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DTE Energy

10 CFR 52.79

April 23, 2009
NRC3-09-0008

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. 5 Related to the SRP Sections 09.05.01, 02.01.02, 11.03, 14.02, 17.04, and 12.03-12.04 for the Fermi 3 Combined License Application", dated March 25, 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 Letters No. 5

In the referenced letters, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combined License Application (COLA). The responses to the following Requests for Additional Information (RAIs) are provided as Attachments 1 through 8 of this letter:

• RAI Question 09.05.01-1	Fire Protection Program
• RAI Question 02.01.02-1	Exclusion Area Authority and Control
• RAI Question 02.01.02-2	Cumulative Resident Populations
• RAI Question 11.03-1	Gaseous Waste Management System (GWMS)
• RAI Question 14.02-1	Initial Plant Test Program
• RAI Question 17.04-1	Reliability Assurance Program (RAP)
• RAI Question 12.03-12.04-2	Radiation Protection Design Features
• RAI Question 12.03-12.04-1	Radiation Protection Design Features

D095
NRO

Information contained in these responses has either been incorporated into the submission of the Fermi 3 Revision 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 23rd 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. 5 (Question No. 09.05.01-1)
2) Response to RAI Letter No. 5 (Question No. 02.01.02-1)
3) Response to RAI Letter No. 5 (Question No. 02.01.02-2)
4) Response to RAI Letter No. 5 (Question No. 11.03-1)
5) Response to RAI Letter No. 5 (Question No. 14.02-1)
6) Response to RAI Letter No. 5 (Question No. 17.04-1)
7) Response to RAI Letter No. 5 (Question No. 12.03-12.04-2)
8) Response to RAI Letter No. 5 (Question No. 12.03-12.04-1)

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
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 1989)

RAI Question No. 09.05.01-1

NRC RAI 09.05.01-1

Section 9.5.1.4 of the Fermi 3 SCOLA references Table 9.5-1 of the ESBWR regarding information on Fire Protection Water Supply. Table 9.5-2 should have been referenced. Table 9.5-1 lists applicable codes for fire prevention. Table 9.5-2 lists Fire Protection System component design characteristics.

Response

Detroit Edison submitted Revision 1 of the COLA by letter dated March 25, 2009 (Reference 3). Revisions to the COLA to address this RAI were included in Revision 1 of the COLA. The revision involved removing the references to DCD Table 9.5-1 and FSAR Figure 9.5-201 in the first paragraph of Section 9.5.1.4. The affected Revision 1 page is included with this response.

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

9.5.1.1 **Design Bases**

Codes, Standards, and Regulatory Guidance

Add the following at the end of this section.

EF3 SUP 9.5.1-1 Table 9.5-201 supplements DCD Table 9.5-1 for those portions outside the DCD and operational aspects of the fire detection and suppression systems.

9.5.1.2 **System Description**

Add the following after the first sentence in the first paragraph.

EF3 COL 9.5.1-4-A Figure 9.5-201 and DCD Table 9.5-1 provide simplified diagrams of the site-specific firewater supply piping.

9.5.1.4 **Fire Protection Water Supply System**

Water Sources

Replace the first paragraph with the following.

EF3 COL 9.5.1-4-A Water for the Fire Protection System is supplied from a minimum of two sources: i) at least one "primary" source to the suctions of primary fire pumps and corresponding jockey fire pumps and, ii) at least one "secondary" source to suctions of secondary fire pumps and corresponding jockey fire pumps. The primary source is two dedicated, Seismic Category I, firewater storage tanks. Each primary firewater storage tank has sufficient capacity to meet the maximum firewater demand of the system for a period of 120 minutes.

EF3 COL 9.5.1-1-A The secondary firewater source is Lake Erie. This large body of water has a capacity well in excess of the 2082m^3 (550,000 gal) required by NFPA 804.

The water from Lake Erie is treated with sodium hypochlorite.

Primary Firewater Source

The Pretreated Water Supply System (PWSS) provides treated and filtered water to the firewater storage tanks. PWSS pumps are located in

Attachment 2
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 2128)

RAI Question No. 02.01.02-1

NRC RAI 02.01.02-1

NUREG 0800, Section 2.1.2(II) 1 states "To meet the requirements of 10 CFR Part 100, the applicant must demonstrate, before issuance of a CP or limited work authorization, that it has the authority within the exclusion area as defined in 10 CFR 100.3, or must provide reasonable assurance that it will have such authority before either the start of construction or commencing activities allowed by 10 CFR 52.25. NUREG 0800, Section 2.1.2(II) 1 also states that "Absolute ownership of all lands within the exclusion area, including mineral rights, is considered to carry with it the required authority to determine all activities on this land and is acceptable. Fermi 3 FSAR Section 2.1.2.1 states that for one small section, 0.88 acres, the mineral rights are owned by another party. The applicant states that this section is outside the plant construction area, but does not state whether or not it is within the exclusion area boundary. Please clarify that the mineral rights within the exclusion area are owned by the applicant or exactly where this un-owned section is located in relation to Fermi 3 so the NRC can perform its own evaluation of potential interference with plant operation by activation of mineral removal from the noted 0.88-acre section.

