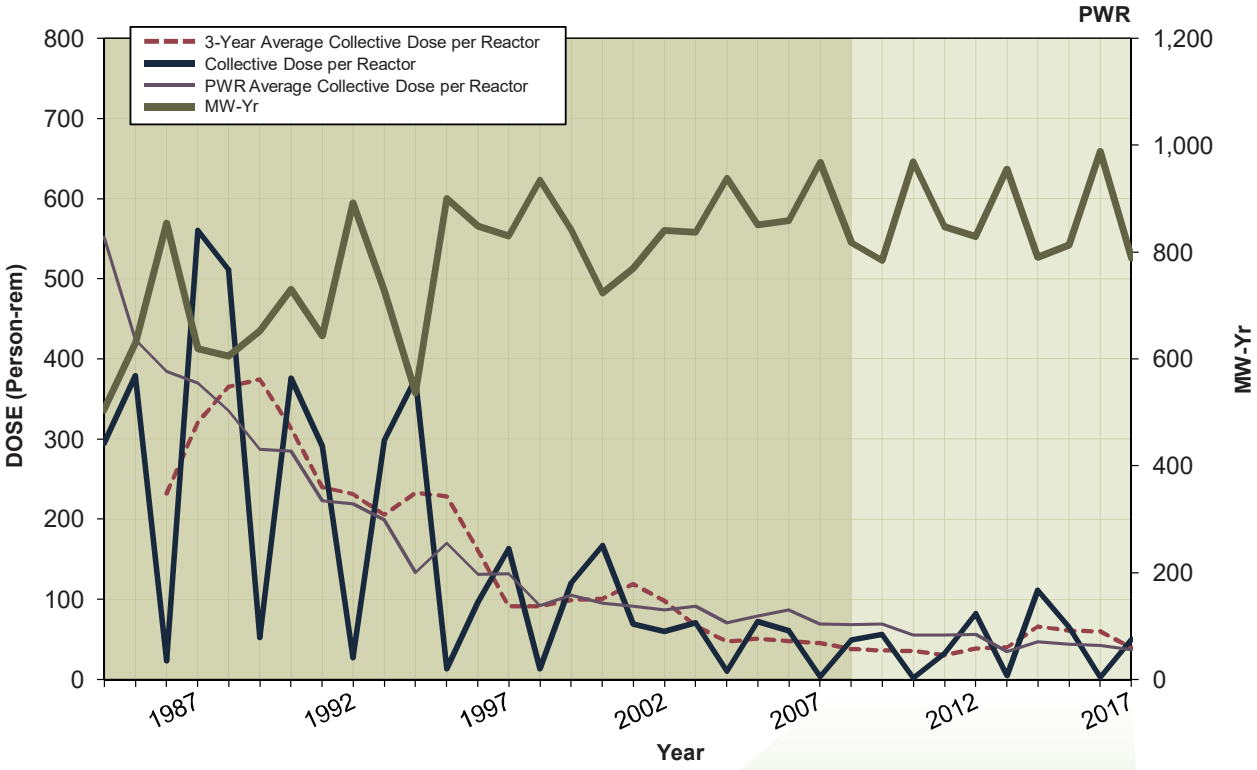
ST. LUCIE 1, 2
Dose Performance Trends



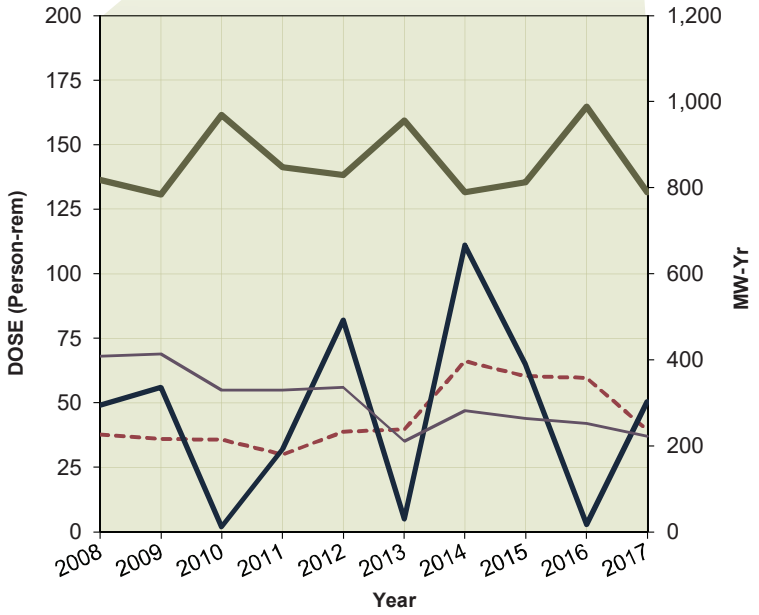
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	107.000	56.000	1,566.5
2009	109.177	66.000	1,490.6
2010	73.737	98.000	1,440.2
2011	104.242	148.000	1,200.9
2012	113.002	92.000	1,139.5
2013	92.597	38.000	1,783.4
2014	63.574	60.000	1,805.7
2015	64.018	94.044	1,720.9
2016	64.301	38.314	1,779.5
2017	55.973	35.562	1,875.3



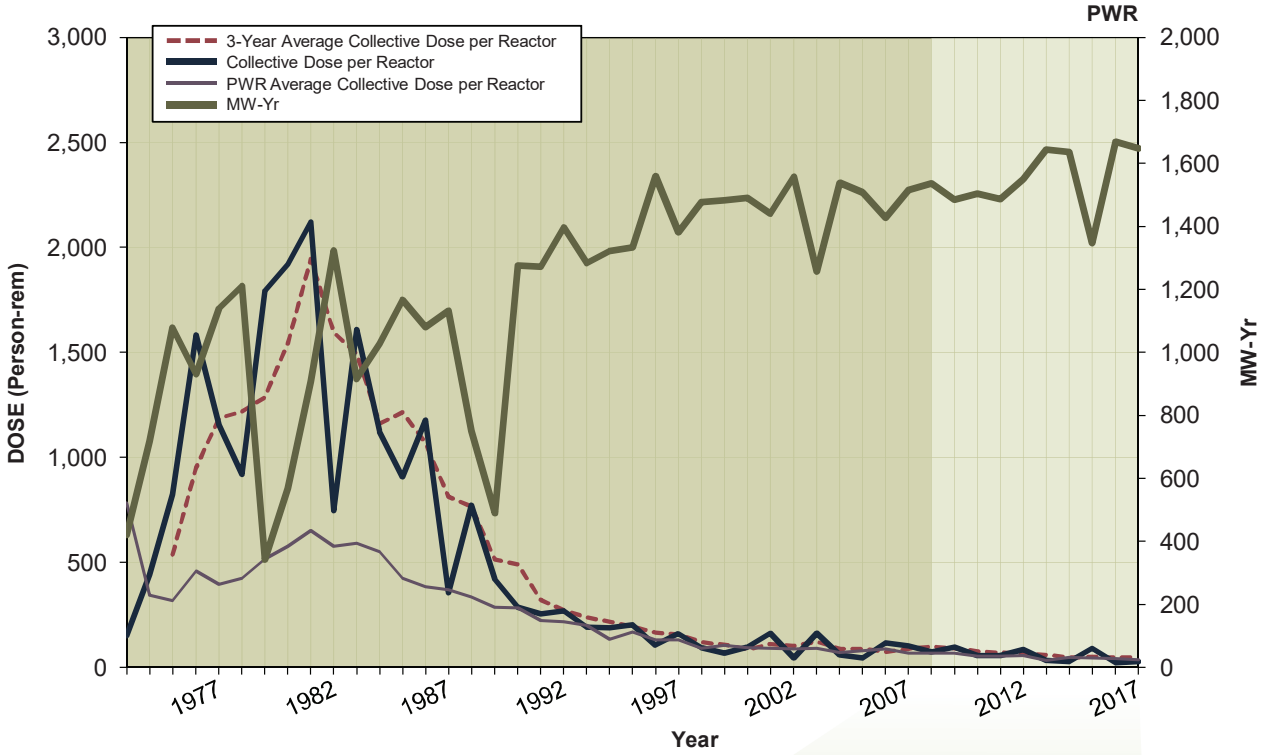
SUMMER 1
Dose Performance Trends



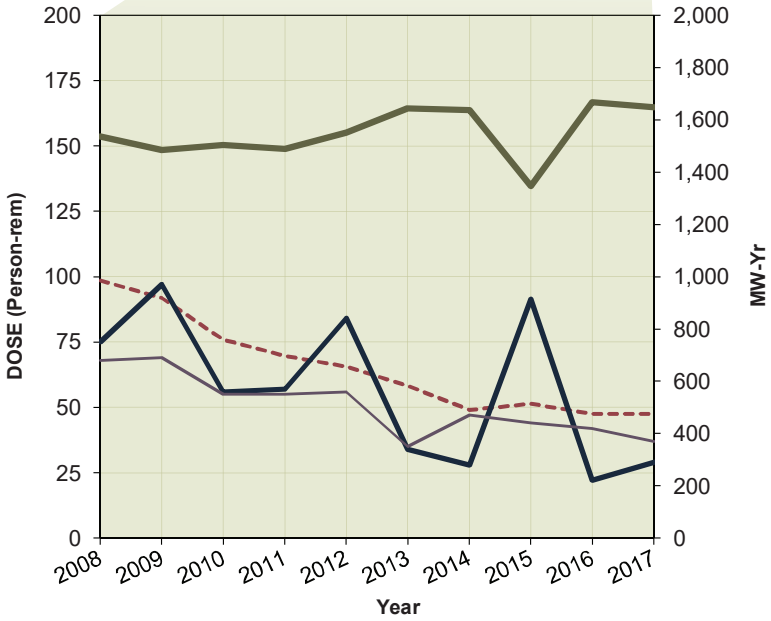
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	37.700	49.000	817.2
2009	35.947	56.000	784.5
2010	35.760	2.000	968.8
2011	29.920	32.000	847.7
2012	38.657	82.000	829.0
2013	39.651	5.000	955.5
2014	66.101	111.000	789.4
2015	60.333	64.958	812.3
2016	59.583	2.862	988.4
2017	39.376	50.308	789.2



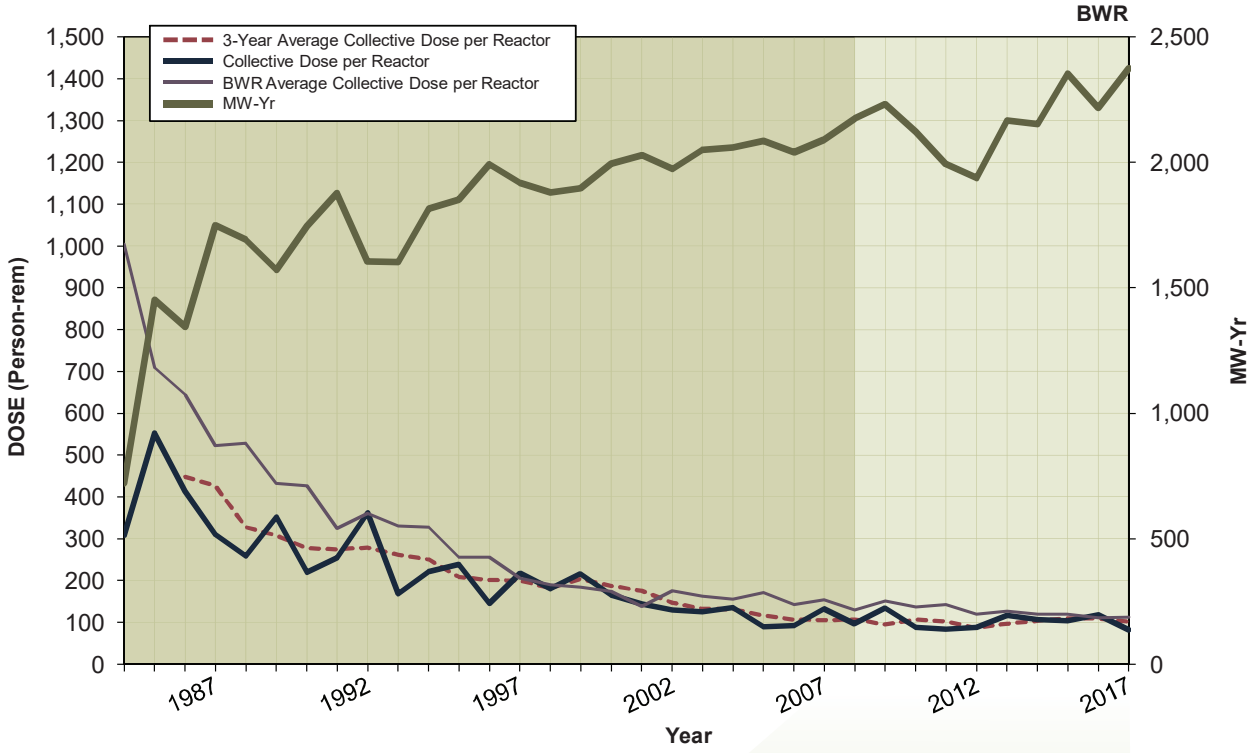
SURRY 1, 2
Dose Performance Trends



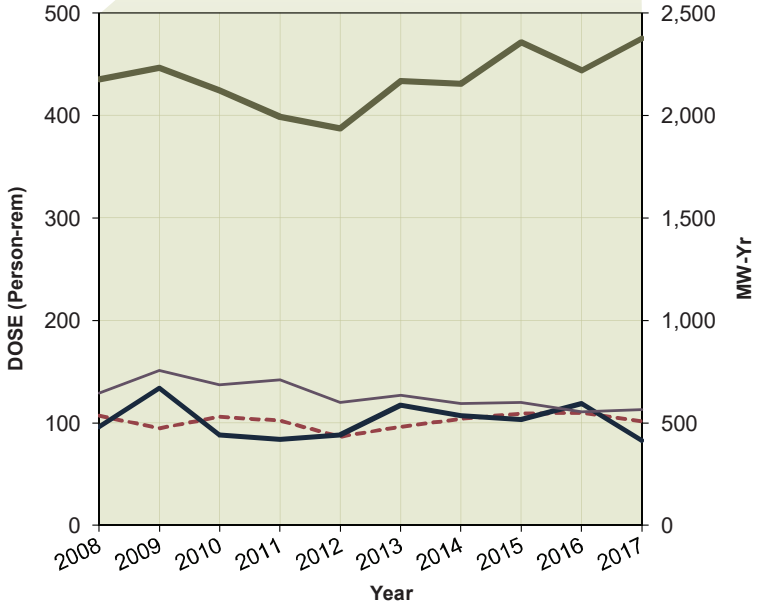
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	98.567	75.000	1,536.6
2009	91.851	97.000	1,485.1
2010	75.839	56.000	1,503.7
2011	69.759	57.000	1,487.4
2012	65.600	84.000	1,549.9
2013	58.334	34.000	1,644.4
2014	48.962	28.000	1,636.1
2015	51.333	91.490	1,345.9
2016	47.484	22.216	1,667.9
2017	47.571	29.006	1,647.0



