

MONTICELLO NUCLEAR GENERATING PLANT		ODCM-02.01
TITLE:	LIQUID EFFLUENTS	Revision 4
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OFFSITE DOSE CALCULATION MANUAL - TABLE OF CONTENTS

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1.0 RECORD OF REVISION

<u>Revision No.</u>	<u>Date</u>	<u>Reason for Revision</u>
1	December - 1998	Corrected reference to Table 2.1-1 from 2.1.2.
2	October - 2000	Incorporated Radiological Effluents Tech Specs section 3.8.A and 4.8.A. into document.
3	September - 2002	Revised Actions 2.2.3 and 2.3.3 to standardize documentation and reporting.
4	December - 2002	Table numbering was restarted to reflect 1, 2 and 3 verses 3, 4 and 5 throughout the document.

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2.0 LIQUID EFFLUENTS

2.1 Concentration

2.1.1 Controls

- A. In accordance with T.S.6.8.D.2, the concentration of liquid radioactive material released from the site (Figure 1) **SHALL** be limited to ten times the concentration values specified in Appendix B, Table 2, Column 2 of 10CFR20.1001-20.2402 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration **SHALL** be limited to 2×10^{-4} $\mu\text{Ci/ml}$ total activity.

2.1.2 Applicability

At all times.

2.1.3 Action

- A. When the concentration of radioactive material in liquid released from the site exceeds the above limits, immediately restore the concentration within acceptable limits.
- B. Radioactive material in liquid effluent released from the site **SHALL** be continuously monitored in accordance with Table 3.
- C. The liquid effluent monitors having provisions for automatic alarms as listed in Table 3 **SHALL** be used to limit the concentration of radioactive material released at any time from the site to the values given in 2.1.1.A. Setpoints **SHALL** be determined in accordance with the methods in Section 4.0 of the ODCM.
- D. Report all deviations in the Annual Radioactive Effluent Release Report.

2.1.4 Surveillance Requirements

- A. Radioactive liquid wastes **SHALL** be sampled and analyzed according to the sampling and analysis program of Table 2.
- B. The results of radioactive analysis **SHALL** be used in accordance with the methods of the ODCM to assure that the concentrations at the point of release are maintained within the limits of Control 2.1.1.A.
- C. Liquid effluent monitoring instrumentation surveillance **SHALL** be performed as required by Table 1.

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2.2 Dose

2.2.1 Controls

- A. In accordance with T.S.6.8.D.4, the dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released from the site **SHALL** be limited:
1. During any calendar quarter to ≤ 1.5 mrem to the total body and to ≤ 5 mrem to any organ, and
 2. During any calendar year to ≤ 3 mrem to the total body and to ≤ 10 mrem to any organ.

2.2.2 Applicability

At all times.

2.2.3 Action

- A. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, document and report IAW ODCM-01.01, Section 2.4.1.C.

2.2.4 Surveillance Requirements

- A. Cumulative dose contributions for the current calendar quarter and current calendar year **SHALL** be determined monthly in accordance with the ODCM.

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2.3 Liquid Radwaste Treatment Systems

2.3.1 Controls

- A. In accordance with T.S.6.8.D.6, the LIQUID RADWASTE TREATMENT SYSTEM **SHALL** be used to reduce the radioactive materials in liquid wastes prior to their discharge when the projected doses, due to the liquid effluent from the site would exceed 0.06 mrem to the whole body or 0.2 mrem to any organ when averaged over one month.

2.3.2 Applicability

At all times.

2.3.3 Action

- A. With radioactive liquid waste being discharged without treatment and in excess of the above limits, document and report IAW ODCM-01.01, Section 2.4.1.C.

2.3.4 Surveillance Requirements

- A. Doses due to liquid releases **SHALL** be projected at least once each month in accordance with the ODCM.

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2.4 Liquid Holdup Tanks

2.4.1 Controls

- A. In accordance with T.S.6.8.1.3, the quantity of radioactive material contained in each outside temporary tank **SHALL** be limited to ≤ 10 curies, excluding tritium and dissolved or entrained gases.

2.4.2 Applicability

At all times.

2.4.3 Action

- A. With the quantity of radioactive material contained in any outside temporary tank exceeding the limit in 2.4.1.A. above, immediately suspend all additions of radioactive material to the tank and within 48 hours reduce the tank contents to within the limit.

2.4.4 Surveillance Requirements

- A. The quantity of radioactive material contained in each outside temporary tank **SHALL** be determined to be within the limit in 2.4.1.A. by analyzing a representative sample of the tank's contents at least weekly when radioactive materials are being added to the tank.