Response

As described in FSAR Section 2.1.2.1, the 0.36 hectare (0.88 acres) of mineral rights owned by the Michigan Department of Natural Resources (MDNR) is located in the far southeast portion of the Fermi site and is remote from the portions of the site affected by Fermi 3 site preparation, preconstruction, construction or operation.

FSAR Reference 2.1-204 shows the location of the MDNR owned mineral rights on the Fermi site property. Consistent with the description in FSAR Section 2.1.2.1, the 0.88 acres is located at the southeast portion of the property boundary. The Exclusion Area Boundary (EAB) is shown on FSAR Figure 2.1-204, "Fermi 3 Site Plan." Comparing the location of the MDNR owned mineral rights (Reference 2.1-204) to the EAB (FSAR Figure 2.1-204) shows that the MDNR owned mineral rights are outside of the EAB. Therefore, Detroit Edison owns all mineral rights within the exclusion area.

Proposed COLA Revision

In order to clarify the description in FSAR Section 2.1.2.1, consistent with above response, the text will be modified as shown on the attached markup to clearly state that Detroit Edison owns all mineral rights within the exclusion area.

Markup of Detroit Edison COLA
(following 1 page)

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.

firing range is located off the north end of Doxy Road near Bullit Road. The station's small heliport is on the east side of Quarry Lake in the southwest part of the site across the lake from the Nuclear Training Center and the Nuclear Operations Center. The applicant's private rail spur is served by Canadian National Railway and parallels Fermi Drive on the north side of the road from Dixie Highway onto the site. The northern and southern areas of the site are dominated by large lagoons. The western areas are dominated by several woodlots and quarry lakes. Site elevation ranges from the level of Lake Erie, on the eastern edge of the site, to approximately 7.6 m (25 ft) above the lake level on the western edge of the site.

EF3 COL 2.0-3-A

2.1.2 Exclusion Area Authority and Control

2.1.2.1 Authority

As shown in Figure 2.1-204, the Fermi 3 Exclusion Area Boundary (EAB) is designated as the area encompassed by an 892.45 m (2928 ft) radius circle around the reactor center. The Fermi 2 and Fermi 3 exclusion areas overlap a significant amount of the same area and are entirely within the 509.9 hectares (1260 acres) owned by Detroit Edison with the exception of a few small areas in Lake Erie to the east. Detroit Edison owns a 16.2 hectare (40 acre) parcel of submerged land in Lake Erie expressly for protection and maintenance of the intake channel. Detroit Edison has fee simple absolute ownership of all the land within the Fermi site property boundary, and therefore the applicant has the authority to determine all activities, including exclusion and removal of personnel and property from the EAB, as specified by 10 CFR 100.21(a). All points of personnel and vehicle access to the site are strictly controlled utilizing methods such as searches, escorts for visitors, and ensuring individuals are evacuated in the event of an emergency.

, and all of the mineral rights within the EAB.

Detroit Edison owns and controls 99.93 percent of the mineral rights within the Fermi site. One third party, the Michigan Department of Natural Resources (MDNR), owns 0.36 hectare (0.88 acre) of mineral rights in the far southeast portion of the Fermi site (Reference 2.1-204). This very small mineral rights holding by the MDNR is in an area removed from the portions of the site that will be affected by Fermi 3 site preparation, preconstruction, construction, or operation; therefore, Detroit Edison owns and effectively controls the mineral rights in the Fermi 3 power

Attachment 3
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 2128)

RAI Question No. 02.01.02-2

NRC RAI 02.01.02-2

RG 1.206, Section C.1.2.1.3.6 and RG 4.7 state that the applicant should provide a plot out to at least 20 miles showing the cumulative resident populations (including the weighted transient population) at the time of the projected COL approval and within 5 years thereafter. For Fermi 3 FSAR Tables 2.1-216 and 2.1-217, the 0–10 mile population sum does not match the sums of the populations of the 16 1–10 mile quadrants plus the 0–1 population of Table 2.1-210. Please explain, and revise Fermi FSAR Tables 2.1- 216 and 2.1-217 as necessary.

