AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

October 29, 2008

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

ULNRC-05559

Ameren UE

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
ADDITIONAL INFORMATION PROVIDED TO MISSOURI DNR CONCERNING GROUND WATER MONITORING

The enclosed Union Electric Company (AmerenUE) letter contains additional information provided to the Missouri Department of Natural Resources (DNR) pertaining to the Ground Water Monitoring Program for Callaway Plant. Although the enclosed letter involves no changes to the Callaway NPDES Permit itself, the information is being provided as it may be of public interest in accordance with Callaway Plant Operating License NPF-30, Appendix B, Section 3.2.

This letter does not contain any new commitments. Please contact Tom Elwood, Supervising Engineer, Regulatory Affairs and Licensing, at 573-676-6479 for any questions you may have regarding this issue.

Sincerely,

Luke H. Graessle
Manager, Regulatory Affairs

GPG/nls

Enclosure: Ameren letter to the Missouri Department of Natural Resources dated October 8, 2008.

IE25
NRR

cc: Mr. Elmo E. Collins, Jr.
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U.S. Nuclear Regulatory Commission
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Senior Resident Inspector
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Index and send hardcopy to QA File A160.0761

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Mr. Floyd Gilzow (DNR)

Enclosure to
ULNRC-05559

Ameren Letter to the Missouri Department of Natural Resources
Dated October 8, 2008
(97 Pages)

AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

October 8, 2008

AURA 2008031

Mr. Robert K. Morrison, Chief
Water Pollution Control Branch
Post Office Box 176
Jefferson City, Missouri 65102-0176

SUBJECT: Callaway Plant Groundwater Monitoring Program

Dear Mr. Morrison:

This letter provides our response to your additional questions and concerns related to Callaway's groundwater monitoring program submitted in your letter dated July 22, 2008. As discussed in our meeting at Callaway Plant on September 11, 2008, a more complete description of the plant design and our ground water monitoring wells is included to provide a better understanding of our overall program.

Callaway has a total of six ground water monitoring wells along with the Ground Water Sump (GWS) installed at strategic locations within the area surrounding the main plant structures known as the power block. The power block was constructed within a bathtub shaped excavation when the plant was built during the late 1970's. The excavated area is approximately 30 feet deep situated on top of the Greydon Chert and is lined with approximately three feet of compacted clay material. After placement of building foundations and ancillary infrastructure (pipes, conduits, etc.) the excavation was then back filled with a compacted granular structural fill material and capped with an additional three feet of clay. A cohesive fill consisting of modified loess (clay) was used for several locations to block water flow and prevent seepage along infrastructure pathways to and from this power block area to other areas such as the ultimate heat sink pond. The reactor building, control building, auxiliary building, radwaste building, and portions of the turbine building were constructed near the base of this bathtub. Several drawings were included in Attachment F to the previous letter dated April 18, 2008. These drawings provide cross-sectional views of the Power Block excavated area. Twenty five additional monitoring wells for Unit 1 are located on the plant site outside of this power block area. In addition, numerous wells have been installed on the Callaway Plant site during the past few years to assist in preparing the environmental report for the proposed Unit 2.

The ground water sump and pump were installed during the mid 1990s to assist in the remediation of a site fuel oil leak. This sump is located near the reactor building and the corner of the fuel building and is normally pumped continuously at a rate of near 65 gpm to a waste oil separator. The GWS pump was actually shut down for

about 4 weeks this past summer to support extended maintenance on portions of the waste oil treatment system. Normally the GWS pump is taken out of service for approximately one day every 6 months for routine maintenance or for pump replacement. Therefore, the almost continuous pumping of the GWS pump should eventually draw any potential radioactive contamination within the power block area towards the ground water sump.

Callaway has four specific radioactive source areas within the power block area that could demonstrate a potential risk of leakage to the ground. For reasons stated below, we believe the likelihood of any leakage from these systems or components is extremely small. The four areas include the spent fuel pool liner and transfer canal, the Refueling Water Storage Tank (RWST) and associated underground piping, the underground piping associated with the two Discharge Monitor Tanks (DMTs) and the current plant blowdown/discharge piping to the river. 1) The spent fuel pool is located inside of the fuel building and the bottom of this stainless steel lined concrete pool is approximately six feet above ground level. A leakage detection system of tell-tale drains is installed under this pool and transfer canal to collect any leakage. These tell-tale drains are routed to a small tank where the level is monitored by the plant computer. A system engineer routinely trends and monitors this tank level and any leakage observed. 2) The stainless steel RWST is located above ground and adjacent to the fuel building and the radwaste building. All associated underground piping is welded stainless steel. 3) The two stainless steel DMTs are located next to the radwaste building and are surrounded by a concrete dike designed to contain one tank volume. All underground piping associated with these tanks is welded stainless steel. 4) As you are aware, the old plastic and carbon steel blowdown discharge piping has experienced several breaks or leaks over the years. A new high density polyethylene pipe line is currently being installed and the tie in should be completed before the end of the year. This installation has taken longer than expected due to the abnormal rainfall and flooding we have experienced several times this year.

Tritium is generally the radionuclide expected to have the highest concentration in these radioactive systems. As it moves through the environment as water, it is most likely the first radionuclide to be detected should a leak or spill to ground water occur. However, there is no effective method to analyze tritium present at or near environmental levels with an in-line detector. The EPA limit for tritium in drinking water is 20,000 pCi/liter. Callaway can measure tritium in water samples at concentrations down to approximately 6,000 pCi/liter in our on-site laboratory. By comparison, the contract environmental laboratory we use (located in Chicago) can measure tritium levels in environmental samples to near 200 pCi/liter. Several samples collected from the power block wells have shown positive tritium concentrations at or slightly above background levels. Although these concentrations are very close to background levels, we believe that tritium is being washed out of the air by rainfall and condensation from allowed airborne releases of tritium gas. Tritium gas is released in very low concentrations from both the unit vent and the radwaste vent located within the power block area in compliance with NRC regulations.

AURA 2008031
October 8, 2008

Below is our response to your specific request for additional information.

1. **What is the maximum and minimum length of time that water contaminated with radioactive materials or uranium would take to travel the distance from the center of the bottom of the reactor building to (a) the Groundwater Sump (GWS) and (b) the other monitoring wells given the porosity of the site material?**

Callaway Plant is designed to minimize any leakage of uranium or other radioactive materials from all plant systems and components. For example, the reactor is designed such that the uranium fuel has three barriers to the environment. The first barrier is the Zircaloy-4 fuel cladding surrounding the fuel pellets. The second barrier is the reactor vessel and the third barrier is the three foot thick reinforced concrete containment building (reactor building) that houses the reactor vessel, piping and associated components. Therefore, it is very unlikely that any significant leakage from these systems will occur that would reach groundwater.

Slug tests were recently completed by Paul C. Rizzo Associates, Inc. for several monitoring wells to generate an updated groundwater model for Callaway Unit 1. Results from two slug tests for wells located within the power block area indicate hydraulic conductivity measurements in the range of 0.4 to 1.0 feet per day. Should a leak occur near the bottom of the center of the reactor building or near the bottom of fuel building, it is estimated that it would take ground water approximately 133 days to reach the ground water sump. The time range for travel will be variable depending on the leak location and the hydraulic gradient created by the ground water sump. Without the ground water sump, leaks would take a significant amount of time (years) to detect in other monitoring wells due to the extremely low hydraulic gradient.

The porosity of the site materials is variable and dependant on the location within the plant. The granular fill located within the bathtub consists of primarily structural granular fill with a limited layer of bedding and clay materials. EDP-ZZ-02002, Backfill/Material, Selection, Preparation, Placement & Compaction (provided in Attachment A), contains requirements for the structural backfill and cohesive fill used for the Unit 1 power block excavation. The porosity of the structural backfill is estimated to be near 5%, due to the compaction requirement of a minimum dry density of 138.7 pcf. Outside of the power block the soil consists of silty clay with a porosity estimated to be 35% from laboratory tests of the unconsolidated samples. For compacted silty clay used both within and outside of the power block, the impact of compaction requirements and capillary forces is estimated to reduce the porosity to less than 15%. As a result, porosity varies according to soil material, location and use.

2. **Assuming a rather short length of travel time, given the porous media, how can quarterly monitoring be justified in a leakage detection situation? Three months is a long time for a leak to cause contamination. Wouldn't a continuous monitoring alarm system provide more timely information if the GWS or monitoring wells**

detected radiation and uranium, or in lieu of that, at least weekly monitoring?

Based on the above discussion, Callaway Plant believes that quarterly monitoring of the ground water wells and the GWS for tritium and principle gamma emitters is adequate to determine any type of leakage in the power block area. Travel time through this material occurs over a period of months. In addition, a large leak or spill would be identified rapidly due to inventory monitoring and routine inspections of plant systems, tanks and components. Small leakage to groundwater would be held-up within the bathtub area and eventually be drawn towards the GWS. Finally as mentioned above, there is no in-line tritium monitor available that would be capable of detecting tritium near background environmental levels.

3. **How will Ameren test the groundwater leakage detection system to ascertain if it actually functions as designed? Will this be done by dye tracing or actual Tritium (or other radioactive material) tracing?**

Callaway has no plans to perform a test of the leakage detection capability of the monitoring wells within the power block bathtub. Tritium is both a fission product and an activation product and is present in all radioactive systems at Callaway. Our contract environmental laboratory has detected very low levels of tritium in several samples collected from ground water monitoring wells in the power block area. Tritium has been detected at levels less than 200 pCi/liter. This level is near background and well below the EPA limit of 20,000 pCi/liter for tritium in drinking water.

4. **Please send us a copy of the comprehensive groundwater program monitoring document being generated under the requirements of the NEI Groundwater Protection Initiative *NEI-07-07*, which you indicate will be available in September 2008.**

Attachment B contains a copy of Callaway's Ground Water Protection Program procedures. EDP-ZZ-01136, Ground Water Protection Program, contains the overall guidance for implementing our ground water protection program and meets the requirements of NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document. A copy of HTP-ZZ-07101, Radiological Environmental Monitoring Program, is also included. Attachment 4 of this procedure provides details on the groundwater wells and ponds sampled. Finally, we have included a copy of RP-DTI-ENVIRONMENTAL-SPILLRESP that provides direction for Response to Spills or Leaks of Radioactive Material.

5. **Ameren Services cites a phenomenon known as washout as the reason why tritium levels are sporadically detected in the monitored points at levels well below MCL. Ameren Services states, "The NRC [Nuclear Regulatory Commission] recognizes this phenomenon and has issued Regulatory Issue Summary (RIS) 2008-03 to provide guidance to licenses." However, Ameren Services does not indicate where the**

gaseous phase tritium originates or how it enters the fill material to then be transported to the groundwater by the washout phenomenon.

Gaseous tritium is routinely released from several locations at Callaway Plant including the unit vent and the radwaste vent (photograph provided in Attachment C). These small quantities of gaseous tritium are released in accordance with 10 CFR 20.2001(a)(3) and reported annually in Callaway's Annual Radiological Effluent Release Report. A copy of this annual report is also sent to the Missouri Department of Natural Resources each year at the same time it is submitted to the NRC. A portion of the gaseous tritium released from the operation of Callaway Plant is believed to condense to the ground around the power block as part of a natural process such as through equipment condensation or by rainfall. Operating experience at many other nuclear plants has been reported providing evidence of tritium concentrating in rainwater collected in the vicinity of the power block areas and in condensate collected from building air conditioners. Callaway has confirmed this phenomenon is occurring with on-site testing of condensate from air conditioning units.

6. **Not enough data has been submitted pertaining to groundwater flow in the power block, therefore an assessment as to the validity of the monitoring points chosen is in question. It is not clear if the chosen monitoring points are in the correct location to detect a release from the Reactor and Fuel buildings. An illustration detailing the locations of the piezometers is needed to determine the apparent groundwater flow direction on the site.**

The Callaway Unit 1 Final Groundwater Model Report prepared by Rizzo and Associates will be provided as soon as the final document is available. Ground water levels in this area indicate that the ground water flow within the power block bathtub is normally drawn towards the ground water sump as expected. Plant buildings such as the auxiliary building and reactor building do provide a partial barrier to the flows from either side of the buildings but any leakage from the area near or around the fuel building or reactor building should not be affected by these structures as it moves toward the groundwater sump. Therefore, we believe the current monitoring wells located within the power block area provide adequate indication of any leakage to groundwater from plant systems, structures or components.

7. **Table 2.4-25 included by Ameren Services contains water level readings from the ten "permanent" piezometers (M1-M10) located at the facility. An item to note is that the readings are from July and August 1979 and may not accurately reflect the current conditions. As figure 2.4-30 was not included in Ameren Services response, the locations of the piezometers are not known. It is possible that at least some of the ten piezometers are located in undisturbed areas and most likely the information won't be of much value concerning the perched groundwater zone in the filled areas. Because the location of the piezometers is not known, we cannot make a judgment as to whether the**

chosen monitoring points are accurately located to detect releases from the potential sources at the Callaway Plant site.

Recently a ground water monitoring study was completed of the general site area for the proposed Callaway Unit 2. This study supports the original ground water hydrology study originally completed for Unit 1. However, no permanent piezometers have been placed within the Unit 1 power block structural fill area.

Attachment D provides a drawing showing the current power block monitoring well locations in relation to buildings and components. The yellow rectangle at the roads surrounding the plant buildings indicates the approximate location of the bathtub area beneath the power block. We believe that the ground water sump and the six power block monitoring wells are positioned appropriately to provide indication of any leakage of radioactive material from a system, structure or component within this power block area. In addition, a more detailed cross-sectional drawing is being generated to provide a better understanding of the power block excavation and location of the monitoring wells.

Water levels are recorded by Terracon for each of the monitoring wells when sampling is conducted each quarter. The table below provides water level elevation data recorded during the past three years for the GWS and for the power block wells. In reviewing the ground water elevations, it is apparent that there is generally a depression within this bathtub area, with the GWS being at the lowest elevation compared to the surrounding wells.

POWER BLOCK WELL WATER LEVEL ELEVATION (FEET)

DATE	GWS	936	937A	937B	937C	937D	937E	937F
April 2006	824.1	827.0			827.6	827.4		
July 2006	822.6	826.1	831.6		827.4	827.6		
October 2006	826.2	829.3	830.0	830.7	829.8	829.9		830.6
January 2007	827.6	830.5	831.0	832.0	831.0	831.4		832.1
April 2007	828.0		831.4	832.6	831.7	831.9		832.5
July 2007	827.4	830.7	830.9	832.1	831.2	831.4	831.8	832.1
October 2007	825.8	830.7	830.7	832.1	831.1	831.3	831.7	832.0
January 2008	827.9	830.8	831.4	832.3	831.5	831.8	832.2	832.4
April 2008	828.2	831.2	831.8	832.1	832.1	832.6	833.1	833.2
May 2008	825.5	830.8	831.6	832.3	831.6	832.1	832.3	832.3
June 2008			831.1	832.0	831.5	831.7	831.9	832.0
July 2008	830.9	830.1	830.7	831.2	830.6	830.5		831.0
August 2008	830.6	831.5	831.0	831.1	830.1	830.2		830.8

* GWS pump was out of service for approximately one month during July-August 2008.

8. **The department requested development of cross-sections in the area of the proposed monitoring wells to depict geologic units, areas of backfill, any structural features (utility of piping trenches) that impact the movement of groundwater, and any other hydrogeologic information**

that may be pertinent at the Callaway Plant site. Ameren Services submitted several construction-era cross-sections for various locations across the plant site. As was stated previously, the submitted cross-sectional diagrams were scaled to largely to be of value in the determination of a groundwater monitoring network for the power block area.

Piping trenches such as those providing barriers for the Essential Service Water (ESW) piping between the ESW pumphouse and the Ultimate Heat Sink (UHS) retention pond are lined with clay type materials to prevent water seepage. In addition, the area surrounding the circulating water piping at the edge of the Power Block was constructed on the Graydon Chert conglomerate and back filled with a clay material to prevent groundwater movement into and out of this area. The drawings supplied previously (Attachment F to Letter dated April 18, 2008) are the only cross-sectional drawings available for the power block area. Larger copies of these drawings can be provided to you upon request.

