The Detroit Edison Company
One Energy Plaza, Detroit, MI 48226-1279

10 CFR 52.79

January 29, 2010
NRC3-10-0001

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 R. Hale (USNRC) to Jack M. Davis (Detroit Edison), "Request for Additional Information Letter No. 18 Related to the SRP Sections 8.2, 9.2.1, 10.4.5, 11.4, 12.2, 12.3-12.4, And 14.2 for the Fermi 3 Combined License Application," dated December 1, 2009
3) Letter from Peter W. Smith (Detroit Edison) to USNRC, "Detroit Edison Company Response to NRC Request for Additional Information Letters No. 14 & 15 Related to SRP Sections 14.03.02, 02.04.02, 02.04.05, and 02.04.13 for the Fermi 3 Combined License Application," dated November 20, 2009

Subject: Detroit Edison Company Response to NRC Request for Additional Information Letters No. 18 and Supplemental Response to Letter No. 15

In Reference 2, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combined License Application (COLA). The responses to these Requests for Additional Information (RAIs) are provided as Attachments 1 through 19 of this letter. Information contained in these responses will be incorporated into a future COLA submission as described in the RAI response.

Detroit Edison submitted a response to NRC RAI 02.04.05-2 in Reference 3. As a result of a subsequent telephone discussion with the NRC Staff, Detroit Edison is providing a supplemental response to this RAI as Attachment 20.

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

D095
NRO

I state under penalty of perjury that the foregoing is true and correct. Executed on the 29th day of January 2010.

Sincerely,

Peter W. Smith, Director
Nuclear Development – Licensing & Engineering
Detroit Edison Company

Attachments:
1) Response to RAI Letter No. 18 (Question No. 08.02-14)
2) Response to RAI Letter No. 18 (Question No. 08.02-15)
3) Response to RAI Letter No. 18 (Question No. 08.02-16)
4) Response to RAI Letter No. 18 (Question No. 08.02-17)
5) Response to RAI Letter No. 18 (Question No. 09.02.01-1)
6) Response to RAI Letter No. 18 (Question No. 09.02.01-2)
7) Response to RAI Letter No. 18 (Question No. 09.02.01-3)
8) Response to RAI Letter No. 18 (Question No. 09.02.01-4)
9) Response to RAI Letter No. 18 (Question No. 09.02.01-5)
10) Response to RAI Letter No. 18 (Question No. 09.02.01-6)
11) Response to RAI Letter No. 18 (Question No. 09.02.01-7)
12) Response to RAI Letter No. 18 (Question No. 09.02.01-8)
13) Response to RAI Letter No. 18 (Question No. 09.02.01-9)
14) Response to RAI Letter No. 18 (Question No. 10.04.05-1)
15) Response to RAI Letter No. 18 (Question No. 11.04-2 Supplement 1)
16) Response to RAI Letter No. 18 (Question No. 12.02-5)
17) Response to RAI Letter No. 18 (Question No. 12.03-12.04-4)
18) Response to RAI Letter No. 18 (Question No. 14.02-2)
19) Response to RAI Letter No. 18 (Question No. 14.02-3)
20) Supplemental Response to RAI Letter No. 15 (Question No. 02.04.05-2)

cc: Chandu Patel, NRC Fermi 3 Project Manager
Jerry Hale, NRC Fermi 3 Project Manager
Ilka Berrois, NRC Fermi 3 Project Manager
Bruce Olson, 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
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3868 Revision 1)

RAI Question No. 08.02-14

NRC RAI 08.02-14

In RAI-08.02-4, the staff requested the applicant to discuss why the phenomenon of galloping conductors will not be accentuated in the corridor resulting in flashovers and structural damage to multiple transmission line conductors and hardware as a result of the common transmission line corridor used by Fermi for the three lines to the Milan substation. In response to the RAI, the applicant cited EPRI document No. 1010223, "Updating the EPRI Transmission Line Reference Book: Wind-Induced Conductor Motion ("The Orange Book")" and stated that "the frequency with which galloping occurs is closely related to environmental conditions, such as frequency of icing, smooth countered terrain with few large obstacle, and localized areas near lakes and rivers." The applicant also added that "no relationship to the number of transmission lines in a transmission corridor was identified in a search of industry operating experience."