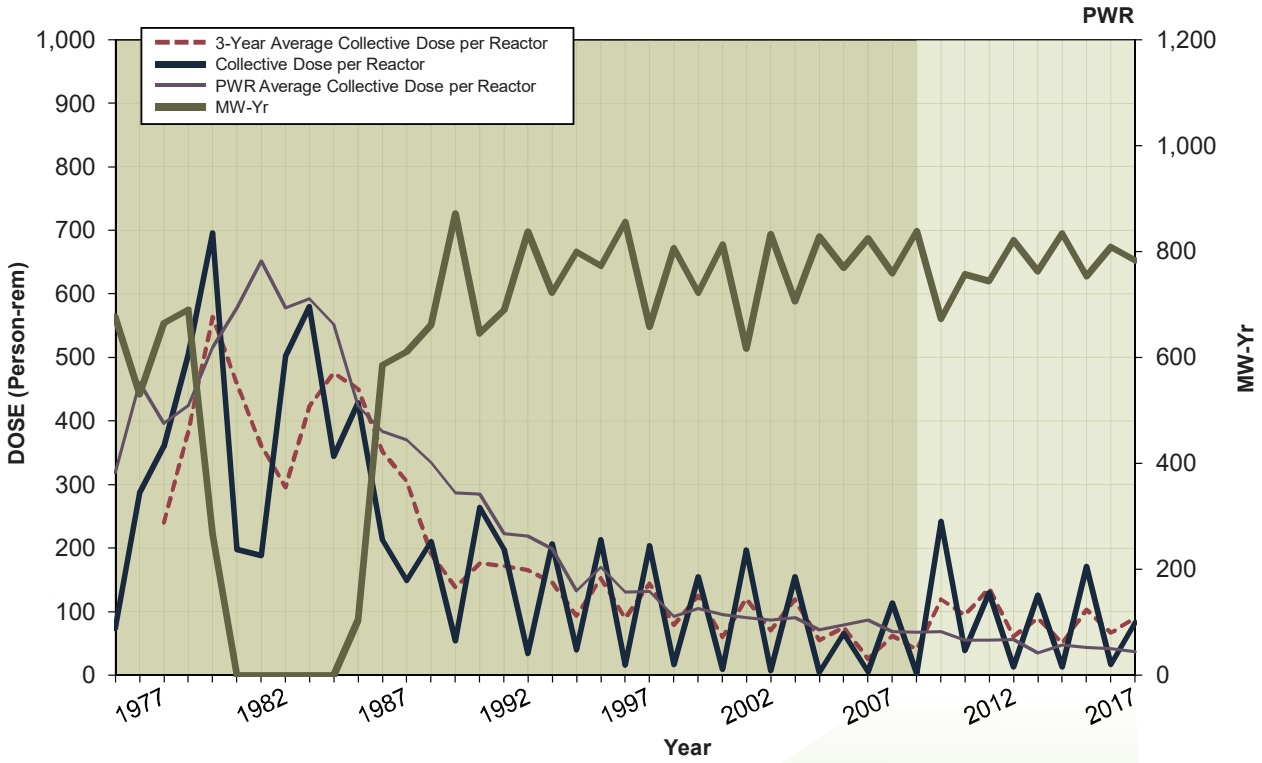
SUSQUEHANNA 1, 2
Dose Performance Trends



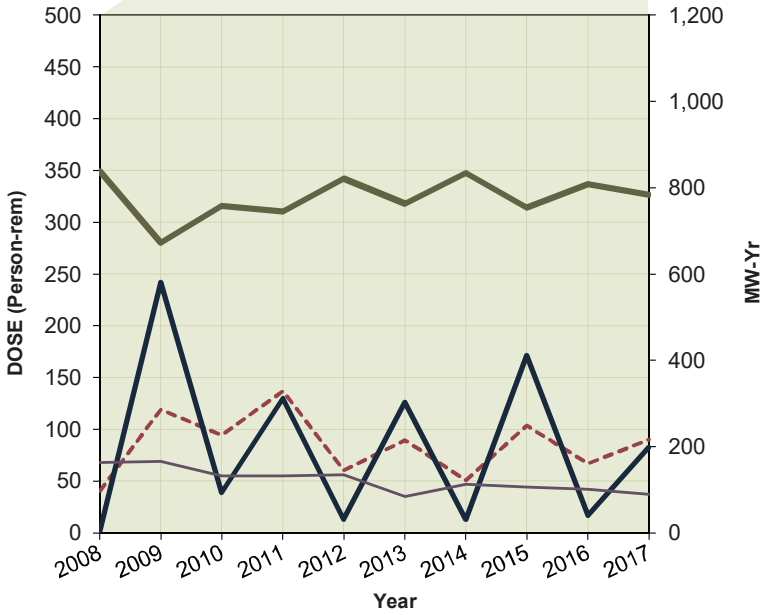
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	106.800	96.000	2,174.1
2009	94.500	134.000	2,231.1
2010	105.927	88.000	2,121.6
2011	101.954	84.000	1,992.0
2012	86.835	88.000	1,936.5
2013	96.397	117.000	2,166.2
2014	103.980	107.000	2,153.1
2015	109.026	103.077	2,354.3
2016	109.660	118.668	2,217.2
2017	101.493	82.734	2,375.6



THREE MILE ISLAND 1*
Dose Performance Trends

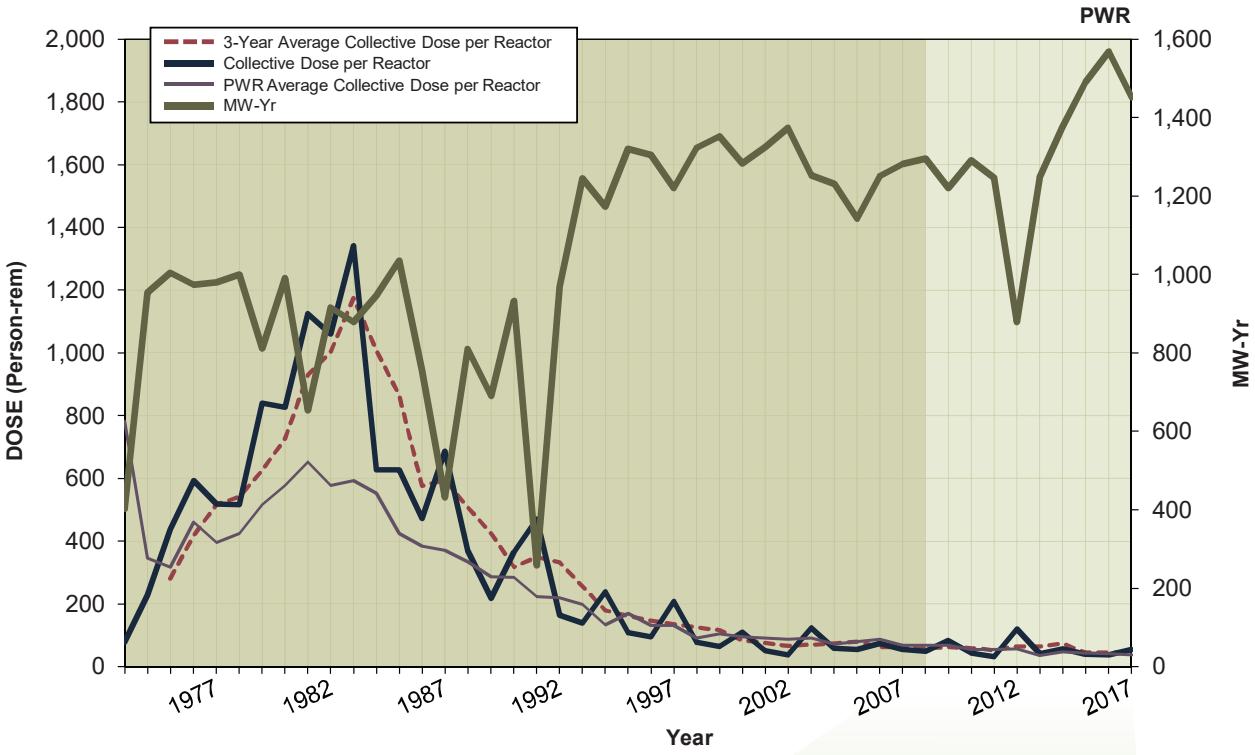


Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	40.500	2.000	838.5
2009	119.394	242.000	672.6
2010	94.325	39.000	757.3
2011	136.890	130.000	744.2
2012	60.614	13.000	820.7
2013	89.550	126.000	762.5
2014	50.465	13.000	834.3
2015	103.251	171.431	753.2
2016	66.931	16.843	808.5
2017	90.310	82.657	783.3

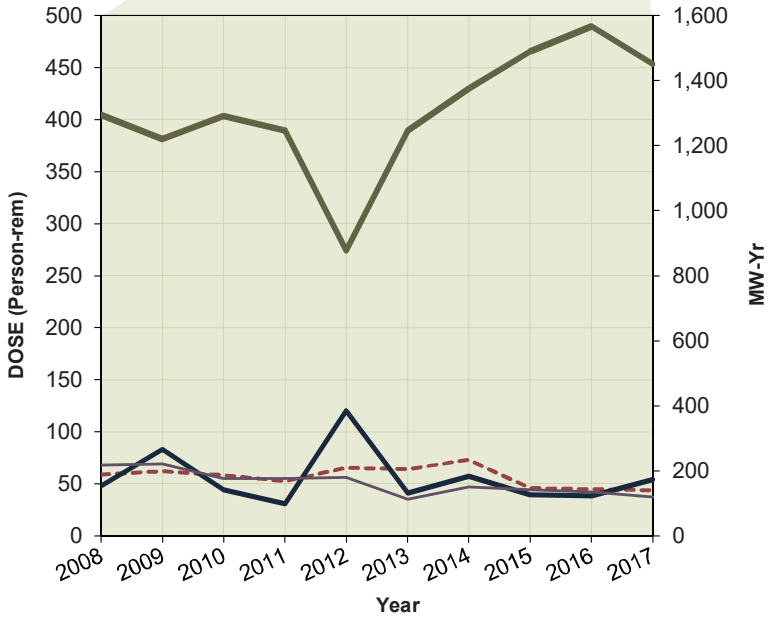


* Graph includes data for Three Mile Island 2 for the years 1975–1985.

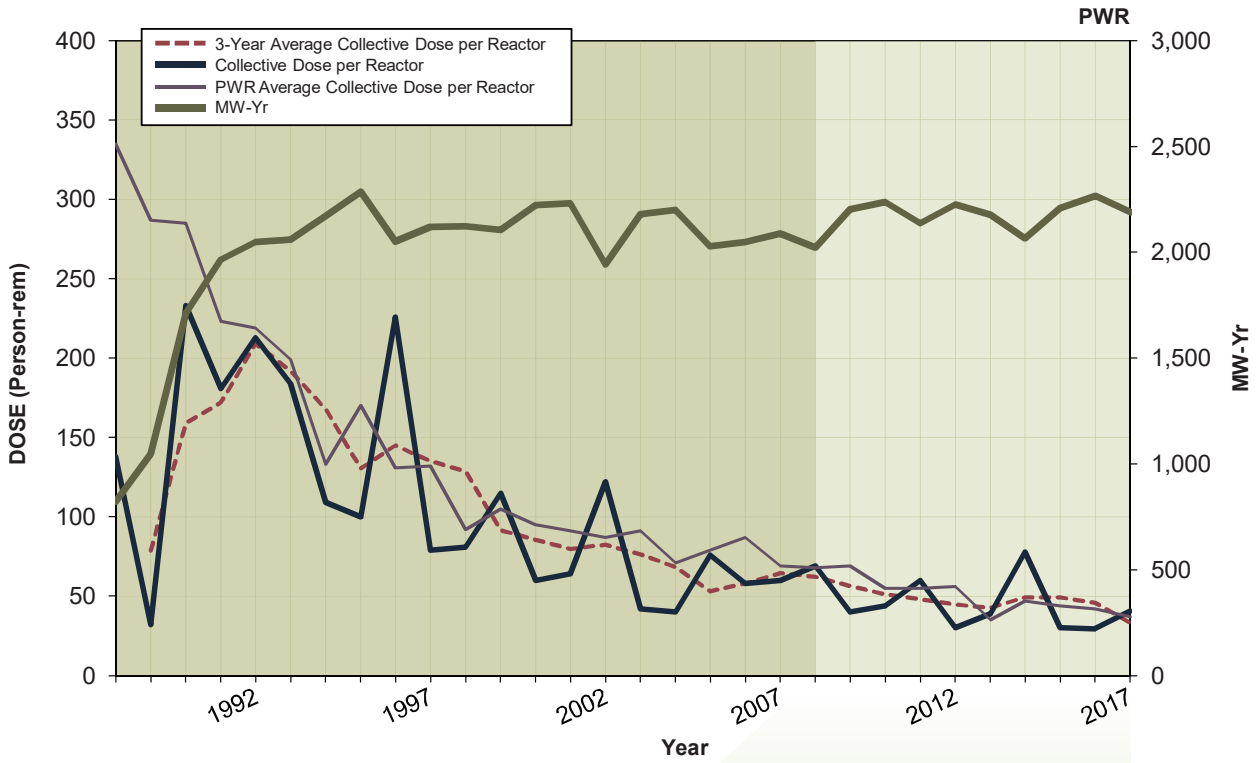
TURKEY POINT 3, 4
Dose Performance Trends