9. **The department requested a complete listing of the radionuclides to be included in the groundwater monitoring program and the sampling methodology, handling and associated laboratory QA/QC information. Ameren Services indicated that the monitoring points are to be analyzed quarterly for tritium and primary gamma emitters. Ameren Services did not indicate which radionuclides the "primary gamma emitters" include.**

A complete list of the "primary gamma emitters" analyzed could include any radionuclide that emits gamma rays within the energy range analyzed and with a half life long enough to allow detection following sampling, shipment, etc. This could include but is not limited to radionuclides such as Co-60, Co-58, Cs-134, Cs-137, Cs-136, Cr-51, Mn-54, I-131, Zr-89, Rb-86-Sb-122, Np-239, Zr-95, Nb-95, Mo-99, Tc-99m, Zr-97, Nb-97, Ba-140, La-140, Be-7, Fe-59, Sb-124, Sb-125, Ag-110m, Zn-65, Cd-109, Ce-141, Ce-144, Ru-105, Ru-103, and Ru-106. All samples are handled and analyzed to the requirements of Regulatory Guide 4.15, Rev. 1 - QUALITY ASSURANCE FOR RADIOLOGICAL MONITORING PROGRAMS (NORMAL OPERATIONS)-EFFLUENT STREAMS AND THE ENVIRONMENT and our environmental laboratory's Quality Assurance Manual.

We believe that this response contains much of the additional information you have requested concerning the Callaway Plant groundwater monitoring program. Unfortunately, the report being prepared to update our current Unit 1 Groundwater Model is not yet complete. This document will be forwarded to you as soon as the final report is received from our contractor. In addition, a drawing is being prepared to provide a better understanding of the power block area. This cross-sectional drawing will include the power block area monitoring wells, details of the excavated bathtub area, general ground water flow and major plant structures. You should receive this additional information by November 30, 2008.

Should you have additional questions or desire further information, please contact John Pozzo (314-554-2280) or Gail Gary (314-554-2824) of the Environmental Services Department.

Sincerely,

Luke H. Graessle
Manager, Regulatory Affairs

GPG/nls

Attachments

AURA 2008031
October 8, 2008

bcc: S. D. Abraham w/o attachments
C. M. Cash w/o attachments
C. C. Graham w/o attachments
R. E. Farnam/J. S. Geyer w/o attachments
J. F. Small/J. H. Howard/D. D. Schultz w/o attachments
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G. P. Gary w/attachments
WQ-3.1.1 w/attachments
A160.0502 w/attachments

ATTACHMENT A

Ameren UE
Callaway Plant

EDP-ZZ-02002

BACKFILL/MATERIAL SELECTION, PREPARATION, PLACEMENT, & COMPACTION

MINOR Revision 004

INFORMATION USE

BACKFILL/MATERIAL SELECTION, PREPARATION, PLACEMENT, & COMPACTION

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INFORMATION USE

BACKFILL/MATERIAL SELECTION, PREPARATION, PLACEMENT, & COMPACTION

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BACKFILL/MATERIAL SELECTION, PREPARATION, PLACEMENT, & COMPACTION

1.0 PURPOSE

1.1. Describes the responsibilities and actions for the selection, preparation, placement and compaction of the bedding, fill and backfill materials within the Power Block, ESWS and UHS Excavation limits.

1.2. Provides guideline for proper installation requirements, but NOT to be construed as complete within its entirety. Section 5.0, of this procedure, references additional specifications governing conditions NOT stipulated in this procedure. Such conditions require additional work instructions implemented into the work authorizing document.

NOTE

Graydon Chert Conglomerate is hard clay with chert fragments, sandstone and sandy chert combined in its original undisturbed natural state.

1.3. Provides protection of the Graydon Chert Conglomerate in all locations and the selection, preparation, placement and compaction of the bedding, fill and backfill materials within the Power Block, ESWS and UHS Excavation limits.

2.0 SCOPE

This procedure covers the selection, preparation, placement and compaction of bedding, fill and backfill materials in all locations at the Callaway Plant within the Power Block, ESWS and UHS Excavation limits.

-END OF SECTION-

3.0 RESPONSIBILITIES

3.1. Engineering

Establishes and maintains the grades for all areas ensuring that they slope away from the Power Block, Essential Service Water System (ESWS) and the Ultimate Heat Sink (UHS) Structures or components until final acceptance of the work.

3.2. Performing Work Group

3.2.1. Complies with all State, Federal and OSHA Regulations pertaining to fill and backfill operations, including nuclear testing methods.

3.2.2. Ensures work performed is in conformity with the lines, grades, typical sections and dimensions, including tolerances, either shown on the drawings or indicated in reference specifications.

3.2.3. When Power Block fill and backfill operations include the use and placement of material described in Section 4.2, Material Designations and Requirements, ensures materials used are obtained from approved sources and be free of stumps, frozen soil, vegetation, rubbish, contamination from other sources and objectionable matter.

3.2.4. Ensures areas designated to receive Power Block fill and backfill are shown on drawings or as provided by Specification 4645-4B(Q), Section 2A, Protection of the Graydon Chert Conglomerate.

3.2.5. Removes unsuitable materials, encountered at or below the design grade, such as soft and soaked earth, vegetation, debris and organic and objectionable matter.

3.2.6. Ensures all work is in accordance with the Current Edition of the "Missouri Standard Specifications for Highway Construction", which shall form a part of these specifications (referenced) to hereafter as the Standard Specifications. Also ensures that modifications and/or additional requirements from the referenced Specifications or contract drawings are adhered to.

3.2.7. Ensures Specification 4645-30A(Q), Final Grading & Drainage Elevation Control, governs where there are conflicts between Standard Specifications, this specification, or Specification 4645-4A(Q), Power Block Fill and Backfill.

3.2.8. Ensures compaction of fills, embankments and cut areas conform to applicable requirements of subsection 203.3 of Standard Specification with the following exceptions:

NOTE

Additional "Q" placement area exist around the UHS Retention Pond, beginning at the top of slope proceeding outward fifty (50) feet.

a. Within the Power Block "Q" Areas bounded by Plant Coordinates N99,535; N100,615; E99,670 and E100,139 the compaction requirements are at least 90 percent of maximum density as determined by ASTM D1557, Method A AND the moisture content of the material at the time of compaction cannot exceed 5 percentage points from the optimum moisture content as determined by ASTM D1557, Method A.

b. Outside the limits of the Power Block Areas as defined in previous step, the compaction requirements are at least 85 percent of maximum density as determined by ASTM D1557.

c. The backfill required for small trenches approximately six (6) inches wide and two (2) feet deep as well as other areas too restrictive for normal compaction procedures are compacted either by a mechanical roller or by hand compaction to the satisfaction of QC by visual inspection.

d. An area around the Outage Maintenance Facility (OMF) was excluded by RFR 09993, Rev. A, from "Q" excavation and backfill requirements. The area is defined within the following boundary: Beginning at a point located N100262.00, E99730.00 thus plant north to a point N100700.00, E99730.00 thus plant west to a point N100700.00, E99450.00 thus plant south to a point N100340.00, E99450.00 thus plant east to a point N100340.00, E99520.00 thus plant south to a point N100262.00, E99520.00 thus plant east to a point N100262.00, E99730.00 the point of beginning. Refer to the RFR to view an attachment showing this area and to review requirements and options within the defined boundary.

e. Areas brought to Final Grade and accepted may be reworked due to construction activities.

- If the area is larger than 100 sq. ft. AND the compacted depth is six (6) inches or more, compaction test are required.
- Any cohesive materials placed under permanent roads require a compaction test.

3.3. Supervisor, Quality Control

Performs quality inspections and tests on various types of soils and aggregate materials.

3.4. Person Supervising Field Work

3.4.1. Verifies work performed is in conformity with the lines, grades, typical sections and dimensions, including tolerances, either shown on the drawings or indicated in referenced specifications/work authorizing documents.

3.4.2. Ensures all materials required in accordance with work authorizing document are free of stumps, frozen soil, vegetation, rubbish and other objectionable matter during preparation and placement.

3.4.3. Ensures all areas to be filled or backfilled are free of construction debris, loose or decayable matter and standing water or free ice and snow on the surface.

3.4.4. Ensures, when applicable, Category I Granular Structural Fill or Backfill is placed over frozen, placed, and compacted Category I Granular Structural Fill or Backfill, but NOT over frozen clay subgrade.

3.4.5. Ensures Category I Cohesive Fill is NEVER placed over frozen clay subgrade or over frozen, placed, and compacted Category I Cohesive Fill.

3.4.6. Ensures water for compaction purposes meets the following criteria:

a. Is applied with suitable sprinkling devices and is thoroughly and uniformly incorporated into the material to be compacted.

b. Compaction proceeds as soon as practicable after sprinkling process.

c. Excessive amounts of water, as determined by QC, is NOT applied while compacting granular materials, which include Category I Granular Structural Fill, Backfill and Crushed Stone.

3.4.7. Ensures excavation, fill, embankment areas and adjacent transition areas are uniformly smooth grades.

3.4.8. Ensures finished surface is reasonably smooth, compacted and free from irregular surface changes.

3.4.9. Ensures the degree of finish is that ordinarily obtainable from blade-grader operation, except as otherwise specified by these specifications.

3.4.10. Ensures ditches are finished to permit adequate drainage.

3.4.11. Ensures surface of areas to be seeded are finished to smoothness suitable for the preparation of the seed beds.

3.4.12. Ensures surface of embankment or excavated areas for road construction or other areas on which surfacing material is to be placed can NOT vary more than 0.10 foot from the final grade or elevation.

3.4.13. Ensures area surfaces within area bounded by Plant Coordinates N99,535; N100,615; E99,670 and E100,139 are finished NOT more than 0.15 foot above or below the final grade elevation.

3.4.14. Ensures area surfaces outside of the area described in the previous step are finished NOT more than 0.5 foot above or below the final grade elevation.

3.5. Work Group Supervisor

3.5.1. Ensures testing is performed by Quality Control or an approved commercial testing laboratory.

3.5.2. Ensures field density tests are in accordance with subsection 203.3 of the Standard Specifications.

3.5.3. Ensures test results are documented in the Work Authorizing Document completion notes.

3.5.4. When test results indicate that the compaction is NOT as specified, ensures material is removed and replaced or recompacted to meet specification requirements.

3.5.5. Ensures subsequent tests of recompacted areas are performed to determine conformance with specification requirements.

-END OF SECTION-

4.0 PROCEDURE INSTRUCTIONS

4.1. Generic Information

4.1.1. Limits of Elevation Control

- The limits for elevation control of finished grades in the horizontal plane are indicated on drawings and identified as the Limits of Quality Control.
- The limits for elevation control of finished grades in the vertical plane are indicated on drawings and identified as Final Grades and Elevations.

4.1.2. Overflow Points

- CHECK by survey, all elevations at Probable Maximum Precipitation (PMP) overflow points on roads and former railroad embankments.
- PMP overflow points are shown on the PMP Drainage Plan of the Final Grading and Drainage drawings.

4.1.3. Protection

PROTECT all newly graded areas from traffic and erosion until accepted.

4.1.4. Temporary Bracing

a. WHEN temporary bracing of foundation walls for fill and backfill operation is needed, PERMIT **ONLY** after obtaining written permission from Nuclear Engineering.

b. Do NOT place fill and backfill near temporary bracing of foundation walls, prior to written permission which will state the conditions and provisions for placing of fill and backfill.

-END OF SECTION-

NOTE

For material designations and requirements for ESW underground ASME Section III HDPE piping, Refer To Specification S-1080 Rev. 001, The Installation of Replacement ASME Section III Buried Essential Service Water System Piping, Section 5.0.

4.2. Material Designations and Requirements

4.2.1. Category I Granular Structural Fill

a. MANUFACTURE Category I Granular Structural Fill from one of the following sources:

- Callaway Limestone Formation obtained from Mertens, Inc. Reform MO. quarry approximately five (5) miles north of the site
- Portion of the Auxvasse Quarry approved as a source of concrete aggregate.

b. Do NOT include or add organic matter and material above or below the Callaway Limestone Formation.

c. ENSURE the Category I Granular Structural Fill meets the following gradation limits:

Sieve Size	Allowable Range (% Passing)
2 in. (50 mm)	100
1-1/2 in. (37.5 mm)	90 - 100
1 in. (25.0 mm)	80 - 100
3/4 in (19.0 mm)	70 - 93
3/8 in. (9.5 mm)	50 - 73
No. 4 (4.75 mm)	35 - 55
No. 10 (2.0 mm)	19 - 37
No. 30 (600 micron)	10 - 23
No. 40 (425 micron)	7 - 20
No. 200 (75 micron)	0 - 10*
* The portion passing the No. 200 sieve cannot exceed 60 percent of the portion passing the No. 30 sieve.	

4.2.2. Category I Granular Structural Backfill

ENSURE Category I Granular Structural Backfill meets one of the following requirements:

- Is of the same material and the same gradation limit as specified in Section 4.2.1, Category I Granular Structural Fill.

  OR

- As specified in Specification 4645-4A(Q), Power Block Fill and Backfill.

4.2.3. Category I Cohesive Fill

a. ENSURE Category I Cohesive Fill is modified loess obtained from on site excavation or an approved alternate source.

b. *QC* – VERIFY acceptability of material.

c. IF desired, TREAT material with hydrated lime to facilitate placement and compaction.

d. *Nuclear Engineering* – WHEN requested by QC or Responsible Engineer, ESTABLISH criteria for lime treatment to meet field conditions.

4.2.4. Stabilized Backfill

a. ENSURE Stabilized Backfill consists of granular material stabilized with Portland cement to produce a minimum 28 day unconfined compressive strength (as determined by ASTM C39) of 1000 pounds per square inch (psi).

b. *Vendor for Stabilized Backfill* - PRIOR to start of work, PROVIDE mix design.

c. WHEN approved in writing by Nuclear Engineering, USE Stabilized Backfill in lieu of Category I Granular Structural Fill and Backfill where mechanical compaction of these granular materials are impractical.

4.2.5. Clay Blanket

a. USE a Clay Blanket as a Non-Q impervious seal over Category I Granular Structural Fill and Backfill as shown on the drawings or as directed by Nuclear Engineering.

b. ENSURE Clay Blankets is of the same material as specified in Section 4.2.3, Category I Cohesive Fill.

c. IF desired, SUBSTITUTE six (6) in. (min) of concrete or asphalt in lieu of a two (2) ft. clay blanket.

4.2.6. Category I Bedding Material - Sand, (See CAR 200704068)

a. ENSURE Category I Bedding Material is clean, dredged Missouri River Sand.

b. ENSURE Category I Bedding Material is in accordance with ASTM C136 and meets the following gradation limits:

Sieve Size	Allowable Range (% Passing)
3/8 in	100
No. 4	95 - 100
No. 8	80 - 100
No. 16	50 - 85
No. 30	14 - 45
No. 50	0 - 17
No. 100	0 - 5

4.2.7. Alternate Category I Bedding Material - Aggregate Fines (See CAR 200704068)

a. IF desired, in lieu of Category 1 Bedding Material described in Section 4.2.6, USE aggregate fines obtained from the Callaway Limestone Formation meeting the following gradation limits.

Sieve Size	Allowable Range (% Passing)
3/8 in	100
No. 4	90 - 100
No. 8	50 - 85
No. 16	25 - 50
No. 30	10 - 35
No. 50	5 - 30
No. 100	0 - 25

b. IF using aggregate fines in lieu of Category 1 Bedding Material, ENFORCE the following additional stipulations (besides the gradation requirements):

1. WHEN possible, MAINTAIN the same bedding material throughout the project.

2. IF the bedding material must be changed from sand to fines or fines to sand, ENSURE the following requirements are met.

- Prior to use, Nuclear Engineering approves the bedding material in writing.
- Bedding material is NOT mixed in trench cross section.

