

**DSAR-11.3**

**Radioactive Waste and Radiation  
Protection and Monitoring**

**Radiological Effluent Requirements**

**Rev 1**

**Safety Classification:**

**Safety**

**Usage Level:**

**Information**

<b>Change No.:</b>	<b>EC 69788</b>
<b>Reason for Change:</b>	<b>This section is being updated to reflect the PDTS and related ODCM revision. The contents of this section have been changed to remove any information which is not applicable during decommissioning.</b>
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**Fort Calhoun Station**

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## 11.3 Radiological Effluent Requirements

### 11.3.1 General

NUREG-1301<sup>(11.4.5)</sup> addressed Standard Radiological Effluent Control for Pressurized Water Reactors.

### 11.3.2 Requirements of RETS

There were twelve essential criteria given for the Offsite Dose Calculation Manual (ODCM), and the Process Control Program (PCP). The means of meeting these criteria are summarized.

#### 11.3.2.1 Effluent Instrumentation

The criteria are that all significant releases of radioactivity shall be controlled and monitored.

All liquid effluents from the Fort Calhoun Station that potentially contain significant radioactivity are released through the overboard header, which is equipped with monitor RM-055, providing automatic termination of release in case of high radiation levels. Adequate instrument testing is performed on the monitoring systems.

Dilution of the radioactive liquid effluent from the plant is provided in the circulating water discharge tunnel by mixing with flow of the raw water system.

There are two monitored release points for radioactive gaseous effluents from the Fort Calhoun Station. The releases are from the Auxiliary Building ventilation stack and the Radioactive Waste Processing Building ventilation stack.

The Auxiliary Building ventilation stack has a noble gas monitor (RM-062). RM-052, when aligned to the Auxiliary Building ventilation stack, is functionally the same as RM-062. The Auxiliary Building ventilation stack is the release point for radioactive gases from the Waste Gas system and auxiliary building releases.

The potentially radioactive gaseous and particulate effluents from the laboratory portion of the CARP Building and the Radioactive Waste Processing Building are released to the atmosphere after being monitored. RM-043 provides monitoring of the noble gas releases and samples releases for particulates and iodine.

The radioactive gaseous effluent monitors have adequate surveillance requirements which meet the intent of NUREG-1301.

Fort Calhoun's Offsite Dose Calculation Manual requires that the release rate of radioactive material in liquid or gaseous effluents shall be in accordance with the requirements of 10 CFR Part 20, and that gaseous concentrations shall be calculated based upon the annual average  $\chi/Q$ <sup>(11.4.11, 11.4.12)</sup>. The setpoints for the radioactive liquid and gaseous effluent instrumentation will be determined in accordance with the ODCM to provide alarm and/or automatic termination of release upon a high radiation condition.

The maintenance of the radioactive liquid and gaseous effluent monitoring instrumentation satisfies the provisions and meets the intent of NUREG-1301.

#### 11.3.2.2 Concentration and Dose Rates of Effluents

Offsite concentrations of radioactivity shall be in accordance with the requirements of 10 CFR Part 20.

Fort Calhoun is required to maintain the concentration of radioactive material, other than dissolved or entrained noble gases, released in liquid effluents to unrestricted areas to within ten times 10 CFR Part 20, Appendix B, Table 2 limits. For dissolved or entrained noble gases, the concentration should be limited to 2.0E-04  $\mu\text{Ci/ml}$  total activity. If the concentration of liquid effluents to the unrestricted area exceeds these limits, it will be restored immediately to a value equal to or less than the effluent concentration ions specified in 10 CFR Part 20. Batch releases are sampled and analyzed periodically in accordance with an acceptable sampling and analysis program.