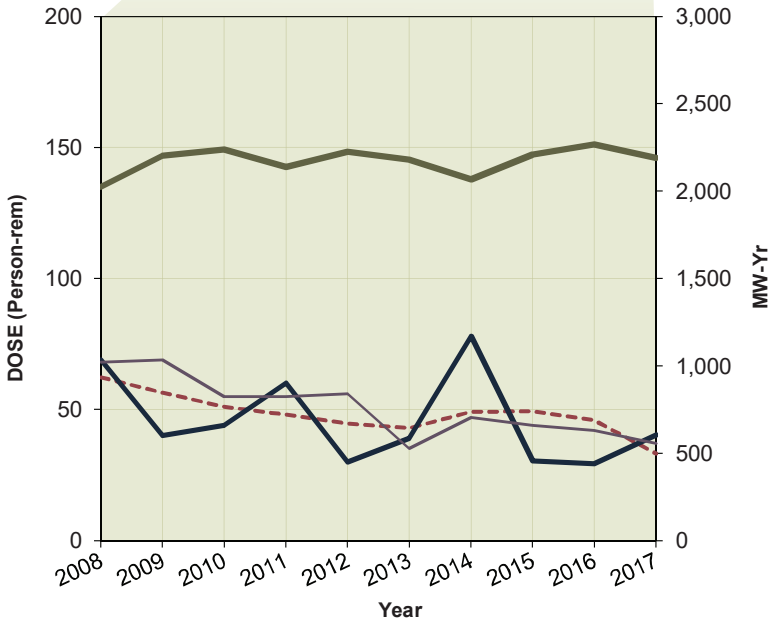
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	59.000	48.000	1,294.9
2009	61.870	83.000	1,219.7
2010	58.395	44.000	1,290.9
2011	52.549	31.000	1,245.7
2012	65.038	120.000	878.0
2013	64.282	41.000	1,245.9
2014	72.949	57.000	1,375.7
2015	45.944	39.562	1,489.7
2016	44.953	38.135	1,567.7
2017	43.932	54.100	1,451.9



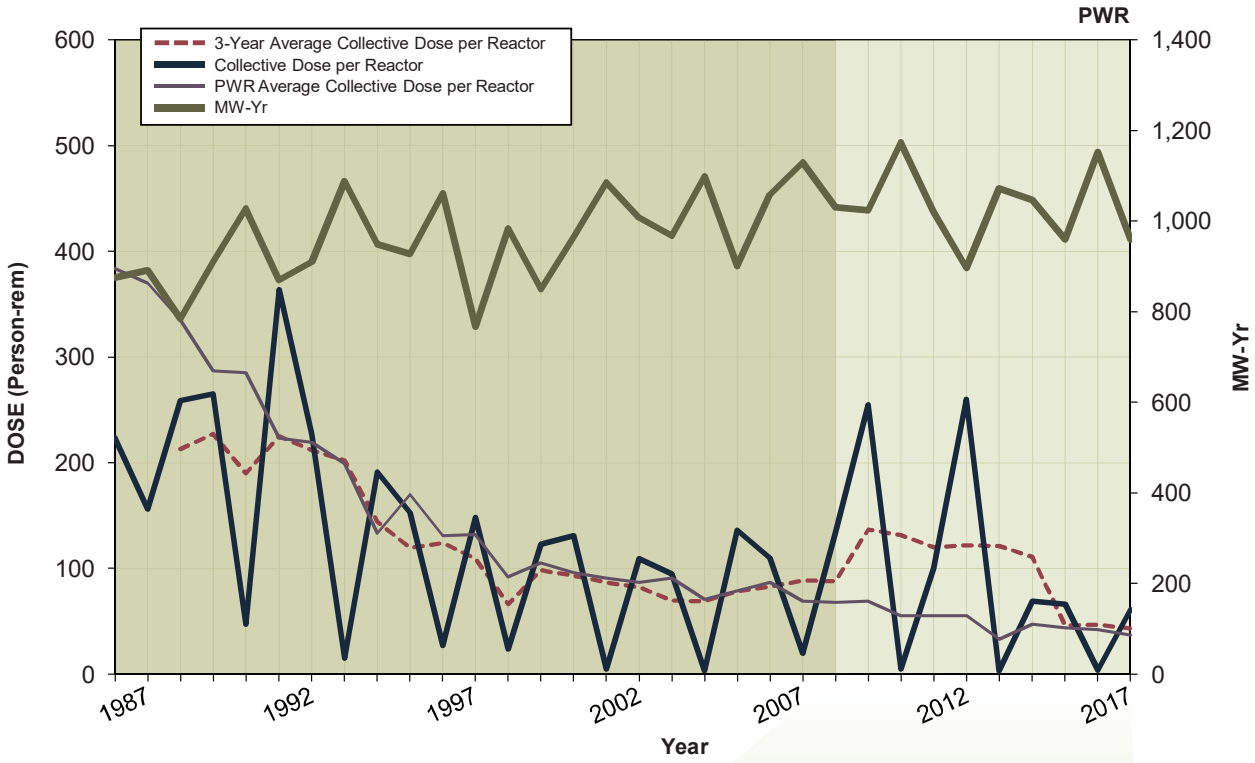
VOGTLE 1, 2
Dose Performance Trends



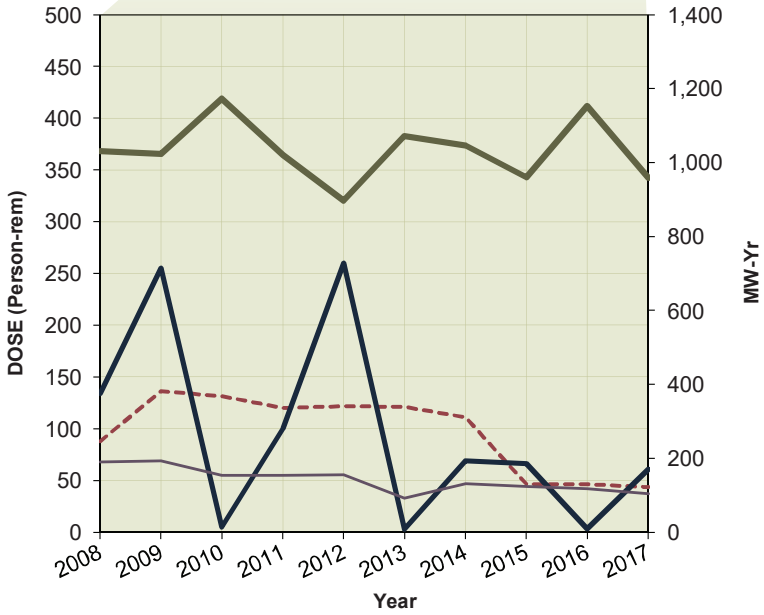
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	62.300	69.000	2,023.9
2009	56.314	40.000	2,201.6
2010	51.077	44.000	2,238.6
2011	47.966	60.000	2,138.0
2012	44.572	30.000	2,226.6
2013	42.758	39.000	2,178.4
2014	49.060	78.000	2,065.8
2015	49.268	30.283	2,210.0
2016	45.964	29.236	2,267.1
2017	33.266	40.278	2,189.0



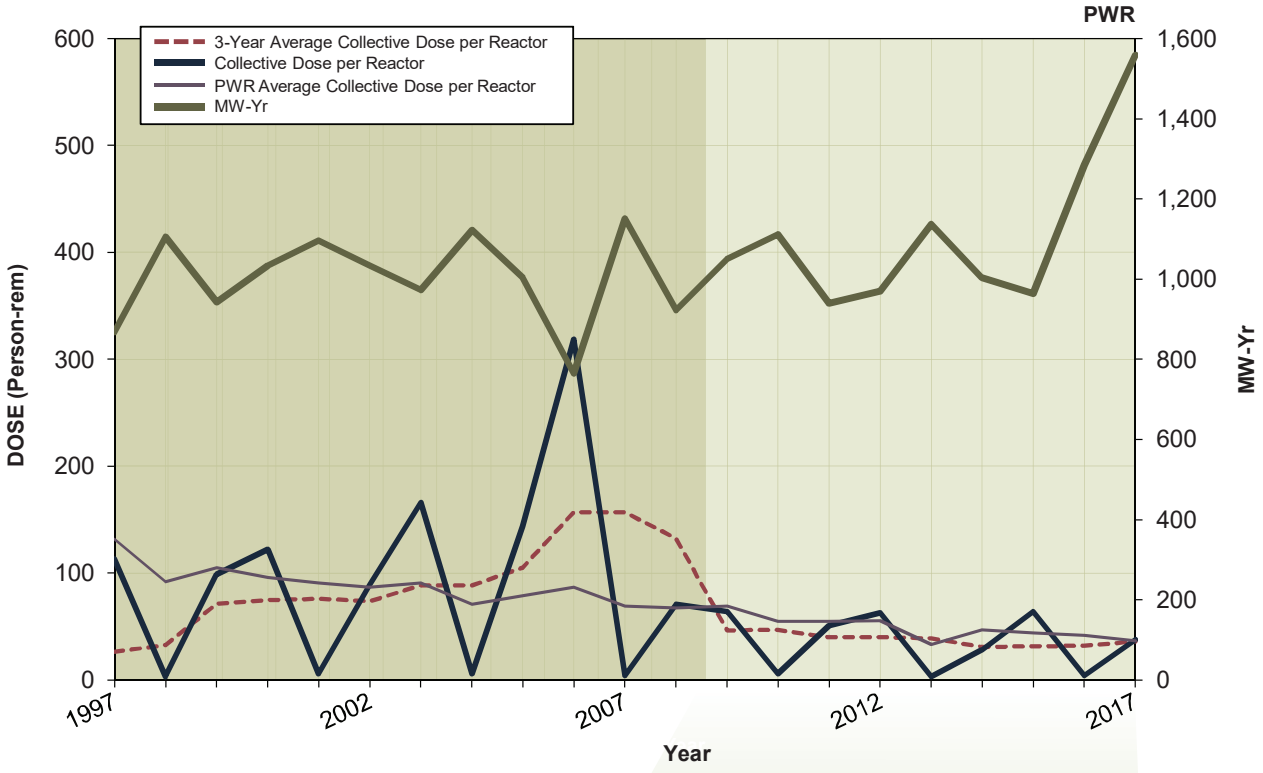
WATERFORD 3
Dose Performance Trends



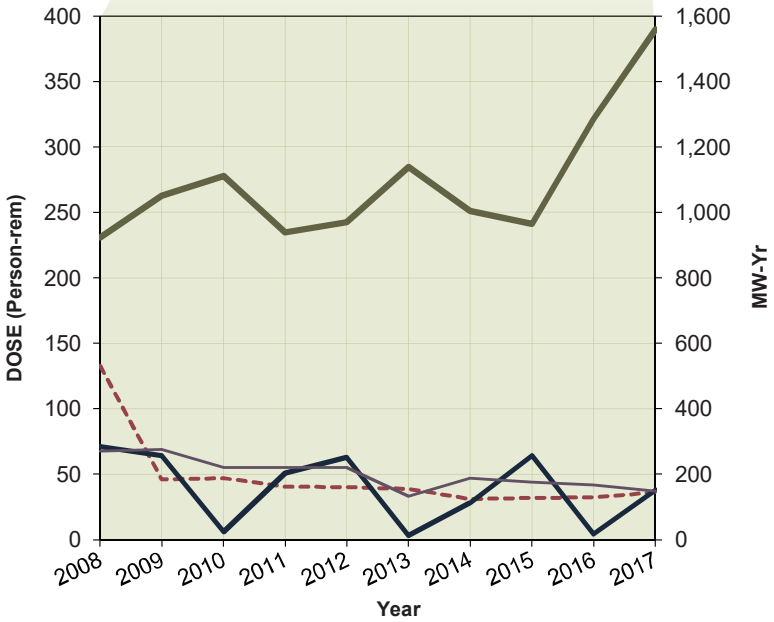
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	88.000	134.000	1,030.7
2009	136.471	255.000	1,023.4
2010	131.400	5.000	1,173.1
2011	120.018	100.000	1,020.8
2012	121.723	260.000	897.1
2013	121.128	3.000	1,071.6
2014	110.931	69.000	1,046.4
2015	46.330	66.399	959.5
2016	46.418	3.392	1,152.5
2017	43.506	60.728	959.1



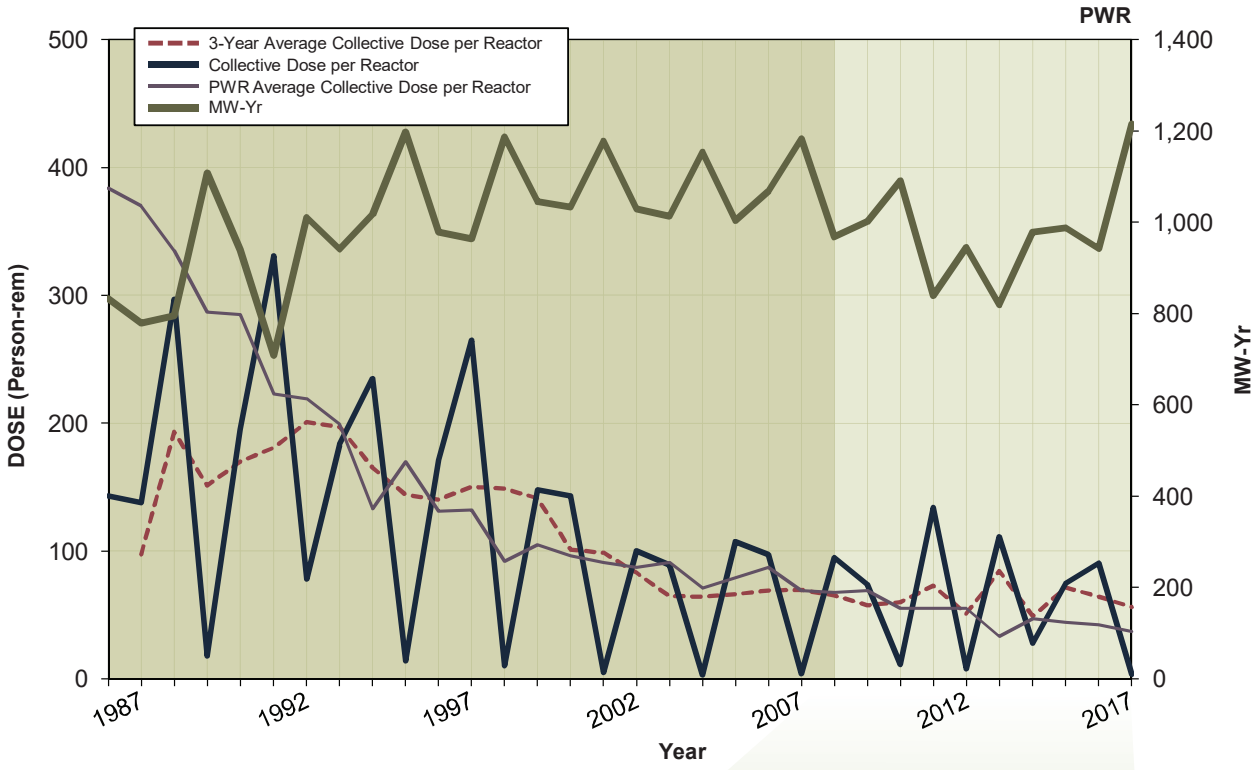
WATTS BAR 1, 2
Dose Performance Trends



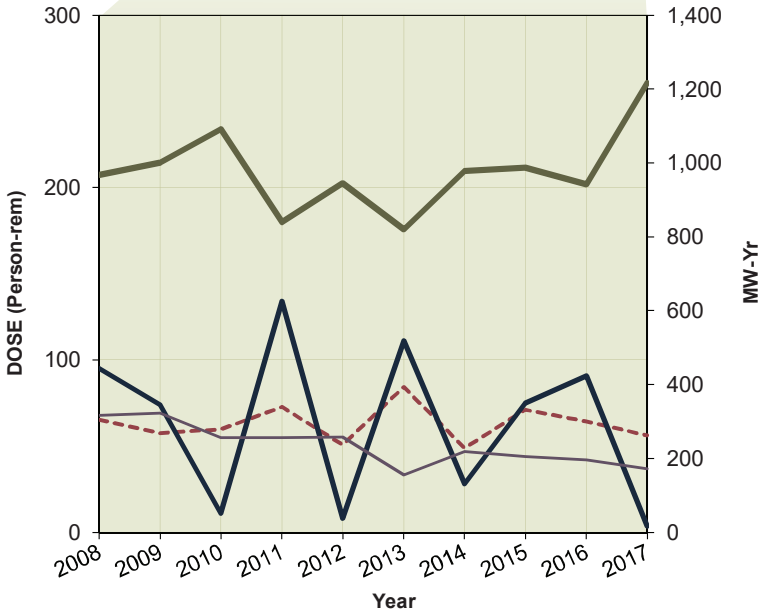
Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	132.600	71.000	923.5
2009	46.287	64.000	1,051.1
2010	46.880	6.000	1,111.7
2011	40.353	51.000	939.6
2012	39.998	63.000	969.5
2013	38.805	3.000	1,137.9
2014	31.221	28.000	1,003.4
2015	31.735	64.320	964.5
2016	32.359	4.489	1,284.1
2017	36.120	37.836	1,558.2



