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DTE Energy

10 CFR 52.79

April 8, 2009
NRC3-09-0007

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington DC 20555-0001

References:
1) Fermi 3
Docket No. 52-033
2) Letter from Jerry Hale (USNRC) to Peter W. Smith (Detroit Edison), "Request for Additional Information Letter No. 4 Related to the SRP Sections 11.02, 11.04, 11.05 and 12.02 for the Fermi 3 Combined License Application," dated March 9, 2009
3) Letter from Jack M. Davis (DTE Energy) to USNRC, "Detroit Edison Company Application for a Combined License Fermi 3 - Submission 2," NRC3-09-0006, dated March 25, 2009

Subject: Detroit Edison Company Response to NRC Request for Additional Information Letter No. 4

In the referenced letter, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combine License Application (COLA). The responses to the following Requests for Additional Information (RAIs) are provided as Attachments 1 through 6 of this letter:

- RAI Question 11.02-1 — Liquid Waste Management System
- RAI Question 11.04-1 — Solid Waste Management System
- RAI Question 11.04-2 — Solid Waste Management System
- RAI Question 11-05 BTP-1 — Postulated Radioactive Releases Due to Waste Gas System Leak or Failure
- RAI Question 12.02-1 — Radiation Sources
- RAI Question 12.02-2 — Radiation Sources

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Information contained in these responses have either been incorporated into the submission of the Fermi 3 Rev. 1 COLA (Reference 3), or will be incorporated in a future submission as described in the RAI response.

If you have any questions, or need additional information, please contact Mr. Peter W. Smith at (313)235-3341.

I state under penalty of perjury that the foregoing is true and correct. Executed on the 8th day of April 2009.

Sincerely,

Jack M. Davis
Senior Vice President and Chief
Nuclear Officer
Detroit Edison Company

Attachments: 1) Response to RAI Letter No. 4 (Question No. 11.02-1)
2) Response to RAI Letter No. 4 (Question No. 11.04-1)
3) Response to RAI Letter No. 4 (Question No. 11.04-2)
4) Response to RAI Letter No. 4 (Question No. 11-05 BTP-1)
5) Response to RAI Letter No. 4 (Question No. 12.02-1)
6) Response to RAI Letter No. 4 (Question No. 12.02-2)

cc: NRC Fermi 3 Project Manager
NRC Fermi 3 Environmental Project Manager
Fermi 2 Resident Inspector
NRC Region III Regional Administrator
NRC Region II Regional Administrator
Supervisor, Electric Operators, Michigan Public Service Commission
Michigan Department of Environmental Quality
Radiological Protection and Medical Waste Section

Attachment 1
NRC3-09-0007

Response to RAI Letter No. 4
(eRAI Tracking No. 2182)

RAI Question 11.02-1

NRC RAI 11.02-1

FSAR Section 11.2.1, EF3 SUP 11.2-1 indicates that the ESBWR already contains all of the augments identified in Table A-1 of Regulatory Guide (RG) 1.110, and that the ESBWR liquid waste management system is designed to recycle 100 percent (zero liquid release), which would indicate that no cost-benefit analysis is required. In FSAR Chapter 12, Tables 12.2-203 and 12.2-204, the applicant provides the total annual liquid pathway doses to the maximum exposed individual and the population for expected liquid effluents. These sections indicate that there is a potential for liquid effluents and resulting pathway doses. Therefore, the NRC is requesting that the applicant perform an appropriate cost-benefit analysis using the method and data outlined in Regulatory Guide 1.110.

Response

A cost-benefit analysis specific to Fermi 3 and the Fermi site has been performed and included in COLA Revision 1 (Reference 3). The analysis demonstrates that the design of the Fermi 3 Liquid Waste Management System (LWMS) complies with the As Low As Reasonably Achievable (ALARA) cost-benefit requirements of Section II.D of Appendix I to 10 CFR 50. RG 1.110 methodology was applied to satisfy the cost-benefit analysis requirements for the system augments compatible with the BWR plant design features.

Cost parameters used to calculate the Total Annual Cost (TAC) for each applicable radwaste treatment system augment listed in RG 1.110 were taken without exception from RG 1.110, Appendix A. These costs are Annual Operating Costs (AOC) (Table A-2), Annual Maintenance Costs (AMC) (Table A-3), Direct Cost of Equipment and Materials (DCEM) (Table A-1) and Direct Cost of Labor (DLC) (Table A-1). Other cost parameters used to determine the TAC are as follows:

The Indirect Cost Factor (ICF) was determined based on Table A-5 of RG 1.110. The Fermi site is a multi-unit site, including Fermi 2 and the proposed Fermi 3. Each unit has a separate, non-shared radwaste system. Therefore, the ICF is calculated to be 1.625.

The Labor Cost Correction Factor (LCCF) was determined from Figure A-1 and Table A-4 of RG 1.110. Since the Fermi site is in Region II, the LCCF is 1.5.

The Capital Recovery Factor (CRF) was obtained from Table A-6 of RG 1.110. The CRF is based upon an assumed cost of money value of 7%, consistent with OMB Circular A-94, and a 30 year service life. The CRF was determined to be 0.0806.

A value of $1,000 per person-rem is taken from 10 CFR 50, Appendix I, Section II.D.

FSAR Section 12.2.2.4 and Table 12.2-204 provide the collective total body doses for the population within a 50 mile radius of Fermi 3 due to potential liquid effluent releases. Doses for total body and thyroid are 17.7 and 21.1 person-rem/year, respectively. Total body and thyroid dose are considered for cost-benefit analysis, per Section II.D of Appendix I, 10 CFR 50. Therefore, augments less than $21,100 need be considered for implementation.

Using the information and methodology described above, the lowest-cost augment is $11,900 per year for a 20 gpm cartridge filter. Should this 20 gpm filter be installed in the liquid radwaste discharge line (flow rate of 105 gpm, taken from Figure 3.1-1 of the Fermi 3 Environmental Report Revision 0) approximately 20% of the discharge would be treated and a maximum dose reduction of 20% would be realized. Since the thyroid dose is the larger of the dose in Table 12.2-204; largest dose reduction would be 20% of 21.1 person-rem per year or 4.2 person-rem per year. Thus, the cost of the augment exceeds the value of the dose savings and the augment is not cost-effective.

In addition to 20 gpm cartridge filter, there are two other augments that fall below the $21,100 threshold. These augments are the evaporator distillate demineralizer, and the 10,000 gallon tank. The evaporator distillate demineralizer requires the use of an evaporator. The ESBWR design does not include an evaporator, therefore, this augment is not cost-beneficial. The 10,000 gallon tank would be used for holdup, based on 105 gpm effluent discharge; holdup time would be approximately 95 minutes. The list of nuclides in the effluent discharge can be found from the average annual liquid release in ESBWR DCD Table 12.2-19b. By examining the half life of each nuclide, only three of the half-lives are less than the 95 minute holdup. Compared to overall release, these comprise <0.001% of the total annual release; therefore this augment will not significantly reduce the dose and is not cost effective.

Proposed COLA Revision

Revisions to the COLA to address the liquid waste management system were previously submitted as part of Revision 1 (Reference 3), submitted March 25, 2009. Specifically, the sections revised as part of Revision 1 are as follows:

- COLA FSAR Section 11.2.1 has been revised in Revision 1 of the COLA FSAR, to provide a cost-benefit analysis for the liquid waste management system that complies with NRC's guidance in RG 1.110.

- FSAR Section 11.2.7 has been revised in Revision 1 of the COLA FSAR, to reference OMB Circular A-94, as a basis for the assumed cost of money.