-END OF SECTION-

4.3. Installation of Category I Granular Structural Fill

4.3.1. **Preparation (prior to placement)**

a. PRIOR to requesting an inspection, REMOVE any construction debris, vegetation, water, ice or snow.

b. WHEN area is cleaned, NOTIFY QC.

c. ENSURE that any previously disturbed materials are recompacted and accepted by QC.

d. ENSURE that any sieve testing for gradation requirements has been performed on material and accepted.

4.3.2. **Placement (in process)**

a. START at respective lowest elevations, PLACE and COMPACT designated fill and backfill materials, in lifts.

b. PRIOR to starting next lift, LEVEL, SMOOTH, and properly COMPACT as specified, each lift.

c. PLACE the surface of each lift approximately horizontal in coordination with the planned construction and drainage conditions.

d. PLACE the first two (2) foot of Category I Granular Structural Fill above the Graydon Chert Conglomerate (GCC) surface in uniform lifts of twelve (12) inches loose thickness and compacted to a minimum dry density of 134.3 pounds per cubic foot (pcf).

e. PLACE the remainder of the Category I Granular Structural Fill above this two (2) foot region in uniform lifts of nine (9) inches loose thickness and compacted to a minimum dry density of 138.7 pcf.

f. IF it can be demonstrated to the satisfaction of QC that proper compaction can be obtained, INCREASE the nine (9) inch thickness of lifts to twelve (12) inches, if desired.

g. PRIOR to continuing backfilling, ENSURE lifts during installation are inspected and accepted accordingly.

h. ENSURE that material is placed and spread in such a manner that segregation is minimized.

4.3.3. **Post-Placement (after placement)**

ENSURE compaction requirements have been achieved and accepted by QC.

-END OF SECTION-

4.4. Installation of Category I Granular Structural Backfill

4.4.1. **Preparation (prior to placement)**

CHECK the requirements stipulated in the following list of steps have been reviewed, inspected, and approved:

- Step 4.3.1.a
- Step 4.3.1.b
- Step 4.3.1.c
- Step 4.3.2.g

4.4.2. **Placement (in process)**

a. START at respective lowest elevations, PLACE and COMPACT designated backfill materials, in lifts.

b. PRIOR to starting next lift, LEVEL, SMOOTH, and properly COMPACT as specified, each lift.

c. PLACE the surface of each lift approximately horizontal in coordination with the planned construction and drainage conditions.

d. DEPOSIT Category I Granular Structural Backfill in uniform lifts of nine (9) inches maximum loose thickness and compacted to a minimum dry density of 131.4 pcf.

e. IF it can be demonstrated to the satisfaction of QC that proper compaction can be obtained, INCREASE the nine (9) inch thickness of lifts to twelve (12) inches maximum loose thickness, if desired.

f. PRIOR to continuing backfilling, ENSURE lifts during installation are inspected and accepted accordingly.

g. ENSURE that material is placed and spread in such a manner that segregation is minimized.

4.4.3. **Post Placement (after placement)**

ENSURE compaction requirements have been achieved and accepted by QC.

-END OF SECTION-

4.5. Installation of Category I Cohesive Fill

4.5.1. **Preparation (in-process)**

a. CHECK the requirements stipulated in the following list of steps have been reviewed, inspected, and approved:

- Step 4.3.1.a
- Step 4.3.1.b
- Step 4.3.1.c

b. CHECK that moisture/density relationship test was performed and accepted.

c. CHECK that excavated area is to design grade or as required by work authorizing document.

4.5.2. **Placement (in-process)**

a. IF using Category I Cohesive Fill, PERFORM the following:

1. PLACE in uniform lifts of six (6) inches maximum loose thickness and compacted to a minimum dry density of 90 percent of maximum dry density as determined by ASTM D1557, Method A.

2. ENSURE the moisture content of material at time of compaction does NOT exceed five (5) percentage points from optimum moisture content.

3. IF it can be demonstrated to the satisfaction of QC that proper compaction can be obtained, INCREASE the six (6) inch thickness of lifts to nine (9) inches, if desired.

CAUTION

Category I Granular Structural Backfill may ONLY be substituted for Category I Cohesive Fill when approved in writing by Nuclear Engineering.

b. IF substituting Category I Granular Structural Backfill for Category I Cohesive Fill, PERFORM the following:

1. PRIOR to starting, ENSURE approval in writing from Nuclear Engineering has been obtained.

2. PLACE and COMPACT substitute material in accordance with Steps 4.4.2.d and 4.4.2.e.

Step 4.5.2.b Cont'd

3. PLACE substitute material to an elevation two (2) feet below the finished elevation shown on the drawings.

4. SEAL substitute material on top with a minimum two (2) feet thick clay blanket, OR six (6) inches (min.) of concrete or asphalt pavement.

c. PRIOR to continuing installation, ENSURE that lifts during installation are inspected and accepted.

4.5.3. **Post-Placement (after placement)**

ENSURE compaction requirements have been achieved and accepted by QC.

-END OF SECTION-

4.6. Installation of Stabilized Backfill

4.6.1. **Preparation (pre-pour)**

CHECK the requirements stipulated in the following list of steps have been reviewed, inspected, and approved:

- Step 4.3.1.a
- Step 4.3.1.b
- Step 4.3.1.c
- Step 4.3.2.g

4.6.2. **Placement (in-process)**

a. PLACE stabilized backfill in a manner to achieve uniform consistency and maintain a near horizontal surface.

b. Do NOT drag material more than ten (10) feet on the ground during spreading.

c. Do NOT leave pot-holes, gaps or traffic marks in the finished surface of the placed Stabilized Backfill.

d. WHEN a gross thickness exceeding two (2) feet is anticipated to be placed over more than fifty (50) percent of the area below any Category I structure. PROVIDE notification to the Responsible Engineer in written form with dimensions (within 6 inches accuracy) **prior** to proceeding with placement of Stabilized Backfill.

e. NOTIFY QC to ENSURE sample tests of first load each day is taken and additional tests for each 100 cubic yards thereafter.

4.6.3. **Post-Placement (after placement):**

a. CHECK finished elevation is acceptable.

b. Do NOT permit construction equipment or construction traffic on newly placed Stabilized Backfill until material has attained sufficient strength to avoid damage by the traffic.

c. IF QC determines damage has occurred to Stabilized Backfill, REPAIR or REPLACE as directed.

-END OF SECTION-

NOTE

For installation requirements for ESW underground ASME Section III HDPE piping, Refer To Specification S-1080 Rev. 001, The Installation of Replacement ASME Section III Buried Essential Service Water System Piping, Section 9.0.

4.7. Installation of Category I Bedding Material - Sand, (See CAR 200704068)

4.7.1. **Preparation (prior to placement)**

CHECK the requirements stipulated in the following list of steps have been reviewed, inspected, and approved:

- Step 4.3.1.a
- Step 4.3.1.b
- Step 4.3.1.c
- Step 4.3.2.g

4.7.2. **Placement (in-process)**

a. PROVIDE a minimum of six (6) inches below and six (6) inches above all ESWS piping and ductbanks.

b. PLACE Category I Bedding Material in uniform lifts of eight (8) inches maximum loose thickness and compact to minimum 70 percent relative density plus one pound per cubic foot as determined by ASTM D4253 (Replaced ASTM D2049).

c. IF it can be demonstrated to the satisfaction of QC that proper compaction can be obtained, INCREASE the eight (8) inch thickness of lifts to twelve (12) inches, if desired.

d. PRIOR to continuing installation, ENSURE that lifts during installation are inspected and accepted.

4.7.3. **Post-Placement (after placement)**

ENSURE compaction requirements have been achieved and accepted by QC.

-END OF SECTION-

4.8. Installation of Category I Bedding Material - Aggregate Fines, (See CAR 200704068)

4.8.1. **Preparation (prior to placement)**

CHECK the requirements stipulated in the following list of steps have been reviewed, inspected, and approved:

- Step 4.3.1.a
- Step 4.3.1.b
- Step 4.3.1.c
- Step 4.3.2.g

4.8.2. **Placement (in-process)**

a. PROVIDE a minimum of six (6) inches below and six (6) inches above all ESWS piping and ductbanks.

b. PLACE Aggregate Fines in uniform lifts of eight (8) inches loose thickness and compact to a minimum dry density of 124.5 pcf.

c. IF it can be demonstrated to the satisfaction of QC that proper compaction can be obtained, INCREASE the eight (8) inch thickness of lifts to twelve (12) inches, if desired.

d. PRIOR to continuing installation, ENSURE that lifts during installation are inspected and accepted.

4.8.3. **Post-placement (after placement)**

ENSURE compaction requirements have been achieved and accepted by QC.

-END OF SECTION-

4.9. Installation of Clay Blanket

4.9.1. PREPARE, PLACE, and COMPACT a Clay Blanket to Commercial Standards as directed by Nuclear Engineering Department.

4.9.2. *Nuclear Engineering Department* – PERFORM a visual inspection to meet acceptance criteria.

-END OF SECTION-

5.0 REFERENCES

5.1. Implementing

5.1.1. Specification 4645-4A(Q), Power Block Fill and Backfill

5.1.2. Specification 4645-4B(Q), Section 2A, Protection of the Graydon Chert Conglomerate

5.1.3. Specification 4645-4C(Q), UHS Area Fill & Backfill

5.1.4. Specification 4645-30A(Q), Final Grading & Drainage Elevation Control

5.1.5. FSAR 2.4

5.1.6. FSAR 2.5

5.1.7. FSAR 3.8

5.1.8. OQCM, Operational Quality Control Manual

5.1.9. CAR 200704068

5.1.10. Specification S-1080 Rev. 001, The Installation of Replacement ASME Section III Buried Essential Service Water System Piping

5.2. Developmental

5.2.1. Specification, 4645-1B, Site Grading Powerblock and UHS Area Excavation Sections 2B and 2C

5.2.2. Specification, 4645-4C(Q), Ultimate Heat Sink (UHS) Area Fill and Backfill

5.2.3. Specification, 4645-30B, Final Grading & Drainage

5.2.4. Specification, 4645-32A(Q), Excavation and Backfill for Essential Service Water Systems (ESWS) Piping and Ductbanks

5.2.5. Specification, 4645-40A, Ultimate Heat Sink Area Excavation

5.2.6. RFR-09993A, Backfill Requirements for the OMF

5.2.7. RFR-13860A, Clay Blanket Classification & Backfill Requirements

5.2.8. Missouri Standard Specifications for Highway Construction

5.2.9. ASTM C39 Standard Test Methods for Compressive Strength of Cylindrical Concrete Specimens

5.2.10. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

5.2.11. ASTM D4253 Standard Test Methods for Maximum Index Density and Unit Weights of Soils Using a Vibratory Table

5.2.12. QCP-ZZ-07101, Soils Testing Procedure

5.2.13. QCP-ZZ-07204, Inspection of Concrete, Grout, and Drypack Operations

5.2.14. QCP-ZZ-07205, Destructive Testing Procedure

6.0 RECORDS

None

7.0 DEFINITIONS

None

8.0 SUMMARY OF CHANGES

Page(s)	Section or Step Number	Description
		Changes listed below are per Engineering markups based upon CAR 200809195. Additional minor corrections/changes are IAW Procedure Writing Manual (PWM).
10	4.2	Added Note prior to Step 4.2 for material designations and requirements for ESW underground ASME Section III piping to refer to S-1080 Rev. 001.
18	4.7	Added Note prior to Step 4.7 for installation requirements for ESW underground ASME Section III piping to refer to S-1080 Rev. 001.
21	5.1.10	Added specification S-1080 Rev. 001 to Implementing References.

Attachment 1

Drawing Lists

Sheet 1 of 2

Power Block, UHS, ESWS Fill and Backfill

Power Block	Drawing No.
1. Title Sheet, Power Block	8600-X-88126
2. Typical Sections and Summary of Quantities, Power Block	8600-X-88127(Q)
3. Detail Sheet, Power Block	8600-X-88128(Q)
4. Detail Sheet, Power Block	8600-X-88129(Q)
5. Plan Sheet, Power Block	8600-X-88130(Q)
6. Cross Sections, Power Block	8600-X-88131(Q)
7. Cross Sections, Power Block	8600-X-88132(Q)
8. Cross Sections, Power Block	8600-X-88133(Q)
9. Cross Sections, Power Block	8600-X-88134(Q)
10. Cross Sections, Power Block	8600-X-88135(Q)
11. Cross Sections, Power Block	8600-X-88136(Q)
12. Cross Sections, Power Block	8600-X-88139(Q)
13. Cross Sections, Power Block	8600-X-88140(Q)
14. Cross Sections, Power Block	8600-X-89605(Q)

UHS Area	Drawing No.
1. Title Sheet, Ultimate Heat Sink Area	8600-X-88273
2. Typical Sections and Summary of Quantities, Ultimate Heat Sink Area	8600-X-88274
3. Plan Sheet, Ultimate Heat Sink Area	8600-X-88275
4. Cross Sections, Ultimate Heat Sink Area	8600-X-88276
5. Cross Sections, Ultimate Heat Sink Area	8600-X-88277

ESWS Piping and Ductbanks	Drawing No.
1. Title Sheet	8600-X-88376
2. Section	8600-X-88377
3. Section and Details	8600-X-88378
4. Yard Location	8600-X-88379
5. Elevations	8600-X-88380
6. Elevation & Summary of Quantities	8600-X-88381

Attachment 1 (Cont'd.)

Sheet 2 of 2

Final Grade and Drainage

Property-Grading	Drawing No.
1. Title Sheet, Final Grading and Drainage	8600-X-88285
2. Typical Section, Final Grading and Drainage	8600-X-88286
3. Details, General Notes, Symbols, Summary of Quantities, Final Grading and Drainage	8600-X-88287
4. Summary of Quantities, Final Grading and Drainage	8600-X-88288
5. Alignment Sheet, Final Grading and Drainage	8600-X-88289
6. Key Plan, Final Grading and Drainage	8600-X-88290
7. Power Block Area, Final Grading and Drainage	8600-X-88291(Q)(UNO)
8. Ultimate Heat Sink Area, Final Grading and Drainage	8600-X-88292(Q)(UNO)
9. Cooling Tower No. 1 Area, Final Grading and Drainage	8600-X-88293(Q)(UNO)
10. Cooling Tower Area, Final Grading and Drainage	8600-X-88294(Q)(UNO)
11. Switchyard Area-East, Final Grading and Drainage	8600-X-88295(Q)(UNO)
12. Construction Plant Area, Final Grading and Drainage	8600-X-88296(Q)(UNO)
13. Road Profiles, Final Grading and Drainage	8600-X-88297(Q)
14. Road Profiles, Final Grading and Drainage	8600-X-88298(Q)
15. Railroad and Road Profiles, Final Grading and Drainage	8600-X-88299(Q)
16. P.M.P. Drainage Plan, Final Grading and Drainage	8600-X-88300(Q)
17. Downspout and Storm Drain Plan, Final Grading and Drainage	8600-X-88301
18. Downspout Drain Elevations, Final Grading and Drainage	8600-X-88302
19. Downspout Drain Elevations and Details, Final Grading and Drainage	8600-X-88303
20. Erosion Control, Final Grading and Drainage	8600-X-88304

ATTACHMENT B

Ameren UE
Callaway Plant

EDP-ZZ-01136

GROUND WATER PROTECTION PROGRAM

Revision 000

INFORMATION USE

GROUND WATER PROTECTION PROGRAM

TABLE OF CONTENTS

GROUND WATER PROTECTION PROGRAM

1.0 PURPOSE

1.1. Provides guidance for implementing a ground water protection program incorporating the objectives described in Industry Ground Water Protection Initiative - Final Guidance Document NEI 07-07.

1.2. Ensures timely detection and effective response to inadvertent radiological releases to ground water.

1.3. Ensures the trust and confidence of state/local officials, the Nuclear Regulatory Commission (NRC), and the public by demonstrating nuclear industry's commitment to a high standard of public radiation safety and protection of the environment.