WOLF CREEK 1
Dose Performance Trends



Year	3-Year Average Collective Dose per Reactor	Collective Dose per Reactor	MW-Yr
2008	65.400	95.000	968.3
2009	57.648	74.000	1,001.0
2010	59.718	11.000	1,090.8
2011	72.704	134.000	839.1
2012	50.788	8.000	944.4
2013	84.368	111.000	819.2
2014	48.882	28.000	978.2
2015	71.187	74.804	987.9
2016	64.312	90.631	942.0
2017	56.291	3.437	1,215.5



APPENDIX E

PLANTS NO LONGER IN OPERATION

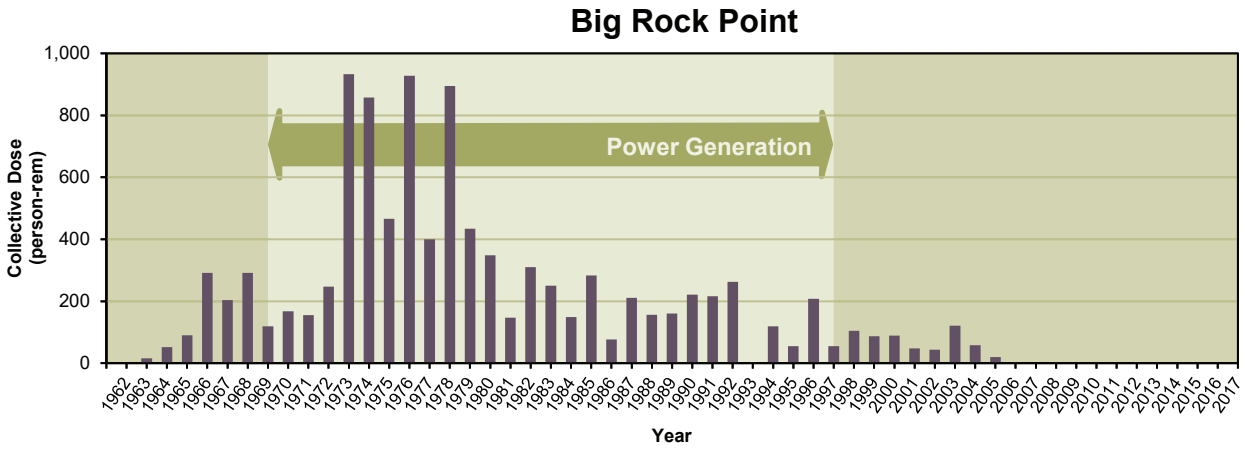
2017

Information in this appendix was obtained from References 20, 21, and 22.

Big Rock Point

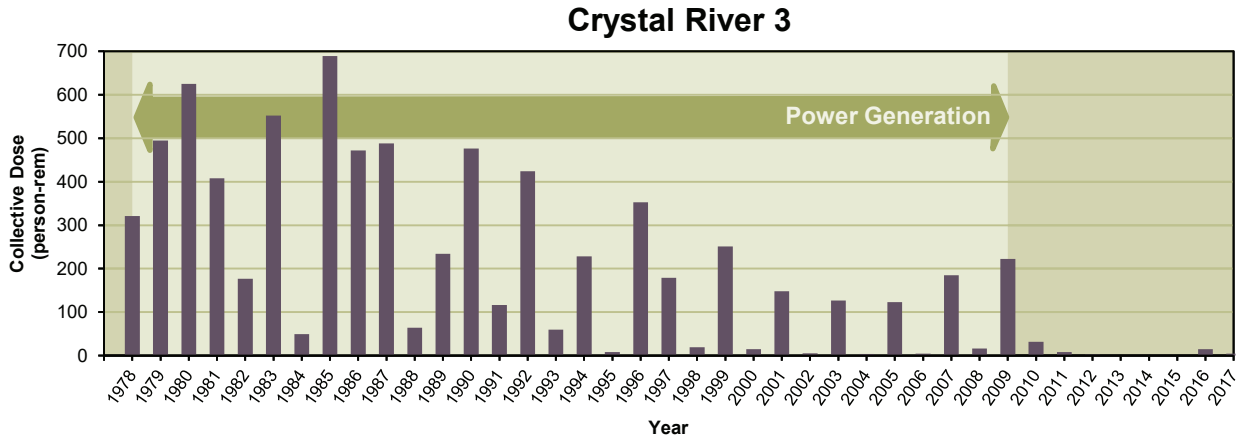
Big Rock Point (BRP) was a boiling-water reactor rated at 75 megawatt (MW) electric (MWe), designed by General Electric Company, and owned by Consumers Energy Company (CE). BRP was permanently shut down on August 29, 1997, and fuel was transferred to the spent fuel pool by September 20, 1997. The site completed decommissioning to a "green field" status. Big Rock Point will retain its 10 CFR Part 50 license until the fuel is removed from the ISFSI.

All fuel was transferred to the independent spent fuel storage installation (ISFSI) by March 2003. After fuel is removed from the site to a U.S. Department of Energy (DOE) facility, the ISFSI will be decommissioned and the license terminated.



Crystal River 3

Crystal River Nuclear Generating Plant Unit 3 (CR-3) was a 2,609 MW thermal (MWt), pressurized-water reactor that was licensed to operate from December 1976 to February 20, 2013, and is located on approximately 4,700 acres in Crystal River, FL. During a refueling outage that started on September 26, 2009, CR-3 replaced the steam generators (SGs), requiring a large hole to be made in the containment building structure. When attempting to restore the containment structure following the SG replacement, damage to the containment structure was observed. The licensee attempted to repair the damage, but later decided to decommission the reactor.



The facility is currently transitioning to a SAFSTOR condition, although they are still considering beginning active decommissioning. The licensee submitted the CR-3 post-shutdown decommissioning activities report (PSDAR), including the site-specific cost estimate, on December 2, 2013. Transfer of project management responsibility from the Office of Nuclear Reactor Regulation to the Decommissioning Program was completed in 2015. The plant began construction of an ISFSI in 2016 and began loading fuel in the summer of 2017. Fuel transfer to the ISFI was completed in January 2018. Estimated date for license termination is 2074.

The licensee began construction of an ISFSI in 2016, and begin loading fuel in summer 2017. Fuel transfer to the ISFSI was completed in January 2018. Currently, major decommissioning efforts are not planned for approximately 50 years while the licensee remains in SAFSTOR. Crystal River will retain its 10 CFR Part 50 license until the fuel is removed from the ISFSI.

Dresden Unit 1

Dresden Unit 1 (Dresden 1) produced power commercially from August 1, 1960, to October 31, 1978, and is now designated a Nuclear Historic Landmark by the American Nuclear Society. Dresden 1 was taken off line on October 31, 1978, to backfit the unit with equipment to meet new Federal regulations and to perform a chemical decontamination of major piping systems. While the unit was out of service for retrofitting, additional regulations were issued as a result of the March 1979 accident at Three Mile Island. The estimated cost to bring Dresden 1 into compliance with these regulations was more than $300 million. Commonwealth Edison, the owner of the facility, concluded that the age of the unit and its relatively small size did not warrant the added investment and submitted a Decommissioning Plan to the NRC. The NRC approved the Decommissioning Plan in September 1993. Dresden 1 is currently in SAFSTOR.

During the SAFSTOR period, through 2027, the Dresden 1 facility will be subjected to periodic inspection and monitoring. These activities will include condition monitoring of the ISFSI, ongoing environmental surveys, and maintenance of equipment required to support the SAFSTOR condition of the facility. The licensee plans that decontamination and dismantlement of Dresden 1 will take place from 2029 through 2031. A 4-year site restoration delay will follow the major decontamination and dismantlement of Dresden 1 to allow for the decontamination and dismantlement of Units 2 and 3, with completion of these activities tentatively planned for 2035. Site restoration will be conducted in 2035 and 2036, concluding with a final site survey in late 2036. The licensee will monitor the ISFSI complex with site security and periodic inspections until final transfer of the spent fuel to DOE.

Fermi Unit 1

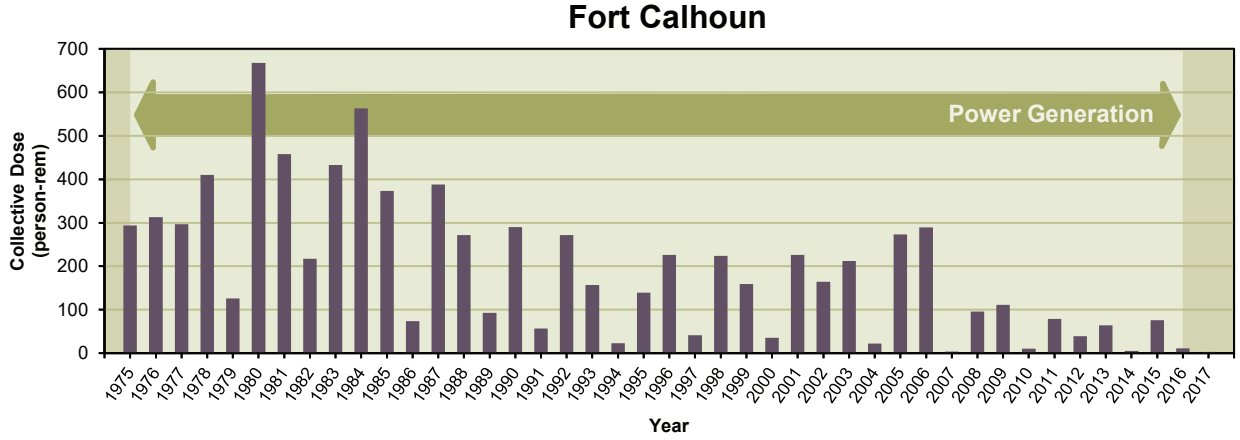
The Enrico Fermi Atomic Power Plant Unit 1 (Fermi 1) was a fast breeder reactor power plant cooled by sodium and operated at essentially atmospheric pressure. The reactor plant was designed for a maximum capacity of 430 MW; however, the maximum reactor power was 200 MW. The primary system was filled with sodium in December 1960 and criticality was achieved in August 1963. The reactor was tested at low power in the first couple of years of operation. Power ascension testing above 1 MW began in December 1965, immediately following receipt of the high-power operating license. In October 1966, during power ascension, a zirconium plate at the bottom of the reactor vessel became loose and blocked sodium coolant flow to some fuel subassemblies. Two subassemblies started to melt. Radiation monitors

alarmed and the operators manually shut down the reactor. No abnormal releases to the environment occurred. Three years and nine months later, the cause had been determined, cleanup was completed, and fuel was replaced; Fermi 1 was restarted. In 1972, the core was approaching the burnup limit. In November 1972, the Power Reactor Development Company made the decision to decommission Fermi 1.

The fuel and blanket subassemblies were shipped off site in 1973. The nonradioactive secondary sodium system was drained and the sodium was sent to Fike Chemical Company. The radioactive primary sodium was stored in storage tanks and in 55-gallon drums until the sodium was shipped off site in 1984. Decommissioning of the Fermi 1 plant was originally completed in December 1975. The license for Fermi 1 expires in 2025. The licensee submitted a revised license termination plan (LTP) in March 2010, and the NRC staff completed an expanded acceptance review of the revised LTP for Fermi Unit 1. The NRC LTP review was deferred at the request of the licensee in 2012.

Fort Calhoun

Fort Calhoun Station (FCS) was a 1,500 Mwt, pressurized water reactor that began operation in 1973 and is owned by the Omaha Public Power District (OPPD). The reactor was permanently shut down on October 24, 2016. By letter dated November 13, 2016, OPPD certified that all fuel had been removed from the reactor.



OPPD submitted the FCS Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC on March 30, 2017. In the PSDAR, OPPD stated its intention to move all of the spent nuclear fuel into dry cask storage by the end of 2022 and put the plant into SAFSTOR until it is ready to fully decommission the facility starting in 2060. License termination is scheduled to take place by 2065.