As a result of this RAI response, Detroit Edison has included additional information in Section 11.2 that discusses additional augments considered. These changes are shown on the attached markup.

Additionally, FSAR Section 12.2.2.4.2 will be revised per the attached markup. FSAR Section 12.2.2.4.2 previously contained a statement that a cost-benefit analysis was not necessary. This statement has been revised to state that a cost-benefit analysis is included in FSAR Section 11.2. These changes are shown on the markups provided on the attached markup.

Markup of Detroit Edison COLA
(following 4 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next appropriate update of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

3 will not be shared with the radwaste system for Fermi 2; which gives an ICF of 1.625.

- Labor Cost Correction Factor (LCCF) - Obtained from RG 1.110, Table A-4, this factor takes into account the relative labor cost differences among geographical regions. A factor of 1.5 is assumed in the analysis based on Fermi being located in Region II as shown on RG 1.110, Figure A-1.

INSERT A

A value of $1,000 per person-rem is prescribed in 10 CFR 50, Appendix I.

If it is conservatively assumed that each radwaste treatment system augment is a "perfect" technology that reduces the effluent dose by 100 percent, the annual cost of the augment can be determined and the lowest annual cost can be considered a threshold value. The lowest-cost option for augments is a 20 gpmcartridge filter at $11,900 per year, which yields a threshold value of 11.9 person-rem whole body or thyroid dose from liquid effluents.

Neglecting the modeling of filters in the development of the source term, the addition of a 20 gpm cartridge filter would treat only 20 percent of the total analyzed liquid radwaste discharge of 105 gpm. Assuming 100 percent effectiveness, this would represent a dose reduction of 21.08 person-rem x 20 percent = 4.216 person-rem. The cost benefit ratio for this augment is therefore greater than the $1000/person-rem and not a cost benefit augment.

INSERT B

Note that the ESBWR Radwaste LWMS is designed to monitor and process all radioactive liquid streams and to provide water management for those streams. Under normal conditions, the water management is not expected to result in any routine release of radioactive effluents in the liquid discharges.

11.2.2.3 **Detailed System Component Description**

11.2.2.3.3 **Processing Systems**

Replace the first two paragraphs with the following.

STD COL 11.2-1-A

Specific equipment connection configuration and plant sampling procedures are used to implement the guidance in Inspection and Enforcement (IE) Bulletin 80-10 (DCD Reference 11.2-10). The permanent and mobile/portable non-radioactive systems, which are

Insert A

There are three augments which fall below the $1000 per person-rem threshold value; these are a 20 gpm cartridge filter, evaporator distillate demineralizer, and 10,000 gallon tank.

Insert B

The addition of an evaporator distillate demineralizer is dependent on the existence of an evaporator. Even though the cost of the option, $16,400, is below the threshold value, this system cannot be incorporated without the use of an evaporator which would have a cost greater than the $21,080 threshold. Based on the threshold of $21,080 and the presence of the evaporator, it is determined that this augment is not cost-beneficial.

The cost to incorporate a 10,000 gallon tank is $18,600. The purpose of such a tank is to provide additional holdup capacity to allow decay of short-lived radionuclides prior to discharge. The 10,000 gallon tank would be used for holdup, based on 105 gpm effluent discharge; holdup time would be 95 minutes. The list of nuclides in the effluent discharge can be found from the average annual liquid release in ESBWR DCD Table 12.2-19b. By examining the half-life of each nuclide, only three of the half-lives are less than the 95 minute holdup time. Compared to overall release, these comprise <0.001% of the total annual release; therefore this augment will have little affect and is not a cost benefit augment.

Of the three augments which fall below the $1000 per person-rem threshold value, none of these is cost-beneficial.

1.113 were used as described in DCD References 12.2-7 and 12.2-4, respectively.

The liquid effluent pathway offsite dose calculation bases are provided in Table 12.2-20aR. The bases include values that are default parameters in RG 1.109 and other values that are Fermi 3 site-specific inputs.

Based on the annual liquid release offsite values in DCD Table 12.2-19b, the Fermi 3 annual liquid release concentrations were calculated based upon the criteria specified in DCD Section 12.2.2.3 and the Fermi 3 specific input values shown in Table 12.2-20aR.

The LADTAP II code is used to perform the liquid effluent dose analysis (DCD Reference 12.2-3). The results of the dose calculation are given in Table 12.2-20bR.

12.2.2.4.1 **Compliance with 10 CFR 50, Appendix I, Section II.A**

Table 12.2-202 demonstrates that offsite dose due to Fermi 3 radioactive liquid effluents comply with the regulatory dose limits in 10 CFR 50, Appendix I, Section II.A.

12.2.2.4.2 **Compliance with 10 CFR 50, Appendix I, Section II.D**

Insert C →

Population dose is determined for the liquid effluent releases from Fermi 3 for both total body dose and thyroid dose. The total body dose is 17.7 person-rem/yr as shown in Table 12.2-204. The thyroid dose is 21.1 person-rem/yr. ~~Table A-1 of RG 1.110 lists several liquid radwaste augments for light-water-cooled nuclear power reactors. The ESBWR already contains all of these augments as part of the conceptual design for the Liquid Radwaste Management System. The conceptual design information is the plant specific design. Therefore, a cost-benefit analysis of the liquid radwaste augments is not necessary because the augments discussed in RG 1.110 have already been incorporated into the ESBWR design.~~ Therefore, Fermi 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.4.3 **Compliance with 10 CFR 20 Appendix B, Table 2, Column 2**

Compliance with 10 CFR 20 Appendix B, Table 2, Column 2 is demonstrated in DCD Table 12.2-19b.

Insert C

The cost-benefit analysis performed to consider liquid radwaste augments to reduce dose due to liquid effluents is presented in Section 11.2. Based on the above liquid effluent dose estimate values and the threshold value from the cost-benefit analysis, no augments are cost-beneficial.

Attachment 2
NRC3-09-0007

Response to RAI Letter No. 4
(eRAI Tracking No. 2184)

RAI Question 11.04-1

NRC RAI 11.04-1

FSAR Revision 0, Section 11.4 incorporates the conceptual design and features of the Solid Waste Management System (SWMS) described in ESBWR DCD, Tier 2, Revision 4, Section 11.4. This approach has been revised by GEH in Revision 5 of Chapter 11.4 of the ESBWR DCD by including specific SWMS design details for permanently installed subsystems not previously described in Revision 4 of the DCD. Please revise the FSAR, Revision 0, Section 11.4 to the extent that you intend to incorporate the specific endorsements and/or departures to the SWMS described in revision 5 of the ESBWR DCD, Tier 2, Section 11.4. If departures or exceptions to the SWMS are taken in the FSAR when compared to the most current revision of the ESBWR DCD, provide the justification and supporting information for the staff to evaluate the technical and regulatory merits of such deviations for the purpose of conducting an independent confirmation of compliance with Part 50.34a and guidance of Chapter 11.4 of the Standard Review Plan (NUREG-0800) and Regulatory Guide 1.206.

Response

ESBWR DCD, Revision 5 implements changes, including Section 11.4.2.3.5 – SWMS Processing Subsystem. COL Item 11.4-1-A requires the COL applicant to ensure the Processing Subsystem is in compliance with the operations and testing requirements in Regulatory Guide (RG) 1.143 and RG 8.8. FSAR Section 11.4.2.3.5 incorporates changes based on Revision 5 of the ESBWR DCD, including removal of text that was applicable to DCD, Revision 4 and addition of text that is appropriate for DCD, Revision 5, including references to RG 1.143 and RG 8.8.