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2.5 Bases

2.5.1 Liquid Effluents

A. Concentration

Control 2.1.1.A. is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to Unrestricted Areas will be less than 10 times the concentration values specified in Appendix B, Table 2, Column 2 to 10CFR20.1001-20.2402. The control provides operational flexibility for releasing liquid effluents in concentrations to follow the Section II.A and II.C design objectives of Appendix I to 10CFR Part 50. This limitation provides reasonable assurance that the levels of radioactive materials in bodies of water in Unrestricted Areas will result in exposures within (1) the Section II.A design objectives of Appendix I, 10CFR Part 50, to a Member of the Public and (2) restrictions authorized by 10CFR20.1301(e). The concentration limit for the dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radionuclide and its effluent concentration in air (submersion) was converted to an equivalent concentration in water. This control does not affect the requirement to comply with the annual limitations of 10CFR20.1301(a).

B. Dose

Control 2.2.1.A. is provided to implement the requirements of Sections II.A, III.A and IV.A of Appendix I, 10CFR Part 50. Action required by Control 2.2.1 provides the required operating flexibility and at the same time implements the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as is reasonably achievable". Considering that the nearest drinking water supply using the receiving water is 33 river miles downstream, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40CFR141.

The dose calculations in the ODCM implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents will be consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with

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10CFR50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I, Revision 1," April 1977. NUREG-0133, October 1978 provides methods for dose calculations consistent with Regulatory Guides 1.109 and 1.113.

C. Liquid Radwaste Treatment Systems

Control 2.3.1.A. provides assurance that the liquid radwaste treatment system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirements that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable". This control implements the requirements of 10CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10CFR Part 50 and design objective Section II.D of Appendix I to 10CFR Part 50. The specified limits governing the use of appropriate portions of the liquid radwaste treatment system were specified as a suitable fraction of the guide set forth in Section II.A of Appendix I, 10CFR Part 50, for liquid effluents.

The radioactive liquid effluent monitoring instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoint for these instruments **SHALL** be calculated and adjusted in accordance with the methodologies and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10CFR Part 50.

D. Liquid Holdup Tanks

Restrictions on the quantity of radioactive liquid material contained in tanks are required only for temporary tanks. All exterior permanent tanks are diked to prevent release of their contents in the event of leakage. Restricting the quantity of radioactive material contained in the specified tanks provides assurance that in the event of an uncontrolled release of the tanks contents, the resulting concentrations would be less than the values given in Appendix B, Table 2, Column 2, to 10CFR20.1001-20.2402 at the nearest potable water supply and the nearest surface water supply in an unrestricted area.

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Surveillance requirements for continuous liquid release points are not provided since all Monticello releases are “batch” type releases.

Radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The alarm setpoints for these instruments will be calculated in accordance with NRC approved methods in the ODCM to ensure that the alarm will occur prior to exceeding the limits of 10CFR20. The operability requirements for instrumentation are consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10CFR Part 50.

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Figure 1 Monticello Nuclear Generating Plant Site Boundary for Liquid Effluents