Since all three transmission lines are routed through the corridor and, hence, exposed to the same environmental conditions, the applicant is requested to indicate whether any of the EPRI-evaluated environmental conditions could result in the galloping conductor phenomenon impacting multiple lines at the same time and result in complete loss of offsite power. The applicant is also requested to discuss their experience with this phenomenon at Units 1 and 2.

NOTE: This is a supplemental to the original RAI# 2168 that was issued in RAI Letter #6, ML091890740

Response

The occurrence of the phenomenon of wind induced conductor vibration called galloping conductors is related to environmental conditions including frequency of icing, wind conditions, terrain, and localized areas near lakes and rivers. No such occurrences have been reported or resulted in any outages on the existing lines that would be sharing the Fermi 3 to Milan transmission corridor in ITC Transmission's operating history which started in February 2003.

ITC Transmission design practices space towers to preclude contact of an adjacent tower's conductors if galloping.

Due to the rarity and unpredictability of these phenomena there is no recognized relationship between location and occurrence within an area of common environmental conditions. Regionally galloping conductors could occur in a common transmission corridor or independent corridors exposed to similar situational weather conditions. ITC is the nation's largest independent electric transmission company and transmits high voltage electricity throughout the central United States. System expansion goals focus on reliability and system loss reduction. As an industry leader it reviews, sponsors, and participates in research and evaluations to insure that its system additions reflect the latest proven design and techniques to minimize transmission losses. ITC's experience and research to date provide this common corridor routing as a highly reliable power supply system to the Fermi 3 facility.

Proposed COLA Revision

None

Attachment 2
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3868 Revision 1)

RAI Question No. 08.02-15

NRC RAI 08.02-15

In RAI 08.02-05, the staff asked the applicant to identify how the lightning protection mentioned in Section 8.2.2.1 and DCD Section 8.2.3 would be implemented for the transmission system and switchyard. The staff also requested that the applicant indicate how the lightning protection system would be periodically maintained and tested to assure functionality and effectiveness throughout the life of EF3. In their response, the applicant stated that the Fermi 3 lightning protection system would be designed in accordance with IEEE Standard 998-1996 (reaffirmed in 2002), "IEEE Guide for Direct Lightning Stroke Shielding of Substations." However, the response failed to indicate conformance with the guidance of RG 1.204, "Guidelines for Lightning Protection of Nuclear Power Plants."

The staff review of Section 8.1 of the DCD observed that the DCD endorses RG 1.204. Additionally, EF 3 FSAR Table 1.9-202, "Conformance with Regulatory Guides," shows that Fermi 3 conforms to the guidance of RG 1.204. Based on the above, discuss why the guidance of the IEEE standards endorsed by RG 1.204 is not applicable to Fermi 3 and provide justification for not using such guidance.

NOTE: This is a supplemental to the original RAI# 2168 that was issued in RAI Letter #6, ML091890740

Response

Detroit Edison letter NRC3-09-0011 (ML092450483) dated August 27, 2009 indicated that the Fermi 3 lightning protection system would be designed in accordance to IEEE Standard 998-1996 (reaffirmed in 2002). This standard deals with physical and spacial relationships of equipment, masts and shield wires in a switchyard to minimize direct lightning strokes to the equipment and buswork.

Detroit Edison identifies in EF3 FSAR Table 1.9-202 that Fermi 3 will conform to the guidance of NRC Regulatory Guide 1.204, Guidelines for Lightning Protection of Nuclear Power Plants. If any conflicts do arise between the guidance of IEEE standard 998-1996 (reaffirmed in 2002) and NRC Regulatory Guide 1.204, the Regulatory Guide will take precedence.

Proposed COLA Revision

None

Attachment 3
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3868 Revision 1)

RAI Question No. 08.02-16

NRC RAI 08.02-16

In RAI 08.02-06, the staff requested that the applicant describe the periodic surveillance and maintenance tests that will be performed on the batteries and battery chargers located in the 345 kV switchyard, and the criteria established for battery replacement. Additionally the staff requested that the applicant describe the periodic surveillance and maintenance tests that will be performed on the circuit breakers, potential transformers, lightning arrestors, capacitive coupling voltage transformers, current transformers, protective relays, microwave channels, communication equipment, annunciator panels, security equipment, switchyard grounding system, and surge arrestors in the 345 kV switchyard.