2.0 SCOPE

2.1. Identifies actions necessary for implementation of a timely and effective ground water protection program.

2.2. Specifies the frequency at which each program element is performed.

2.3. Describes the reporting requirements for sample results that exceed the criteria outlined in this document.

2.4. This program does NOT apply to:

2.4.1. Normal or routine releases managed in accordance with HTP-ZZ-07101, Radiological Environmental Monitoring Program (REMP) or APA-ZZ-01003, Off-Site Dose Calculation Manual (ODCM).

2.4.2. Planned or routine releases within the scope of the approved facility design or operation as provided in Technical Specifications, Final Safety Analysis Report (FSAR), procedures or related documents.

2.4.3. Radioactive material that is NOT licensed material, or that was NOT generated as a result of plant operations.

3.0 RESPONSIBILITIES

3.1. Engineering

3.1.1. Implements the Ground Water Monitoring Program.

3.1.2. Conducts periodic reviews of site hydrogeologic studies.

a. Maintains the ground water model up to date based on current plant conditions.

b. Ensures the appropriate sections of the FSAR are updated with the current ground water model.

3.1.3. Performs initial and periodic reviews on risk assessments and calculation(s) of Priority Index (PI) for SSCs expected to contain licensed radioactive material that could impact ground water.

3.1.4. Notifies Regulatory Affairs regarding any informal communications to NRC or state/local officials.

3.1.5. Monitors and improves the Preventive Maintenance (PM) program for ground water monitoring wells.

3.1.6. Performs reviews of ground water monitoring program every five years.

3.1.7. Initiates self assessment of ground water program every five years.

3.2. Radiation Protection (RP)

3.2.1. Ensures sample collections and shipment of samples to the lab.

3.2.2. Ensures samples are analyzed, reviewed and documented.

3.2.3. Responsible for Laboratory Quality Assurance Program.

3.2.4. Trends and monitors ground water monitoring wells.

3.2.5. Notifies Engineering regarding any abnormal trends in samples or inadvertent leaks/spills in the plant which have a potential to reach ground water.

3.3. Regulatory Affairs

3.3.1. Contacts state/local officials and the NRC regarding any informal communications related to ground water.

3.3.2. Ensures notification/reports are made in a timely manner.

3.3.3. Initiates and submits 30-day reports to Missouri Department of Natural Resources (MO DNR), Callaway County Presiding Officer and the NRC.

3.4. Environmental Services

3.4.1. Ensures records of leaks, spills, remediation efforts are retained and retrievable to meet the requirements of 10 CFR 50.75(g).

3.4.2. Provides an interface with MO DNR.

-END OF SECTION-

4.0 PROCEDURE INSTRUCTIONS

4.1. Monitoring Program Description

4.1.1. Callaway Ground Water Model

a. UTILIZE the ground water model to IDENTIFY the following: [Ref: 5.2.8]

- Potential pathways for ground water migration from on-site to off-site locations.
- Potential affected areas.

b. PERFORM a review of site hydro geologic studies every five years or whenever any of the following occurs:

- Significant onsite construction or disturbance of site property.
- Significant changes in onsite or nearby offsite use of water.
- Significant changes in onsite or nearby offsite pumping rates of ground water.

c. UPDATE FSAR with changes to the characterization of hydrology and/or geology, as applicable. [Ref: 5.2.4]

4.1.2. Risk Assessment of Systems, Structures and Components (SSC)

a. PERFORM initial risk assessment of SSCs and work practices which contain or could contain licensed materials and ASSIGN a Priority Index (PI) based on the evaluation. [Ref: 5.2.9]

b. RE-EVALUATE the SSCs in the event of any leaks or spills.

c. RE-CALCULATE the Priority Index (PI) in accordance with the severity of the leaks/spills.

d. To minimize the potential for inadvertent releases of licensed materials due to equipment failure, PERFORM a review of the SSCs evaluated as a part of this program every five years to ensure any enhancements or additional PMs or surveillances needed are included.

4.1.3. Trending and Monitoring

1. REVIEW abnormal ground water analysis trends provided by Radiation Protection.

NOTE

Sampling and analysis protocols of ground water and review of station or contract lab(s) analytical capabilities are performed by RP per HTP-ZZ-07101, Radiological Environmental Monitoring Program.

b. CONDUCT semi-annual meetings with members from Plant Engineering, Radiation Protection and Environmental Service Departments to review the ground water monitoring program.

c. MONITOR SSCs which have a high PI and are highly susceptible to leaks/spills which may result in ground water contamination.

4.1.4. Remediation Process

a. EVALUATE all leaks/spills or other instances of inadvertent releases of radioactive material in accordance with RP-DTI-ENVIRONMENTAL-SPILLRESP, Response to Spills or Leaks of Radioactive Material.

NOTE

Planned releases of liquids and/or airborne materials from the plant are NOT considered LICENSED MATERIALS when returned to the plant as long as the concentration of the radioactive material does NOT exceed 10 CFR Part 30 "Rules of general applicability to Domestic Licensing to By-product material". [Ref: 5.2.7]

b. RECORD all documents related to decommissioning impacts resulting from spills or leaks and remediation in accordance with APA-ZZ-00500, Corrective Action Program, with the following keywords:

- REMP
- RETS
- DECOMMISSION

4.1.5. Decommission Record Keeping

APA-ZZ-00221, Reporting and Recordkeeping for Decommissioning Planning, provides reporting and recordkeeping requirements for decommission planning in accordance with 10 CFR 50.75(g).

4.2. Ground Water Monitoring Wells

NOTE

HTP-ZZ-07101 Appendix A, REMP Sample Locations, Attachment 4, provides the list of all ground water monitoring wells that Callaway samples. Attachment 1 shows the map of all the ground water monitoring wells.

4.2.1. Based on hydrology and highest priority SSCs, DETERMINE appropriate placement of ground water monitoring wells.

a. LABEL ground water monitor wells with a unique identifier.

b. ENSURE all ground water monitoring wells are sampled per HTP-ZZ-07101, Radiological Environmental Monitoring Program.

c. ENSURE the well maintenance vendor(s) perform the following:

1. ENSURE well preventive maintenance and repairs are performed by qualified or knowledgeable personnel in accordance with state and industry standards.

2. PERFORM a visual inspection to the following and ENSURE the structural integrity of the well casing, seals and well cap is maintained to prevent surface water and contaminants from entering the well:

- Cracked or corroded well casing
- Broken or missing well cap or lock
- Damage to protective casing
- Settling and cracking of surface seals

3. ENSURE the wells are properly labeled.

4. DOCUMENT any well abnormalities in accordance with APA-ZZ-00500, Corrective Action Program.

5. ENSURE inspection and maintenance records are properly maintained.

6. ENSURE wells which are no longer used for their intended purpose are decommissioned or abandoned in accordance with state regulations.

4.3. Communication with NRC, State and Local Officials

4.3.1. Voluntary Communication

a. REVIEW Attachment 2 to determine the communication protocol as it applies to leaks, spills or ground water sample results.

b. ENSURE Regulatory Affairs communicates with the following authorities regarding any onsite leak or spill into ground water as required by Attachment 2, **OR** any onsite or offsite water sample results exceeding the limits of HTP-ZZ-07101, Radiological Environmental Monitoring Program, in accordance with APA-ZZ-00520, Reporting Requirements and Responsibilities:

1. Missouri Department of Natural Resources (MO DNR)
2. Callaway County Presiding Commissioner
3. NRC Resident Inspector
4. NRC Region IV Office

c. COMMUNICATE with designated state or local authorities before the end of the next business day IF an inadvertent leak or spill to the environment has occurred which can potentially get into the ground water **and** satisfies any of the following conditions:

1. Exceeds or likely to exceed 100 gallons from a source containing LICENSED MATERIAL.
2. Regulatory Affairs determines a voluntary communication is necessary regardless of volume or activity from spills/leaks.

Step 4.3.1 Cont'd

NOTE

"Leak or spill" events that meet the criteria shall be communicated regardless of whether or NOT the on-site ground water is, or could be used as, a source of drinking water.

d. COMMUNICATE with designated state/local officials before the end of the next business day for a water sample result:

1. Of off-site ground water or surface water that exceeds any of the REMP reporting criteria for water as described in the ODCM **or**

NOTE

The basis for concluding the on-site ground water is not or would not be considered a source of drinking water will depend on the hydrological data of that area. In the absence of adequate hydrological data, any leak / spill into ground water which exceeds the reporting levels of FSAR-SP Table 16.11-8, must be assumed to be a potential contaminant of drinking water and must be communicated as per Step 4.3.1.d.2 and also reported pursuant to Step 4.3.3.a.1.

2. Of on-site surface water, hydrologically connected to ground water, or ground water used or could be used as a source of drinking water, and exceeds any of the REMP reporting criteria for water as described in the ODCM/ODAM.

e. PROVIDE the following information regarding a spill or leak WHEN communicating with the Missouri Department of Natural Resources (MO DNR) or local officials, and the NRC and DOCUMENT each event in a CAR in accordance with APA-ZZ-00500, Corrective Action Program:

1. A statement that the communication is being made as part of the NEI Ground Water Protection Initiative.

2. Date and time of spill, leak, or sample result(s).

3. Whether or NOT spill has been contained or leak has been stopped.

4. Location of leak or spill or water sample(s), IF known.

5. Source of leak or spill, IF known.

6. List of contaminant(s) and verified concentration(s).

Step 4.3.1.e Cont'd

7. Description of action(s) already taken and general description of future actions.

8. Estimate of potential or bounding annual dose to a member of the public, IF available at this time.

9. Estimated time/date to provide additional information or follow-up.

f. NOTIFY the NRC regarding voluntary communication to state and/or local officials per 10 CFR 50.72(b)(2)(xi).

g. NOTIFY NEI by email at GW_Notice@nei.org.

h. PROVIDE a copy of each communication with MO DNR to Environmental Services – Water Quality.

4.3.2. State Officials Briefing

OFFER annual update meetings with MO DNR regarding the ground water protection program.

4.3.3. Reporting Requirements

a. Thirty-day Reports

1. Submit a thirty-day report to the NRC for all on-site and off-site water sample results that exceed any of the REMP reporting criteria and could potentially reach the ground water used or could be used as a source of drinking water.

NOTE

The initial discovery of ground water contamination greater than the REMP reporting criterion is the event documented in a written 30-day report. It is NOT expected that a written 30-day report will be generated each time a subsequent sample(s) suspected to be from the same "plume" identifies concentrations greater than any of the REMP criteria as described in the ODCM/ODAM.

2. The 30-day special report should include:

- A statement that the report is being submitted in support of the Ground Water Protection Initiative (CPI).
- Lit of contaminant(s) and verified concentration(s).
- Description of the action(s) taken.
- Estimate of potential or bounding annual dose to a member of the public.
- Corrective action(s) IF necessary, that will be taken to reduce projected annual dose to a member of the public to less than the limits in 10 CFR 50 Appendix 1.

3. Concurrently FORWARD all written 30-day NRC reports generated to MO DNR and Callaway County Presiding Commissioner.

b. Annual Reporting

1. ENSURE all onsite and offsite ground water sample results taken in support of the GPI (also included in REMP) are documented in AREOR.

2. ENSURE all voluntary communications made to the MO DNR and local officials are included in the report with a description of the spills/leaks or sample results.

4.4. GPI Program Assessments

4.4.1. Self Assessment

NOTE

Self assessments could be an internal or external assessment but should only be performed by an independent, knowledgeable individual(s) NOT involved in the implementation of the GPI program.

a. PERFORM an initial self assessment in accordance with APA-ZZ-01400, Performance Improvement Program, within one year of implementation of the GPI program.

b. PERFORM periodic self-assessment of the GPI program at least once every five years after initial self-assessment.

c. EVALUATE in the self-assessment, at a minimum, the implementation of all of the objectives identified in this document.

d. ENSURE the self-assessment is documented in accordance with APA-ZZ-00500, Corrective Action Program, or applicable procedures or programs.

4.4.2. NEI Assessment

a. CONDUCT a review of the GPI program under the auspices of NEI within one year from the initial self assessment as per Step 4.4.1.a.

b. ENSURE a review of the GPI program is performed every five years, subsequent to Callaway's periodic self-assessment performed as per Step 4.4.1.b.

5.0 REFERENCES

5.1. Implementing

5.1.1. 10CFR50.75 (g), Reporting and Record Keeping for Decommissioning

5.1.2. APA-ZZ-00221, Reporting and Recordkeeping for Decommissioning Planning

5.1.3. APA-ZZ-00500, Corrective Action Program

5.1.4. APA-ZZ-00520, Reporting Requirements and Responsibilities

5.1.5. APA-ZZ-01003, Off-Site Dose Calculation Manual

5.1.6. APA-ZZ-01400, Performance Improvement Program

5.1.7. FSAR-SP Table 16.11-8

5.1.8. HTP-ZZ-07101, Radiological Environmental Monitoring Program

5.1.9. HTP-ZZ-07101 Appendix A, REMP Sample Locations

5.1.10. RP-DTI-ENVIRONMENTAL-SPILLRESP, Response to Spills or Leaks of Radioactive Material

5.2. Developmental

5.2.1. 10CSR23.4, Monitoring Well Construction Code

5.2.2. ANI Nuclear Liability Insurance Guideline 07-01

5.2.3. EPRI 1015118, Ground Water Protection Guidelines for Nuclear Power Plants

5.2.4. FSAR 2.4.13

5.2.5. NEI 07-07, Industry Ground Water Protection Initiative – Final Guidance Document

5.2.6. NRC Information Notice 2006-13, Ground Water Contamination Due to Undetected Leakage of Radioactive Water

5.2.7. RIS 2008-03, Return/Re-use of Previously Discharged Radioactive Effluents

5.2.8. Ground Water Model Report for Callaway Unit 1

5.2.9. SA08-PE-S06, Assessment of SSCs as a part of Groundwater Protection Initiative program (NEI 07-07) *(I:\NUCENG\COMMON\Groundwater Protection Initiative\SSC Evaluation NEI 07-07)*

6.0 RECORDS

6.1. QA Record

6.1.1. Annual Environmental Operating Report (E160.0608)

6.2. Commercial Record

6.2.1. SA08-PE-S06, Assessment of SSCs as a part of Groundwater Protection Initiative program (NEI 07-07) (G110.0031)

7.0 DEFINITIONS

7.1. **AREOR (Annual Radiological Environmental Operating Report)** - summarizes the results of the REMP to the NRC.

7.2. **Ground Water** - any subsurface water, whether in the unsaturated or vadose zone, or in the saturated zone of the earth.

7.3. **Informal (Communication)** - a communication, typically by telephone, between licensee personnel and the state/local officials. Subsequent notification of the NRC under 10 CFR 50.72 should be performed consistent with station policy.

7.4. **Leak or Spill** - The "leak or spill" represents an inadvertent event or perturbation in a system or component's performance. This event threshold is intended to ensure that state/local officials are made aware there has been an event of interest at the site and to keep them apprised of the licensee's action to contain and, as needed, remediate the event. "Leak or spill" events that meet the criteria shall be communicated regardless of whether or NOT the on-site ground water is, or could be used as, a source of drinking water.

7.5. **Licensed Material** (From 10CFR20.1003) - source material, special nuclear material, or byproduct material received, possessed, used, transferred or disposed of under a general or specific license issued by the Commission.

7.6. **LLD** – Lower Limit of Detection

7.7. **Monitoring Well** - a borehole drilled in the earth and lined, either partially or entirely, with a casing to stabilize and isolate one or more sections of the borehole. They are used to collect environmental media for examination and testing. They are intended to be in service for long periods (typically years) to allow continued sampling of ground water.

7.8. **ODCM/ODAM (Offsite Dose Calculation Manual** or **Offsite Dose Assessment Manual)** - The licensee's manual required by Technical Specifications that contains the dose assessment methodology and radiological effluent technical specifications.

7.9. **Potential to Reach Ground Water**:

Spills or leaks with the potential to reach ground water:

- Spill or leak directly onto native soil or fill
- Spill or leak onto an artificial surface (i.e., concrete or asphalt) IF the surface is cracked or the material is porous or unsealed
- Spill or leak that is directed into unlined or non impervious ponds or retention basins (i.e., water hydrologically connected to ground water)

7.10. **REMP (Radiological Environmental Monitoring Program)** - program specified by the ODCM/ODAM that provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides, which lead to the highest potential radiation exposures of individuals resulting from the station operation.