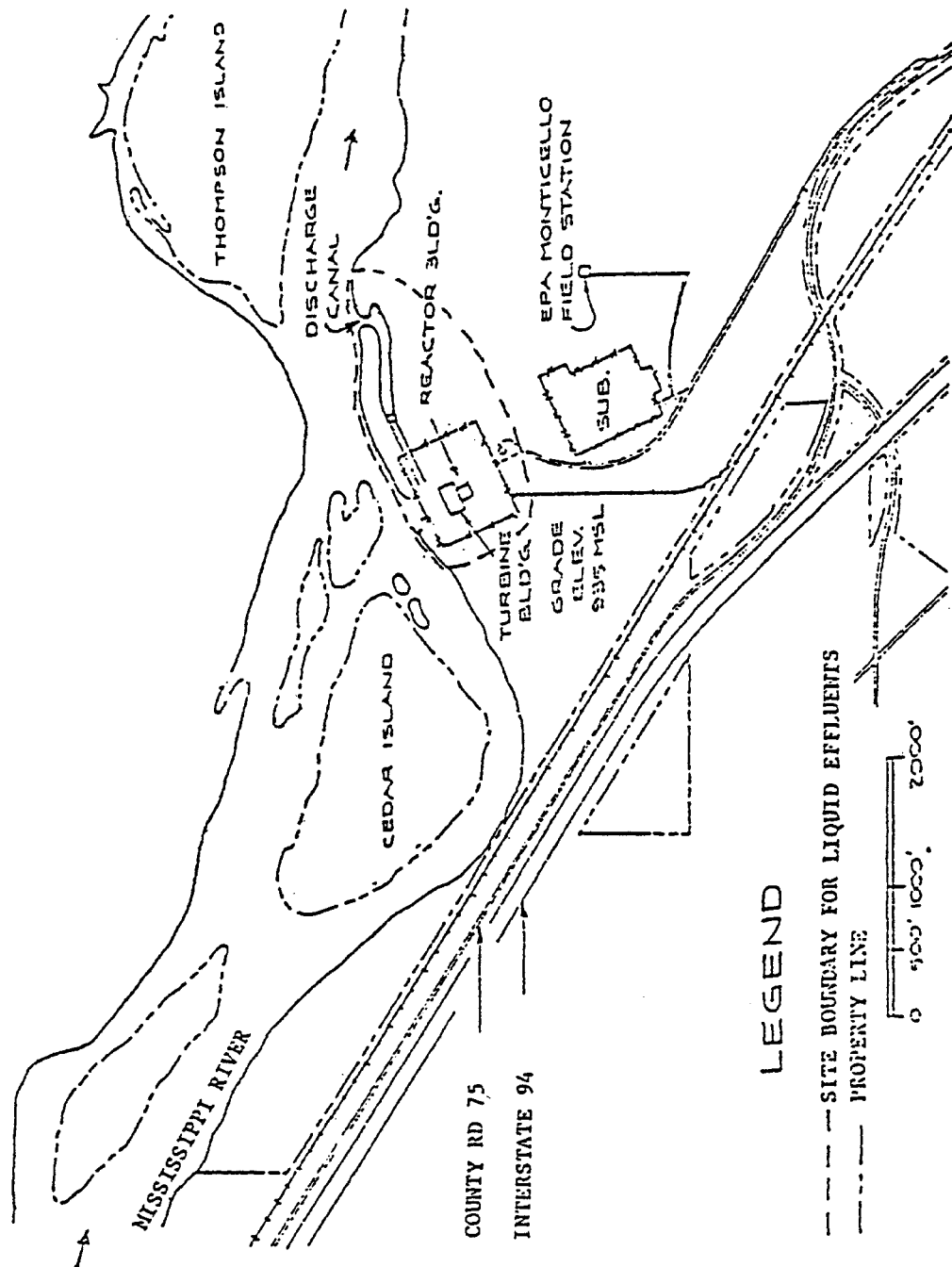


Table 1 Radioactive Liquid Effluent Monitoring Instrumentation Surveillance Requirements

Instrument	Sensor Check Frequency	Source Check Frequency	Functional Test Frequency	Calibration Frequency
Liquid Radwaste Effluent Line Gross Radioactivity Monitor	Daily during release	Immediately Prior to Each Release	Within 3 months prior to making a release	Within 12 months prior to making a release.*
Liquid Radwaste Effluent Line Flow Instrument	Daily during release	-	Within 3 months prior to making a release	Within 12 months prior to making a release.
Instruments used in Determination of Discharge Canal Flow	Daily during release	-	Within 3 months prior to making a release	Within 18 months prior to making a release.
Service Water Discharge Pipe Gross Radioactivity Monitor	Daily	Monthly	Quarterly	Each Operating Cycle*
Discharge Canal Gross Radioactivity Monitor	Daily	Monthly	Quarterly	Each Operating Cycle **
Turbine Building Normal Drain Sump Monitor	Daily	Monthly	Quarterly	Each Operating Cycle
Level Monitors for Temporary Outdoor Tanks Holding Radioactive Liquid	Daily when in use	-	Quarterly when in use	Each Operating Cycle when in use

* - The initial Instrument Calibration **SHALL** be performed using one or more of the reference standards certified by the National Bureau of Standards (NBS) or using sources traceable to NBS standards. These standards **SHALL** permit calibrating the system over its intended range of energy and measurement range. For subsequent calibration sources that have been related to the initial calibration **SHALL** be used.

** - An initial Instrument Calibration was performed using a liquid reference standard over the systems intended range of energy and measurement range. Solid calibration sources traceable to NBS Standards currently being applied for instrument calibrations were related to the initial calibration. If, in the future, the canal radioactivity monitor is replaced, the following conditions **SHALL** apply:

- a. Detector response and system efficiency **SHALL** be equal to or better than the present system.
- b. Footnote (*) **SHALL** apply

Table 2 Radioactive Liquid Waste Sampling And Analysis Program

Liquid Release Type	Sampling Frequency	Minimum Analysis Frequency	Type of Activity Analysis	Lower Limit of Detection (LLD) (uci/m) ^{a,e}
Batch Waste Release Tanks ^b	Each Batch	Each Batch	Principal Gamma Emitters ^d	5×10^{-7}
			I-131	1×10^{-6}
	One Batch Each Month	One Batch Each Month	Dissolved and Entrained Gases	1×10^{-5}
	Each Batch	Monthly Composite ^c	H-3	1×10^{-5}
			Gross alpha	1×10^{-7}
	Each Batch	Quarterly Composite ^c	Sr-89, Sr-90	5×10^{-8}
			Fe-55	1×10^{-6}