GE Vallecitos Boiling Water Reactor (VBWR)

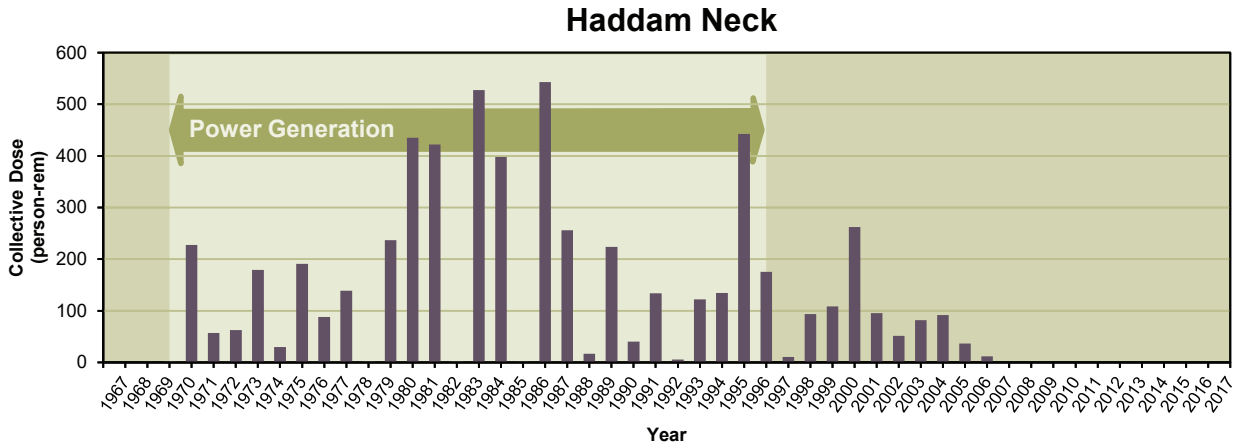
The VBWR was shutdown in 1963 and NRC issued a possession only license in 1965. The license was renewed in 1973 and the license has remained effective under the provisions of 10 CFR 50.51(b). The facility has been maintained in SAFSTOR condition with a limit of 60 years under 10 CFR 50.82(a)(3). The licensee has requested to maintain the facility in SAFSTOR past 60 years until other ongoing nuclear activities are terminated so that the entire site can be decommissioned in an integrated fashion. The spent fuel has been removed from the site.

GE ESADA Vallecitos Experimental Superheat Reactor (EVESR)

On April 15, 1970, NRC authorized the licensee to possess, but not operate the reactor. The license was renewed on June 11, 1976, and remains in effect under the provisions of 10 CFR 50.51(b). The facility has been maintained in SAFSTOR condition. The facility is next to the Vallecitos Boiling Water Reactor which is also in SAFSTOR. The licensee plans to maintain the facility in SAFSTOR until other ongoing nuclear and radioactive activities are also to be decommissioned to provide an integrated site decommissioning.

Haddam Neck – Connecticut Yankee

Haddam Neck was a 619 MWe (1,825 MWt) pressurized-water reactor that began commercial operation in January 1968, and ceased power operations in 1996. Decommissioning activities began in May 1998. Steam generators, reactor coolant pumps, the pressurizer, the reactor vessel, and shield wall blocks from the reactor building were disposed of off site and demolition of the administration and turbine buildings began in spring 2004. As of March 30, 2005, all spent fuel and greater-than-Class-C waste had been transferred to the ISFSI, which is currently operational.



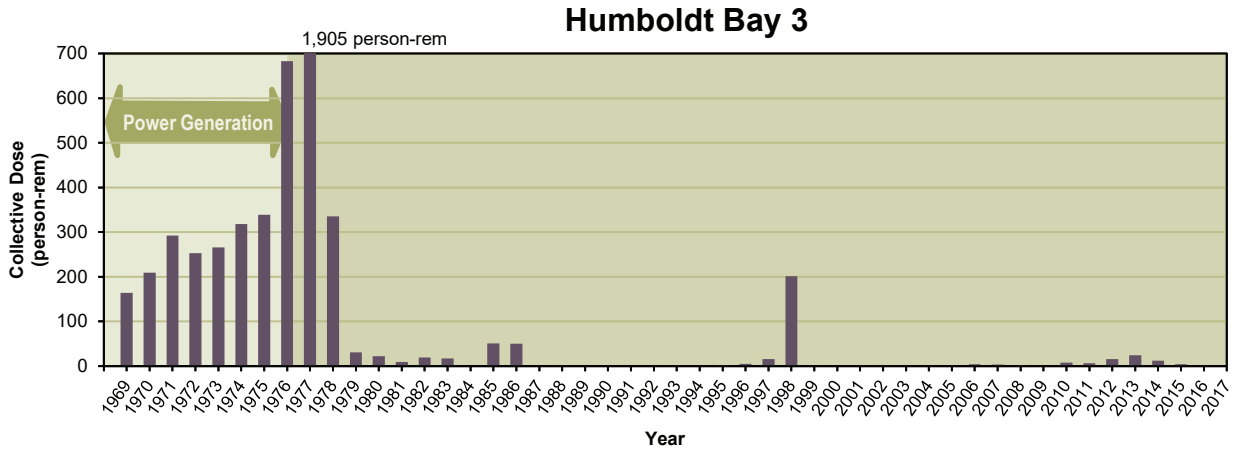
Decommissioning at Haddam Neck was completed in 2007 and the applicable NRC reactor license under Title 10 of the Code of Federal Regulations (10 CFR) was terminated.

Humboldt Bay Unit 3

Humboldt Bay Power Plant (HBPP) Unit 3 produced power commercially from August 1, 1963, to July 1976. In July 1976, Unit 3 was shut down to conduct seismic modifications. In 1983, with the plant still shut down, Pacific Gas & Electric, the owner of the facility, determined that required seismic modifications and the requirements imposed as a result of the accident at Three Mile Island made continued operations no longer economically feasible and decided to decommission the plant. The NRC approved the licensee's Decommissioning Plan in July 1988.

The licensee submitted a PSDAR in February 1998 and has begun incremental decommissioning activities. In December 2003, the licensee submitted an ISFSI application to the NRC. Humboldt Bay was to have unique dry cask storage because of the short length of its fuel assemblies. Moreover, the casks were to be stored below-grade to accommodate regional seismicity issues, security concerns, and site boundary dose limits. The NRC issued

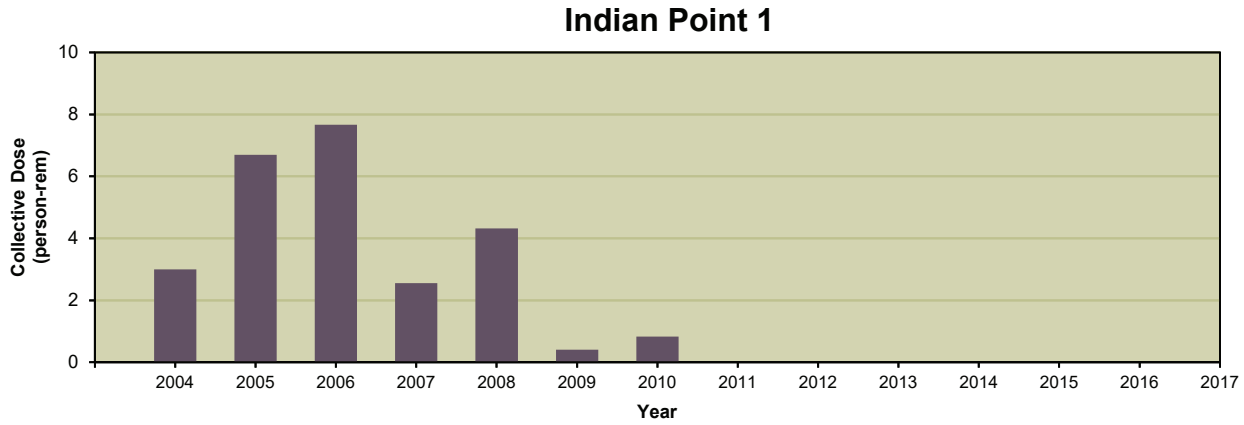
the ISFSI license on November 18, 2005, and the licensee began constructing the ISFSI in 2007. Following fuel loading into the ISFSI in 2008, the licensee began constructing new combustion units in 2008 and 2009 to replace the old Humboldt Bay fossil Units 1 and 2. Decommissioning activities at the old fossil Units 1 and 2 were completed in 2013. During this period, decommissioning of Unit 3 commenced and HBPP successfully completed removal of the reactor vessel internals in September 2013. The Humboldt Bay Unit 3 decommissioning status is DECON. Remaining Activities include site restoration and radiological final status surveys. It is estimated that all decommissioning activities will be completed by December 31, 2019. The ISFSI remains under a separate NRC license.



During 2012, the NRC staff issued two 10 CFR 20.2002 approvals for alternative disposal of Humboldt Bay decommissioning debris and soils. The NRC approved the LTP in 2016. Remaining regulatory activities include review of the licensee's final status surveys and the performance of NRC confirmatory radiological surveys prior to license termination. The ISFSI remains under a separate NRC license. Humboldt Bay Unit 3 will retain its 10 CFR Part 50 license until the fuel is removed from the ISFSI.

Indian Point Unit 1

Indian Point Unit 1 (IP-1) produced power commercially from August 1962 to October 1974. IP-1 was shut down on October 31, 1974, because the emergency core cooling system did not meet regulatory requirements. Some decommissioning work associated with spent fuel storage was performed from 1974 through 1978. By January 1976, all spent fuel had been removed from the reactor vessel. The NRC order approving SAFSTOR was issued in January 1996.

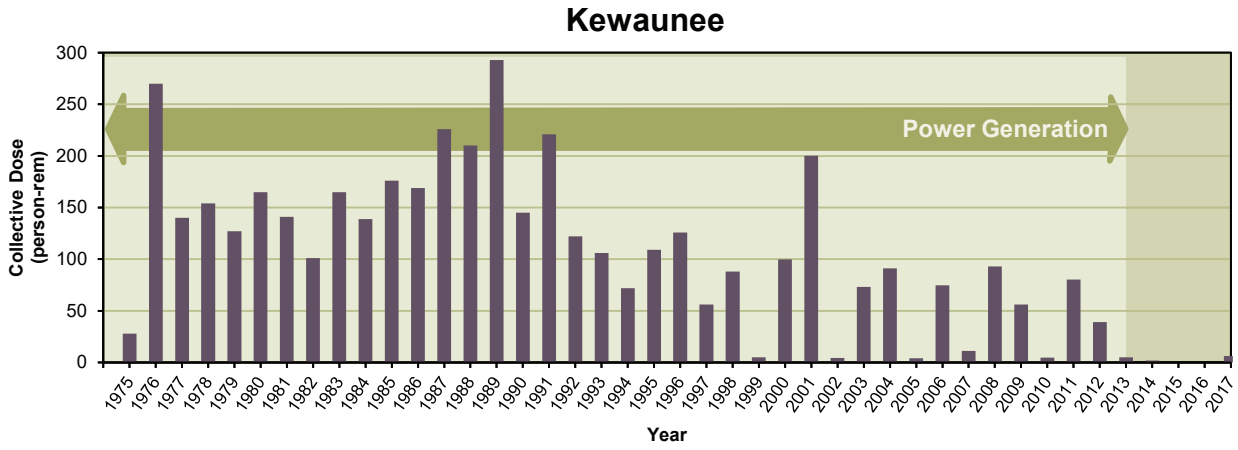


A PSDAR public meeting was held on January 20, 1999. The licensee plans to decommission IP-1 with Indian Point Unit 2 (IP-2), which is currently in operation. The licensee does not plan to begin active decontamination and decommissioning of IP-1 until IP-2 ceases operation. In February 2017, the licensee notified the NRC that IP-2 will be shutdown by April 30, 2020.

Kewaunee

Kewaunee Power Station was a 1,772 MWt, pressurized-water reactor that was licensed to operate from December 1973 to May 2013. Kewaunee is located in Carlton, WI, on Lake Michigan about 35 miles southeast of Green Bay.

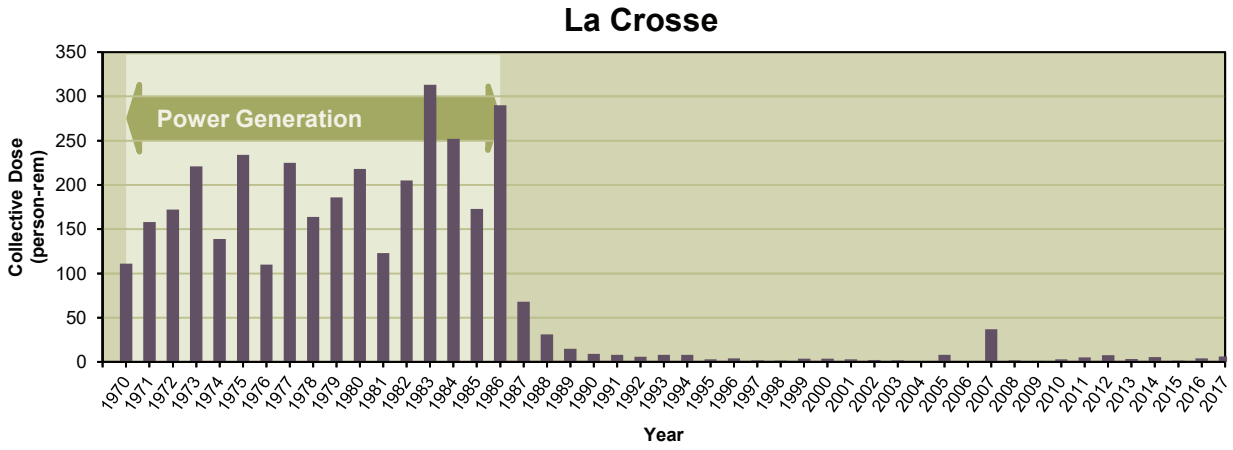
At present, the facility has transitioned to a SAFSTOR condition. Kewaunee submitted a PSDAR and conducted a public meeting near the site in April 2013. Current planning is to transfer the entire spent fuel pool inventory to dry cask storage at its onsite IFSFI by December 2016. Major decommissioning and dismantlement activities are scheduled to begin in 2069 with license termination following in 2073. Project management responsibility from the Office of Nuclear Reactor Regulation to the Decommissioning Program was completed on March 13, 2015.