Fort Calhoun's RETS include a requirement to maintain the release rate of radioactive materials other than noble gases, in gaseous effluents to the unrestricted area to within ten times 10 CFR 20, Appendix B, Table 2 limits. For noble gases, the concentration shall be limited to five times 10 CFR 20, Appendix B, Table 2. Unrestricted area concentrations of radioactive gaseous materials will be calculated based upon the annual average  $\chi/Q$ <sup>(11.4.11, 11.4.12)</sup>. If the concentration of gaseous effluents exceeds these limits, actions will be taken immediately to restore concentrations to within these limits.

The radioactive gaseous waste sampling and analysis program provides adequate sampling and analysis of the discharges.

Therefore, Fort Calhoun's RETS on liquid and gaseous effluent dose rates meets the intent of NUREG-1301.

#### 11.3.2.3 Offsite Doses from Effluents

The objectives of the model RETS with regard to offsite doses from effluents are to ensure that offsite doses are kept ALARA, are in compliance with dose specifications of NUREG-1301 and are in accordance with 10 CFR Part 50, Appendix I and 40 CFR Part 190.

Fort Calhoun's RETS include a requirement to:

1. Limit the dose or dose commitment to a member of the public during any calendar quarter to within the NUREG-1301 criteria.
2. Limit the air dose during any calendar quarter to within the NUREG-1301 criteria.
3. Limit the dose or dose commitment to any organ of an individual in an unrestricted area during any calendar quarter to within the NUREG-1301 criteria.
4. Limit the dose or dose commitment from the uranium cycle to less than 25 mrem/yr to a real individual.

In addition, the annual dose design objectives are equal to the annual dose limits of NUREG-1301 for liquid effluents, air dose due to noble gas releases, and dose to any organ due to release of tritium, and radionuclides in particulate form with half-lives greater than eight days.

Therefore, Fort Calhoun's RETS requirements on offsite doses from radioactive effluents meets the intent of NUREG-1301.

#### 11.3.2.4 Effluent Treatment

The objectives of the model RETS with regard to effluent treatment are to ensure that the radioactive waste treatment systems are used to keep releases ALARA and to satisfy the provisions for the ODCM governing the maintenance and use of rad waste treatment equipment.

Fort Calhoun's RETS include a requirement to operate the liquid radwaste treatment system as identified in the ODCM prior to the discharge of radioactive materials in liquid wastes. If the radioactive liquid wastes were discharged without treatment and in excess of the 31 day limits to the unrestricted areas, a special report shall be submitted to the Commission within 30 days.

The ODCM includes a requirement to use the ventilation exhaust treatment system to treat gaseous effluents prior to discharge of radioactive materials in gaseous wastes. If the radioactive gaseous wastes were discharged without treatment and in excess of the 31 day limits to the areas at and beyond the site boundary, a special report shall be prepared and submitted to the Commission within 30 days. Therefore, Fort Calhoun's RETS on effluent treatment meets the intent of NUREG-1301.

#### 11.3.2.5 Tank Inventory Limits

The objectives of the model RETS with regard to a curie limit on liquid-containing tanks is to ensure that in the event of a tank rupture, the concentrations in the nearest potable water supply and the nearest surface water supply in an unrestricted area would not exceed ten times 10 CFR Part 20, Appendix B, Table 2 limits. The objective of the model RETS with regard to a curie limit on gas-containing tanks is to ensure that in the event of an uncontrolled release of the tank's contents the resulting total body exposure to an individual at the nearest unrestricted area boundary will not exceed 0.1 Rem/yr TEDE.

The ODCM includes a requirement to limit the quantity of radioactive materials in outside temporary liquid radwaste tanks to 10 curies.

Waste gas decay tanks are empty and the waste gas header is vented to the Auxiliary Building.

Therefore, Fort Calhoun's RETS and ODCM submittals on tank inventory limits meets the intent of NUREG-1301.

11.3.2.6 Deleted

11.3.2.7 Solid Radwaste System

The objective of the model RETS with regard to the solid radwaste system is to ensure that radwaste will be properly processed and packaged before it is shipped from the plant to the burial site to satisfy the requirements of 10 CFR Part 20 and 10 CFR Part 71.<sup>(11.4.9)</sup>

Fort Calhoun's RETS include a requirement to use the solid radwaste system in accordance with a Process Control Program (PCP) to process wet radioactive wastes to meet the acceptance criteria of the PCP.