Response

FSAR Tables 2.1-216 and 2.1-217 have been corrected and revised in Revision 1 of the COLA to match the sums of the populations from Table 2.1-210. The values for the quadrants corresponding to each year from Table 2.1-210 have been summed together and are shown in Tables 2.1-216 and 2.1-217 for 2013 and 2018, respectively.

FSAR Tables 2.1-216 and 2.1-217 show the population projections at 2013 and 2018, respectively. The population projection in 2013 is less than the population projection in 2018. FSAR Tables 2.1-216 and 2.1-217 both include a column for population density; this column indicates that the population density, out to a 20 mile radius, is less than 500 persons per square mile, per the guidance in RG 1.206 and 4.7.

Proposed COLA Revision

Detroit Edison submitted Revision 1 of the COLA by letter dated March 25, 2009 (Reference 3). 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)

Table 2.1-216 2013 Population Density by Concentric Circle [EF3 2.0-4-A]

Concentric Circle	Permanent and Transient Population	Area (Sq. Mi.)	Population Density
0 - 5 mi	18,176	79	231
0 - 10 mi	118,146	314	376
0 - 20 mi	467,587	1257	372
0 - 30 mi	2,275,116	2827	805
0 - 40 mi	4,403,983	5027	876
0 - 50 mi	5,923,346	7854	754

Source: Reference 2.1-215

Table 2.1-217 2018 Population Density by Concentric Circle [EF3 COL 2.0-4-A]

Concentric Circle	Permanent and Transient Population	Area (Sq. Mi.)	Population Density
0 - 5 mi	18,992	79	242
0 - 10 mi	122,667	314	390
0 - 20 mi	473,393	1257	377
0 - 30 mi	2,297,882	2827	813
0 - 40 mi	4,476,285	5027	891
0 - 50 mi	6,070,076	7854	773

Source: Reference 2.1-215

Attachment 4
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 2240)

RAI Question No. 11.03-1

NRC RAI 11.03-1

Final Safety Analysis Report (FSAR) Section 11.3.1, EF3 SUP COL 11.3-1 incorporates by reference the current draft of NEI Template 07-11 as the basis of the cost-benefit analysis intended to justify the design of the Gaseous Waste Management System (GWMS). NEI, however, withdrew NEI Template 07-11 from further consideration. As a result, NEI Template 07-11 is no longer relevant. Accordingly, please provide an updated plant- and site-specific cost-benefit analysis in FSAR Section 11.3.1 for the GWMS. This cost/benefit analysis should provide sufficient information for the staff to evaluate the bases and assumptions used in the analysis and to conduct an independent confirmation of compliance with NRC regulations and guidance.

Response

As stated in the question above, the EF3 SUP COL 11.3-1 Left Margin Annotation (LMA) was not used in the referenced section and is not a normal LMA convention as defined in FSAR Table 1.1-201.

Fermi 3 FSAR Section 11.3 (EF3 SUP 11.3-1) did not incorporate by reference the current draft of NEI Template 07-11 as the basis of the cost-benefit analysis intended to justify the design of the Gaseous Waste Management System (GWMS). FSAR Section 11.3 identifies that NRC RG 1.110 was used as the basis for the site specific analysis for the GWMS.

FSAR Section 11.3.1 includes a site specific cost-benefit analysis for the GWMS, based on NRC Regulatory Guide (RG) 1.110, "Cost-Benefit Analysis for Radwaste Systems for Light Water Cooled Nuclear Power Reactors." The section outlines the bases and assumptions that were used in developing the analysis, as well as the results of the analysis.

Proposed COLA Revision

None

Attachment 5
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 2307)

RAI Question No. 14.02-1

NRC RAI 14.02-1

FSAR Section 14.2.9.1.4 states that "Performance is observed and recorded during a series of individual component and integrated system tests to demonstrate the following: (1) Proper operation of initiating, transfer, and trip devices (2) Proper operation of relaying and logic (3) Proper operation of equipment protective devices, including permissive and prohibit interlocks (4) Proper operation of instrumentation and alarms used to monitor system and equipment status (5) Proper operation and load carrying capability of breakers, switchgear, transformers, and cables (6) The capability of transfer between onsite and offsite power sources as per design."

Please address the following additional item or provide justification for exclusion: (a) Proper operation of the automatic transfer capability of normal preferred power source to the alternate preferred power source is verified.

Response

Detroit Edison submitted Revision 1 of the COLA by letter dated March 25, 2009 (Reference 3). Revisions to the COLA to address this RAI were included in Revision 1 of the COLA.