7.11. **RETS (Radiological Effluent Technical Specifications)** - Specifications required to control the release of radioactive liquids and airborne materials from the site. Standard radiological effluent technical specifications are found in NUREG CR-1301.

7.12. **Significant (leak or spill)** - an item or incident of interest to the public or stakeholders. It does NOT imply or refer to regulatory terminology nor is it intended to indicate the leak or spill has public health and safety or environmental protection consequences.

7.13. **Site Conceptual Model** - A unifying hypothesis to describe how a contaminant release may be observed and measured currently in the site environment, and to identify the ultimate fate of the contaminant in the future. The model incorporates the site's hydrogeology, existing and past site activities that may have resulted in contaminant releases to the environment, location of those releases, contaminants of concern, their fate and transport within the environment, and receptors of those contaminants.

7.14. **Source Containing Licensed Material** - A liquid, including steam, for which a statistically valid positive result is obtained when the sample is analyzed to the following a priori lower limits of detection (analytical sensitivity).

The analytical sensitivity for identifying a source containing licensed material is at a minimum - the licensee's lower limits of detection that are required for radioactive liquid effluents for all isotopes.

7.15. **Substantial On-Site Construction** or **Substantial Disturbance of Site Property** - Substantial refers to the likelihood that the construction or disturbance has affected the subsurface flow of ground water.

7.16. **Surface Water** - Water within streams, lakes reservoirs, discharge canals, cooling towers, retention ponds, water from precipitation events, wetlands, estuaries, and oceans.

7.17. **Vadose Zone** - The subsurface zone where earth materials are NOT saturated.

7.18. **Voluntary** (as used in the GPI) - NOT required by statute or regulation.

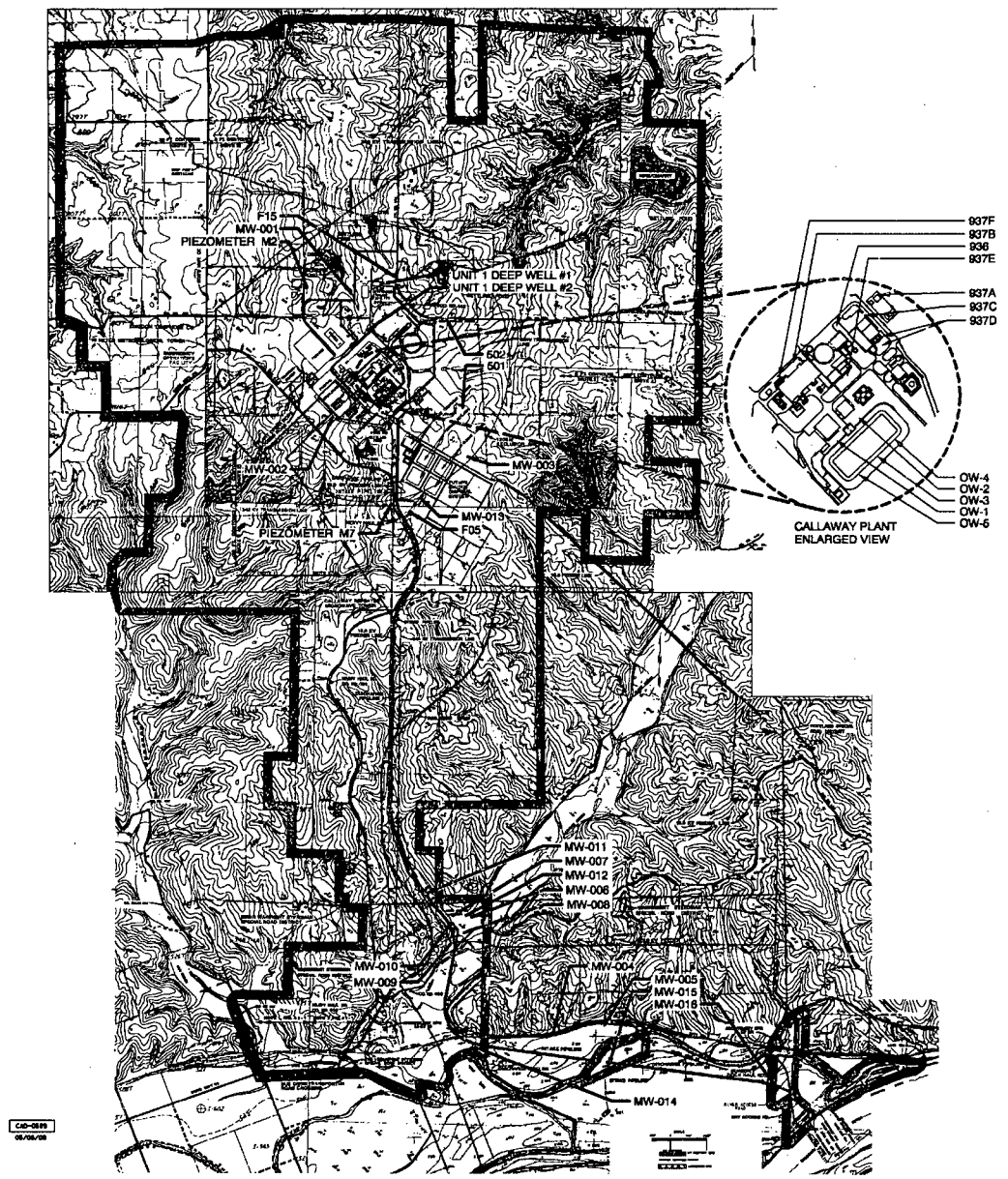
8.0 SUMMARY OF CHANGES

Page(s)	Section or Step Number	Description
All	All	New Procedure (CAR 200800353)

Attachment 1

Map of Ground Water Monitoring Wells

Sheet 1 of 1



MW = MONITORING WELLS
F05, F15 = NPDES MONITORING WELLS
OW-1,2,3,4,5 = OBSERVATION WELLS (SEE ENLARGED VIEW)
UNIT 1 DEEP WELLS 1 & 2
936 = DIESEL FUEL REMEDIATION WELL (SEE ENLARGED VIEW)
937A,B,C,D,E,F = UNIT 1 MONITORING WELLS (SEE ENLARGED VIEW)
501, 502 = LANDFILL MONITORING WELLS
PIEZOMETERS M2, M7 = FSAR-SA FIG. 2.4-30

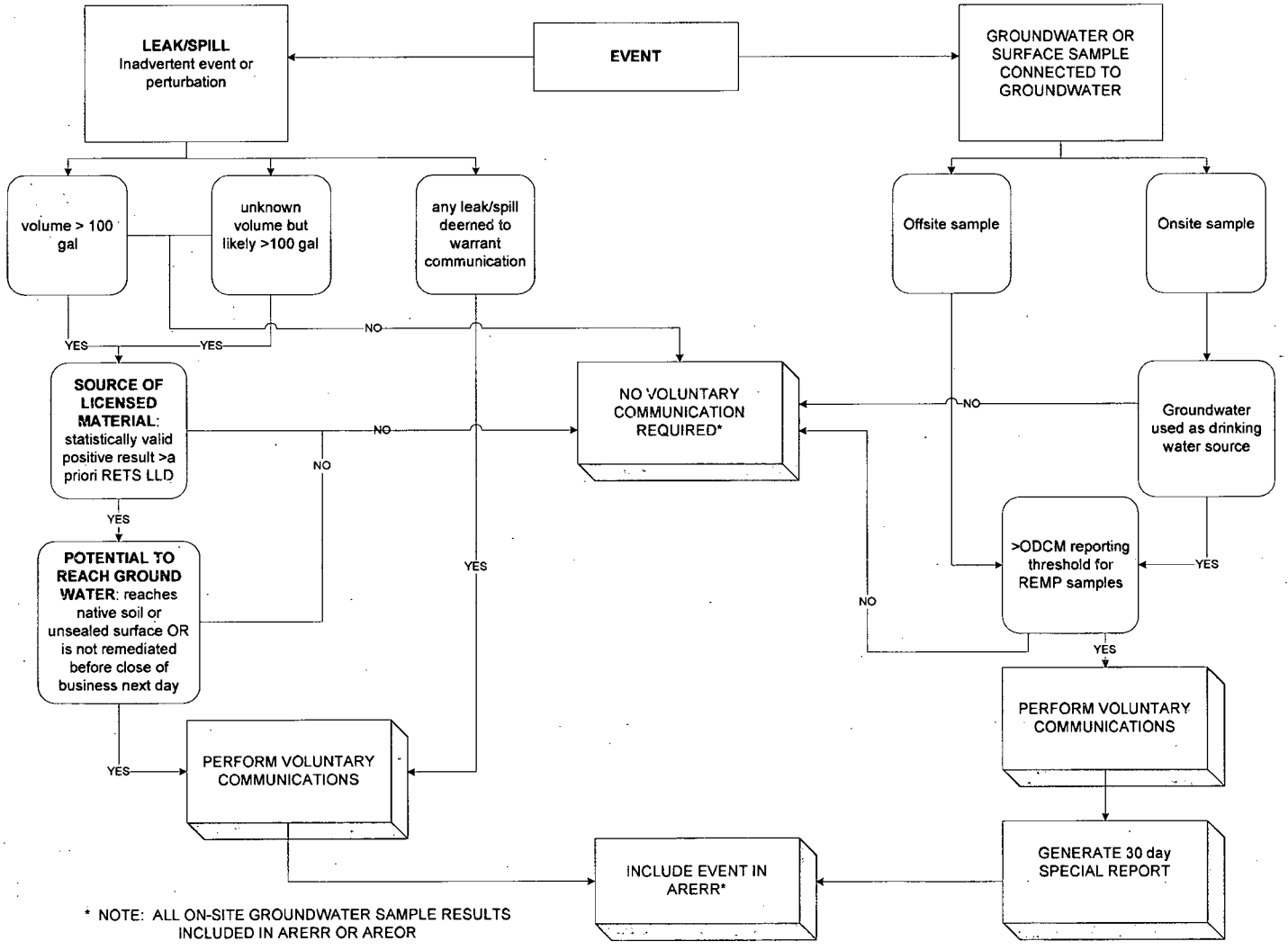
REF: HTP-ZZ-07101, APPENDIX A

INFORMATION USE

Attachment 2

Communication Protocol for Leak/Spill and Ground Water Sample Results (NEI 07-07)

Sheet 1 of 1



HTP-ZZ-07101

RADIOLOGICAL ENVIROMENTAL MONITORING PROGRAM

MINOR Revision 015

INFORMATION USE

RADIOLOGICAL ENVIROMENTAL MONITORING PROGRAM

TABLE OF CONTENTS

RADIOLOGICAL ENVIROMENTAL MONITORING PROGRAM

1.0 PURPOSE

This procedure provides the program for implementation of the Radiological Environmental Monitoring Program (REMP) for the Callaway Plant.

2.0 SCOPE

2.1. Provides a description of the REMP implemented to meet APA-ZZ-01003, Off-site Dose Calculation Manual,

2.2. Establishes the process for tracking radiological environmental monitoring requirements conducted at the Callaway Plant.

2.3. Describes the reporting requirements for sampling and spills to NRC, state and local officials.

3.0 RESONSIBILITIES

None

4.0 PRECAUTIONS AND LIMITATIONS

None

5.0 PREREQUISITES

None

-END OF SECTION-

6.0 PROCEDURE INSTRUCTIONS

NOTE

This procedure is performed by the REMP Program Owner unless noted.

6.1. Monitoring Program

6.1.1. Program Description

a. Ensure sample locations for the REMP are shown and described in HTP-ZZ-07101 Appendix A, REMP Sample Locations.

b. IF any changes to sample locations, approve the sample locations in HTP-ZZ-07101 Appendix A, REMP Sample Locations.

c. Ensure the sample collection frequencies for each sample type is maintained.

-END OF SECTION-

6.1.2. Sample Identification System

a. Ensure sample identification code for each sample type and location as follows:

1. Plant Code - CA

NOTE

Sample media codes AQF, AQS, and FPL require additional information that further describes the sample media. For example, fish should include species (i.e., carp, flathead catfish, etc.).

2. Media Code - Three letters identifying the media being sampled is defined as follows:

MEDIA CODE	SAMPLE TYPE
AIO	Air Iodine
APT	Air Particulate
AQF	Fish
AQS	Sediment
FPL	Leafy Green Vegetables
IDM	TLD
MLK	Milk
SOL	Soil
SWA	Surface Water
WWA	Ground Water
DWA	Drinking water, well
FC	Farm Crop

3. Location Code - defined in HTP-ZZ-07101 Appendix A, REMP Sample Locations.

-END OF SECTION-

6.2. Tracking

6.2.1. Schedule and track the completion of the following activities:

- REMP sample collection and analysis required in Attachment 1
- Land Use Census
- Vendor Interlaboratory Comparison and Cross Check Programs
- REMP reportable Nuclide Evaluation Report
- Vendor Monthly Progress Report
- Annual Environmental Operating Report

-END OF SECTION-

6.3. Laboratory Quality Control Program

6.3.1. Laboratory Quality Assurance Program

a. Bid specifications used for procurement of REMP radioanalytical services must contain requirements for an outside laboratory quality assurance program using the requirements in the USNRC Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations) Effluent Streams and Environment, APA-ZZ-01003, Off-site Dose Calculation Manual and FSAR-SP Chapter 16.11.4.3, Interlaboratory Comparison Program Limiting Condition at operation, as applicable.

b. Outside laboratories that perform REMP analysis services should be audited at least triennially.

c. Submit a CA1592, Request for Supplier Evaluation, when new laboratories are added to the program.

6.3.2. Intralaboratory Analysis

a. Ensure Radioanalytical laboratories conduct an acceptable Intralaboratory Comparison Program with results periodically reported in Monthly Progress Reports per USNRC Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations) Effluent Streams and Environment.

b. Ensure Primary Monitoring Device (PMD) service provider meets the requirements of USNRC Regulatory Guide 4.13, " Performance, Testing, and Procedural Specifications for Thermoluminescent Dosimetry Environmental Applications" Rev 1 and is accredited by NVLAP in accordance with ANSI N.13.11 For Photon Mixtures And Photon/Beta Mixtures.

c. Ensure Radioanalytical Intralaboratory Comparison Program contains the following elements:

- Replicate samples, usually duplicates, are analyzed routinely. These samples are replicates of monitoring program samples and/or reference test materials. The size and composition of replicate samples are similar to samples analyzed routinely.
- Spiked and blank samples are submitted for analysis as unknowns to provide a basis for estimating accuracy of analytical results. These blanks and spikes may include blind replicates.

6.3.3. Interlaboratory Comparison Program

a. Contract laboratories that provide radiological environmental monitoring radioanalytical services must be required to participate in an Interlaboratory Comparison Program, as described in FSAR-SP Chapter 16.11.4.3, Interlaboratory Comparison Program Limiting Condition at operation and APA-ZZ-01003, Off-site Dose Calculation Manual, with results periodically reported in Monthly Progress Report.

b. Interlaboratory Comparison Program results and corrective actions taken by the outside laboratories for sample results which do NOT meet the acceptance criteria are reviewed per appropriate Callaway Plant procedures.

c. The Interlaboratory Comparison Results and Review Comments must be incorporated into the Annual Radiological Environmental Operating Report per the APA-ZZ-01003, Off-site Dose Calculation Manual.

d. The PMD vendor conducts an Interlaboratory Comparison Program which meets the NVLAP requirements.

-END OF SECTION-

6.4. Reporting Requirements

6.4.1. Annual Radiological Environmental Operating Report (AREOR)

a. The requirements for the AREOR are described in FSAR-SP Chapter 16.11.5.1 and FSAR-SP 16.11.4.1.

b. Submit the AREOR per requirements of APA-ZZ-00520, Reporting Requirements and Responsibilities.

c. Document all onsite and offsite groundwater sample results.

d. Describe all onsite leaks/ spills into groundwater as reported in Section 6.4.2.

