UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATING TO ACCEPTANCE OF REVISION 5 TO THE

OFFSITE DOSE CALCULATION MANUAL (ODCM)

NORTHERN STATES POWER COMPANY

MONTICELLO NUCLEAR GENERATING PLANT

DOCKET NO. 50-263

1.0 INTRODUCTION

On December 17, 1982, the staff issued Amendment No. 15 to Facility Operating License No. DPR-22 for the Monticello Nuclear Generating Plant (Monticello). The amendment incorporated the Radiological Effluent Technical Specifications (RETS) into the Monticello Technical Specifications (TS). Section 6.5.E of the TS referenced an Offsite Dose Calculation Manual (ODCM) and prescribed the methods for its change.

2.0 EVALUATION

The docketed submittal on July 23, 1982, of an ODCM by Northern States Power Company (NSP, licensee) received NRC approval by letter dated December 17, 1982, from D. Vassallo to the licensee.

Since 1982, a number of changes have been made in the Monticello ODCM and reported to NRC in ODCM revisions in accordance with Monticello TS 6.5.E.1. The latest of these, Revision 5, dated May 3, 1984 and submitted August 31, 1984, has been reviewed for us by EG&G Idaho, Inc. (EG&G) as part of our technical assistance contract program. The contractor's Technical Evaluation Report (TER), which is enclosed as Appendix D from EGG-PHY-7157, provides a technical evaluation of the compliance of the Licensee's submittal with NRC criteria. The staff has reviewed this report, and agrees with the evaluation that the Monticello ODCM, Rev. 5, generally uses documented and approved methods that are consistent with the methodology and guidelines in NUREG-0133.

However, two items have been identified in the TER by the contractor which require consideration of refinements in interpretation of NRC guidance developed during the implementation of RETS in operating reactors (OR). Monticello was the first OR, operating prior to 1979, to implement the RETS; thus, the licensee's RETS are based on early staff guidance in these areas. Present staff understanding directs that the calculation of the limiting gaseous effluent dose rate corresponding to the inhalation pathway be made with respect to the thyroid of a child instead of an infant. The basis for this is that the dose rate due to the combination of the breathing rate and the dose factor for a child is more restrictive than the dose rate due to the same combination for an infant. The basis statements for the Gaseous Effluent Dose Rate TS in current staff guidance

for BWRs are included for information as Attachment I to this SER.

Similarly, the TS on the total dose incorporated in the Monticello RETS is based on an early revision of the staff's model RETS guidance. More recent guidance, enclosed as Attachment II to this SER, clarifies the actions required to meet the intent of the total dose regulations. The statement in the middle of page 4-1 of the Monticello ODCM excludes direct shine from consideration in calculating the total dose. This is in error, as borne out by Attachment II. Although the present Monticello TS 3.8.D for the total dose is acceptable, the licensee may want to consider the clarification provided by the alternate wording of Attachment II. At a minimum, the statements on total dose in the ODCM should be made consistent with the Monticello TS and the guidance of Attachment II.

Since these two problems involve refinements to a basically sound ODCM document, there is no need for immediate action. However, they should be addressed in the next revision to the ODCM. Similarly the several typographical errors identified by the contractor in the TER should also be addressed in the next ODCM revision.

One further addition to the ODCM should be considered. As the implementation of the RETS progressed, the function of the ODCM for some ORs was extended to include not only calculational parameters and methodology but also documentation of details, approaches, or interpretations not appropriate for inclusion in the TS. Since the ODCM is a staff-reviewed document, some licensees are using it to add perspective to the commitments of the RETS. In the case of Monticello, neither the RETS nor ODCM Section 2 on liquid effluents gives any hint of the licensee's philosophy of minimal, if not zero, discharge of radioactive liquid effluents. An introductory paragraph to ODCM Section 2 describing the plant's normal approach to radioactive liquid effluents and monitoring would provide a useful perspective for the following sections on methodology.

3.0 CONCLUSIONS

The Monticello ODCM, Rev. 5, is an acceptable reference for use with Monticello TS 6.5.E. The changes incorporated in Revs. 3, 4, and 5 are in compliance with Monticello TS 6.5.E.1.

Principal Contributor: W. Meinke

Dated: October 22, 1986.

Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, 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," April 1977.

This specification applies to the release of liquid effluents from each reactor at the site. For units with shared radwaste treatment systems, the liquid effluents from the shared system are proportioned among the units sharing that system.

3/4.11.1.3 LIQUID RADWASTE TREATMENT SYSTEM

The requirement 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 specification implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR 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 dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

This specification applies to the release of liquid effluents from each reactor at the site. For units with shared radwaste treatment systems, the liquid effluents from the shared system are proportioned among the units sharing that system.