FSAR Section 14.2.8.1.36, AC Power Distribution System Preoperational Test, has been added with a requirement to perform a test demonstrating the capability to transfer power from the normal preferred power supply to the alternate preferred power supply consistent with the Reference COLA (R-COLA) response to RAI Question 14.02-1.

The affected Revision 1 page is included with this response.

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

no later than 60 days prior to scheduled fuel loading for power ascension tests. **[END COM 14.2-002]**

14.2.2.5 Test Records

Add the following at the end of this section.

STD SUP 14.2-2

[START COM 14.2-005] Startup test reports are prepared in accordance with RG 1.16. **[END COM 14.2-005]**

14.2.7 Test Program Schedule And Sequence

Replace the last paragraph with the following.

STD COL 14.2-3-H

[START COM 14.2-003] The detailed testing schedule will be developed and made available for review prior to actual implementation. The schedule may be updated and continually optimized to reflect actual progress and subsequent revised projections. **[END COM 14.2-003].** The implementation milestones for the Initial Test Program are provided in Section 13.4.

14.2.8.1.36 AC Power Distribution System Preoperational Test General Test Methods and Acceptance Criteria

Add the following at the end of this section.

STD-SUP 14.2-4

Proper operation of the automatic transfer capability of the normal preferred power source to the alternate preferred power source.

14.2.9 Site-Specific Preoperational and Startup Tests

Replace the second and third paragraphs with the following.

EF3 COL 14.2-5-A

This section describes the site specific preoperational and initial startup tests not addressed in DCD Section 14.2.8.

EF3 COL 14.2-6-H

[START COM 14.2-004] Specific testing to be performed and the applicable acceptance criteria for each preoperational and startup test are documented in test procedures to be made available to the NRC

Attachment 6
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 2313)

RAI Question No. 17.04-1

NRC RAI 17.04-1

Regulatory Guide 1.206, Section C.III.1, Subsection C.I.17.4.4 states that the COL applicant should provide in Chapter 17 of the final safety analysis report (FSAR) in accordance with the provisions in SRP Section 17.4 the quality controls (organization, design control, procedures and instructions, records, corrective action, and audit plans) for developing and implementing the D-RAP. Section 17.4.5 ("GEH Organization for D-RAP") of the ESBWR Design Control Document (DCD) discusses the quality controls for developing and implementing the D-RAP that GEH imposed during the design certification phase. The Fermi FSAR incorporates Section 17.4.5 of the ESBWR DCD by reference. While the quality controls applied by the applicant for developing and implementing the D-RAP may be similar to that described in the Section 17.4.5 of the ESBWR DCD, the applicant should impose its own quality controls for developing and implementing D-RAP.

The staff requests that the applicant include in the Fermi FSAR the description of the quality controls (organization, design control, procedures and instructions, records, corrective action, and audit plans) that will be applied by the applicant during all phases of design and construction prior to the initial fuel load.

Response

The quality controls that will be applied by Detroit Edison during the design and construction phases are described in Section 17.1, Section 17.2, Section 17.5, and Section 17AA of the FSAR. These quality controls would apply to the development and implementation of D-RAP during the design phase. Fermi 3 FSAR Chapter 17 Quality Assurance is consistent with the R-COLA quality control description with regard to applicability of the program during design and construction.

The ESBWR DCD, Revision 5, Section 17.4.1 contains one COL Item (COL 17.4-1-H) that requires the Holder to provide a description of operational reliability assurance activities. Detroit Edison has provided standard information addressing this COL Holder Item within FSAR Section 17.4.1 (STD COL 17.4-1-H), consistent with the R-COLA.

Detroit Edison understands that neither GEH nor the R-COLA has received a request to provide quality controls information that will be applied by applicants during all phases of design and construction prior to the initial fuel load. This appears to be inconsistent with the design centered review approach outlined in Regulatory Issue Summary 2006-06.

Proposed COLA Revision

None

Attachment 7
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 2377)

RAI Question No. 12.03-12.04-2

NRC RAI 12.03-12.04-2

STD CDI 1.2.2.12.15, Zinc Injection System, states that a Zinc Injection System will not be utilized by the applicant. One of the benefits of utilizing a Zinc Injection System to inject depleted zinc oxide (DZO) in the feedwater is to suppress cobalt plate-out on reactor building piping. Minimizing the plate-out of radioactive cobalt on reactor building piping can lead to potentially lower dose rates in the vicinity of this piping and result in correspondingly lower doses to personnel in this portion of the plant. Justify your decision to not utilize a Zinc Injection System in light of the requirement in 10 CFR 20.1101 which states that the licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses that are ALARA.