6.4.2. 30 Day Reports

a. Special report to the NRC are submitted within 30 days per requirements of APA-ZZ-00520, Reporting Requirements and Responsibilities for the following:

- The level of radioactivity in an environmental sampling medium resulting from plant effluents exceeds the reporting levels of FSAR-SP Table 16.11-8 when averaged over any calendar quarter.
- The reporting level- weighted concentration of two or more nuclides is greater than 1.0.
- Nuclides are detected that are not listed in FSAR-SP Table 16.11-8 and the calculated annual dose a Member of the Public from all radionuclides is equal to or greater than the limits of FSAR-SP sections 16.11.1.2, FSAR-SP sections 16.11.2.2, or FSAR-SP sections 16.11.2.3.

NOTE

Residents along Mud Creek and Logan Creek take their drinking water from wells.

b. Special report to the NRC and to the Missouri Department of Natural Resources are submitted within 30 days per requirements of APA-ZZ-00520, Reporting Requirements and Responsibilities if the level of radioactivity in onsite groundwater that is used or may be used as a source of drinking water exceeds the reporting levels as described in 6.4.2.a.

c. In the absence of adequate hydrological data, any leak / spill into groundwater which exceeds the reporting levels of FSAR-SP Table 16.11-8, must be assumed to be a potential contaminant of drinking water and must be reported pursuant to 6.4.2.b.

Step 6.4.2 Cont'd

d. If ground water is not currently used for drinking water but is potable, consider ground water a potential source of drinking water.

e. All written 30 day reports generated under must be concurrently forward to the Missouri Department of Natural Resources and the Callaway County Presiding Commissioner.

6.4.3. Informal Notifications

NOTE

Informal notification is made per the requirements of APA-ZZ-00520, Reporting Requirements and Responsibilities.

Informal notifications do NOT require a 4 hour report per 10CFR50.72

a. *Manager, Regulatory Affairs,* Evaluate each spill or leak in accordance with the flowchart provided in Attachment 1.

b. *Groundwater Protection Program Owner*, Notify NEI of any informal notifications pursuant to Attachment 1.

c. Make all informal notifications by the end of the next business day.

d. Notify the following (in this order):

1. Missouri Department of Natural Resources
2. NRC Resident Inspector
3. NRC Region IV Office

-END OF SECTION-

6.5. REMP Problem Reporting

6.5.1. Review the REMP sample collection sheets and REMP Monthly Progress Report for any of the following:

- Adverse trend in obtaining samples.
- Adverse trend in sample results including an unusual increase in natural background levels.
- Measurable level of a nuclide that could have been caused by operation of the plant (excluding tritium in surface water).
- Unresolved problem identified in the vendor quality control or cross check programs.
- The Lower Limit of Detection (LLD) required by FSAR-SP Table 16.11-9 is NOT achieved.
- Radiological Environmental Monitoring Program was NOT conducted as required by APA-ZZ-01003, Off-site Dose Calculation Manual.
- The level of radioactivity at a specific location exceeds the reporting level of FSAR-SP Table 16.11-8.
- A milk or vegetation sample location required by APA-ZZ-01003, Off-site Dose Calculation Manual is no longer available.
- The Land Use Census identifies a new location that yields a calculated dose or dose commitment 20% greater than at a location currently sampled.

6.5.2. If any of the items above are found, or if any samples are missed, generate a CARS per APA-ZZ-00500, Corrective Action Program.

6.5.3. At the end of the calendar year, review all REMP CARs for the year and include significant problems in the Annual Environmental Operating Report.

-END OF SECTION-

7.0 REFERENCES

7.1. Implementing

7.1.1. APA-ZZ-00500, Corrective Action Program

7.1.2. APA-ZZ-00520, Reporting Requirements and Responsibilities

7.1.3. APA-ZZ-01003, Off-site Dose Calculation Manual

7.1.4. HTP-ZZ-07101 Appendix A, REMP Sample Locations

7.1.5. CA1592, Request for Supplier Evaluation

7.1.6. USNRC Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations) Effluent Streams and Environment

7.1.7. USNRC Regulatory Guide 4.13, " Performance, Testing, and Procedural Specifications for Thermoluminescent Dosimetry Environmental Applications" Rev 1

7.1.8. FSAR-SP Chapter 16.11.4.3, Interlaboratory Comparison Program Limiting Condition at operation

7.1.9. FSAR-SP Chapter 16.11.5.1, Annual Radiological Environmental Operating Report

7.1.10. FSAR-SP 16.11.4.1, Monitoring Program Limiting Condition of Operation

7.1.11. FSAR-SP Table 16.11-8, Reporting g Levels for Radioactivity Concentrations in Environmental Samples

7.1.12. FSAR-SP Table 16.11-9, Detection Capabilities for Environmental Sample Analysis

7.1.13. FSAR-SP sections 16.11.1.2, Bases

7.1.14. FSAR-SP sections 16.11.2.2, Dose –Noble Gases Limiting Condition for Operation

7.1.15. FSAR-SP sections 16.11.2.3, Dose- Iodine-131 and 133, Tritium, and Radioactive Material in Particulate form Limiting Condition of Operation

7.1.16. ANSI N.13.11 For Photon Mixtures And Photon/Beta Mixtures

7.1.17. 10CFR50.72

7.2. Developmental

EDP-ZZ-01136, Ground Water Protection Program

8.0 RECORDS

8.1.1. REMP Monthly Progress Reports, (E160.0622)

8.1.2. Sample Collection Data Sheet, (E160.0602)

8.1.3. REMP Reportable Nuclide Evaluation, (E160.0604)

8.1.4. Annual Environmental Operating Report, (E160.0608)

8.1.5. Quarterly TLD Calculation Worksheets, (E160.0612)

8.1.6. Land Use Census Field Study, (E160.0616)

8.1.7. Annual Effluent Release Reports / Meteorologist's, (H240.0030)

8.1.8. Air Sampler Calibration, (H170.0064)

9.0 DEFINITIONS

Groundwater - Water located beneath the ground surface in soil pore spaces and in the fractures of geologic formations. Groundwater includes soil moisture and immobile water in very low permeability materials such as clay or bedrock. A formation of rock/soil is called an aquifer when it can yield a useable quantity of water. The depth at which soil pore spaces become saturated with water is called the water table. Groundwater is recharged from, and eventually flows to, the surface naturally; natural discharge often occurs at springs and seeps and can form oases or wetlands. Groundwater is naturally replenished by surface water from precipitation, streams, and rivers. Usable groundwater is contained in aquifers, which are subterranean areas (or layers) of permeable material (like sand and gravel) that channel the groundwater's flow. Aquifers can be confined or unconfined. If a confined aquifer follows a downward grade from a recharge zone, groundwater can become pressurized as it flows. This can create artesian wells that flow freely without the need of a pump. The top of the upper unconfined aquifer is called the water table or phreatic surface, where water pressure is equal to atmospheric pressure.

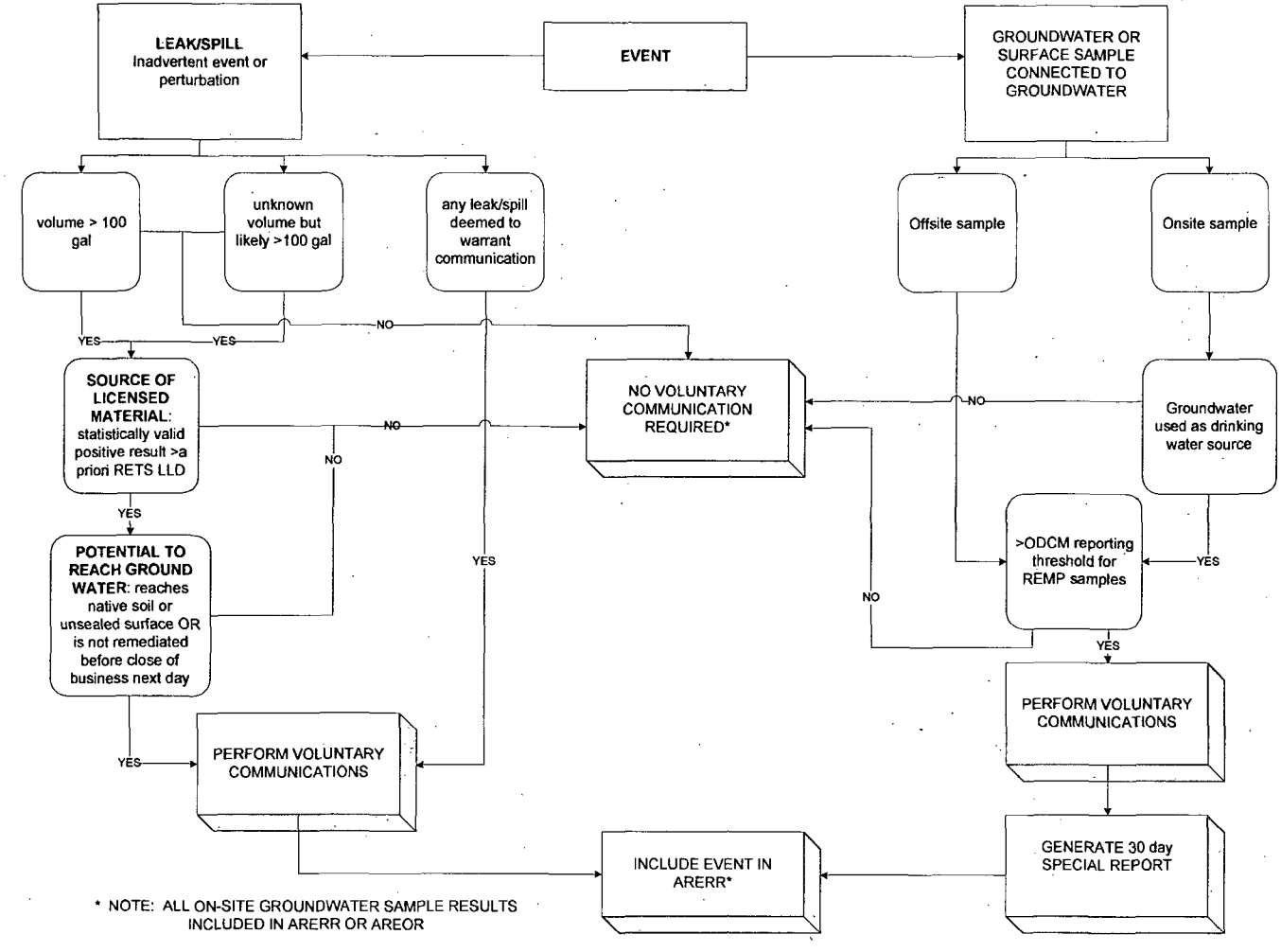
10.0 SUMMARY OF CHANGES

Page(s)	Section or Step Number	Description
10	6.4.3.c, 6.4.3.d	Added instructions for making notifications of APA-ZZ-00520. CAR200808950
13	8.0	Deleted records since records are no longer generated.
12	7.2	Added EDP-ZZ-01136 as reference.

Attachment 1

Communication Protocol For Leak/Spill And Groundwater Sample Results

Sheet 1 of 1



INFORMATION USE

Ameren UE
Callaway Plant

HTP-ZZ-07101 APPENDIX A

REMP SAMPLE LOCATIONS

MINOR Revision 015

REMP SAMPLE LOCATIONS

TABLE OF CONTENTS

REMP SAMPLE LOCATIONS

1.0 REFERENCES

1.1. Implementing

1.1.1. FSAR Section 2.1.1.1

1.2. Developmental

None

2.0 SUMMARY OF CHANGES

Page(s)	Section or Step Number	Description
6	Attachment 1	Changed Location for dosimeter #44 CAR 200807515
11	Attachment 4	Changed Power Block to granular fill. CAR 200803054
12	Attachment 4	Changed ODCM req'd column block entries from QUARTERLY to YES

Attachment 1

Gamma Dose Collection And Analysis Schedule

Sheet 1 of 4

Loc Code	Description	Sample Location	Analysis Frequency (each sample)	ODCM Req'd
1a	10.8 mi. NW; City of Fulton on Hwy Z, 0.65 mi. East of Business 54, West of Campus Apartments.	N38 51.759 W 91 55.972	Quarterly	Yes
3	1.2 mi. NW; 0.1 mi. West of Hwy CC on Gravel Road, 0.8 mi. South Hwy O, Callaway Electric Cooperative Utility Pole No. 18559.	N 38° 46.377 W 91° 47.966	Quarterly	Yes
5	1.3 mi. ENE; Primary Meteorological Tower.	N 38° 45.918 W 91° 45.448	Quarterly	Yes
6	2.0 mi. W; County Road 428, 1.2 mi. West of Hwy CC, Callaway Electric Cooperative Utility Pole No. 18609.	N 38° 45.833 W 91° 49.048	Quarterly	Yes
7	1.4 mi. S; County Road 459, 2.6 mi. North of Hwy 94, Callaway Electric Cooperative Utility Pole No. 35097.	N 38° 44.496 W 91° 46.988	Quarterly	Yes
9	3.8 mi. S; NW Side of the County Road 459 and Hwy 94 Junction, Callaway Electric Cooperative Utility Pole No. 06754.	N 38° 42.453 W 91° 47.100	Quarterly	Yes
10	3.9 mi. SSE; Hwy 94, 1.8 mi. East of County Road 459, Callaway Electric Cooperative Utility Pole No. 12182.	N 38° 42.522 W 91° 45.320	Quarterly	Yes
11a	4.7 mi. SE; City of Portland, Callaway Electric Cooperative Utility Pole No. 12110.	N 38° 42.616 W 91° 43.454	Quarterly	Yes
14	4.9 mi. ESE; SE Side of Intersection Hwy D and Hwy 94, Callaway Electric Cooperative Utility Pole No. 11940.	N 38° 43.472 W 91° 42.277	Quarterly	Yes
17	3.8 mi. E; County Road 4053, 0.3 mi. East of Hwy 94, Kingdom Telephone Company Pole No. 3X12.	N 38° 45.801 W 91° 42.702	Quarterly	Yes
18a	3.7 mi. ENE; East side of Hwy D, 0.5 mi. South of Hwy O, Callaway Electric Cooperative Utility Pole No. 38579.	N 38° 46.971 W 91° 43.083	Quarterly	Yes
20	4.7 mi. NE; City of Readsville, Callaway Electric Cooperative Utility Pole No. 12830.	N 38° 48.534 W 91° 43.121	Quarterly	Yes

Attachment 1 (Cont'd.)

Sheet 2 of 4

Loc Code	Description	Sample Location	Analysis Frequency (each sample	ODCM Req'd
21	3.8 mi. NNE; County Road 155, 1.9 mi. North of Hwy O, Callaway Electric Cooperative Utility Pole No 19100	N 38° 48.780 W 91° 45.199	Quarterly	Yes
22a	1.9 mi. NNE; North side of Hwy O, 100 feet East of County Road 150, Callaway Electric Cooperative Utility Pole No. 31094.	N 38° 47.238 W 91° 46.068.	Quarterly	Yes
23	6.6 mi. NNE; City of Yucatan, Callaway Electric Cooperative Utility Pole No. 12670	N 38° 51.254 W 91° 44.999.	Quarterly	Yes
26**	11.7 mi. E; Town of Americus, Callaway Cooperative Utility Pole No. 11159.	N 38° 47.041 W 91° 34.026.	Quarterly	Yes
27**	9.3 mi. ESE; Town of Bluffton, Callaway Electric Cooperative Utility Pole No. 11496.	N 38° 42.358 W 91° 37.472.	Quarterly	Yes
30a	4.4 mi. SSW; City of Steedman, N side of Belgian Dr., 150 feet East of Hwy CC, Callaway Electric Cooperative Utility Pole No. 06557.	N 38° 42.286 W 91° 48.967.	Quarterly	Yes
31a	7.8 mi. SW; City of Mokane, Junction Hwy C and County Road 400, 0.9 mi. North of Hwy 94, Callaway Electric Cooperative Utility Pole. 52071.	N 38° 40.880 W 91° 52.901.	Quarterly	Yes
32	5.4 mi. WSW; Hwy VV, 0.6 mi. West of County Road 447, Callaway Electric Cooperative Utility Pole No. 27031.	N 38° 44.051 W 91° 52.536.	Quarterly	Yes
32a	5.0 mi. WSW; County Road 447, Callaway Electric Cooperative Utility Pole No. 06354.	N 38° 43.677 W 91° 51.788.	Quarterly	Yes
33	7.4 mi. W; City of Hams Prairie, SE of Hwy C and Hwy AD Junction.	N 38° 46.006 W 91° 55.083.	Quarterly	Yes
34	9.5 mi. WNW; NE Side of Hwy C and County Road 408 Junction.	N 38° 48.751 W 91° 56.705.	Quarterly	Yes
35	5.8 mi. NNW; City of Toledo, Callaway Electric Cooperative Utility Pole No. 17684.	N 38° 50.401 W 91° 49.070.	Quarterly	Yes

Attachment 1 (Cont'd.)