3/4.11.1.4 LIQUID HOLDUP TANKS

The tanks listed in this Specification include all those outdoor tanks that are not surrounded by liners, dikes, or walls capable of holding the tank contents and that do not have tank overflows and surrounding area drains connected to the liquid radwaste treatment system.

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 limits of 10 CFR Part 20, Appendix B, Table II, Column 2, at the nearest potable water supply and the nearest surface water supply in an UNRESTRICTED AREA.

3/4.11.2 GASEOUS EFFLUENTS

3/4.11.2.1 DOSE RATE

This specification is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. The annual dose limits are the doses associated with the concentrations of 10 CFR Part 20, Appendix B, Table II, Column 1. These limits provide reasonable

assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table II of 10 CFR Part 20 (10 CFR Part 20.106(b)). For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, shall be given in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrems/year to the total body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

This specification applies to the release of gaseous effluents from all reactors at the site.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLDs). Detailed discussion of the LLD, and other detection limits can be found in HASL Procedures Manual, HASL-300 (revised annually), Currie, L. A., "Limits for Qualitative Detection and Quantitative Determination - Application to Radiochemistry," Anal. Chem. 40, 586-93 (1968), and Hartwell, J. K., "Detection Limits for Radioanalytical Counting Techniques," Atlantic Richfield Hanford Company Report ARH-SA-215 (June 1975).

3/4.11.2.2 DOSE - NOBLE GASES

This specification is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable." The Surveillance Requirements 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 a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are 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 10 CFR Part 50, Appendix I," Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors," Revision 1, July 1977.

RADIOACTIVE EFFLUENTS

3/4.11.4 TOTAL DOSE

LIMITING CONDITION FOR OPERATION

3.11.4 The annual (calendar year) dose or dose commitment to any MEMBER OF THE PUBLIC due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems.

APPLICABILITY: At all times.

ACTION:

a. With the calculated doses from the release of radioactive materials in liquid or gaseous effluents exceeding twice the limits of Specification 3.11.1.2.a, 3.11.1.2.b, 3.11.2.2.a, 3.11.2.2.b, 3.11.2.3.a, or 3.11.2.3.b, calculations should be made including direct radiation contributions from the reactor units and from outside storage tanks to determine whether the above limits of Specification 3.11.4 have been exceeded. If such is the case in lieu of a Licensee Event Report, prepare and submit to the Commission within 30 days, pursuant to Specification 6.9.2, a Special Report that defines the corrective action to be taken to reduce subsequent releases to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR Part 20.405c, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

b. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.11.4.1 Cumulative dose contributions from liquid and gaseous effluents shall be determined in accordance with Specifications 4.11.1.2, 4.11.2.2, and 4.11.2.3, and in accordance with the methodology and parameters in the ODCM.

4.11.4.2 Cumulative dose contributions from direct radiation from the reactor units and from radwaste storage tanks shall be determined in accordance with the methodology and parameters in the ODCM. This requirement is applicable only under conditions set forth in Specification 3.11.4.a.

3/4.11.4 TOTAL DOSE

This specification is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20 by 46 FR 18525. The specification requires the preparation and submittal of a Special Report whenever the calculated doses from plant generated radioactive effluents and direct radiation exceed 25 mrems to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to 4 reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the reactor units and outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits. For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR Part 190.11 and 10 CFR Part 20.405c, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to the limits of 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Specifications 3.11.1.1 and 3.11.2.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

APPENDIX D

Changes to the ODCM

for the

Monticello Nuclear Generating Plant

D.1 EVALUATION OF LICENSEE-REPORTED REVISIONS TO ODCM

The Licensee has made changes to the existing ODCM that was issued by the Licensee on July 23, 1982 and approved by NRC on December 17, 1982.[a] These changes appeared as Revisions 3 through 5 to the ODCM in the Semiannual Radioactive Effluent Release Reports as issued by the Licensee in 1983 and in the first 6 months of 1984.

These changes have been incorporated into the Licensee's existing ODCM and reviewed as a whole. The result of the evaluation is intended to be a stand-alone document, and is given in Supplement A to Appendix D.

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a. Letter from D. B. Vassallo (NRC/DL) to D. M. Musolf (NSPC), December 17, 1982.