Response

The use of zinc injection has been beneficial in plants where cobalt-containing alloys have been employed. Radioactive cobalt plates out on surfaces, especially stainless steel, subsequently leading to increased dose rates and increased personnel exposure throughout the coolant system areas. Since the ESBWR does not have recirculation piping and ESBWR material selection has reduced stellite (a principal source of cobalt) in the plant, the beneficial effects of implementing zinc injection at startup are limited. Operating experience has indicated that a reduction in the use of cobalt can decrease dose rates. An example is Japan's ABWR Kashiwazaki-Kariwa 6 and 7 units where reduced dose rates have been achieved without zinc injection but with the use of low cobalt materials.

Based on this knowledge and operating experience, the selection of components for cobalt minimization/elimination was performed by General Electric-Hitachi (GEH) and is part of the standard ESBWR plant design. The ESBWR standard plant incorporates the following measures which are discussed in DCD Sections 5.2.3.2.2, 12.3.1, 12.4.1 and 12.4.6:

- Reducing the amount of cobalt in alloys used in high fluence areas (fuel assemblies and control rods)
- Using non-cobalt alloys for pins and rollers in control rods
- Restricting the cobalt content in stainless steel components in the reactor vessel and other selected stainless steel components that have large surface areas exposed to high flow rates toward the reactor vessel, and minimizing the use of Stellite, which is a high cobalt alloy

DCD Section 9.3.11 states that "(t)he ESBWR Standard Plant design includes the capability to connect a Zinc Injection System (ZIS), but the system itself is not part of the ESBWR Standard Plant design". FSAR Section 9.3.11 incorporates this statement by reference without departures. Fermi 3 retains the option of utilizing a Zinc Injection System at a later date, consistent with the R-COLA.

Proposed COLA Revision

None

Attachment 8
NRC3-09-0008

Response to RAI Letter No. 5
(eRAI Tracking No. 2378)

RAI Question No. 12.03-12.04-1

NRC RAI 12.03-12.04-1

A review of Construction Worker Dose as reported in Section 12.4 of the COLA refers to the EF3 Environmental report without explanation. Upon reviewing the Environmental report it was noted that the thermo luminescent dosimeters (TLDs) used as the basis for the dose calculation may not be conservative with regards to projected exposure. In addition, generic independent spent fuel storage installation (ISFSI) exposure data was provided as an input to this calculation. Since Fermi 2 is moving towards ISFSI construction, the actual expected exposure rates are needed. Accordingly, please provide a justification for the TLDs selected as a basis for the construction worker dose calculation and the expected ISFSI exposure rates. Also, include in Section 12.4 enough detail to explain the construction worker dose assessment methodology.

In addition, it has been noted the applicant uses total body dose and whole body dose interchangeably. Accordingly, please revise the COLA to use consistent terminology and provide justification for the terminology chosen.

Response

In Reference to the Construction Worker Dose portion of the preceding RAI question, Detroit Edison is developing clarifying information to respond to this RAI. This information will be provided in a future update of the COLA.

In Reference to the whole body dose versus total body dose, the Fermi 3 FSAR will be revised to use consistent terminology. There is no difference in the meaning between these terms. Detroit Edison notes that these terms are used interchangeably in NRC regulatory guidance (e.g. SRP 11.2 and SRP 11.3); however, for consistency, only the term whole body will now be used in the FSAR, consistent with 10 CFR 20 which only defines this term.

Proposed COLA Revision

The text of FSAR Chapter 11 and FSAR Chapter 12 will be modified as shown on the attached markups.

Markup of Detroit Edison COLA
(following 12 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.

11.3.1 **Design Basis**

Add the following at the end of this section.

EF3 SUP 11.3-1

Regulatory Guide 1.110 was used as the basis for a cost benefit evaluation to assess gaseous radwaste system augments. The overall principle behind Regulatory Guide 1.110 is to determine when it is economically feasible to implement an augmented system to reduce radiation exposure to the public further below the regulatory threshold. The regulatory guidance specifies that an augmented system should be implemented if the cumulative dose to a population within an 80-km (50-mile) radius of the reactor site can be reduced at an annual cost of less than $1000 per person-rem or $1000 per person-thyroid-rem.

Only the augments applicable to the ESBWR conceptual design are considered.