Fermi 3 FSAR, Revision 1 contains no departures or deviations from Revision 5 of the ESBWR DCD. Additional changes have also been made in Section 11.4 to remain consistent with standard COL items and the RCOLA.

Proposed COLA Revision

Detroit Edison submitted Revision 1 of the COLA by letter dated March 25, 2009 (Reference 3). Revision 1 specifically addresses Revision 5 of the DCD. Revisions to the COLA to address this RAI were included in Revision 1 of the COLA. The affected Revision 1 pages are included with this response.

Excerpts from Revision 1 of the Detroit Edison COLA
(following 2 pages)

11.4 Solid Waste Management System

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

11.4.1 SWMS Design Bases

Add the following after the second paragraph.

STD SUP 11.4-1

The LWMS offsite dose calculations, which are described in Subsection 12.2.2.4, include the offsite doses from the SWMS liquid effluents, as they are processed by the LWMS. Similarly, the GWMS offsite dose calculations, which are described in Subsection 12.2.2.2 include the offsite doses from the SWMS gaseous effluents, as they are inputs processed by the GWMS. The cost-benefit analyses in Section 11.2.1 for the LWMS and in Section 11.3.1 for the GWMS address the liquid and gaseous effluents that are generated from solid waste processing by the SWMS. Because these two cost-benefit analyses include the liquid and gaseous effluents from the SWMS, the augments considered for the LWMS and GWMS apply to the SWMS, which provides inputs to those systems. As described in Sections 11.2.1 and 11.3.1, no augments are needed for the LWMS and GWMS to comply with 10 CFR 50, Appendix I, Section II.D. Therefore, no augments are needed for the SWMS to comply with 10 CFR 50, Appendix I,Section II.D.

Add the following to the seventh bullet.

STD COL 11.4-4-A

The site does not utilize any temporary storage facilities to support plant operation.

Replace the fourth sentence of the fifth paragraph with the following:

STD COL 11.4-5-A

Section 12.6 discusses how the ESBWR design features and procedures for operation will minimize contamination of the facility and environment, facilitate decommissioning, and minimize the generation of radioactive wastes, in compliance with 10 CFR 20.1406. Section describes the requirement for procedures for operation of the radioactive waste processing system. Operating procedures for mobile/portable SWMS required by Section 12.5, Section 12.6, and Section address requirements of 10 CFR 20.1406.

11.4.2.3 **Detailed System Component Description**

11.4.2.3.5 **SWMS Processing Subsystem**

Replace the last three sentences of the second paragraph with the following.

STD COL 11.4-1-A Testing of the SWMS includes testing specified in Table 1 of RG 1.143. Implementation of the programs described in Section 12.1, for maintaining occupational dose ALARA, and Section 12.5, Radiation Protection Program, ensure that operation, maintenance, and testing of the SWMS satisfy the guidance in RG 8.8.

STD COL 11.4-2-A Specific equipment connection configuration and plant sampling procedures are used to implement the guidance in Inspection and Enforcement (IE) Bulletin 80-10 (DCD Reference 11.4-19). The permanent and mobile/portable non-radioactive systems, which are connected to radioactive or potentially radioactive portions of SWMS, are protected from contamination with an arrangement of double check valves in each line. The configuration of each line is also equipped with a tell-tale connection, which permits periodic checks to confirm the integrity of the line and its check valve arrangement. Plant procedures describe sampling of non-radioactive systems that could potentially become contaminated by cross-connection with systems that contain radioactive material. In accordance with the guidance in RG 1.109, exposure pathways that may arise due to unique conditions are considered for incorporation into the plant-specific ODCM if they are likely to contribute significantly to the total dose.

STD COL 11.4-3-A Waste classification and process controls are described in the PCP. NEI 07-10, "Generic FSAR Template Guidance for Process Control Program (PCP)," which is under review by the NRC, is incorporated by reference. (Reference 11.4-201). The milestone for development and implementation of the PCP is addressed in Section 13.4.

Attachment 3
NRC3-09-0007

Response to RAI Letter No. 4
(eRAI Tracking No. 2185)

RAI Question 11.04-2

NRC RAI 11.04-2

FSAR Section 11.4.1, STD COL 11.4-4-A states that the proposed plant will not utilize temporary low-level radioactive waste storage facilities to support plant operation. The ESBWR DCD, however, provides the capacity to store the amount of low-level radioactive waste that could be generated in 6 months of operation. Accordingly, the staff requests the applicant to describe the facilities plan for long-term storage of low-level radioactive wastes projected to be generated during operation of Fermi Unit 3, and the operational program addressing the long-term management and storage of such wastes using the guidance of Regulatory Guide 1.206 and Section 11.4 of the Standard Review Plan (NUREG-0800, Rev. 3).

Response

Detroit Edison is developing clarifying information to respond to this RAI. This information will be provided in a future submission of the COLA.

Attachment 4
NRC3-09-0007

Response to RAI Letter No. 4
(eRAI Tracking No. 2186)

RAI Question 11-05 BTP-1

NRC RAI 11.05 Branch Technical Position-1

FSAR Section 11.5.4.6, on process and effluent monitoring and sampling, presents information in Table 11.5-201 on sampling for several Fermi Unit 3 plant systems, including the plant service water system (item 2), storm drains and cooling tower blowdown (item 11), and sanitary waste water (item 14). Footnotes to the table appear internally inconsistent in describing sampling provisions and where the supporting information may be found in the DCD and/or FSAR.

The apparent inconsistencies are:

(a) Plant Service Water System (PSWS, line item 2) - For this system, footnotes No. 6 and 8 of Table 11.5-201 are provided in clarifying sampling provisions and how this sampling stream would be treated through the Liquid Waste Management System (LWMS). However, a review of MFN 06-417 (Supp. 4) indicates that in response to DCD RAI 9.2-8 S02, footnote 8 is being replaced with footnote 4, but Table 11.5-201 does not reflect that change. Accordingly, update FSAR Table 11.5-201, line item 2 for the PSWS, to include the proper footnote citations. This information would ensure that such provisions are clearly identified in the FSAR and not likely to be omitted during the development of the sampling and analysis program for the plant specific Offsite Dose Calculation Manual in confirming compliance with liquid effluent concentration limits of Table 2 in Appendix B to Part 20 and numerical objectives of Appendix I to Part 50.

Response

The Plant Service Water System (PSWS) is classified as a nonradioactive system. It is extremely unlikely that this system could become contaminated with radioactive liquid. Since the PSWS is nonradioactive, there is no need for continuous sampling. Thus, footnotes 6 and 8, as well as "S&A" have been removed from Line 2 of Table 11.5-201, in the "Continuous" column.

Line 2 of Table 11.5-201has also been changed to add the Circulating Water System (CIRC). The CIRC is also classified as a nonradioactive system, and also unlikely that this system could become contaminated with radioactive liquid. Leakage from the condenser into the CIRC is highly unlikely because the condenser operates at a vacuum. Leakage from the CIRC into the condenser could be postulated to occur; however this is monitored, as described in DCD, Rev. 5, Section 10.4.1.5.4.

In the unlikely event that either the PSWS or CIRC would become contaminated with radioactive liquid, grab sampling will be performed from the PSWS and CIRC cooling tower basins. Note 9 has been added to account for the grab sampling from the cooling tower basins.

Proposed COLA Revision

Detroit Edison submitted Revision 1 of the COLA by letter dated March 25, 2009 (Reference 3). Revision 1 addresses Table 11.5-201. Revisions to the FSAR to address this RAI are included in Revision 1 of the COLA. The affected Revision 1 pages are included in this response.