La Crosse

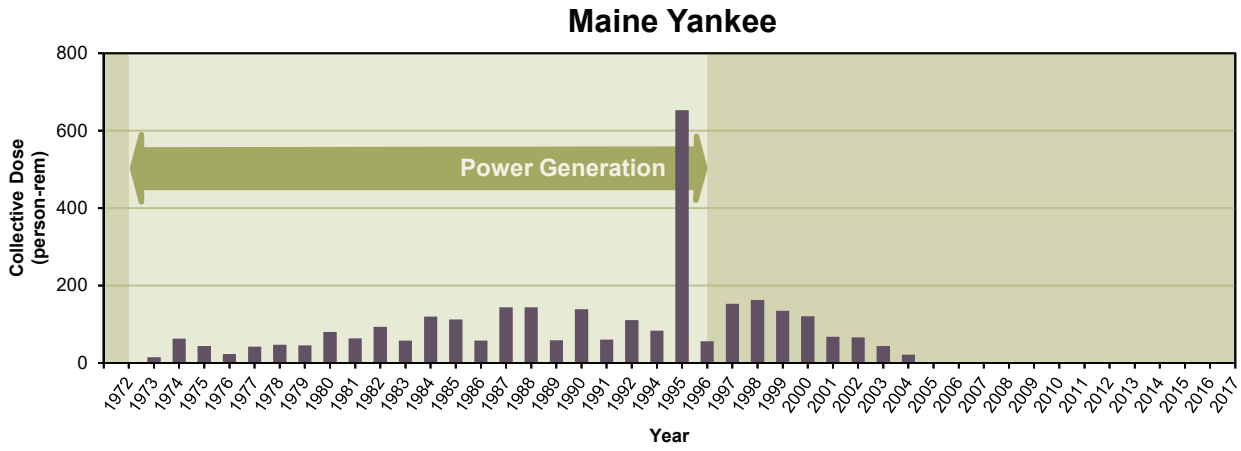
The La Crosse Boiling-Water Reactor (LACBWR) produced power commercially from November 1, 1969, to April 30, 1987. The plant was one of a series of demonstration plants funded, in part, by the U.S. Atomic Energy Commission (AEC). The nuclear steam supply system and its auxiliaries were funded by the AEC, and the balance-of-plant equipment was funded by the Dairyland Power Cooperative (DPC). The AEC later sold the plant to DPC and provided it with a provisional operating license. LACBWR was shut down on April 30, 1987, and the NRC approved its Decommissioning Plan on August 7, 1991.

Because the NRC approved DPC's DP before August 28, 1996 (the effective date of an NRC final rule concerning reactor decommissioning (61 FR 39278; July 29, 1996)), the DP is considered the Post-Shutdown Decommissioning Activities Report (PSDAR) for LACBWR (see 10 CFR 50.82). The PSDAR public meeting was held on May 13, 1998, and subsequent updates to the LACBWR decommissioning report have combined the DP and PSDAR into the "LACBWR Decommissioning Plan and Post-Shutdown Decommissioning Activities Report" (D-Plan/PSDAR). DPC constructed an onsite Independent Spent Fuel Storage Installation (ISFSI) and completed the movement of all 333 spent nuclear fuel elements from the Fuel



Element Storage Well to dry cask storage at the ISFSI by September 19, 2012. The remaining associated buildings and structures are ready for dismantlement and decommissioning.

By order dated May 20, 2016, the NRC approved the direct transfer of Possession Only License No. DPR-45 for LACBWR from DPC to LaCrosse*Solutions*, LLC (LS), a wholly-owned subsidiary of Energy*Solutions*, LLC, and approved a conforming license amendment, pursuant to 10 CFR 50.80, "Transfer of licenses," and 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit." The order was published in the *Federal Register* on June 2, 2016 (81 FR 35383). The transfer assigns DPC's licensed possession, maintenance, and decommissioning authorities for LACBWR to LS in order to implement expedited decommissioning at the LACBWR site. By letter dated June 27, 2016, as supplemented by letter dated December 1, 2016, LS submitted the LTP for LACBWR in accordance with 10 CFR 50.82(a)(9). Final decommissioning activities at LACBWR are currently underway and are scheduled to be completed in 2018.



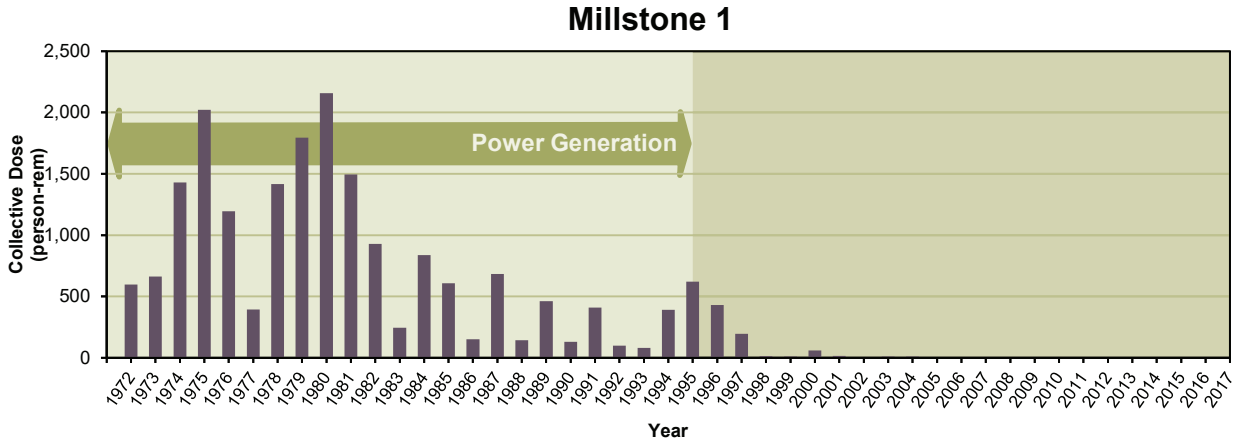
Maine Yankee

Maine Yankee was an 860 MWe pressurized-water reactor located on Bailey Point in Wiscasset, ME, that started commercial power operations in 1972. The Maine Yankee plant was shut down on December 6, 1996. Certification of permanent cessation of operations was submitted on August 7, 1997. The PSDAR was submitted on August 27, 1997, and the NRC approved the LTP on February 28, 2003.

In 2003, the reactor pressure vessel was shipped to Barnwell, SC via barge. Spent nuclear fuel and greater-than-Class-C waste were transferred to the onsite ISFSI between August 2002 and February 2004. Decommissioning was completed in June 2005, and Maine Yankee will retain its 10 CFR Part 50 license until the fuel is removed from the ISFSI. The NRC LTP approval date is to be determined.

Millstone Unit 1

Millstone Unit 1 produced power commercially from December 28, 1970, to November 4, 1995. Millstone Unit 1 was a single-cycle, boiling-water reactor with a reactor thermal output of 2011 MW and a net electrical output of 652.1 MW. The unit was shut down on November 4, 1995. On July 21, 1998, pursuant to 10 CFR 50.82(a)(1)(i) and 10 CFR 50.82(a)(1)(ii), the licensee certified to the NRC that, as of July 17, 1998, Millstone Unit 1 had permanently ceased operations and that fuel had been permanently removed from the reactor vessel. Dominion Nuclear Connecticut, the owner of the facility, submitted its PSDAR to the NRC on June 14, 1999, and has chosen a



combination of DECON and SAFSTOR options. After a formal assessment of spent fuel storage options in 2007, the licensee concluded that they would keep the Millstone Unit 1 fuel in the Spent Fuel Pool, in a SAFSTOR status, until 2048 rather than move the fuel to an ISFSI.

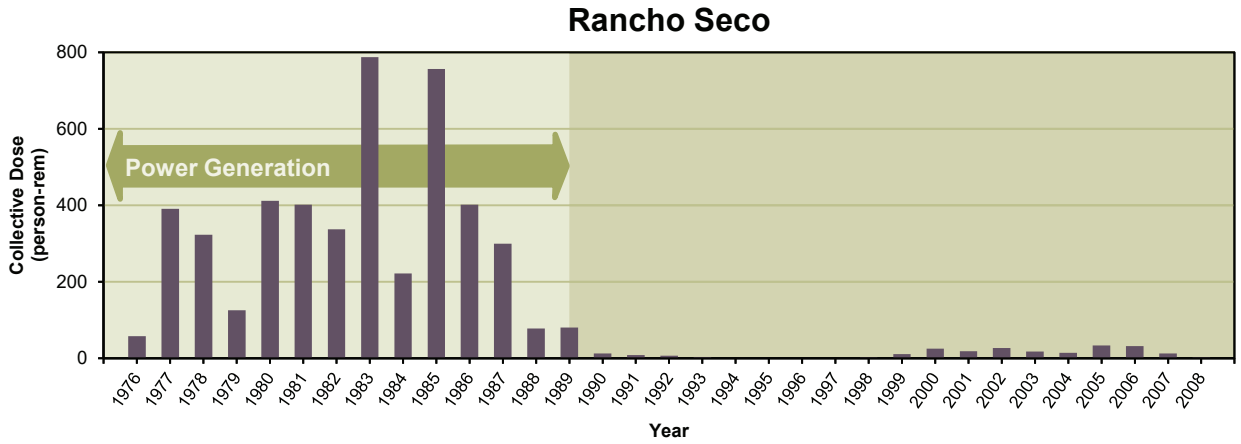
Safety-related structures, systems, and components and those important to safety remaining at Millstone Unit 1 are associated with the spent fuel pool island where the spent fuel is stored. Besides nonessential systems that support the balance-of-plant facilities, the remaining plant equipment has been de-energized, disabled, or removed from the unit and can no longer be used for power generation. Irradiated reactor vessel components have been removed. The reactor cavity and vessel have been drained, and a radiation shield has been installed to limit occupational radiation doses to workers. Currently, the licensee has estimated 2056 for completion of all decommissioning activities and the estimated closure date of this site.

Peach Bottom 1

Peach Bottom Atomic Power Station Unit 1 was a 200 Mwt, high temperature, gas cooled reactor that was operated from June of 1967 to its final shutdown on October 31, 1974. All spent fuel has been removed from the site, and the spent fuel pool is drained and decontaminated. The reactor vessel, primary system piping, and steam generators remain in place. The facility is currently in a SAFSTOR condition. Final decommissioning is not expected until 2034 when Units 2 and 3 are scheduled to shut down.

Rancho Seco

Rancho Seco Nuclear Generating Station was a 913 MW pressurized-water reactor owned by the Sacramento Municipal Utility District (SMUD). Rancho Seco permanently shut down in June 1989, after approximately 15 years of operation. The licensee was granted a site-specific 10 CFR Part 72 license for an onsite ISFSI on June 30, 2000. SMUD completed transfer of all the spent nuclear fuel to the Rancho Seco ISFSI in August 2002. Rancho Seco completed decommissioning of the former reactor site in 2009 and the site was released with the exception of a 6-acre ISFSI site and a class B and C waste storage building. The B/C waste building was decommissioned in 2017, and the 10 CFR Part 50 license was terminated on August 31, 2018. The ISFSI is still in operation.

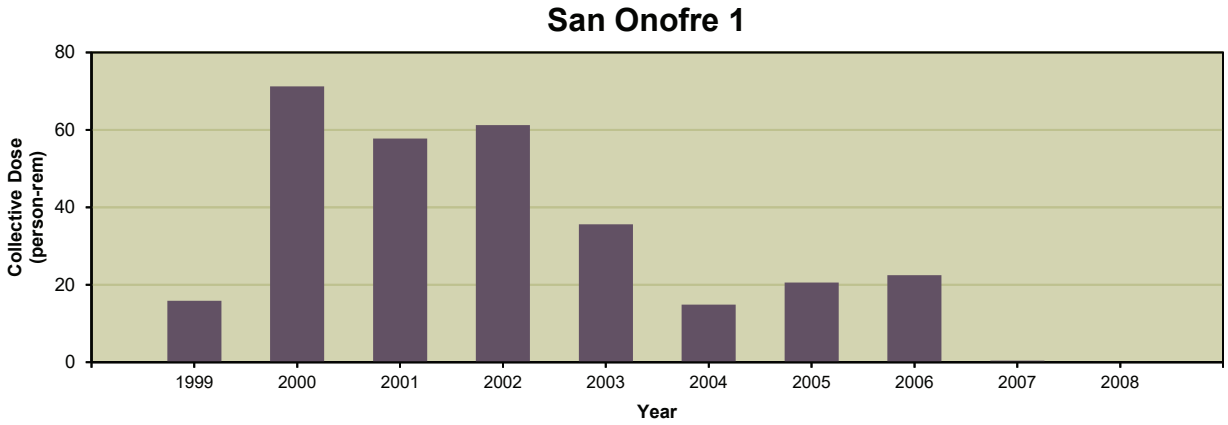


San Onofre Unit 1

The San Onofre Nuclear Generating Station Unit 1 (SONGS-1), operated by Southern California Edison (SCE), produced power commercially from January 1, 1968, to November 30, 1992. Unit 1 was a Westinghouse three-loop pressurized-water reactor with a reactor thermal output of 1,347 MW.

Defueling of SONGS-1 was completed on March 6, 1993, and the NRC approved the Permanently Defueled Technical Specifications on December 28, 1993. On November 3, 1994, SCE submitted a Proposed Decommissioning Plan to place SONGS-1 in SAFSTOR until the shutdown of SONGS-2 and SONGS-3. However, on December 15, 1998, SCE submitted the PSDAR for SONGS-1 to begin decontamination in 2000. Since that time, SCE has been actively decommissioning the facility, which has been almost entirely dismantled. SCE has removed and disposed of most of the structures and equipment. The SONGS-1 turbine building was removed and the licensee completed internal segmentation and cutup of the reactor pressure vessel. The licensee plans to store the vessel on site for the foreseeable future, as long as licensed activities are ongoing. In addition, the licensee transferred SONGS-1 spent fuel to an onsite generally licensed ISFSI. The ISFSI will be expanded into the area previously occupied by SONGS-1, as needed, to store all spent fuel from SONGS-2 and SONGS-3.

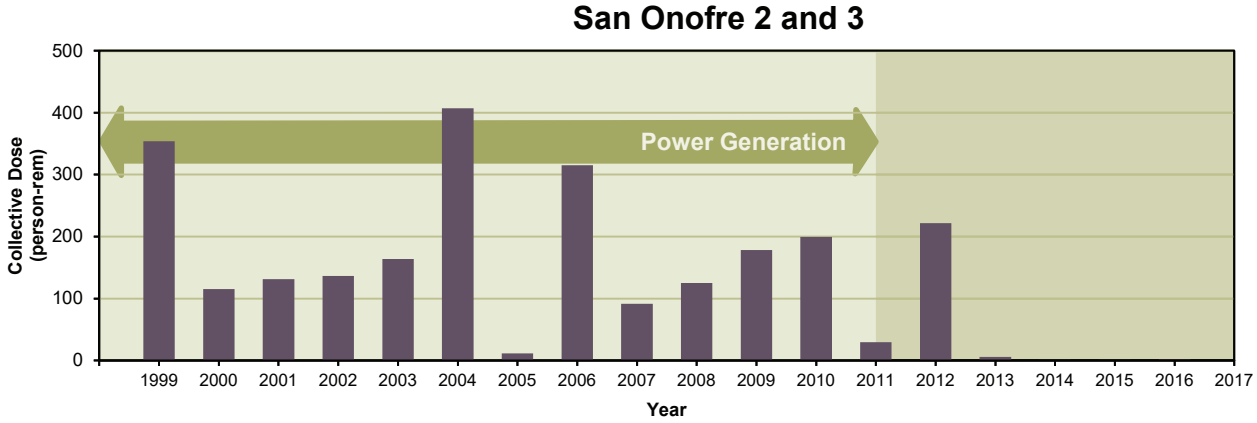
In February 2010, the NRC staff issued a license amendment to release offshore portions of the SONGS-1 cooling intake and outlet pipes for unrestricted use. It is estimated that all decommissioning activities for SONGS-1 will be completed in 2030.