Cost Benefit Analysis Determination

Appendix A of Regulatory Guide 1.110 states that augments with a Total Annual Cost (TAC) lower than the reduced dose multiplied by $1000 per person-rem and/or $1000 per person-thyroid-rem, should be implemented in order of diminishing cost-benefit. TAC of radwaste system augments considered herein is determined following Regulatory Guide 1.110, Appendix A, assuming that Fermi 2 and Fermi 3 will have separate radwaste systems and a seven percent per year cost of money. The maximum reduction of any augment is bounded by the total annual dose exposures. As shown in Table 12.2-204, the annual whole body dose from gaseous effluents is less than 4.5 person-rem/year ~~total body~~ and 23.5 person-rem/year thyroid for the 80-km (50-mile) population. Therefore, for augments that have a TAC below the $4500 and $23,500 thresholds, the TAC is divided by the amount of the total annual dose that the augment is assumed to eliminate.

whole body

3-Ton Charcoal Absorber

The annual cost of the 3-ton charcoal absorber is $9691/year; thus, potential reductions to thyroid dose are considered. Per DCD Table 11.3-1, the total mass of charcoal in the Offgas System (OGS) is 237,000 kg (523,000 lb), or approximately 237 metric tonnes (262 tons). Addition of a 3-ton charcoal absorber provides an additional 1.1 percent capacity to the existing OGS. Section 12.2 shows that the annual airborne releases from the OGS represent approximately 4 percent of the total annual airborne releases. Additional charcoal absorbers would improve the holdup times of the xenon and krypton isotopes, but those only contribute 4.1 percent to the thyroid dose. Therefore, additional charcoal absorber material could make a maximum improvement of 0.16 percent of the 23.5 person-rem/year thyroid dose, or 0.04 person-rem/year. The $9691/year cost of the 3-ton charcoal absorber augment divided by the annual dose reduction of 0.04 person-rem/year, results in an estimated cost of over $240,000/person-rem saved. This augment exceeds the cost-benefit ratio of $1000/person-rem and is eliminated from further consideration.

Charcoal Vault Refrigeration

Charcoal vault refrigeration would improve the performance of the OGS which uses activated charcoal absorber beds to minimize and control the release of radioactive material into the atmosphere by delaying release of the offgas process stream. The annual cost of the charcoal vault refrigeration system is $29,655/year. This value exceeds $23,500 for person-rem/year thyroid dose and $4500 person-rem/year whole body ~~total body~~ dose; therefore this augment exceeds the cost-benefit ratio of $1000/person-rem and is eliminated from further consideration.

Main Condenser Vacuum Pump Charcoal/HEPA Filtration System

The annual cost of the main condenser vacuum pump charcoal/HEPA filtration system is $8210/year; thus, potential reductions to thyroid dose are considered. The addition of a main condenser vacuum pump charcoal/HEPA filtration system would provide for a reduction in the amount of iodides discharged from the plant. DCD Table 12.2-16 shows the mechanical vacuum pump contributes approximately 0.7 percent of the total iodine releases. The maximum improvement to the off-site dose would be 0.7 percent of the 23.5 person-rem/year thyroid dose, or less than 0.20 person-rem/year. The $8210/year cost of the main condenser vacuum pump HEPA filtration system augment divided by the annual dose reduction of 0.2 person-rem/year, results in an estimated cost of over $41,000/person-rem saved. This augment exceeds the cost-benefit ratio of $1000/person-rem and is eliminated from further consideration.

15,000-cfm HEPA Filtration System

ESBWR has four structures that contain potentially radioactive air: the Fuel Building, Radwaste Building, Reactor Building, and Turbine Building. Because the buildings all have flow rates that exceed the 15,000-cfm flow rate, multiple 15,000-cfm HEPA filters would be needed. The total annual cost for each 15,000-cfm HEPA filter is $17,167 for those located in the Turbine Building, and $27,952 for all other locations. The number of HEPA filters and the total annual cost for those filters is shown in Table 11.3-201.

These values all exceed $23,500 for person-rem/year thyroid dose and $4500 person-rem/year whole body ~~total body~~ dose; therefore this augment exceeds the cost-benefit ratio of $1000/person-rem and is eliminated from further consideration.

Charcoal/HEPA Filtration Systems

Table A-1 of Regulatory Guide 1.110 lists several charcoal/HEPA filtration system sizes, 1000-cfm, 15,000-cfm, and 30,000-cfm. It is assumed that these are to be combined in the most economical manner to envelope the building flow rates. There are different direct costs for the 15,000-cfm and 30,000-cfm systems depending on their location.

ESBWR has four structures that contain potentially radioactive air: the Fuel Building, Radwaste Building, Reactor Building, and Turbine Building. The exhaust systems for these buildings and their flow rates are listed in Table 11.3-201.

Because the buildings all have flow rates that exceed the 30,000-cfm flow rate, combinations of 1000-cfm, 15,000-cfm, and 30,000-cfm charcoal/HEPA filters are needed. The total annual cost for each 1000-cfm charcoal/HEPA filter is $8231; each 15,000-cfm charcoal/HEPA filter is $33,286 for those located in the Turbine Building, and $34,972 for all other locations; and each 30,000-cfm charcoal/HEPA filter is $54,958 for those located in the Turbine Building, and $57,578 for all other locations. The number of HEPA filters and the total annual cost for those filters is shown in Table 11.3-202.