SUPPLEMENT A

to

APPENDIX D

EVALUATION OF LICENSEE-REPORTED REVISIONS TO THE ODCM

1.0 INTRODUCTION

1.1 Purpose of Review

The purpose of this document is to review and evaluate the changes to the Offsite Dose Calculation Manual (ODCM) made by the Monticello Nuclear Generating Plant Unit 1 since July 23, 1982 when the ODCM was issued by the Licensee as Revision 0,[1] which was subsequently approved by the NRC.[2]

The ODCM is a supplementary document for implementing the Radiological Effluent Technical Specifications (RETS) in compliance with 10CFR50, Appendix I requirements.[3]

1.2 Scope of Review

As specified in NUREG-0472[4] and NUREG-0473,[5] 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 radioactive effluent system. As a minimum, the ODCM should provide equations and methodology for the following topics:

- Alarm and trip setpoint on effluent instrumentation
- Liquid effluent concentration in unrestricted areas
- Gaseous effluent dose rate at or beyond the site boundary
- Liquid and gaseous effluent dose contributions
- Liquid and gaseous effluent dose projections.

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.

1.3 Plant-Specific Background

On behalf of Monticello Nuclear Generating Plant, the Northern States Power Company submitted changes to the existing ODCM[1] in the Semiannual Radioactive Effluent Release Reports issued by the Licensee. The Licensee issued Revision 3 of the ODCM in the first six months of 1983,[6] Revision 4 in the second six months,[7] and Revision 5 in the first six months of 1984.[8]

The Licensee's Semiannual Reports and the changes to the ODCM were transmitted to an independent review team at the Idaho National Engineering Laboratory (INEL) for review. The review was subsequently conducted by EG&G Idaho, and the results and conclusions of the ODCM evaluation are presented in Sections 3 and 4 of this document.

2.0 REVIEW CRITERIA

Review criteria for the ODCM were provided by the NRC in three documents:

NUREG-0472, RETS for PWRs[4]
NUREG-0473, RETS for BWRs[5]
NUREG-0133, Preparation of RETS for Nuclear Power Plants.[10]

In the ODCM review, the following NRC guidelines are used: "General Contents of the Offsite Dose Calculation Manual," Revision 1,[9] and NUREG-0133.[10] Regulatory Guide 1.109[11] also provides technical guidance for the review. The ODCM format is left to the Licensee and may be simplified by tables and grid printouts.

3.0 EVALUATION

The Licensee has followed the methodology of NUREG-0133[10] to determine the alarm and trip setpoints for the liquid and gaseous effluent monitors, which ensures that the maximum permissible concentrations, as specified in 10CFR20, will not be exceeded by discharges from various liquid or gaseous release points. There are three liquid effluent monitors: the radwaste discharge line monitor; the discharge canal monitor; and the service water discharge pipe monitor. All normal releases are monitored by the radwaste discharge line monitor. The discharge canal monitor and service water discharge line monitor are provided to detect unplanned or accidental releases. There are therefore no multiple release points and monitor settings do not have to be reduced to account for multiple releases. The methodology in the ODCM satisfies the equations in NUREG-0133 to determine the high high alarm setpoints for the reactor building vent isolation monitor and the stack isolation monitor. The monitor's setpoints are reduced to half the calculated value to ensure the site boundary limit is not exceeded due to simultaneous releases from several release points. This provides assurance that the alarm and trip actions will occur prior to exceeding the dose rates identified in the Licensee's RETS. The methodology for calculating the high high alarm setpoint for the accident monitors (the condenser air ejector radioactivity monitor) is described in the ODCM. The accident monitors measure the gross radioactivity of noble gases removed from the main condenser by the steam jet air ejector. The Licensee's method for setpoint calculations meets the guidelines of NUREG-0133.

Compliance to the maximum permissible concentrations (MPCs) of 10 CFR Part 20 is partially assured by analysis of a grab sample from the liquid waste batch tank prior to the release and the methodology is described in the ODCM. Table 2.1-1 on page 2-4d of the ODCM should include Mn-54, Fe-59, Co-58, Zn-65 and Ce-141 which are part of the nuclide list in footnote d on page 189r of the Licensee's RETS. Regardless, the method satisfies the guidance of NUREG-0133.

Compliance to the 10 CFR Part 20 MPC values for noble gases is assured by the setpoint calculations previously discussed. Compliance to the 10 CFR Part 20 MPC values for iodines, particulates and radionuclides with half lives greater than eight days is assured by implementing the dose rate calculation described in the ODCM. The dose rate calculation is made prior to a drywell purge and weekly for all releases. The source terms in the calculation are determined from the results of weekly analysis of the main stack and reactor building particulate filters and charcoal cartridges. The critical receptor location for the dose rate calculation is based on the highest calculated annual average X/Q value for the reactor building vent's long-term releases for any area at or beyond the site boundary for all sectors. However, the calculation should be made for the dose rate to the thyroid of a child instead of an infant via the inhalation pathway as identified in Draft 7", Revision 3 to NUREG-0473. Additionally, Table 3.2-1 should contain the dose factors for a child's thyroid. Instead the table contains the highest dose factors from all organs for an infant. However, calculations based on the data in this table would result in a more restrictive limit on radioactive releases than if the dose rate to the thyroid only had been calculated.