COLA FSAR Table 11.5-201 has been revised in Revision 1 of the COLA FSAR, according to the above discussion. Additional changes have also been made in Section 11.5 and Table 11.5-201 to remain consistent with standard COL Items and the RCOLA.

Excerpts from Revision 1 of the Detroit Edison COLA
(following 4 pages)

11.5-4-A Site Specific Offsite Dose Calculation

STD COL 11.5-4-A This COL item is addressed in Subsection 11.5.4.8.

11.5-5-A Instrument Sensitivities

STD COL 11.5-5-A This COL item is addressed in Subsection 11.5.4.9.

11.5.8 References

11.5-201 NEI 07-09, "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description"

DCD Table 11.5-2

Replace the ** note with the following.

STD COL 11.5-3-A Activity levels are expected to be at the subsystem's lower limit of detection (LLD). Applicable values are included in the plant-specific ODCM. See Section 12.2 for expected activity of various processes and effluents

---

DCD Table 11.5-4

Replace the ** note with the following.

STD COL 11.5-3-A Activity levels are expected to be at the subsystem's LLD. Applicable values are included in the plant-specific ODCM. See Section 12.2 for expected activity of various processes and effluents.

Table 11.5-201 Provisions for Sampling Liquid Streams (Sheet 1 of 2) [STD COL 11.5-3-A]

No.	Process Systems as listed in NUREG-0800, SRP 11.5 Table 2 (Draft Rev. 4)	ESBWR System(s) that Perform the Equivalent SRP 11.5 Function (Note 1)	In Process	In Effluent	
			Grab Notes 2 & 7	Grab Notes 2 & 7	Continuous Notes 2 & 7
1	Liquid Radwaste (Batch) Effluent System Note 3	Equipment (Low Conductivity) Drain Subsystem Floor (High Conductivity) Drain Subsystem Detergent Drain Subsystem	S&A	S&A, H3 Note 4	--
2	Service Water System and/or Circulating Water System	Plant Service Water System and Circulating Water System	--	S&A, H3 Note 9	
3	Component Cooling Water System	Reactor Component Cooling Water System	S&A	S&A H3	(S&A) Notes 6 & 8
4	Spent Fuel Pool Treatment System	Spent Fuel Pool Treatment System	S&A	S&A H3	(S&A) Notes 6 & 8
5	Equipment & Floor Drain Collection and Treatment Systems	LCW Drain Subsystem HCW Drain Subsystem Detergent Drain Subsystem Chemical Waste Drain Subsystem Reactor Component Cooling Water System (RCCWS) Drain Subsystem	--	S&A H3	(S&A) Notes 6 & 8
6	Phase Separator Decant & Holding Basin Systems	Equipment (Low Conductivity) Drain Subsystem Floor (High) Drain Subsystem	--	S&A H3	(S&A) Notes 6 & 8
7	Chemical & Regeneration Solution Waste Systems	Chemical Waste Drain Subsystem	--	S&A H3	(S&A) Notes 6 & 8
8	Laboratory & Sample System Waste Systems	Chemical Waste Drain Subsystem	--	S&A H3	(S&A) Notes 6 & 8
9	Laundry & Decontamination Waste Systems	Detergent Drain Subsystem	--	S&A H3	(S&A) Notes 6 & 8
10	Resin Slurry, Solidification & Baling Drain Systems	Equipment (Low Conductivity) Drain Subsystem Floor (High) Drain Subsystem	--	S&A H3	(S&A) Notes 6 & 8
11	Storm & Underdrain Water System	Storm Drains	--	S&A, H3 Notes 3 & 10	

Table 11.5-201 Provisions for Sampling Liquid Streams (Sheet 2 of 2) [STD COL 11.5-3-A]

No.	Process Systems as listed in NUREG-0800, SRP 11.5 Table 2 (Draft Rev. 4)	ESBWR System(s) that Perform the Equivalent SRP 11.5 Function (Note 1)	In Process: Grab Notes 2 & 7	In Effluent: Grab Notes 2 & 7	In Effluent: Continuous Notes 2 & 7
12	Tanks and Sumps Inside Reactor Building	Equipment (Low Conductivity) Drain Subsystem Floor (High) Drain Subsystem Chemical Waste Drain Subsystem Detergent Drain Subsystem	--	S&A H3	(S&A) Notes 6 & 8
13	Ultrasonic Resin Cleanup Waste Systems	Note 5	--	Note 5	Note 5
14	Non-Contaminated Waste Water System	Sanitary Waste Discharge System	--	S&A, H3 Note 11	
15	Liquid Radioactive Waste Processing Systems (Includes Reverse Osmosis Systems)	Liquid Radioactive Waste Processing Systems (Includes Reverse Osmosis Systems)	S&A	(S&A, H3)	(S&A) Notes 6 & 8

Table 11.5-201 Provisions for Sampling Liquid Streams (Notes) [STD COL 11.5-3-A]

Notes for Table 11.5-201:

1. Table 11.5-201 addresses sampling provisions for ESBWRs as recommended in Table 2 of SRP 11.5 for BWRs. For process systems identified for BWRs in SRP 11.5 Table 2, but not shown in Table 11.5-201, those systems are not applicable to ESBWR. In some cases, there are multiple subsystems that are used to perform the overall equivalent SRP function and are listed as such in the column.
2. S&A = Sampling & Analysis of radionuclides, to include gross radioactivity, identification and concentration of principal radionuclides and concentration of alpha emitters; R = Gross radioactivity (beta radiation, or total beta plus gamma); H3 = Tritium.
3. Liquid Radwaste is processed on a batch-wise basis. The Liquid Waste Management System sample tanks can be sampled for analysis of the batch. See DCD Section 11.2.2.2 for more information on Liquid Radwaste Management.
4. Monitoring of effluents from the Equipment, Floor, and Detergent Drain Subsystems is included in the Offsite Dose Calculation Manual.
5. The ESBWR does not include ultrasonic resin cleanup waste system at this time. Should one be installed, the Liquid Waste Management System would provide sampling and monitoring provisions.
6. The use of parenthesis indicates that these provisions are required only for the systems not monitored, sampled, or analyzed (as indicated) prior to release by downstream provisions.
7. The sensitivity of detection, also defined here as the Lower Limit of Detection (LLD), for each indicated measured variable, is based on the applicable radionuclide (or collection of radionuclides as applicable) as given in ANSI/IEEE N42.18.
8. Processed through radwaste Liquid Waste Management System (LWMS) prior to discharge. Therefore, this process system is monitored, sampled, or analyzed prior to release by downstream provisions. See Note 6 above. Depending on utility's discretion, additional sampling lines may be installed. Continuous Effluent sampling is not required per Standard Review Plan 11.5 Draft Rev. 4, April 1996, Table 2 for this system function.

9 Grab samples can be obtained from a cooling tower basin. See Subsection 9.2.1.2 for the PSWS cooling tower basin and Subsection 10.4.5.2.3 for the Circulating Water System cooling tower basin.