These values all exceed $23,500 for person-rem/year thyroid dose and $4500 person-rem/year whole body ~~total body~~ dose; therefore this augment exceeds the cost-benefit ratio of $1000/person-rem and is eliminated from further consideration.

600-ft^3 Gas Decay Tank

The gas decay tank would be used as an augment to the OGS. The gas decay tank would be utilized to allow noble gas decay before release through the exhaust. Based on the OGS flow rate of 54 m^3/hr (31.8 cfm) (DCD Table 12.2-15), the average residence time in the decay tank is 18.9 minutes.

The total tank size would need to be sized for 4.48 hours (Kr-85m half-life) of hold-up to impact the half-lives of the Ar and Kr isotopes (with the exception of Kr-85). Fifteen 600 ft^3 tanks would be required to provide a hold-up of 4.48 hours. Each 600 ft^3 tank has a total annual cost of $9036, and 15 tanks would cost over $135,000. This value exceeds the $23,500 threshold for person-rem/year thyroid dose, and the $4500 person-rem/year ~~total body~~ dose; therefore this augment is not cost beneficial for dose reduction.

whole body

Conclusion

There are no gaseous radwaste system augments that are cost beneficial to implement for Fermi 3.

12.2.2.2.1 Compliance with 10 CFR 50, Appendix I, Sections II.B and II.C

Table 12.2-201 demonstrates that offsite doses due to Fermi 3 radioactive airborne effluents comply with the regulatory dose limits in 10 CFR 50, Appendix I, Sections II.B and II.C.

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

Population dose is determined for the gaseous effluent releases from Fermi 3 for both ~~total body~~ dose and thyroid dose. The ~~total body~~ dose is

whole body

4.5 person-rem/yr as shown in Table 12.2-204. The thyroid dose is 23.5 person-rem/yr. The cost-benefit analysis performed to consider gaseous radwaste augments to reduce doses due to gaseous effluents is presented in Section 11.3. Based on the results from the cost-benefit analyses, no augments are cost-beneficial. Therefore, Fermi 3 complies with 10 CFR 50, Appendix I, Section II.D.

12.2.2.2.3 Compliance with 10 CFR 20 Appendix B, Table 2, Column 1

Table 12.2-17R provides the gaseous effluent concentrations in comparison to the 10 CFR 20, Appendix B, Table 2, Column 1 limits. The Fermi 3 gaseous effluent concentrations comply with 10 CFR 20, Appendix B, Table 2, Column 1.

12.2.2.2.4 Compliance with 10 CFR 20.1301 and 20.1302

Compliance with 10 CFR 20.1301 and 20.1302 is demonstrated in Subsection 12.2.2.4.4 and 12.2.2.4.5, respectively.

12.2.2.4 Liquid Doses Offsite

Replace this section with the following.

EF3 COL 12.2-3-A

The ESBWR LWMS is designed with the capability to recycle 100 percent of the liquid radwaste (zero liquid release). The analysis of dose via liquid effluents is presented in order to provide a conservative representation of unit operation. Detroit Edison intends to operate Fermi 3 with zero liquid effluents.

Liquid pathway doses were calculated based on the criteria specified in DCD Section 12.2.2.3 for compliance with 10 CFR 50, Appendix I. Dose conversion factors and methodologies consistent with RGs 1.109 and

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
whole body
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.

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.

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~~ whole 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 12.2-18bR Gaseous Pathway Doses to the MEI [EF3 COL 12.2-2-A]