Therefore, RETS on solid radioactive wastes meets the intent of NUREG-1301.

11.3.2.8 Radiological Environmental Monitoring Program

The objectives of the model RETS with regard to a radiological environmental monitoring program are to ensure that (a) an adequate full-area coverage environmental monitoring program exists, (b) there is an appropriate land use census, and (c) an acceptable Interlaboratory Comparison Program exists. The monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50, the land use census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50, and the requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks are performed as part of the quality assurance program for environmental monitoring to demonstrate that valid results are obtained for Section IV.B.2 of Appendix I to 10 CFR Part 50.

Fort Calhoun's RETS and ODCM on a radiological environmental monitoring program have in general followed the model RETS and the Branch Technical Position on the subject as applicable to the site, and have provided an adequate number of sample locations for pathways identified. The method of sample analysis and maintenance of the monitoring program satisfies the requirements of Appendix I, 10 CFR Part 50. The RETS contain a land use census specification which requires the appropriate annual information for a PWR. The RETS requires that Fort Calhoun participate in an NRC-approved Interlaboratory Comparison Program.

Thus, the Technical Specifications and ODCM for a radiological environmental program meets the intent of NUREG-1301.

#### 11.3.2.9 Audits and Reviews

The objective of the model RETS with regard to audits and reviews is to ensure that audits and reviews of the radwaste and environmental monitoring programs are properly conducted.

The Plant Operations Review Committee (PORC) and the Decommissioning Oversight Committee (DOC) are identified as the two groups comparable to the Unit Review Group (URG) and the Company Nuclear Review and Audit Group (CNRAG), respectively.

The PORC is responsible for reviewing changes to the PCP and ODCM as a derivative of the responsibility for reviewing changes to the Technical Specifications. It was determined the requirement to review accidental, unplanned or uncontrolled radioactive releases was satisfied by existing Specifications.

The DOC is responsible for auditing the Radiological Effluent Program including the Radiological Environmental Monitoring Program and results thereof, the Offsite Dose Calculation Manual and implementing procedures, and the Process Control Program for the solidification of radioactive wastes at least once per two years. The Licensee is required to meet or exceed the requirements of Appendix A of USNRC Regulatory Guide 1.33, which specifies requirements for the Quality Assurance Program.

The PORC and DOC encompass the total responsibility for reviews and audits specified in NUREG-1301. Therefore, the requirement for audits and reviews meets the intent of NUREG-1301.

#### 11.3.2.10 Procedures and Records

The objective of the model RETS with regard to procedures is to ensure that written procedures be established, implemented, and maintained for the PCP, the ODCM, and the QA program for effluent and environmental monitoring. The objective of the model RETS with regard to records is to ensure that documented records pertaining to the radiological environmental monitoring program are retained for the duration of the operating license.

Fort Calhoun's RETS include a requirement to establish, implement, and maintain written procedures for the radwaste solidification program (PCP) and the dose evaluation program (ODCM). It was determined the procedure requirement for the quality assurance program was satisfied by the requirement for written procedures recommended in Appendix A of Regulatory Guide 1.33.

The RETS state that records of analyses required by the Radiological Environmental Monitoring Program shall be retained for the duration of the Facility Operating License.

Therefore, the RETS on procedures and records meets the intent of NUREG-1301.

#### 11.3.2.11 Reports

The objective of the model RETS with regard to reporting requirements is to ensure that appropriate annual periodic reports and special reports are submitted to the NRC.

Fort Calhoun's RETS include requirements to submit the following reports:

1. Annual Radiological Environmental Operating Report

This report includes summaries, interpretations and analysis of trends of the results of the radiological environmental surveillance program. The report also includes the results of the land use census, and results of participation in the Interlaboratory Comparison Program. The report will be submitted prior to May 1 of each year.