10 Grab samples can be obtained from the Condensate Storage Tank (CST) basin sump. See DCD Section 9.2.6.2.

11 Grab samples can be obtained from the sewage treatment plant. See Subsection 9.2.4.2.

Attachment 5
NRC3-09-0007

Response to RAI Letter No. 4
(eRAI Tracking No. 2222)

RAI Question 12.02-1

NRC RAI 12.02-1

FSAR Subsections 12.2.2.1 and 12.2.2.2.3 present compliance with 10 CFR 20 Appendix B for gaseous effluent concentrations at the site boundary, using ESBWR DCD Revision 5 Standard Design.

a. *A review of gaseous effluent releases indicates inconsistencies in the assigned release values in Fermi 3 COL FSAR Table 12.2-17R for all radionuclides. The ESBWR DCD, Rev. 5 Table 12.2-16 provides the expected normal operational nuclide release source term. In discussions with the applicant, it was determined that the gaseous release source term has been adjusted by the ratio of the Fermi Specific X/Q to the ESBWR DCD X/Q for each release point. Accordingly, please provide the rationale for the adjustment of the release values by this ratio. In addition, please provide an example calculation that indicates how this ratio is applied and the justification for the factors used.*

b. *In demonstrating compliance with the unity rule of Table 2 (Column 1) of Appendix B to 10 CFR Part 20, add a column to FSAR Table 12.2-17R showing the ratio of each gaseous radionuclide to the corresponding value in Table 2, Column 1 and the sum-of-the-ratios for all radionuclides. Currently, the tabulation does not present the sum-of-the-ratios. Accordingly, provide an updated Table 12.2-17R showing the nuclide concentration ratios over values of Table 2 of Appendix B to 10CFR20, and compliance with the unity rule.*

Response

a. Per discussions with the NRC, the previous adjustment to the release values has been removed. The previous adjustment to the release was not appropriate. The values from ESBWR DCD, Revision 5, Table 12.2-16 are used as the nuclide release source term. The site specific concentrations of radionuclides are calculated with the site specific X/Q values and the nuclide release source term from ESBWR DCD, Revision 5, Table 12.2-16. There are three potential release points for gaseous radionuclides during normal operation. They are the turbine building stack, the reactor building/fuel building stack, and the radwaste building stack. The associated X/Q values are taken from FSAR Table 2.0-201, Sheet 20 of 27. Each of these stack locations has a unique and specific atmospheric dispersion factor, or X/Q value, associated with it, from the stack to the site boundary. Certain radionuclides could be released from two or even three stacks. The stack specific release source term is taken from ESBWR DCD, Revision 5, Table 12.2-16 and multiplied by the stack specific X/Q value to yield a concentration at the site boundary. The release from the reactor building/fuel building stack is multiplied by the reactor building stack X/Q, the release from the turbine building stack is multiplied by the turbine building stack X/Q, and the release from the radwaste building stack is multiplied by the radwaste building stack X/Q and the three terms are summed for the total concentration of that particular radionuclide at the site boundary.

An example calculation is performed as follows, using Na-24:

ESBWR DCD, Revision 5, Table 12.2-16 indicates the nuclide release source term for Na-24 is from the Drywell. According to the footnote this is released from the reactor building/fuel building stack. The nuclide release source term for Na-24 is 5.4E+00 MBq/yr or 1.46E-04 Ci/yr (rounded to 1.5E-04 Ci/yr in FSAR Table 12.2-17R). This value is then multiplied by the Fermi site specific, reactor building stack X/Q value of 5.0E-07 s/m^3, yielding a Fermi 3 concentration of 8.6E-08 Bq/m^3 or 2.3E-18 μCi/mL. The example calculation is shown as:

$$1.46E-4\frac{Ci}{yr}*5E-7\frac{\sec}{m^3}*3.171E-8\frac{yr}{\sec}*1E+6\frac{\mu Ci}{Ci}*1E-6\frac{m^3}{mL}=2.3E-18\frac{\mu Ci}{mL}$$

This radionuclide is released only from the reactor building stack, therefore this represents the concentration at the site boundary.

For this particular nuclide there is no additive Fermi 2 concentration. However, if there were, the two values would be combined. Fermi 2 concentrations are obtained from the Fermi 2 UFSAR Table 11.3-6.

For Na-24, the 10 CFR 20 concentration limit is 7.0E-09 μCi/mL, yielding a fraction of 3.3E-10.

b. FSAR Table 12.2-17R has been revised as described above. In addition, FSAR Table 12.2-17R has been revised to add a column showing the ratio of the Fermi 2 and 3 concentration of each radionuclide to the Effluent Concentration Limit (ECL). These ratio values are then summed to show compliance with the unity rule.

Proposed COLA Revision

Detroit Edison submitted Revision 1 of the COLA by letter dated March 25, 2009 (Reference 3). Revision 1 addresses FSAR Table 12.2-17R. Revisions to the FSAR to address this RAI were included in Revision 1 of the COLA. The affected Revision 1 pages are included in this response.

Excerpts from Revision 1 of the Detroit Edison COLA
(following 5 pages)

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit (Sheet 1 of 5)

[EF3 COL 12.2-2-A]

	Fermi 3 Annual Release		Fermi 3 Concentration		Fermi 2 + 3 Concentration	10 CFR 20 Concentration Limit	Fermi 2 + 3 Fraction of 10 CFR 20 Limit
Nuclide	MBq/yr	Ci/yr	Bq/m^3	µCi/ml	µCi/ml	µCi/ml	
Kr-83m	8.5E+01	2.3E-03	1.3E-06	3.6E-17	3.6E-12	5.00E-05	7.2E-08
Kr-85m	6.6E+05	1.8E+01	1.1E-02	3.1E-13	1.4E-10	1.00E-07	1.4E-03
Kr-85	5.2E+06	1.4E+02	9.1E-02	2.4E-12	2.1E-11	7.00E-07	3.1E-05
Kr-87	1.4E+06	3.9E+01	2.5E-02	6.8E-13	3.0E-12	2.00E-08	1.5E-04
Kr-88	2.1E+06	5.6E+01	3.6E-02	9.8E-13	5.4E-11	9.00E-09	6.0E-03
Kr-89	1.4E+07	3.7E+02	6.4E-01	1.7E-11	9.6E-11	1.00E-09	9.6E-02
Xe-131m	1.5E+05	4.1E+00	2.6E-03	7.1E-14	5.8E-12	2.00E-06	2.9E-06
Xe-133m	1.9E+02	5.2E-03	3.0E-06	8.2E-17	2.4E-12	6.00E-07	4.0E-06
Xe-133	4.1E+07	1.1E+03	3.8E+00	1.0E-10	1.1E-09	5.00E-07	2.1E-03
Xe-135m	2.2E+07	6.0E+02	7.8E+00	2.1E-10	2.1E-10	4.00E-08	5.3E-03
Xe-135	2.8E+07	7.5E+02	4.4E+00	1.2E-10	1.4E-10	7.00E-08	2.0E-03
Xe-137	2.8E+07	7.6E+02	1.7E+00	4.5E-11	6.8E-11	1.00E-09	6.8E-02
Xe-138	2.3E+07	6.3E+02	4.3E-01	1.2E-11	1.1E-10	2.00E-08	5.5E-03
I-131	8,4E+03	2.3E-01	3.5E-04	9.6E-15	2.1E-14	2.00E-10	1.0E-04
I-132	5.8E+04	1.6E+00	2.8E-03	7.7E-14	1.8E-13	2.00E-08	8.8E-06
I-133	4.2E+04	1.1E+00	2.1E-03	5.6E-14	1.3E-13	1.00E-09	1.3E-04

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit (Sheet 2 of 5) [EF3 COL 12.2-2-A]