Location	Pathway	Fermi 3		
		Whole Body ~~Total Body~~	Thyroid	Skin
		Annual Dose (mrem/year)		
Site Boundary (1131 m [0.7 mi] SSE)	Plume	1.05E-01	1.05E-01	2.53E-01
Site Boundary (SB) (919 m [0.57 mi] WNW) In direction of Residence, Garden, Meat Cow, Goat Milk, and Cow Milk (WNW)	Ground (SB)	2.57E-01	2.57E-01	3.01E-01
	Vegetable (SB)			
	Adult	1.08E-01	4.35E+00	4.18E-02
	Teen	1.36E-01	6.04E+00	7.02E-02
	Child	2.44E-01	1.17E+01	1.71E-01
	Meat Cow (SB)			
	Adult	2.39E-02	1.61E-01	1.69E-02
	Teen	1.82E-02	1.18E-01	1.42E-02
	Child	3.07E-02	1.84E-01	2.66E-02
	Inhalation (SB)			
	Adult	1.72E-03	1.45E-01	8.61E-04
	Teen	1.75E-03	1.89E-01	8.69E-04
	Child	1.54E-03	2.31E-01	7.67E-04
	Infant	9.24E-04	2.11E-01	4.41E-04
	Goat Milk (3704 m [2.3 mi])			
	Adult	8.42E-03	3.14E-01	1.85E-03
	Teen	1.01E-02	4.98E-01	3.35E-03
	Child	1.42E-02	9.92E-01	8.15E-03
	Infant	2.42E-02	2.41E+00	1.70E-02
	Cow Milk (3513 m [2.18 mi])			
	Adult	4.79E-03	2.54E-01	1.97E-03
	Teen	6.86E-03	4.04E-01	3.60E-03
	Child	1.28E-02	8.04E-01	8.80E-03
	Infant	2.37E-02	1.95E+00	1.83E-02
	Total (Includes Plume)			
	Adult	5.08E-01	5.59E+00	6.17E-01
	Teen	5.35E-01	7.61E+00	6.46E-01
	Child	6.65E-01	1.42E+01	7.69E-01
	Infant	4.11E-01	4.93E+00	5.90E-01

Notes:

1. There are no infant doses for the vegetable and meat cow pathways because infants do not consume these foods.
2. 1 mrem = 0.01 mSv

Table 12.2-20bR Liquid Pathway Doses from Fermi 3 for MEI at Lake Erie

[EF3 COL 12.2-3-A]

	Fermi 3 Dose (mrem/yr)		
Pathway	Whole Body ~~**Total Body**~~	**Thyroid**	**Bone**
Fish	6.46E-03	1.51E-03	9.86E-02
Invertebrate	6.84E-04	1.33E-04	5.37E-03
Drinking	6.09E-04	1.82E-02	7.11E-04
Shoreline (includes water recreation)	1.21E-04	1.21E-04	1.21E-04
Total	7.66E-03	1.82E-02	1.05E-01
Age group receiving maximum dose	Adult	Infant	Child

Notes:

1. Bone of the child is the organ receiving the maximum dose.
2. There are no infant doses for the fish and invertebrate pathways because infants do not consume these foods.
3. 1 mrem = 0.01 mSv

Table 12.2-201 Comparison of Annual Doses to the MEI from Gaseous Effluents

[EF3 COL 12.2-2-A]

Type of Dose	Location	Fermi 3	10 CFR 50 Limit
Gamma Air (mrad/yr)	Site Boundary (1131 m [0.70 mi] SSE)	1.62E-01	10
Beta Air (mrad/yr)	Site Boundary (1131 m [0.70 mi] SSE)	2.00E-01	20
Whole Body ~~Total Body~~ (mrem/yr)	Site Boundary (1131 m [0.70 mi] SSE)	6.65E-01	5
Skin (mrem/yr)	Site Boundary (1131 m [0.70 mi] SSE)	7.69E-01	15
Iodines and Particulates – Max Organ Thyroid (mrem/yr)	WNW Direction, Site Boundary (919 m [0.57 mi]) for Residence, Garden and Meat Cow 3704 m [2.3 mi} for Goat Milk 3513 m [2.18 mi]) for Cow Milk	1.42E+01	15

1 mrad = 0.01 mGy
1 mrem = 0.01 mSv

Table 12.2-202 Comparison of Annual Doses to MEI from Liquid Effluents

[EF3 COL 12.2-3-A]

Whole Body

Type of Dose	Location	Fermi 3	10 CFR 50 Limit
~~Total Body~~ (mrem/yr)	Lake Erie	7.66E-03	3
Thyroid (mrem/yr)	Lake Erie	1.82E-02	10
Bone (mrem/yr)	Lake Erie	1.05E-01	10

1 mrem = 0.01 mSv

Table 12.2-203 Comparison of Site Doses to the MEI

[EF3 COL 12.2-2-A] [EF3 COL 12.2-3-A]

Type of Dose	Fermi 3 (ESBWR) Liquid	Fermi 3 (ESBWR) Gaseous	Fermi 3 (ESBWR) Total	Fermi 2	Site Total(1)	40 CFR 190 Limit
Whole Body ~~Total Body~~ (mrem/yr)	0.008	0.66	0.67	4.68	5.35	25
Thyroid (mrem/yr)	0.018	14.2	14.2	2.66	16.86	75
Bone (mrem/yr)	0.105	1.81	1.92	0.052	1.97	25

Notes:

1. This site total dose includes the Fermi 3 total dose and the dose from Fermi 2.
2. 1 mrem = 0.01 mSv