Doses to members of the public due to radionuclides identified in liquid effluents will be calculated monthly to show compliance with 10 CFR Part 50 Appendix I. The Licensee identifies the water and fish consumption pathways for the dose calculations assuming the adult as the maximum exposed individual. The methodology includes near-field and far-field dilution factors specific to the plant. However, a reference should be cited for the far-field dilution factor. The dose calculation methodology in the ODCM satisfys the relationships presented in NUREG-0133.

Doses resulting from the release of noble gases, and radioiodines and particulates are calculated monthly to show compliance with 10 CFR Part 50 Appendix I. Although the ODCM contains minor discrepancies, the methodology in the ODCM satisfies the relationships presented in NUREG-0133.

Methodology to determine required use of the liquid radwaste treatment system based on dose projections is described in the ODCM. The methodology is based on the dose calculation due to radioactive liquid effluents which satisfies the relationships in NUREG-0133.

Dose projections for gaseous effluents are not required since the Technical Specifications require the offgas holdup system to be operated at all times.

The Licensee's RETS identify a curie limit on the quantity of gas contained in a waste gas decay tank and the method for demonstrating shall be described in the ODCM. The ODCM contains a procedure that provides reasonable assurance that the curie limit in a waste gas decay tank will not be exceeded.

The ODCM does not contain simplified flow diagrams illustrating the treatment paths and the components of the radioactive liquid, gaseous and solid waste management system.

Specific parameters of distance and the direction sector from the plant and additional information have been provided for each and every sample location identified in the Monticello RETS Environmental Monitoring Table 4.16.1. The data are contained in ODCM Table 5.1-1 and in the figures of the ODCM.

Methodology for demonstrating compliance to 40 CFR Part 190 is described in the ODCM. However, it is not clear why "direct shine" is excluded as stated on page 4-1 of the ODCM.

In summary, the Licensee's ODCM as revised uses documented and approved methods that are generally consistent with the methodology and guidance in NUREG-0133, and therefore is an acceptable reference.

4.0 CONCLUSIONS

The Licensee's revisions (Rev. 3 through 5) to the Offsite Dose Calculation Manual (ODCM Rev. 2) as submitted in the Licensee's Semiannual Radioactive Effluent Release Reports for 1983[6,7] and for the first six months of 1984[8] use documented and approved methods and are consistent with the criteria of NUREG-0133, except for the following discrepancies:

- Table 2.1-1 on page 2-4d of the ODCM should include Mn-54, Fe-59, Co-58, Zn-65, and Ce-141 which are part of the nuclide list in footnote d on page 198r of the Licensee's RETS.
- A reference should be cited for the far-field dilution factor D_w reported as 7:1 on page 2-9 of the ODCM.
- The gaseous effluent dose rate calculation should be made for the dose rate to the thyroid of a child instead of an infant via the inhalation pathway as identified in Draft 7", Revision 3 to NUREG-0473. The effects on the dose rate due to the combination of the breathing rate and the DF for a child is more restrictive than the combination for the infant.
- Equation 3.1-1 referenced on pages 3-14 and 3-15 should be Equation 3.2-1.
- The word "dose" should be replaced by "dose rate" in several places in Section 3.2.2 and once in Section 3.2.3.
- Table 3.2-1 should contain the dose factors for a child's thyroid. Instead the table contains the highest dose factors from all organs for an infant as shown on the following page. However, calculations based on the data in this table would result in a more restrictive limit on radioactive releases than if the dose rate to the thyroid had been calculated.

- Appendix E should be modified to address the child thyroid, e.g.,

  P_{iI} = 3.7 E9 DFA_i child

  instead of

  P_{iI} = 1.4 E9 DFA_i infant
- Table 3.3-3 referenced on page 3-18 of the ODCM should be Table 3.3-1.
- The units for R_{ijak} on page 3-22 should be in microcuries instead of curies.
- Table A-5 referenced on page 3-24 should be Table A-4.
- It is not clear why "direct shine" is excluded as stated on page 4-1 of the ODCM.