Sheet 3 of 4

Location Code	Description	Sample Location	Analysis Frequency (each sample	ODCM Req'd
36	4.9 mi. N; County Road 155, 0.8 mi. South of County Road 132, Callaway Electric Cooperative Utility Pole No. 19137.	N 38° 49.969 W 91° 46.218	Quarterly	Yes
37	0.5 mi. SSW; County Road 459, 0.9 mi. South of Hwy CC, Callaway Electric Cooperative Utility Pole No. 35077.	N 38° 45.249 W 91° 47.029	Quarterly	Yes
38	4.6 mi. NNW; County Road 133, 1.5 mi. South of Hwy UU, Callaway Electric Cooperative Utility Pole No. 34708.	N 38° 49.277 W 91° 49.119	Quarterly	Yes
39	5.4 mi. NW; County Road 111, Callaway Electric Cooperative Utility Pole No. 17516.	N 38° 48.844 W 91° 51.283	Quarterly	Yes
39A	5.0 mi. NW; County Road 111, Callaway Electric Cooperative Utility Pole No. 17526.	N 38° 48.321 W 91° 51.224	Quarterly	Yes
40	4.2 mi. WNW; NE Side of County Road 112 and Hwy O Junction, Callaway Electric Cooperative Utility Pole No. 018145.	N 38° 47.066 W 91° 51.263	Quarterly	Yes
41	4.9 mi. W; Hwy AD, 2.8 mi. East of Hwy C, Callaway Electric Cooperative Utility Pole No. 18239.	N 38° 46.227 W 91° 52.240	Quarterly	Yes
42	4.4 mi. SW; County Road 447, 2.6 mi. North of County Road 463, Callaway Electric Cooperative Utility 'Pole No. 06326.	N 38° 43.302 W 91° 50.706	Quarterly	Yes
43	0.5 mi. SW; County Road 459, 0.7 mi. South of Hwy CC, Callaway Electric Cooperative Utility Pole No. 35073.	N 38° 45.415 W 91° 47.225.	Quarterly	Yes
44	0.1 mi. WSW; Hwy CC, 1.0 mi. South of County Road 459, Callaway Electric Cooperative Utility Pole No. 1877.	N 38° 45.3 W 91° 48.735	Quarterly	Yes
45	1.0 mi. WNW; County Road 428, 0.1 mi. West of Hwy CC, Callaway Electric Cooperative Utility Pole No. 18580.	N 38° 45.927 W 91° 47.912	Quarterly	Yes
46	1.5 mi. NNW; NE Side of Hwy CC and County Road 466 Intersection, Callaway Electric Cooperative Utility 'Pole No. 28242.	N 38° 46.831 W 91° 47.790	Quarterly	Yes
47	1.0 mi. N; County Road 448, 0.9 mi. South of Hwy O, Callaway Electric Cooperative Utility Pole No. 28151.	N 38° 46.522 W 91° 46.692.	Quarterly	Yes
48	0.4 mi. NE; County Road 448, 1.5 mi. South of Hwy O, Plant Security Sign Post.	N 38° 46.001 W 91° 46.666	Quarterly	Yes

INFORMATION USE

Attachment 1 (Cont'd.)

Sheet 4 of 4

Loc Code	Description	Sample Location	Analysis Frequency (each sample	ODCM Req'd
49	1.6 mi. E; County Road 448, Callaway Electric Cooperative Utility Pole No. 06959, Reform Wildlife Management Parking Area.	N 38° 45.599 W 91° 45.096	Quarterly	Yes
50	0.9 mi. SSE; County Road 459, 3.3 mi. North of Hwy 94, Callaway Electric Cooperative Utility Pole No. 35086.	N 38° 44.912 W 91° 46.653	Quarterly	Yes
51a	0.3 mi. SE; Owner Control Fence, SE of the Water Treatment Plant.	N 38° 45.465 W 91° 46.695	Quarterly	Yes
52	0.4 mi. ESE; Light Pole Near the East Plant Security Fence.	N 38° 45.593 W 91° 46.492	Quarterly	Yes
60**	13.5 mi. SW; Callaway Electric Cooperative Utility Pole No. 43744 just past Tebbett's City sign.	N 38° 37.314 W 91° 57.295	Quarterly	Yes

**Control Location

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1

-END OF SECTION-

Attachment 2

Airborne Particulate And Iodine

Sheet 1 of 1

Loc Code	Description	Sample Location	Analysis Frequency (each sample	I-131, &Gamma Isotopic	ODCM Req'd
A1	1.3 mi. ENE; Primary Meteorological Tower.	N 38° 45.918 W 91° 45.448.	Weekly	Yes	Yes
A7	9.5 mi. NW; C. Bartley Farm.	N 38° 51.286 W 91° 54.734.	Weekly	Yes	Yes
A8	0.9 mi. NNE; County Road 448, 0.9 miles South of Hwy O.	N 38° 46.485 W 91° 46.687.	Weekly	Yes	Yes
A9	1.9 mi. NNW; Community of Reform.	N 38° 47.168 W 91° 47.769.	Weekly	Yes	Yes
B3	1.8 mi. NNW; 0.3 mi. East of the Hwy O and CC Junction, Callaway Electric Cooperative Utility Pole No. 50422	N 38° 47.192 W 91° 47.540.	Weekly	Yes	Yes

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

Attachment 3

Well Collection And Analysis Schedule (Potable Water)

Sheet 1 of 2

Minimum Sample Volumes:

H^3: 200 ml

PGE (Principle Gamma Emitters): 1 gallon

Drinking Water

Loc Code	Description	Sample Location	Collection Frequency	Tritium	ODCM Req'd	PGE (1)
1	Miller, Roman 9136 County Road 461	N 38° 43.399 W 91° 47.041	Quarterly	Yes		
2	Miller, Robert 9205 County Road 461	N 38° 43.148 W 91° 47.07	Quarterly	Yes		
3	Ward, Rick & Nancy 9204 County Road 448	N 38° 43.252 W 91° 46.225	Quarterly	Yes	Yes	Yes
4	Miller, Albert 9057 County Road 448	N 38° 43.628 W 91° 45.822	Quarterly	Yes	Yes	Yes
5	Hux, Ron 8802 County Road 448	N 38° 43.797 W 91° 45.605	Quarterly	Yes	Yes	Yes
6	Lindeman, Henry 8754 County Road 448	N 38° 44.224 W 91° 45.353	Quarterly	Yes	Yes	Yes
7	Kriete, Stan 8304 County Road 448	N 38° 45.145 W 91° 44.683	Quarterly	Yes	Yes	Yes
8	Brandt, John 9400 County Road 457	N 38° 42.794 W 91° 47.711	Quarterly	Yes	Yes	Yes
9	Clardy, Scott & Tammy 9142 County Road 457	N 38° 43.407 W 91° 48.216	Quarterly	Yes	Yes	Yes
10	Dillon, Susan 9076 County Road 457	N 38° 43.616 W 91° 48.305	Quarterly	Yes	Yes	Yes
11	Dillon, Harry 9291 Dillon Drive	N 38° 42.94 W 91° 45.94	Quarterly	Yes		
12	Dillon, Joe 9549 County Road 464	N 38° 42.71 W 91° 45.83	Quarterly	Yes	Yes	Yes
14	Hinnah, Donald 9360 Sycamore Valley Road	N 38° 42.746 W 91° 44.662	Quarterly	Yes		
15	Schmid, Herbert 9363 Schmid Way	N 38° 42.637 W 91° 44.863	Quarterly	Yes		
16	Smith, Rick 9602 County Road 468	N 38° 43.145 W 91° 45.660	Quarterly	Yes		
17	McGinn, David 9704 County Road 468	N 38° 43.278 W 91° 45.397	Quarterly	Yes		
18	McGonigal, Jerry 9790 County Road 468	N 38° 43.151 W 91° 45.070	Quarterly	Yes		

Attachment 3 (Cont'd.)

Sheet 2 of 2

Loc Code	Description	Sample Location	Collection Frequency	Tritium	ODCM Req'd	PGE (1)
19	Hoover, Darin 9538 County Road 468	N 38° 43.160 W 91° 45.855	Quarterly	Yes		
20	Schmid, Charlie 9349 Schmid Way	N 38° 42.833 W 91° 44.961	Quarterly	Yes		
21	Baumgarth, Phillip 8729 County Road 469	N 38° 44.651 W 91° 44.497	Quarterly	Yes		
22	Robert Plummer 10402 State Road 94	N 38 42.541 W 91 43.408	Quarterly	Yes	Yes	Yes

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

Note 1
If contaminated with gamma emitting nuclides of plant origin, analyze for HTD nuclides.
HTD nuclides are defined as Sr^{89}, Sr^{90}, Fe^{55}, Ni^{63}, Np^{237}, Pu^{238}, $Pu^{239}/^{240}$, Pu^{241}, Am^{241}, Cm^{242} and $Cm^{243}/^{244}$.

Attachment 4

Wells And Ponds Collection And Schedule (Non Drinking Water Wells)

Sheet 1 of 2

Minimum Sample Volumes:
H^3: 200 ml
PGE (Principle Gamma Emitters): 1 gallon

PGE: 1 gallon
Boron: As directed by laboratory

Loc Code	Collection Frequency	Tritium	PGE (1)	Boron	ODCM Req'd	NPDES Req'd
OW-1 UHS pond	Quarterly	Yes				
OW-2 UHS pond	Quarterly	Yes				
OW-3 UHS pond	Quarterly	Yes				
OW-4 UHS pond	Quarterly	Yes				
OW-5 UHS pond	Quarterly	Yes				
MW-001 Outside OCA	Quarterly	Yes	Yes		Yes	
MW-002 Outside OCA	Quarterly	Yes	Yes		Yes	
MW-003 Outside OCA	Quarterly	Yes	Yes		Yes	
MW-004 Dillon	Quarterly	Yes	Yes		Yes	
MW-005 Brownlee/ Hudson	Quarterly	Yes	Yes		Yes	
MW-006 Ward	Quarterly	Yes	Yes		Yes	
MW-007 Ward	Monthly	Yes	Yes			
MW-008 Ward	Monthly	Yes	Yes			
MW-009 Pipeline	Quarterly	Yes	Yes		Yes	
MW-010 Pipeline	Quarterly	Yes				
MW-011 Pipeline	Quarterly	Yes	Yes		Yes	
MW-012 Ward	Quarterly	Yes	Yes		Yes	
MW-013 Pipeline	Quarterly	Yes	Yes		Yes	
MW-014 Pipeline	Quarterly	Yes	Yes		Yes	
MW-015 Pipeline	Quarterly	Yes	Yes		Yes	
MW-016 Pipeline	Quarterly	Yes	Yes		Yes	
MW-501 Landfill	Quarterly	Yes				
MW-502 Landfill	Quarterly	Yes				
936 Granular Fill Diesel Fuel Remediation Plant SE of SFP Building	Quarterly	Yes	Yes	Yes	Yes	Yes
937A Granular Fill Monitoring Well	Quarterly	Yes	Yes	Yes		
937B Granular Fill Monitoring Well	Quarterly	Yes	Yes	Yes	Yes	Yes
937C Granular Fill Monitoring Well Plant East of RW Bldg Drum Storage	Quarterly	Yes	Yes	Yes	Yes	
937D Granular Fill Monitoring Well Plant South of DMTs	Quarterly	Yes	Yes	Yes	Yes	
937E Granular Fill Monitoring Well	Quarterly	Yes	Yes	Yes	Yes	Yes
937F Granular Fill Monitoring Well	Quarterly	Yes	Yes	Yes	Yes	
M-2	Quarterly	Yes				
M-7	Quarterly	Yes				

Attachment 4 (Cont'd.)

Loc Code	Collection Frequency	Tritium	PGE (1)	Boron	ODCM Req'd	NPDES Req'd
GWS – Ground Water Sump Plant East of Containment and SFP Building	Quarterly	Yes	Yes	Yes	Yes	Yes
UHS pond	Quarterly	Yes				
Unit 2 pond	Quarterly	Yes				
CTBD – Cooling Tower Blowdown	Quarterly	Yes				
POND 01	Semi Annual	Yes	Yes		Yes	
Pond 02	Semi Annual	Yes	Yes		Yes	
Outfall 010	Semi Annual	Yes	Yes		Yes	
Outfall 011	Semi Annual	Yes	Yes		Yes	
Outfall 012	Semi Annual	Yes	Yes		Yes	
Outfall 013	Semi Annual	Yes	Yes		Yes	
Outfall 014	Semi Annual	Yes	Yes		Yes	
Outfall 015	Semi Annual	Yes	Yes		Yes	
Sludge Lagoon #4	Semi Annual	Yes	Yes		Yes	

Ground Water Wells

Loc Code	Description	Sample Location	Collection Frequency	H^3 &PGE	ODCM Req'd
D01	5.0 mi. SE Portland Bar/Grill.	N 38° 42.591 W 91° 43.022	Quarterly	Yes	Yes
F05	0.9 mi. SSE Onsite Groundwater Monitoring Well.	N 38° 44.939 W 91° 46.681	Quarterly	Yes	Yes
F15	0.4 mi. NNE Onsite Groundwater Monitoring Well.	N 38° 45.981 W 91° 46.674	Quarterly	Yes	Yes
PW1	Callaway Plant Cafeteria.	N/A	Quarterly	Yes	Yes

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

If contaminated with gamma emitting nuclides of plant origin, analyze for HTD nuclides.
HTD nuclides are defined as Sr^{89}, Sr^{90}, Fe^{55}, Ni^{63}, Np^{237}, Pu^{238}, $Pu^{239}/^{240}$, Pu^{241}, Am^{241}, Cm^{242} and $Cm^{243}/^{244}$.

Attachment 5

Surface Water

Sheet 1 of 1

Loc Code	Description	Sample Location	Collection Frequency	H-3 & Gamma Isotopic	ODCM Req'd	NPDES Req'd
S01**	4.7 mi. SSE; 105 feet Upstream of Discharge North Bank.	N 38 42.12 W 91 44.20	Monthly Composite	Yes	Yes	Yes
S02	4.9 mi. SE; 1.1 River Miles Downstream of Discharge North Bank at Portland.	N 38° 42.545 W 91° 43.232.	Monthly Composite	Yes	Yes	Yes

**Control Location

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

Attachment 6

Soil

Sheet 1 of 1

Loc Code	Description	Sample Location	Collection Frequency	Gamma Isotopic	ODCM Req'd
V3**	15.0 mi. SW; Beazley Farm, West of Tebbetts.	N 38° 37.14, W 91° 57.91.	Annual	Yes	
F2	1.64 mi. SW; Callaway Plant Forest Ecology Plot F2.	N 38° 45.189, W 91° 47.826.	Annual	Yes	
F6	1.72 mi. NE; Callaway Plant Forest Ecology Plot F6.	N 38° 46.60, W 91° 45.46.	Annual	Yes	
PR3	1.02 mi. ESE; Callaway Plant Prairie Ecology Plot PR3.	N 38° 45.45, W 91° 45.87.	Annual	Yes	
PR7	0.45 mi. NNW; Callaway Plant Prairie Ecology Plot PR7.	N 38° 46.01, W 91° 47.20.	Annual	Yes	
W1**	0.61 mi. SE; Callaway Plant Wetlands, High Ground.	N 38° 45.314, W 91° 46.588.	Annual	Yes	
W2	0.60 mi. SSE; Callaway Plant Wetlands, Inlet Area.	N 38° 45.320, W 91° 46.572.	Annual	Yes	
W3	0.72 mi. SSE; Callaway Plant Wetlands, Discharge Area.	N 38° 45.203, W 91° 46.532.	Annual	Yes	
W4	0.68 mi. SSE; Callaway Plant Wetlands, SW Bank.	N 38° 45.211, W 91° 46.583.	Annual	Yes	

**Control Location

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

Attachment 7

Leafy Green Vetetables

Sheet 1 of 1

Samples collected monthly during the growing season.