San Onofre Units 2 and 3

The San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS), operated by the Southern California Edison Company (SCE) is located approximately 4 miles south of San Clemente, California. SONGS, Units 2 and 3, are Combustion Engineering 1127 MWe pressurized water reactors, which were granted Facility Operating Licenses NPF-10 on February 16, 1982, and NPF-15 on November 15, 1982, respectively. In June 2013, pursuant to 10 CFR 50.82(a)(1)(i), the licensee certified to the NRC that as of June 7, 2013, operations had ceased at SONGS, Units 2 and 3. The licensee subsequently certified, pursuant to 10 CFR 50.82(a)(1)(ii), that all fuel had been removed from the reactor vessels of both units, and committed to maintaining the units in a permanently defueled status. Therefore, pursuant to 10 CFR 50.82(a)(2), SCE's 10 CFR part 50 licenses no longer authorize operation of SONGS or emplacement or retention of fuel into the reactor vessels. The licensee is still authorized to possess and store irradiated nuclear fuel. Irradiated fuel is currently being stored onsite in spent fuel pools (SFPs) and in dry casks at an Independent Spent Fuel Storage Installation (ISFSI).

The PSDAR for SONGS, Units 2 and 3, was submitted on September 23, 2014, and the associated public meeting was held on October 27, 2014, in Carlsbad, California. The NRC confirmed its review of the SONGS, Units 2 and 3, PSDAR and addressed public comments in a letter dated August 20, 2015. On July 17, 2015, the NRC approved the Permanently Defueled Technical Specifications for SONGS, Units 2 and 3. It is estimated that all decommissioning activities for SONGS, Units 2 and 3, will be completed in 2030. San Onofre Units 2 and 3 will retain its 10 CFR Part 50 license until the fuel is removed from the ISFSI.



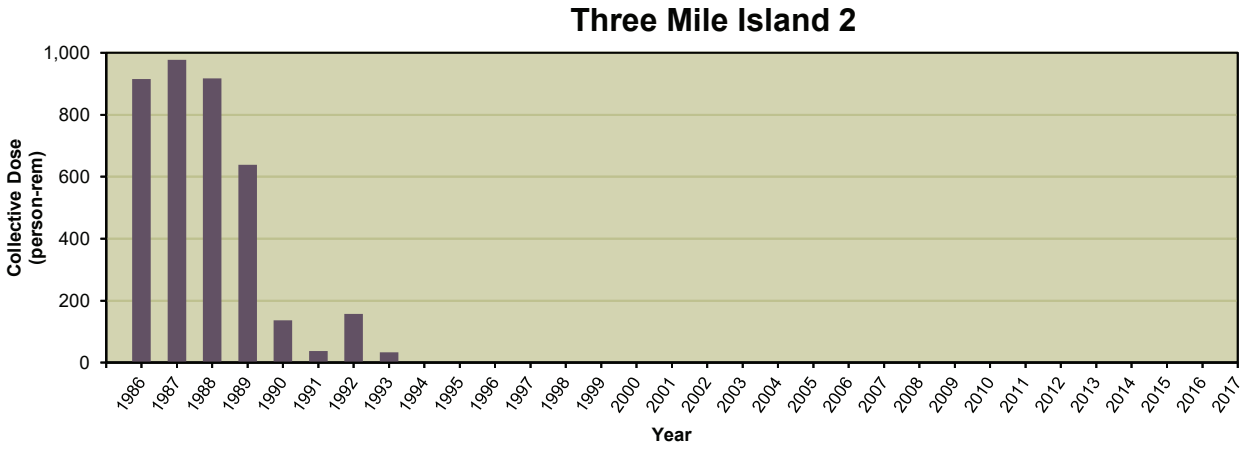
Savannah, Nuclear Ship

The Nuclear Ship (NS) Savannah was removed from service in 1970 and the fuel was removed from the ship in October 1971. The ship has been designated a national historic landmark by the American Nuclear Society. The Savannah is currently berthed in Baltimore, Maryland and is transitioning from SAFSTOR to DECON.

Three Mile Island Unit 2

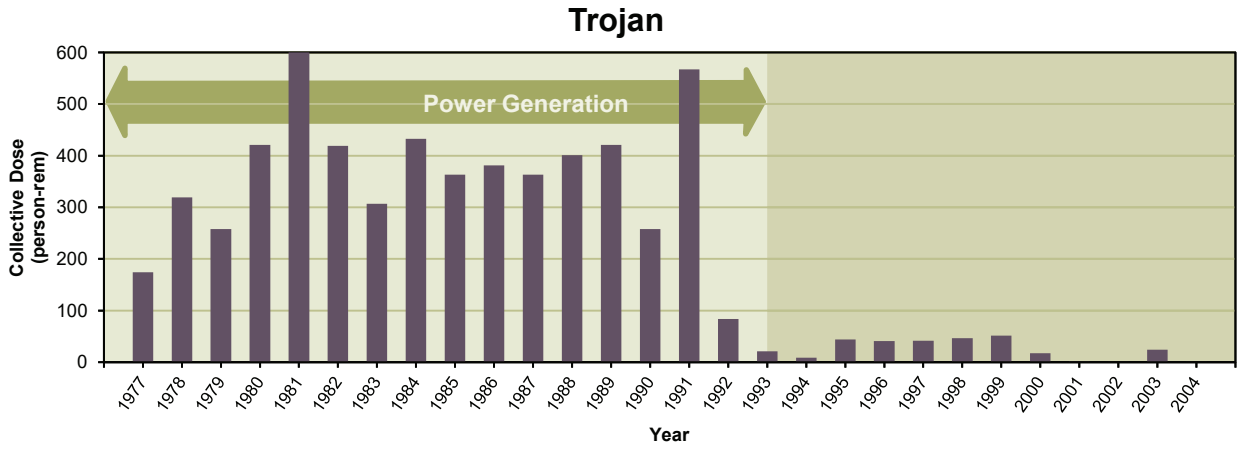
Three Mile Island Unit 2 (TMI-2) produced power commercially from December 30, 1978, to March 28, 1979. On March 28, 1979, the unit experienced an accident that resulted in severe damage to the reactor core. TMI-2 has been in a non-operating status since that time. The licensee conducted a substantial program to defuel the reactor vessel and decontaminate the facility. The plant defueling was completed in April 1990. All spent fuel has been removed except for some debris in the reactor coolant system. The removed fuel is currently in storage at Idaho National Laboratory, and the DOE has taken title and possession of the fuel.

TMI-2 has been defueled and decontaminated to the extent the plant is in a safe, inherently stable condition suitable for long-term management. This long-term management condition is termed post-defueling monitored storage, which was approved in 1993. It is estimated that decommissioning activities for TMI-2 will be completed in 2036. The NRC LTP approval date is to be determined. There is no significant dismantlement underway. The plant shares equipment with the operating Three Mile Island Unit 1 (TMI-1). TMI-1 was sold to AmerGen (now Exelon) in 1999. GPU Nuclear retains the license for TMI-2 and is owned by FirstEnergy Corp. GPU Nuclear contracts with Exelon for maintenance and surveillance activities. The licensee plans to decommission TMI-2 independently of TMI-1, but may coordinate some TMI-2 decommissioning activities to support TMI-1 decommissioning. Three Mile Island Unit 2 will retain its 10 CFR Part 50 license until the fuel is removed from the ISFSI.



Trojan

The Trojan plant was shut down in November 1992, and the SGs and reactor vessel were shipped to the Hanford site. The licensee was granted a site-specific 10 CFR Part 72 license for an onsite ISFSI in March 1999 that is still in operation. The licensee began spent fuel transfer to the ISFSI in December 2002 and finished fuel transfer in August 2003.



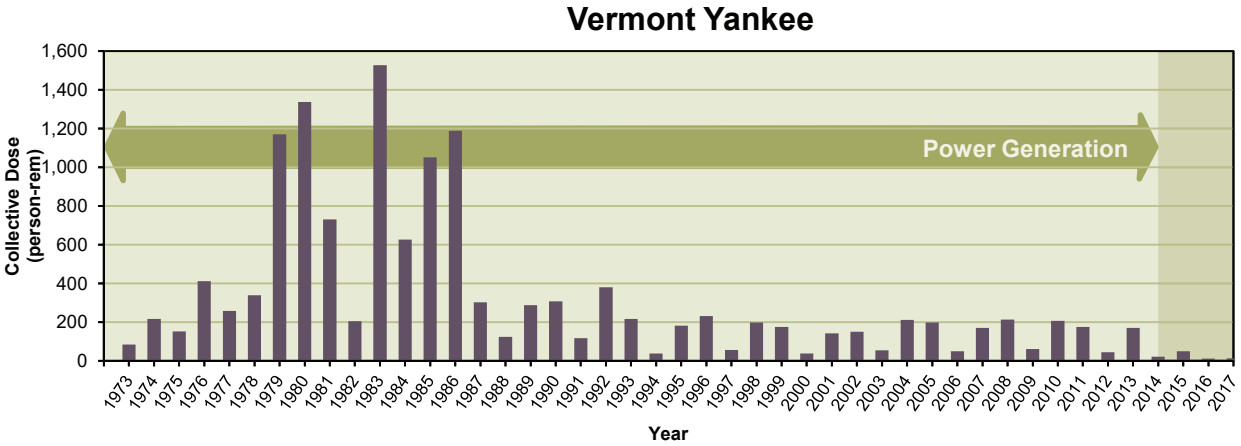
In December 2004, the Trojan Nuclear Plant completed decommissioning activities. The NRC terminated Trojan's 10 CFR Part 50 operating license on May 23, 2005.

Vermont Yankee

Vermont Yankee Nuclear Power Station was a 1,912 Mwt, boiling-water reactor that began operation in 1972. The reactor was permanently shut down on December 29, 2014, and the fuel was removed from the reactor on January 12, 2015.

Entergy, which owns the facility, submitted the Vermont Yankee PSDAR to the NRC on Dec. 19, 2014. In the report, Entergy stated its intention to keep the plant in SAFSTOR until it is ready to fully decommission the facility in 2073. Entergy completed movement of the spent nuclear fuel to dry cask storage in August 2018.

On February 9, 2017, Entergy and NorthStar Group Services, Inc. (NorthStar) submitted a request to transfer the Vermont Yankee Nuclear Power Station license from Entergy to NorthStar for the purposes of decommissioning. This transfer, if approved, would change the estimated date for closure from 2073 to 2030.

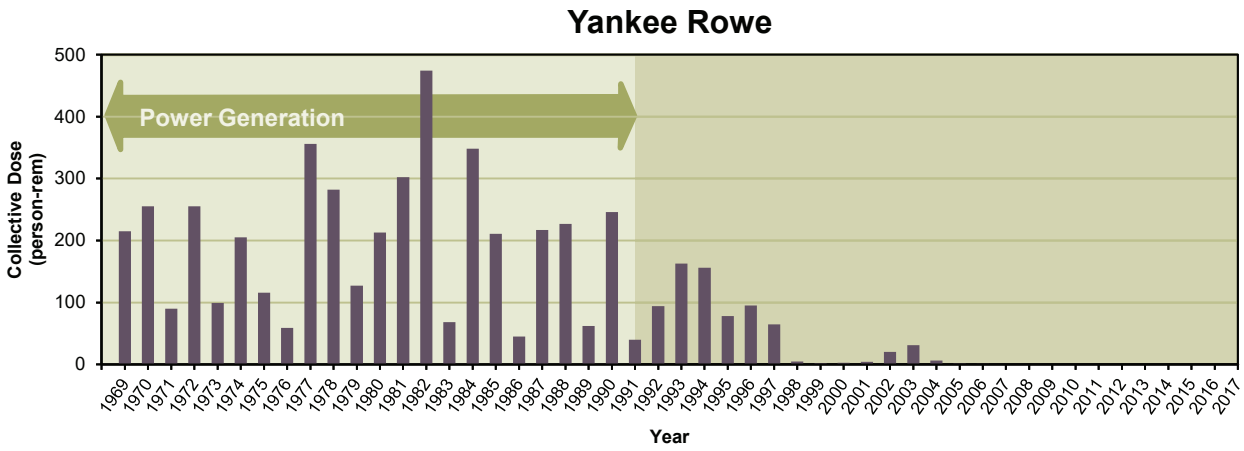


Yankee Rowe

The Yankee Rowe plant was permanently shut down on October 1, 1991, and the SGs were shipped to the Barnwell Low-Level Radioactive Waste Disposal Facility in North Carolina, in November 1993. The reactor vessel was shipped to Barnwell in April 1997.

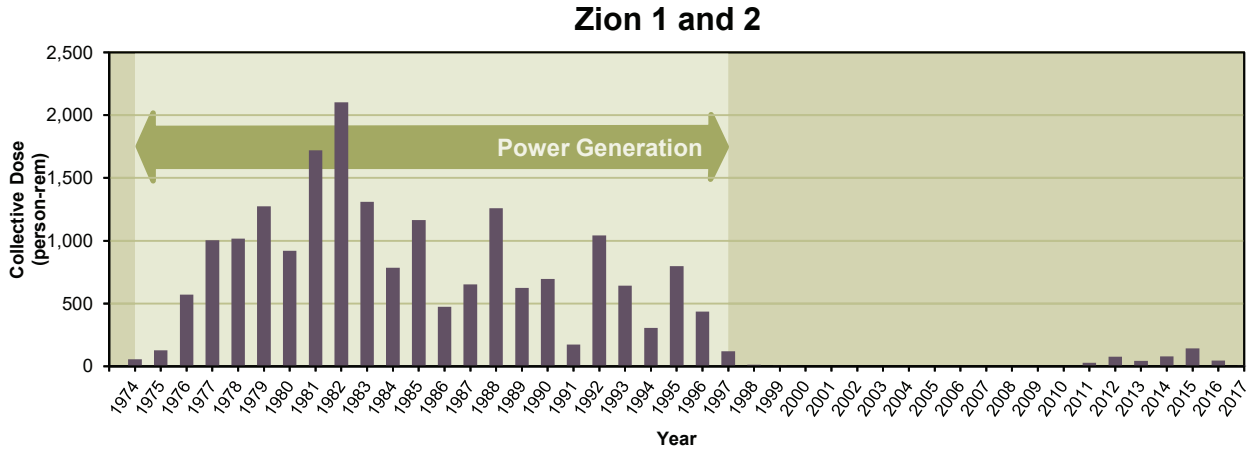
The owner completed construction of an onsite ISFSI and all the fuel from the spent fuel pool was transferred to it.