P_i Values for Infant

Isotope	P_i $\frac{(mrem/yr)}{(uCi/m^3)}$		Basis From Table E-10[a]	
	Formerly	Corrected		
H-3	6.47 E 2	6.47 E 2	4.62 E-7	Lung
P-32	2.03 E 6	--------	--------	
Cr-51	3.57 E 2	1.28 E 4	9.17 E-6	Lung
Mn-54	2.53 E 4	1.00 E 6	7.16 E-4	Lung
Fe-59	2.35 E 4	1.02 E 6	7.31 E-4	Lung
Co-58	1.11 E 4	7.77 E 5	5.57 E-4	Lung
Co-60	3.19 E 4	4.51 E 6	3.23 E-3	Lung
Zn-65	6.25 E 4	6.47 E 5	4.63 E-4	Lung
Rb-86	1.90 E 5	1.90 E 5	1.36 E-4	Liver
Sr-89	3.97 E 5	2.03 E 6	1.45 E-3	Lung
Sr-90	4.09 E 7	4.09 E 7	2.93 E-2	Bone
Y-91	7.00 E 4	2.45 E 6	1.75 E-3	Lung
Zr-95	2.17 E 4	1.75 E 6	1.25 E-3	Lung
Nb-95	1.30 E 4	4.79 E 5	3.43 E-4	Lung
Ru-103	1.60 E 4	5.52 E 5	3.95 E-4	Lung
Ru-106	1.60 E 5	1.16 E 7	8.31 E-3	Lung
Ag-110m	3.30 E 4	3.67 E 6	2.63 E-3	Lung
Te-127m	3.80 E 4	1.31 E 6	9.38 E-4	Lung
Te-129m	3.20 E 4	1.68 E 6	1.20 E-3	Lung
Cs-134	7.02 E 5	7.03 E 5	5.04 E-4	Liver
Cs-136	1.35 E 5	1.35 E 5	9.67 E-5	Liver
Cs-137	6.12 E 5	6.12 E 5	4.38 E-4	Liver
Ba-140	5.59 E 4	1.60 E 6	1.15 E-3	Lung
Ce-141	2.15 E 4	5.17 E 5	3.70 E-4	Lung
Ce-144	1.50 E 5	9.84 E 6	7.05 E-3	Lung
I-131	1.48 E 7	1.48 E 7	1.06 E-2	Thyroid
I-133	3.56 E 6	--------	--------	

a. The largest dose factors from Table E-10 of Reg. Guide 1.109 were used to generate the data in this table.

5.0 REFERENCES

1. Letter from D. M. Musolf (NSPC) to D. B. Vasallo (NRC)
   Subject: Monticello Radiological Effluent Technical Specifications, July 23, 1982.

2. Letter from D. B. Vassallo (NRC) to D. M. Musolf (NSPC)
   Subject: Amendment No. 15 tc Facility Operating License No. DPR-22, December 17, 1982.

3. Title 10, Code of Federal Regulations, Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion, "As Low As Is Reasonably Achievable," for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents"

4. "Radiological Effluent Technical Specifications for Pressurized Water Reactors," Rev. 3, Draft 7", intended for contractor guidance in reviewing RETS proposals for operating reactors, NUREG-0472, September 1982,

5. "Radiological Effluent Technical Specifications for Boiling Water Reactors," Rev. 3, Draft 7", intended for contractor guidance in reviewing RETS proposals for operating reactors, NUREG-0473, September 1982

6. "Effluent and Waste Disposal Semiannual Report for January 1, 1983 through June 30, 1983," Monticello Nuclear Generating Plant, Northern States Power Company,NRC Docket No. 50-263, August 30, 1983

7. "Effluent and Waste Disposal Semiannual Report for July 1, 1983 through December 31, 1983," Monticello Nuclear Generating Plant, Northern States Power Company, NRC Docket No. 50-263, March 1, 1984

8. "Effluent and Waste Disposal Semiannual Report for January 1, 1984 through June 30, 1984," Monticello Nuclear Generating Plant, Northern States Power Company, Docket No. 50-263, August 31, 1984

9. "General Contents of the Offsite Dose Calculation Manual," Revision 1 Branch Technical Position, Radiological Assessment Branch, NRC, February 8, 1979

10. "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, A Guidance Manual for Users of Standard Technical Specifications," NUREG-0133, October 1978,

11. "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR50, Appendix I," Regulatory Guide 1.109, Rev. 1, October 1977

12. W. P. Gamill/F. Congel (NRC), Memo to ETSB/RAB (NRC), "Radiological Effluent Technical Specifications (RETS) Provisions for I-133," November 29, 1982