The growing season is defined as the months of May through November, however, will vary from year to year due to weather conditions.

Loc Code	Description	Sample Location	Collection Frequency	I-131 & Gamma Isotopic	ODCM Req'd
V9	2.0 mi. WNW; Meehan Farm.	N 38° 46.401 W 91° 48.830.	Monthly	Yes	Yes
V11	3.2 mi. NW; Hickman Farm.	N 38° 47.962 W 91° 48.874	Monthly	Yes	Yes
V12*	18.7 mi. WSW, Kissock Farm, South of New Bloomfield.	N 38° 41.498 W 92° 06.953	Monthly	Yes	Yes
V15	2.4 mi. NNE; Mike Plate, 9637 Hwy O, Steedman.	N 38 47.4250 W 91 45.406	Monthly	Yes	Yes

**Control Location

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

Attachment 8

Milk

Sheet 1 of 1

Loc Code	Description	Sample Location	Collection Frequency (Note 1)	I-131 & Gamma Isotopic	ODCM Req'd
M-6	2.64 mi. NW, Eugene Pierce, 7255 County Road 131, Steedman.	N 38° 47.545 W 91° 48.612	Monthly	Yes	
M-9	Donna S Ferguson, 11638 County Rd 485,Tebbetts.	N 38 38.141 W91 57.526	Monthly	Yes	
M-10	Ravena Dobbs 9100 State Road CC, Steedman .	N 38° 42.978 W 91° 49.312	Monthly	Yes	

Note 1: Semi-monthly when animals are on pasture, monthly at other times.

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

Attachment 9

Fish, Shoreline & Bottom Sediment

Sheet 1 of 1

Loc Code	Description	Collection Frequency	Gamma Isotopic	ODCM Req'd	NPDES Req'd
A**[1]	4.9 mi. SSE; 0.6 River Miles Upstream of Discharge North Bank.	Semi-Annual	Yes	Yes	Yes
C[1]	4.9 mi. SE; 1.0 River Miles Downstream of Discharge North Bank.	Semi-Annual	Yes	Yes	Yes

**Control Location

Notes:1.
The fish collection area for location "A" is between 0.6 river miles and 3.0 river miles upstream of the discharge on the north bank and for location "C" is between the discharge area and 1.5 river miles downstream of the discharge on the north bank. The expanded collection areas are needed to guarantee there is sufficient habitat for sampling to ensure the ability to collect the required number of fish species.

ALL distances are measured from the midpoint of the two reactors as described in the FSAR Section 2.1.1.1.

Attachment 10

Farm Crop

Sheet 1 of 1

Samples collected at the time of harvest. If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling should be monthly.

Three samples of each type of farm crop should be taken along the discharge pipeline easement.

Loc Code	Description	Collection Frequency	H3 & Gamma Isotopic	QDCM Req'd
FC1	Between discharge pipeline manhole 8 and the Katy Trail.	Harvest	Yes	Yes
FC2	Between discharge pipeline manholes 5 and 3B.	Harvest	Yes	Yes
FC3	Between Hwy 94 and the barge loading dock access road.	Harvest	Yes	Yes
FC4*	Location unlikely to be influenced by plant operations.	Harvest	Yes	Yes

* One sample of each type of crop sampled along the discharge pipeline, from a control location unlikely to be influenced by plant operations.

Ameren UE
Callaway Plant

H190.0010

RP-DTI-ENVIRONMENTAL-SPILLRESP

RESPONSE TO SPILLS OR LEAKS OF RADIOACTIVE MATERIAL

ADMINISTRATIVE CORRECTION

Revision 001

Written by: Cary Wohlers PIN: 6404 Date: 3/19/08

Approved by: Chris Graham PIN: 2241 Date: 3/22/08

INFORMATION USE

RESPONSE TO SPILLS OR LEAKS OF RADIOACTIVE MATERIAL

TABLE OF CONTENTS

RESPONSE TO SPILLS OR LEAKS OF RADIOACTIVE MATERIAL

1.0 PURPOSE

1.1. This instruction provides guidance for response to a spill or leak of radioactive material that could result in contamination of the groundwater.

2.0 SCOPE

2.1. This instruction applies to spills or leaks that could potentially result in an on- site or off- site release or migration of radioactive material to the terrestrial environment or to groundwater, surface water, or onto native soil.

2.2. This instruction does not apply to routine samples obtained pursuant to the Radiological Environmental Monitoring Program (REMP).

3.0 INSTRUCTIONS

3.1. ENSURE the Radiation Protection Manager or the General Supervisor, Radiation Protection has been notified of the spill or leak.

3.2. INITIATE a CAR:

3.2.1. This CAR documents the radiological environmental impact assessment for the event.

3.2.2. This CAR documents the event in accordance with the recordkeeping requirements of 10 CFR 50.75(g).

3.2.3. ENSURE the following keywords are assigned to the CAR:

- REMP
- RETS
- DECOMMISSION

3.3. ASSESS the need for radiological controls:

- Dose rate surveys
- Posting of the area
- Barricades to prevent entry to the contaminated area

3.4. OBTAIN samples of the source, and ANALYZE Per Steps 3.7, 3.8, and 3.9.

3.5. DETERMINE IF voluntary notifications are necessary.

3.5.1. MAKE informal communication before the end of the next business day to the Missouri DNR and local officials with follow-up notification to the NRC regarding a spill or leak to the environment that has or could potentially reach groundwater **and** meets the following criteria:

- The spill or leak exceeds 100 gallons and is from a source containing licensed material.
- The volume of the spill or leak cannot be quantified but is likely to exceed 100 gallons from a source containing licensed material.
- Any spill or leak, regardless of volume or activity, deemed to warrant voluntary communication.

3.5.2. The Manager, Regulatory Affairs is responsible for making this informal communication.

3.5.3. When communicating to the MDNR, local officials, and the NRC regarding a spill or leak, PROVIDE the following information:

- A statement that the communication is being made as a part of the NEI Ground Water Protection Initiative.
- The date and time of the spill or leak
- Whether or not the spill has been contained or the leak has been stopped
- The location of the spill or leak
- The source of the spill or leak
- A list of the contaminants and the verified concentrations
- Description of the actions already taken
- A general description of future actions
- An estimate of the potential or bounding annual dose to a Member of the Public, if available at the time of the communication
- An estimated time/ date to provide additional information or follow-up.

3.5.4. If voluntary communications are performed, NOTIFY NEI by email at GW_Notice@nei.org.

3.6. SAMPLE the affected area and immediately adjacent area:

- Core soil samples at discrete depths
- Groundwater at the appropriate depth
- Surface water grab sample or composite sample, as appropriate

3.7. ANALYZE each sample for the radionuclides listed in the following table:

Nuclide	Required LLD[1]
Principal Gamma Emitters[2]	5E-7
I^{131}	1E-6
H^3	1E-5[3]
Gross alpha	1E-7

3.8. IF any fission products other than H^3 are reported, ANALYZE the affected sample for the radionuclides listed in the following table:

Nuclide	Required LLD[4]
Sr^{89}/ Sr^{90}	5E-8
Fe^{55}	1E-6

3.9. IF Cs^{137}, Ce^{141}, or Ce^{144} is identified, or if the gross alpha results are > 2X the normally expected background, ANALYZE the affected sample for the radionuclides listed in the following table:

Nuclide	Required LLD[5]
Np^{237}	5E-9
Pu^{238}	5E-9
$Pu^{239/240}$	5E-9
Pu^{241}	5E-9
Am^{241}	5E-9
Cm^{242}	5E-9
$Cm^{243/244}$	5E-9

3.10. DETERMINE IF remediation is necessary.

---

[1] µCi/gm (dry) for soil and µCi/ml for water.
[2] The principal gamma emitters are Mn^{54}, Fe^{59}, Co^{58}, Co^{60}, Zn^{65}, Mo^{99}, Cs^{134}, Cs^{137}, Ce^{141}, and Ce^{144}. Other gamma peaks that are identifiable shall also be analyzed and reported.
[3] H^3 should be reported as µCi/ml for the groundwater in the soil.
[4] µCi/gm (dry) for soil and µCi/ml for water.
[5] µCi/gm (dry) for soil and µCi/ml for water

3.11. INCLUDE the following information in the environmental impact assessment:

- Description of incident with respect to the environment
- Immediate actions taken to assess the event
- Actions taken to mitigate the event
- Remediation actions
- Identification and concentration of radionuclides
- Quantities of radionuclides
- Physical and chemical forms of material(s) (e.g., solubility of the contaminant)
- Description of the physical location of the affected areas
  - GPS coordinates
  - Approximate size of the affected area
  - Relationship to landmarks and permanent structures
  - Drawings indicating the location of the affected area
- Determination of the potential for migration based on the site hydrology study:
  - To areas outside the Owner Controlled Area
  - To areas beyond the company property
  - To drinking water supplies
- Dose to the public
- Dose to plant workers
- Description of revisions to the Radiological Environmental Monitoring Program (REMP) resulting from the event
- Sample chain of custody forms
- Laboratory analysis reports
- Final disposition of the affected areas including final contamination levels

3.12. EVALUATE reportability pursuant to the requirements of 10 CFR 50.72(b)(2)(xi).

3.13. DOCUMENT in the Annual Effluent Radiological Release Report (AERR) all spills or leaks for which voluntary notification was performed.

4.0 DEFINITIONS

4.1. Potential to reach groundwater:

- If the spill or leak is directly onto native soil or fill, then it has the potential to reach groundwater.
- If the spill or leak is onto an artificial surface (e.g., concrete or asphalt) and the surface is cracked or the material is porous or unsealed, or if the contamination runs off the artificial surface, then it has the potential to reach groundwater .
- If the spill or leak is directed into unlined or non- impervious ponds or retention basins (i.e., water hydrologically connected to groundwater), then it has the potential to reach groundwater.
- If a spill or leak is inside a building or containment unit, it is generally unlikely to reach groundwater unless there is a pathway, e.g., cracks in the wall or floor of the structure, leaking expansion joints, or leaks in sumps or drains.
- If the spill or leak is onto a semi- impermeable surface and it is recaptured or remediated before the close of the next business day, then it does not have the potential to reach groundwater.
- It is irrelevant whether or not the potentially affected on- site groundwater is, or could be used as, a source of drinking water, unless the MDNR has designated that it is not, and cannot be used as, a source of drinking water.

4.2. Spill or leak: Inadvertent event or perturbation in a system or component's performance.

4.3. Source containing licensed material: A liquid, including steam, for which a statistically valid positive result is obtained when the sample is analyzed to the required Lower Limit of Detection (LLD).

4.4. Lower Limit of Detection (LLD): The term LLD is defined in the Offsite Dose Calculation Manual (ODCM).

4.5. On- site: The Callaway Plant site as described in the FSAR.

5.0 REFERENCES

5.1. Implementing

5.1.1. None

5.2. Developmental

5.2.1. NEI 07-07, "Industry Ground Water Protection Initiative- Final Guidance Document". August, 2007

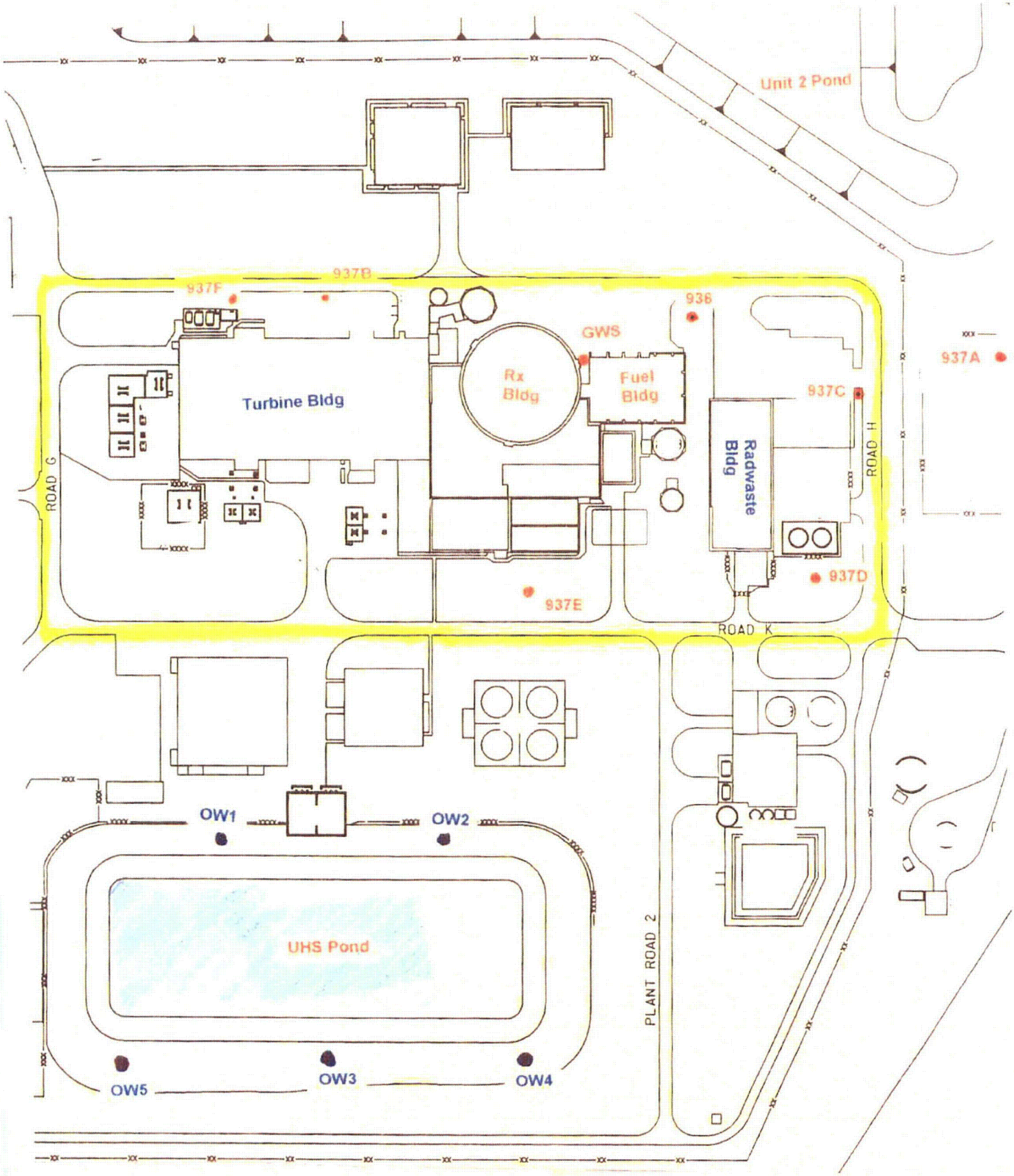
5.2.2. FSAR-SP (ODCM) Table 16.11-1(1)

6.0 SUMMARY OF CHANGES

Page(s)	Section or Step Number	Description
n/a	n/a	Revised Use Level to Information due to APA-ZZ-00100 Changes

ATTACHMENT C

ATTACHMENT D


Unit 2 Pond
937B
937F
936
GWS
937A
Turbine Bldg
Rx Bldg
Fuel Bldg
937C
Radwaste Bldg
ROAD G
ROAD H
937D
937E
ROAD K
OW1
OW2
UHS Pond
PLANT ROAD 2
OW5
OW3
OW4