	Fermi 3 Annual Release		Fermi 3 Concentration		Fermi 2 + 3 Concentration	10 CFR 20 Concentration Limit	Fermi 2 + 3 Fraction of 10 CFR 20 Limit
Nuclide	MBq/yr	Ci/yr	Bq/m^3	µCi/ml	µCi/ml	µCi/ml	
I-134	1.1E+05	3.0E+00	5.2E-03	1.4E-13	3.3E-13	6.00E-08	5.5E-06
I-135	5.9E+04	1.6E+00	2.9E-03	7.9E-14	1.9E-13	6.00E-09	3.1E-05
H-3	2.8E+06	7.6E+01	4.4E-02	1.2E-12	1.3E-12	1.00E-07	1.3E-05
C-14	5.3E+05	1.4E+01	9.2E-03	2.5E-13	2.5E-13	3.00E-09	8.3E-05
Na-24	5.4E+00	1.5E-04	8.6E-08	2.3E-18	2.3E-18	7.00E-09	3.3E-10
P-32	1.3E+00	3.5E-05	2.1E-08	5.6E-19	5.6E-19	5.00E-10	1.1E-09
Ar-41	1.4E+03	3.8E-02	2.4E-05	6.6E-16	6.6E-16	1.00E-08	6.6E-08
Cr-51	1.8E+02	4.7E-03	1.3E-05	3.6E-16	3.6E-16	3.00E-08	1.2E-08
Mn-54	1.5E+02	4.1E-03	6.2E-05	1.7E-15	1.7E-15	1.00E-09	1.7E-06
Mn-56	1.1E+01	3.0E-04	1.7E-07	4.7E-18	4.7E-18	2.00E-08	2.4E-10
Fe-55	4.7E+01	1.3E-03	7.5E-07	2.0E-17	2.0E-17	3.00E-09	6.7E-09
Fe-59	2.0E+01	5.4E-04	4.8E-06	1.3E-16	1.3E-16	5.00E-10	2.6E-07
Co-58	4.0E+01	1.1E-03	3.6E-06	9.8E-17	9.8E-17	1.00E-09	9.8E-08
Co-60	3.2E+02	8.7E-03	1.1E-04	3.0E-15	3.0E-15	5.00E-11	6.0E-05
Ni-63	4.7E+02	1.3E-06	7.5E-10	2.0E-20	2.0E-20	1.00E-09	2.0E-11
Cu-64	6.9E+00	1.9E-04	1.1E-07	3.0E-18	3.0E-18	3.00E-08	9.8E-11

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit (Sheet 3 of 5)

[EF3 COL 12.2-2-A]

	Fermi 3 Annual Release		Fermi 3 Concentration		Fermi 2 + 3 Concentration	10 CFR 20 Concentration Limit	Fermi 2 + 3 Fraction of 10 CFR 20 Limit
Nuclide	MBq/yr	Ci/yr	Bq/m^3	µCi/ml	µCi/ml	µCi/ml	
Zn-65	3.2E+02	8.6E-03	9.6E-06	2.6E-16	2.6E-16	4.00E-10	6.5E-07
Rb-89	2.0E-01	5.4E-06	3.2E-09	8.6E-20	8.6E-20	2.00E-07	4.3E-13
Sr-89	1.5E+02	3.9E-03	2.5E-06	6.8E-17	7.2E-16	2.00E-10	3.6E-06
Sr-90	1.0E+00	2.7E-05	1.7E-08	4.7E-19	4.9E-17	6.00E-12	8.2E-06
Y-90	8.1E-02	2.2E-06	1.3E-09	3.5E-20	3.5E-20	9.00E-10	3.9E-11
Sr-91	6.7E+00	1.8E-04	1.1E-07	2.9E-18	1.4E-14	5.00E-09	2.8E-06
Sr-92	4.6E+00	1.2E-04	7.3E-08	2.0E-18	2.2E-14	9.00E-09	2.4E-06
Y-91	1.7E+00	4.6E-05	2.7E-08	7.3E-19	7.3E-19	2.00E-10	3.6E-09
Y-92	3.7E+00	1.0E-04	5.9E-08	1.6E-18	1.6E-18	1.00E-08	1.6E-10
Y-93	7.2E+00	1.9E-04	1.1E-07	3.1E-18	3.1E-18	3.00E-09	1.0E-09
Zr-95	4.4E+01	1.2E-03	1.2E-05	3.4E-16	3.4E-16	4.00E-10	8.6E-07
Nb-95	2.4E+02	6.5E-03	3.9E-06	1.0E-16	1.0E-16	2.00E-09	5.2E-08
Mo-99	1.7E+03	4.5E-02	2.7E-05	7.2E-16	5.3E-15	2.00E-09	2.7E-06
Tc-99m	2.2E+00	5.9E-05	3.5E-08	9.4E-19	5.7E-14	2.00E-07	2.9E-07
Ru-103	1.0E+02	2.8E-03	1.6E-06	4.4E-17	4.8E-17	9.00E-10	5.3E-08
Rh-103m	3.5E-03	9.5E-08	5.5E-11	1.5E-21	1.5E-21	2.00E-06	7.5E-16
Ru-106	1.4E-01	3.8E-06	2.2E-09	6.0E-20	6.0E-20	2.00E-11	3.0E-09

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit (Sheet 4 of 5) [EF3 COL 12.2-2-A]

	Fermi 3 Annual Release		Fermi 3 Concentration		Fermi 2 + 3 Concentration	10 CFR 20 Concentration Limit	Fermi 2 + 3 Fraction of 10 CFR 20 Limit
Nuclide	MBq/yr	Ci/yr	Bq/m^3	μCi/ml	μCi/ml	μCi/ml	
Rh-106	4.5E-06	1.2E-10	7.1E-14	1.9E-24	1.9E-24	1.00E-09	1.9E-15
Ag-110m	1.0E-01	2.8E-06	1.6E-09	4.4E-20	4.4E-20	1.00E-10	4.4E-10
Sb-124	5.3E+00	1.4E-04	1.1E-06	3.1E-17	3.1E-17	3.00E-10	1.0E-07
Te-129m	1.6E+00	4.3E-05	2.5E-08	6.8E-19	6.8E-19	3.00E-10	2.3E-09
Te-131m	5.5E-01	1.5E-05	8.7E-09	2.4E-19	2.4E-19	1.00E-09	2.4E-10
Te-132	1.4E-01	3.8E-06	2.2E-09	6.0E-20	1.0E-15	9.00E-10	1.1E-06
Cs-134	1.8E+02	4.9E-03	3.8E-05	1.0E-15	1.1E-15	2.00E-10	5.3E-06
Cs-136	1.5E+01	4.0E-04	2.4E-07	6.5E-18	3.0E-17	9.00E-10	3.3E-08
Cs-137	2.7E+02	7.3E-03	6.4E-05	1.7E-15	1.8E-15	2.00E-10	8.8E-06
Cs-138	8.5E-01	2.3E-05	1.3E-08	3.6E-19	3.1E-14	8.00E-08	3.9E-07
Ba-140	7.8E+02	2.1E-02	1.3E-05	3.5E-16	2.2E-15	2.00E-09	1.1E-06
La-140	1.3E+01	3.5E-04	2.1E-07	5.6E-18	5.6E-18	2.00E-09	2.8E-09
Ce-141	2.6E+02	7.1E-03	4.7E-06	1.3E-16	1.3E-16	8.00E-10	1.7E-07
Ce-144	1.3E-01	3.5E-06	2.1E-09	5.6E-20	7.3E-18	2.00E-11	3.6E-07
Pr-144	1.6E-04	4.3E-09	2.5E-12	6.8E-23	6.8E-23	2.00E-07	3.4E-16
W-187	1.3E+00	3.5E-05	2.1E-08	5.6E-19	5.6E-19	1.00E-08	5.6E-11