## 2. Annual Radioactive Effluent Release Report

This report contains a summary of the quantities of radioactive liquid and gaseous effluents released and is submitted each year. The report commits to the requirements of Regulatory Guide 1.21, Rev. 2 which is determined to include a summary of solid waste shipped offsite and a summary of unplanned releases. A summary of the unrestricted area boundary maximum noble gas, gamma air, and beta air doses shall be evaluated. Any changes to the PCP or ODCM are included. The ODCM changes include any changes required by the land use census.

## 3. Special Reports

Fort Calhoun's RETS (in the ODCM) include a requirement to file a special report under the following conditions:

- Exceeding the liquid effluent dose limits according to the ODCM within 30 days of determination.
- Exceeding the gaseous effluent dose limits according to the ODCM within 30 days of determination.
- Exceeding the reporting levels for the radioactivity measured in environmental sampling program in the ODCM within 30 days.
- Exceeding the dose limits of 40 CFR Part 190 according to the ODCM within 30 days of determination.

Therefore, the ODCM required reports meet the intent of NUREG-1301.

### 11.3.2.12 Other Administrative Controls

An objective of the model RETS in the administrative controls section is to ensure that any changes to the PCP and ODCM and major changes to the radioactive waste treatment systems are reported to the NRC.

The Technical Specifications on reports meets the intent of NUREG-1301.

### 11.3.3 Offsite Dose Calculation Manual

As specified in NUREG-1301, the ODCM is to be developed by the Licensee to document the methodology and approaches used to calculate offsite doses and maintain the operability of the effluent system. As a minimum, the ODCM should provide equations and methodology for the following topics:

- Alarm and trip setpoints for effluent instrumentation,
- Liquid effluent concentration in restricted areas,
- Gaseous effluent dose rates or concentrations at or beyond the site boundary,
- Liquid and gaseous effluent dose contributions,
- Total dose compliance,
- Controls and surveillance requirements.

In addition, the ODCM should contain flow diagrams, consistent with the systems being used at the station, defining the treatment paths and the components of the radioactive liquid, gaseous, and solid waste management systems. A description and the location of samples in support of the environmental monitoring program are also needed in the ODCM.

Fort Calhoun's ODCM satisfies the equation in the addendum of NUREG-0133 to determine the alarm and trip setpoints for the overboard discharge header liquid effluent monitor. This assures that the alarm and trip actions will occur prior to exceeding ten times 10 CFR Part 20, Appendix B, Table 2, Column 2 values at the site discharge.

The methodology included in the ODCM to determine maximum allowable release rate setpoints for radioactive noble gases and particulates is based on a limiting activity at the unrestricted area boundary. The methodology and the ODCM requirements to Notes 1 through 4 of 10 CFR Part 20, Appendix B, provides assurance that the maximum permissible concentrations in the unrestricted area are not exceeded.

Compliance to the dose limits of 10 CFR Part 50, Appendix I, is demonstrated by calculating the cumulative dose contributions for liquid and gaseous releases on a quarterly basis. Operating experience has shown that the fish consumption pathway is considered the major pathway of exposure due to radioactive liquid effluents. The dose calculations for the gaseous releases include the noble gas doses to air and the total body and thyroid doses to the child and infant from tritium, and particulates with half-lives greater than eight days. The dose to the individual considers the inhalation, ground plane, and milk, meat and vegetation pathways.

Methodology for demonstrating compliance to 40 CFR 190 is included in the ODCM. The Technical Specifications for Total Dose-Uranium Fuel Cycle describes liquid and gaseous effluent limits that if exceeded will trigger a calculation to determine if 40 CFR 190 limits have been exceeded.

Specific parameters of distance and direction from the centerline of the containment for the radiological environmental monitoring program sample stations are provided in the ODCM.

The ODCM follows the intent of NRC guidance and uses methods consistent with the methodology and guidance prescribed in NUREG-0133 and Regulatory Guide 1.109.