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Table 2 Radioactive Liquid Waste Sampling And Analysis Program (cont'd)

Notes

- a. The LLD is the smallest concentration of radioactive material in a sample that will be detected with 95% probability with 5% probability of falsely concluding that a blank observation represents a "real" signal.
 For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 s_b}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda \Delta t)}$$

where:

- LLD is the a priori lower limit of detection as defined above (as picocurie per unit mass or volume),
- s_b is the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (as counts per minute). Typical values of E, V, Y and Δt **SHALL** be used in the calculations.
- E is the counting efficiency (as counts per transformation),
- V is the sample size (in units of mass or volume),
- 2.22 is the number of transformations per minute per picocurie,
- Y is the fractional radiochemical yield (when applicable),
- λ is the radioactive decay constant for the particular radionuclide, and
- Δt is the elapsed time between midpoint of sample collection and time of counting.

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Table 2 Radioactive Liquid Waste Sampling And Analysis Program (cont'd)

- b. A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch **SHALL** be isolated and then thoroughly mixed to assure representative sampling.
- c. A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen which is representative of the liquids released.
- d. The principle gamma emitters for which the LLD specification will apply are exclusively the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, **SHALL** also be identified and reported.
- e. Nuclides which are below the LLD for the analyses **SHALL** be reported as "less than" the LLD of the nuclide and should not be reported as being present at the LLD level for that nuclide. The "less than" values **SHALL** not be used in the required dose calculations. When unusual circumstances result in LLDs higher than required, the reasons **SHALL** be documented in the Radioactive Effluent Release Report.

Table 3 Radioactive Liquid Effluent Monitoring Instrumentation

Instrument	Minimum Channels Operable	Applicability	Action if Minimum Channels not operable
Liquid Radwaste Effluent Line Gross Radioactivity Monitor	1	During Release of Liquid Radwaste	Liquid radwaste releases may continue for up to 14 days provided that prior to initiating a release: <ul style="list-style-type: none"> a. At least two independent samples are analyzed in accordance with Table 2. b. At least two technically qualified members of the Facility Staff independently verify the release rate calculations and discharge line valving; <p>Otherwise, suspend release of radioactive effluents via this pathway.</p>
Liquid Radwaste Effluent Flow Instrument	1	During Release of Liquid Radwaste	Liquid radwaste releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least every four hours during actual releases. Pump curves may be used to estimate flow.
Discharge Canal Flow Measurement: <ul style="list-style-type: none"> - Open Cycle Mode - Closed/Helper Cycle Mode 	1 1	During Release of Liquid Radwaste	Effluent releases via this pathway may continue for up to 30 days provided the flow rate is estimated at least once every four hours during actual releases. Pump curves may be used to estimate flow.
Discharge Canal Gross Radioactivity Monitor*	1	At all times	Effluent releases may continue for up to 30 days provided that at least once every 8 hours a grab sample SHALL be collected and analyzed for gross beta at an LLD of 10^{-7} $\mu\text{Ci/ml}$ or gamma isotopic for principle gamma emitters at an LLD of 5.0×10^{-7} $\mu\text{Ci/ml}$.

* - Indicates monitor provided with automatic alarm.

Table 3 Radioactive Liquid Effluent Monitoring Instrumentation (cont'd)

Instrument	Minimum Channels Operable	Applicability	Action if Minimum Channels not operable
Service Water Discharge Pipe Gross Radioactivity Monitor*	1	At all times	Service water discharge may continue for up to 30 days provided that at least once every 8 hours a grab sample SHALL be collected and analyzed for gross beta at an LLD of 10^{-7} μ Ci/ml or gamma isotopic for principle gamma emitters at an LLD of 5.0×10^{-7} μ Ci/ml.
Turbine Building Normal Sump Monitor*	1	At all times	Liquid sump releases may continue for up to 30 days provided that at least once every 8 hours a grab sample SHALL be collected and analyzed for gross beta at an LLD of 10^{-7} μ Ci/ml or gamma isotopic for principle gamma emitters at an LLD of 5.0×10^{-7} μ Ci/ml.
Level Monitors for Temporary Outdoor Tanks Holding Radioactive Liquid	1	When tanks are in use	Liquid additions to a tank may continue for up to 30 days provided the tank level is estimated during all liquid additions.

* - Indicates monitor provided with automatic alarm.