Table 12.2-17R Comparison of Airborne Release Concentrations with 10 CFR 20 Limit (Sheet 5 of 5)

[EF3 COL 12.2-2-A]

	Fermi 3 Annual Release		Fermi 3 Concentration		Fermi 2 + 3 Concentration	10 CFR 20 Concentration Limit	Fermi 2 + 3 Fraction of 10 CFR 20 Limit
Nuclide	**MBq/yr**	**Ci/yr**	**Bq/m^3**	**μCi/ml**	**μCi/ml**	**μCi/ml**	
Np-239	8.3E+01	2.2E-03	1.3E-06	3.6E-17	4.9E-14	3.00E-09	1.6E-05
Total (w/ H-3)	1.7E+08	4.6E+03	1.9E+01	5.1E-10	1.9E-09		1.9E-01
Total (w/o H-3)	1.7E+08	4.5E+03	1.9E+01	5.1E-10	1.9E-09		1.9E-01

Attachment 6
NRC3-09-0007

Response to RAI Letter No. 4
(eRAI Tracking No. 2223)

RAI Question 12.02-2

NRC RAI 12.02-2

a. *FSAR Section 12.2.2.4.3 references DCD Table 12.2-19b for compliance with 10 CFR 20 Appendix B, Table 2, Column 2. The liquid effluent values provided in the DCD are for an ESBWR with a dilution flow rate of 20,000 liter per minute. A review of liquid effluent data provided in the Fermi 3 COL FSAR, Table 12.2-20aR identifies a different dilution flow rate from that used in the DCD. Accordingly, please address and resolve.*

b. *In demonstrating consistency with the unity rule of Table 2 (Column 2) of Appendix B to 10 CFR Part 20, please update the FSAR by listing in a tabular format, the liquid discharge nuclide concentrations, along with comparisons to the corresponding values in Table 2 of 10 CFR part 20 Appendix B, for consistency with the unity rule.*

Response

a. The liquid radwaste effluent discharge rate from the Fermi 3 COLA, FSAR Table 12.2-20aR is 400 L/min, with a dilution factor of 115. The dilution factor is the ratio of the total blowdown flow to the liquid radwaste effluent discharge rate. The concentrations from ESBWR DCD Table 12.2-19b are updated according to the Fermi site specific conditions. The Fermi 3 liquid radwaste effluent discharge rate, the corresponding dilution factor, and the annual liquid releases from ESBWR DCD Table 12.2-19b are used to calculate the Fermi 3 effluent concentration. The corresponding values for Fermi 2 are then added to the Fermi 3 values for the site total. The Fermi 2 concentrations are derived from the Fermi 2 UFSAR, Table 11.2-10. The Fermi 2 and Fermi 3 discharge locations are geographically separate, as can be seen in FSAR Figure 2.1-203. This combination of the two effluent concentrations is conservative because it does not account for dilution in the lake between the two discharge locations.

b. The attached FSAR markup for FSAR Table 12.2-19bR includes a column showing the ratio of the Fermi 2 and 3 concentration of each radionuclide to the 10 CFR 20 limit. The ratio values are then summed to demonstrate compliance with the unity rule.

Proposed COLA Revision

An addition of FSAR Table 12.2-19bR, and revisions to Sections 12.2.2.4.3 and 12.2.2.4.4 will be included in a future revision of the COLA.

These changes are shown on the attached FSAR markup.

Markup of Detroit Edison COLA
(following 4 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next appropriate update of the Fermi 3 COLA. However, the same COLA content may be impacted by revisions to the ESBWR DCD, responses to other COLA RAIs, other COLA changes, plant design changes, editorial or typographical corrections, etc. As a result, the final COLA content that appears in a future submittal may be different than presented here.

1.113 were used as described in DCD References 12.2-7 and 12.2-4, respectively.

The liquid effluent pathway offsite dose calculation bases are provided in Table 12.2-20aR. The bases include values that are default parameters in RG 1.109 and other values that are Fermi 3 site-specific inputs.

Based on the annual liquid release offsite values in DCD Table 12.2-19b, the Fermi 3 annual liquid release concentrations were calculated based upon the criteria specified in DCD Section 12.2.2.3 and the Fermi 3 specific input values shown in Table 12.2-20aR.

The LADTAP II code is used to perform the liquid effluent dose analysis (DCD Reference 12.2-3). The results of the dose calculation are given in Table 12.2-20bR.

12.2.2.4.1 Compliance with 10 CFR 50, Appendix I, Section II.A

Table 12.2-202 demonstrates that offsite dose due to Fermi 3 radioactive liquid effluents comply with the regulatory dose limits in 10 CFR 50, Appendix I, Section II.A.

12.2.2.4.2 Compliance with 10 CFR 50, Appendix I, Section II.D

Population dose is determined for the liquid effluent releases from Fermi 3 for both total body dose and thyroid dose. The total body dose is 17.7 person-rem/yr as shown in Table 12.2-204. The thyroid dose is 21.1 person-rem/yr. Table A-1 of RG 1.110 lists several liquid radwaste augments for light water cooled nuclear power reactors. The ESBWR already contains all of these augments as part of the conceptual design for the Liquid Radwaste Management System. The conceptual design information is the plant specific design. Therefore, a cost benefit analysis of the liquid radwaste augments is not necessary because the augments discussed in RG 1.110 have already been incorporated into the ESBWR design. Therefore, Fermi 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.4.3 Compliance with 10 CFR 20 Appendix B, Table 2, Column 2

Compliance with 10 CFR 20 Appendix B, Table 2, Column 2 is demonstrated in ~~DCD Table 12.2-19b.~~ Table 12.2-19bR

12.2.2.4.4 Compliance with 10 CFR 20.1301 and 20.1302

This section demonstrates that offsite doses due to Fermi 3, combined with offsite doses due to Fermi 2 comply with the regulatory limits in 10 CFR 20.1301 for doses to members of the public.

Table 12.2-19bR,

Using the Fermi 3-specific gaseous effluent release activities identified in Table 12.2-17R and the liquid effluent release activities identified in ~~DCD Table 12.2-19b,~~ the total annual doses to the MEI and the population resulting from Fermi 3 liquid and gaseous effluents are calculated and presented in Table 12.2-203 and Table 12.2-204, respectively.

The direct radiation contribution from operation of Fermi 3 is negligible. The direct dose contribution from Fermi 3 at two distances is provided in DCD Table 12.2-21. The annual dose of 5.93E-04 mrem/yr at 800 m (0.5 mi) is negligible. The distance to the site boundary from Fermi 3 is at least 890 m (0.56 mi) and the increase in distance further reduces the low dose rate.

The total annual doses to the MEI and the population resulting from Fermi 2 liquid and gaseous effluents are provided in Table 12.2-203 and Table 12.2-204, respectively. The values shown are representative based on review of Fermi 2 annual radiological environmental reports (Reference 12.2-201).

The direct radiation contribution from operation of Fermi 2 is negligible. An evaluation of operating plants by the NRC states that:

> "...because the primary coolant of an LWR is contained in a heavily shielded area, dose rates in the vicinity of light water reactors are generally undetectable and are less than 1 mrem/year at the site boundary."

The NRC concludes that the direct radiation from normal operation results in "small contributions at site boundaries" (Reference 12.2-202, Section 4.6.1.2).

Table 12.2-203 shows that the total Fermi site doses resulting from the normal operation of Fermi 2 and Fermi 3 are well within the regulatory limits of 40 CFR 190.

Table 12.2-204 shows the total body doses from liquid and gaseous effluents doses attributable to Fermi 3 for the population within 80 km (50 mi) from the Fermi site.