Yankee Rowe completed decommissioning in 2007. The license for the site was reduced to the two acres surrounding the ISFSI, which is still in operation.



Zion Units 1 and 2

Zion Nuclear Power Station (ZNPS) received a construction permit in December 1968 to begin building two nuclear power reactors. Unit 1 produced power commercially from December 31, 1973, to February 21, 1997, and Unit 2 produced power commercially from September 17, 1974, to September 19, 1996. On April 27, 1997, all fuel from Unit 1 was removed and on February 25, 1998, all fuel from Unit 2 was removed and placed in the spent fuel pool. On January 14, 1998, the Unicom Corporation and ComEd Boards of Directors, the joint owners of the facility, authorized the permanent cessation of operations at ZNPS for economic reasons. ComEd certified, in a letter dated February 13, 1998, to the NRC that operations had ceased at ZNPS.



On March 9, 1998, ComEd informed the NRC that all fuel had been removed from the ZNPS reactor vessels and committed to maintain them permanently defueled.

The NRC acknowledged the certification of permanent cessation of power operation and permanent removal of fuel from the reactor vessels in a letter dated May 4, 1998, and ZNPS was placed in SAFSTOR. The owner submitted the PSDAR, site-specific cost estimate, and fuel management plan on February 14, 2000. The SAFSTOR approach is the intended decommissioning method to be used for ZNPS, which involves removal of all radioactive material from the site following a period of dormancy. In 2010, the NRC staff finalized the transfer of the possession license for Zion Units 1 and 2 from Exelon Generating Company, LLC to Zion Solutions, LLC to facilitate decommissioning. At Zion Units 1 and 2, decommissioning planning activities for the removal of large components were performed during 2011. The NRC staff held a public meeting in April 2015 regarding the LTP for Zion Units 1 and 2, which was submitted in December 2014. Virtually all of the above grade plant structures have been removed. Final site survey and license reduction to the ISFSI is currently planned for 2019-2020. It is estimated that license termination will occur in September 2020.

APPENDIX F

GLOSSARY

2017

Information in this appendix was obtained from Reference 23.

Agreement State: as defined in Title 10 of the *Code of Federal Regulations* (10 CFR) 30.4, means any State with which the Atomic Energy Commission or the U.S. Nuclear Regulatory Commission has entered into an effective agreement under subsection 274b. of the [Atomic Energy] Act [of 1954, including any amendments thereto]. To simplify subsection 274b., an Agreement State is a State that has signed an agreement with the NRC under which the State regulates the use of certain byproduct, source, and small quantities of special nuclear material in that State.

As low as is reasonably achievable (ALARA): as defined in 10 CFR 20.1003, means making every reasonable effort to maintain exposures to radiation as far below the dose limits in 10 CFR Part 20 as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

Average measurable dose: the dose obtained by dividing the collective dose by the number of individuals who received a measurable dose. This is the average most commonly used in this and other reports when examining trends and comparing doses received by workers, because it excludes those individuals receiving a less-than-measurable dose.

Boiling-water reactor (BWR): a reactor in which the water, used as both coolant and moderator, is allowed to boil in the core. The resulting steam can be used directly to drive a turbine and electrical generator, thereby producing electricity.

Byproduct material: as partially defined in 10 CFR 20.1003, means any radioactive material (except special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using special nuclear material; and the tailings or wastes produced by the extraction or concentration of uranium or thorium from ore processed primarily for its source material content.

Breeder: a reactor that produces more nuclear fuel than it consumes. A fertile material, such as uranium-238, when bombarded by neutrons, is transformed into a fissile material, such as plutonium-239, which can be used as fuel. [Ref. 23]

Ceased operations: the date of plant shutdown notification to the NRC.

Ceased power generation: the date the plant ceased to generate electricity.

Class (or lung class or inhalation class): as defined in 10 CFR 20.1003, means a classification scheme for inhaled material according to its rate of clearance from the pulmonary region of the lung. Materials are classified as D, W, or Y, which applies to a range of clearance half-times: for Class D (Days) of less than 10 days, for Class W (Weeks) from 10 to 100 days, and for Y (Years) of greater than 100 days.

Collective dose: as defined in 10 CFR 20.1003, is the sum of the individual doses received in a given period of time by a specified population from exposure to a specified source of radiation.

Committed dose equivalent ($H_{T,50}$): as defined in 10 CFR 20.1003, means the dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following the intake (CDE [$H_{T,50}$]). The acronym CDE is an NRC acronym used for this term.

Committed effective dose equivalent ($H_{E,50}$): as defined in 10 CFR 20.1003, is the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent to these organs or tissues (CEDE [$H_{E,50}$] = $\Sigma W_T H_{T.50}$). The acronym CEDE is an NRC acronym used for this term.

Criticality: the normal operating condition of a reactor, in which nuclear fuel sustains a fission chain reaction. A reactor achieves criticality (and is said to be critical) when each fission event releases a sufficient number of neutrons to sustain an ongoing series of reactions. [Ref. 21]

DECON (immediate dismantlement): soon after the nuclear facility closes, equipment, structures, and portions of the facility containing radioactive contaminants are removed or decontaminated to a level that permits release of the property and termination of the NRC license.

Deep-dose equivalent (H_d): as defined in 10 CFR 20.1003, which applies to external whole-body exposure, is the dose equivalent at a tissue depth of 1 cm (1000 mg/cm^2). The acronym DDE is an NRC acronym used for this term.

Effective dose equivalent (H_E): as defined in 10 CFR 20.1003, is the sum of the products of the dose equivalent to the organ or tissue (H_T) and the weighting factors (W_T) applicable to each of the body organs or tissues that are irradiated (EDE [H_E] = $\Sigma W_T H_T$). The acronym EDE is an NRC acronym used for this term.

ENTOMB: radioactive contaminants that are permanently encased on site in a structurally sound material such as concrete and appropriately maintained and monitored until the radioactivity decays to a level permitting restr icted release of the property.

Exposure: as defined in 10 CFR 20.1003, means being exposed to ionizing radiation or to radioactive material.

FBR: a fast breeder reactor is a nuclear reactor that generates more fissile material than it consumes. These devices achieve this because their neutron economy is high enough to breed more fissile fuel than they use from fertile material, such as uranium-238 or thorium-232.

Independent Spent Fuel Storage Installation (ISFSI): as defined in 10 CFR 72.3, means a complex designed and constructed for the interim storage of spent nuclear fuel, solid reactor-related greater-than-Class-C (GTCC) waste, and other radioactive materials associated with spent

fuel and reactor-related GTCC waste storage. An ISFSI which is located on the site of another facility licensed under 10 CFR Part 72 or a facility licensed under 10 CFR Part 50 of [Title 10 of the *Code of Federal Regulations*] and which shares common utilities and services with that facility or is physically connected with that other facility may still be considered independent.

Lens dose equivalent (LDE): as defined in 10 CFR 20.1003, applies to the external exposure of the lens of the eye and is taken as the dose equivalent at a tissue depth of 0.3 centimeters (300 mg/cm2).

License: as defined in 10 CFR 20.1003, means a license issued under the regulations in 10 CFR Parts 30 through 36, 39, 40, 50, 60, 61, 63, 70, or 72 of [Title 10 of the *Code of Federal Regulations*].

Licensee: as defined in 10 CFR 20.1003, means the holder of the NRC license.

Licensed material: as defined in 10 CFR 20.1003, means source material, special nuclear material, or byproduct material received, possessed, used, transferred, or disposed of under a general or specific license issued by the [Nuclear Regulatory] Commission.

Light-water reactor (LWR): the term used in this report to describe commercial nuclear reactors that use ordinary water as a coolant and are operated for the purposes of generating electricity. Light water reactors include boiling-water reactors (BWRs) and pressurized-water reactors (PWRs).

Measurable dose: a dose greater than zero rem (not including doses reported as "not detectable").

Megawatt-year: unit of electric energy, equal to the energy from a power of 1,000,000 watts over a period of 1 year.

Mode of Intake: the manner of intake into the body: inhalation (H), absorption through the skin (B), oral ingestion (G), and injection (J).

Monitoring year: interval during which the radiation exposure monitoring was performed.

Nonreactor licensees: NRC licensees that are not commercial nuclear power reactors. These licensees are industrial radiographers, fuel processors, fabricators, and reprocessors; manufacturers and distributors of byproduct material; ISFSIs; facilities for land disposal of low-level waste; and geologic repositories for high-level waste.

Number of individuals with measurable dose: the count of unique individuals who received a measurable dose during the monitoring year. In some instances in this report, the number of individuals with a measurable dose may include individuals who are counted more than once,

since they may be monitored at more than one licensee during the year. (See Section 5 on the effect of transient individuals.) Tables that have been adjusted for transient workers are noted in the appropriate footnotes to the tables.

Occupational dose: as defined in 10 CFR 20.1003, means the dose received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation or to radioactive material from licensed and unlicensed sources of radiation, whether in the possession of the licensee or other person. Occupational dose does not include doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released under [10 CFR] 35.75, from voluntary participation in medical research programs, or as a member of the public.

Pressurized-water reactor (PWR): a power reactor in which heat is transferred from the core to an exchanger by high-temperature water kept under high pressure in the primary system. Steam used to turn a turbine and electrical generator is generated in a secondary circuit. The majority of reactors producing electric power in the United States are pressurized-water reactors.

Radiation Safety Officer (RSO): as defined in 10 CFR 33, a person appointed who is qualified by training and experience in radiation protection, and who is available for advice and assistance on radiological safety matters.

Radionuclide: a radioisotope. A radioisotope is an unstable isotope that undergoes spontaneous transformation, emitting radiation. [Ref. 20]

REM: as defined in 10 CFR 20.1004, is the special unit of any of the quantities expressed as dose equivalent. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor (1 rem = 0.01 sievert).

SAFSTOR (often considered 'delayed DECON'): a nuclear facility that is maintained and monitored in a condition that allows the radioactivity to decay; afterwards, it is dismantled.

Shallow-dose equivalent for both maximum extremity (SDE-ME) and whole body (SDE-WB): the external exposure of an extremity, taken as the dose equivalent at a tissue depth of 0.007 centimeters.

Sievert: as defined in 10 CFR 20.1004, is the International System of Units (SI) of any of the quantities expressed as dose equivalent. The dose equivalent in sieverts is equal to the absorbed dose in grays multiplied by the quality factor (1 Sv = 100 rem).

Special nuclear material: as defined in 10 CFR 20.1003, means plutonium, uranium-233, uranium enriched in the isotope 233 or in the isotope 235, and any other material that the [Nuclear Regulatory] Commission, pursuant to the provisions of section 51 of the [Atomic Energy] Act [of 1954, as amended], determines to be special nuclear material, but does not include source material, or any material artificially enriched by any of the foregoing.

Statistical comparisons: For statistical comparisons of averages, a two-sided one-sample t test with a 0.05 significance level (i.e., 95 percent confidence) is used to determine whether the difference between the two averages is significantly different. For values that are not averages, such as total collective dose, a 5-year average from the previous five years (not including the current year under consideration) is calculated with 95 percent confidence interval based on the normal distribution. If the value for the current year falls within the 5-year 95 percent confidence interval, then it is not significantly different; whereas, if the value falls outside (i.e., below the lower limit or above the upper limit), there is an indication of a statistical significant change.

Two-sided one-sample t test formula:

$$t = \frac{\overline{X} - \mu}{\frac{s}{\sqrt{N}}}$$

Where:

t = calculated t statistic
$\overline{X}$ = sample mean
μ = population mean
s = sample standard deviation
n = sample number

Example:

We wish to determine if the average measurable dose for a type of nuclear reactor differs from the previous five years. The five year mean for the average measurable dose is 0.080. The population mean is the current year's average measurable dose, 0.060. The sample standard deviation is 0.01, and the sample number is 5. Using the formula,

$$t = \frac{0.080 - 0.060}{\frac{0.01}{2.236}} = 4.472$$

The two-tailed probability value (as obtained from a Student's t distribution table) given a t-value of 4.472 is 0.006 which is statistically significant at a 0.05 significance level.

Total effective dose equivalent (TEDE): as defined in 10 CFR 20.1003, means the sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures) (TEDE = DDE + CEDE).

Total organ dose equivalent (TODE): as defined in the NRC Regulatory Guide 8.7, the sum of the deep dose equivalent and the committed dose equivalent to the organ receiving the highest dose as described in 10 CFR 20.2106(a)(6).

Transient individual: one who is monitored at more than one licensed site during the calendar year.

Unit availability factor: the unit available hours (the total clock hours in the report period during which the unit operated on line or was capable of such operation) times 100 divided by the period hours.

Weighting factor (W_T): as defined in 10 CFR 20.1003, the weighting factor for an organ or tissue (T) is the proportion of the risk of stochastic effects resulting from irradiation of that organ or tissue to the total risk of stochastic effects when the whole body is irradiated uniformly.

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11. ABSTRACT (200 words or less)

This report summarizes the occupational exposure data that are maintained in the U.S. Nuclear Regulatory Commission (NRC) Radiation Exposure Information and Reporting System (REIRS) database. The bulk of the information contained in this report was compiled from the 2017 annual reports submitted by five of the seven categories of NRC licensees subject to the reporting requirements of Title 10 of the Code of Federal Regulations (10 CFR) 20.2206, “Reports of Individual Monitoring.” Because there are no geologic repositories for high-level waste currently licensed and no NRC-licensed low-level waste disposal facilities currently in operation, only five categories are considered in this report. The annual reports submitted by these licensees consist of radiation exposure records for each monitored individual. These records are analyzed for trends and presented in this report in terms of collective dose and the distribution of dose among the monitored individuals. Annual reports for 2017 were received from a total of 191 NRC licensees from the five categories included in this report. The summation of reports submitted by the 191 licensees indicated that 166,526 individuals were monitored, 71,238 of whom received a measurable dose.

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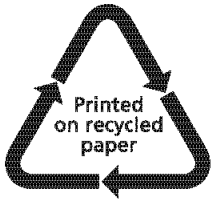

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