Table 12.2-19bR Comparison of Annual Liquid Release Concentrations with 10 CFR 20 Limit (Sheet 1 of 2) [EF3 COL 12.2-3-A]

Nuclide	Fermi 3 Annual Release		Fermi 3 Concentration		Fermi 2 + 3 Concentration	10 CFR 20 Concentration Limit	Fermi 2 + 3 Fraction of 10 CFR 20 Limit
	MBq/yr	Ci/yr	Bq/ml	µCi/ml	µCi/ml	µCi/ml	
I-131	1.55E+02	4.19E-03	6.41E-06	1.73E-10	2.09E-10	1.00E-06	2.09E-04
I-132	3.03E+01	8.18E-04	1.25E-06	3.38E-11	2.19E-10	1.00E-04	2.19E-06
I-133	7.77E+02	2.10E-02	3.21E-05	8.68E-10	1.29E-09	7.00E-06	1.84E-04
I-134	1.48E+00	4.00E-05	6.12E-08	1.65E-12	1.20E-10	4.00E-04	3.00E-07
I-135	2.00E+02	5.40E-03	8.27E-06	2.23E-10	5.30E-10	3.00E-05	1.77E-05
H-3	5.18E+05	1.40E+01	2.14E-02	5.78E-07	1.01E-06	1.00E-03	1.01E-03
Na-24	1.89E+02	5.10E-03	7.82E-06	2.11E-10	2.85E-10	5.00E-05	5.70E-06
P-32	1.55E+01	4.19E-04	6.41E-07	1.73E-11	1.91E-11	9.00E-06	2.12E-06
Cr-51	4.81E+02	1.30E-02	1.99E-05	5.37E-10	5.93E-10	5.00E-04	1.19E-06
Mn-54	5.92E+00	1.60E-04	2.45E-07	6.61E-12	7.25E-12	3.00E-05	2.42E-07
Mn-56	4.81E+01	1.30E-03	1.99E-06	5.37E-11	2.16E-10	7.00E-05	3.08E-06
Fe-55	8.51E+01	2.30E-03	3.52E-06	9.50E-11	1.04E-10	1.00E-04	1.04E-06
Fe-59	2.59E+00	6.99E-05	1.07E-07	2.89E-12	3.21E-12	1.00E-05	3.21E-07
Co-58	1.63E+01	4.40E-04	6.74E-07	1.82E-11	2.00E-11	2.00E-05	9.99E-07
Co-60	3.33E+01	8.99E-04	1.38E-06	3.72E-11	4.09E-11	3.00E-06	1.36E-05
Cu-64	4.81E+02	1.30E-02	1.99E-05	5.37E-10	7.51E-10	2.00E-04	3.76E-06
Zn-65	1.67E+01	4.51E-04	6.91E-07	1.86E-11	2.04E-11	5.00E-06	4.08E-06
Zn-69m	3.40E+01	9.18E-04	1.41E-06	3.80E-11	5.26E-11	6.00E-05	8.77E-07
Br-83	3.33E+00	8.99E-05	1.38E-07	3.72E-12	2.30E-11	9.00E-04	2.56E-08
Sr-89	8.14E+00	2.20E-04	3.37E-07	9.09E-12	1.01E-11	8.00E-06	1.26E-06
Sr-90	7.40E-01	2.00E-05	3.06E-08	8.26E-13	8.26E-13	5.00E-07	1.65E-06
Sr-91	4.44E+01	1.20E-03	1.84E-06	4.96E-11	7.58E-11	2.00E-05	3.79E-06
Y-91	5.18E+00	1.40E-04	2.14E-07	5.78E-12	6.11E-12	8.00E-06	7.63E-07
Sr-92	1.07E+01	2.89E-04	4.43E-07	1.19E-11	4.56E-11	4.00E-05	1.14E-06
Y-92	4.07E+01	1.10E-03	1.68E-06	4.55E-11	9.02E-11	4.00E-05	2.25E-06
Y-93	4.44E+01	1.20E-03	1.84E-06	4.96E-11	7.64E-11	2.00E-05	3.82E-06
Zr-95	7.40E-01	2.00E-05	3.06E-08	8.26E-13	8.26E-13	2.00E-05	4.13E-08
Nb-95	7.40E-01	2.00E-05	3.06E-08	8.26E-13	8.26E-13	3.00E-05	2.75E-08

Table 12.2-19bR Comparison of Annual Liquid Release Concentrations with 10 CFR 20 Limit (Sheet 2 of 2) [EF3 COL 12.2-3-A]

Nuclide	Fermi 3 Annual Release		Fermi 3 Concentration		Fermi 2 + 3 Concentration	10 CFR 20 Concentration Limit	Fermi 2 + 3 Fraction of 10 CFR 20 Limit
	MBq/yr	Ci/yr	Bq/ml	µCi/ml	µCi/ml	µCi/ml	
Mo-99	1.11E+02	3.00E-03	4.59E-06	1.24E-10	1.41E-10	2.00E-05	7.07E-06
Tc-99m	2.04E+02	5.51E-03	8.44E-06	2.28E-10	3.43E-10	1.00E-03	3.43E-07
Ru-103	1.48E+00	4.00E-05	6.12E-08	1.65E-12	1.81E-12	3.00E-05	6.05E-08
Ru-105	6.29E+00	1.70E-04	2.60E-07	7.02E-12	1.64E-11	7.00E-05	2.34E-07
Te-129m	3.33E+00	8.99E-05	1.38E-07	3.72E-12	4.04E-12	7.00E-06	5.77E-07
Te-131m	3.70E+00	9.99E-05	1.53E-07	4.13E-12	4.94E-12	8.00E-06	6.17E-07
Te-132	7.40E-01	2.00E-05	3.06E-08	8.26E-13	8.26E-13	9.00E-06	9.18E-08
Cs-134	2.52E+01	6.80E-04	1.04E-06	2.81E-11	3.10E-11	9.00E-07	3.45E-05
Cs-136	1.52E+01	4.10E-04	6.29E-07	1.70E-11	2.44E-11	6.00E-06	4.06E-06
Cs-137	6.66E+01	1.80E-03	2.75E-06	7.44E-11	7.61E-11	1.00E-06	7.61E-05
Ba-139	1.48E+00	4.00E-05	6.12E-08	1.65E-12	2.00E-11	2.00E-04	9.99E-08
Ba-140	3.03E+01	8.18E-04	1.25E-06	3.38E-11	3.75E-11	8.00E-06	4.69E-06
Ce-141	2.59E+00	6.99E-05	1.07E-07	2.89E-12	3.21E-12	3.00E-05	1.07E-07
La-142	1.11E+00	3.00E-05	4.59E-08	1.24E-12	1.28E-11	1.00E-04	1.28E-07
Ce-143	1.11E+00	3.00E-05	4.59E-08	1.24E-12	1.40E-12	2.00E-05	7.00E-08
Pr-143	3.33E+00	8.99E-05	1.38E-07	3.72E-12	4.04E-12	2.00E-05	2.02E-07
W-187	8.88E+00	2.40E-04	3.67E-07	9.92E-12	1.23E-11	3.00E-05	4.11E-07
Np-239	4.07E+02	1.10E-02	1.68E-05	4.55E-10	5.16E-10	2.00E-05	2.58E-05
Total (w/ H-3)	5.22E+05	1.41E+01	2.16E-02	5.83E-07	1.02E-06		1.63E-03
Total (w/o H-3)	3.62E+03	9.79E-02	1.50E-04	4.05E-09	6.06E-09		6.21E-04