In their response to the RAI, the applicant provided a more comprehensive listing of switchyard equipment and components that will be subjected to routine inspection and testing and the frequency at which each component will undergo such testing. The staff's review of the applicant's response observed that the applicant had not included in the listing provided lightning and surge arresters. Therefore, the staff requests that the applicant address the omitted items.

NOTE: This is a supplemental to the original RAI# 2168 that was issued in RAI Letter #6, ML091890740

Response

Detroit Edison's response to NRC Request for Additional Information Letter No. 6 dated August 26, 2009 (NRC3-09-0011, ML 092450483) identified routine switchyard testing and inspection activities performed by the transmission operator on numerous equipment components. The lightning protection system including its periodic monitoring, maintenance, and testing was described in response to NRC RAI 08.02-5 of that letter. The response stated:

> *"Periodic monitoring, maintenance and testing of the switchyard lighting protection system includes the following activities:*
>
> - *Lightning surge arresters are thermally scanned using infrared technology annually*
> - *Lightning surge arresters are power factor tested during bus inspections and/or relay control scheme testing on a 10 year cycle"*

Proposed COLA Revision

FSAR Section 8.2.1.2.3 will be revised to add a description of the routine testing and maintenance for the lightning surge arresters as shown in the attached markup.

Markup of Detroit Edison COLA
(following 2 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

inspection focuses on such items as right-of-way encroachment, vegetation management, conductor and line hardware condition, and the condition of supporting structures.

~~Routine switchyard inspection activities include, but are not necessarily limited to, the following:~~

- ~~Periodic inspection of circuit breakers~~
- ~~Semi-annual infrared scan of substation equipment~~
- ~~Semi-annual inspection of substation equipment~~
- ~~Periodic relay inspections~~

~~Routine switchyard testing activities include, but are not necessarily limited to, the following:~~

- ~~5-year relay calibration~~
- ~~10-year ground grid testing~~
- ~~Semi-annual battery/charger inspection w/annual preventative maintenance~~ Replace text with Insert "1"

8.2.2.1 Reliability and Stability Analysis

Replace this section with the following.

EF3 COL 8.2.4-9-A
EF3 COL 8.2.4-10A

A system impact study performed by ITC*Transmission* analyzed loadflow, transient stability and fault analysis for the addition of Fermi 3. (Reference 8.2-201) The base case for this analysis represented the expected system configuration and loading in 2017 and included planned transmission projects that had budgetary approval at the time the analysis was performed. The sub-transmission system used for the analysis represented the summer for 2007 case and did not include any planned upgrades beyond that time. Stability analysis was performed on both the 2017 summer peak base model and the 2017 eighty percent model with Fermi 3 and projected network upgrades included.

The ITC*Transmission* system was analyzed for thermal and voltage limitations for normal and post contingency conditions via power flow analysis using Power Technology International Software PSS/E and MUST power flow and contingency analysis simulation tools. The analysis examined potential constraints such as thermal equipment overloads, voltage criteria violations, breakers that exceed their rated

Insert 1

Routine switchyard testing and inspection activities include, but are not necessarily limited to, the following:

- Circuit Breaker Inspections — Every 6 years or after 10 automatic operations
- Station infrared (IR) scans — Annually
- Switchyard Inspection — Monthly manual walk through of substation mat to visually inspect all equipment, including but not limited to; locks, fencing, control houses
- Station Batteries and Chargers — Tested annually. Battery load tested every 5 years
- Relays
  - Electromechanical Type — Calibrated on a 5 year cycle
  - Microprocessor Type — Calibrated on a 10 year cycle
  - Control schemes — Tested for operation and insulation integrity on a 10 year cycle
- Current Transformers (CTs), Potential Transformers (PTs), and Coupling Capacitive
- Voltage Transformer (CCVTs) — Tested concurrently with control schemes on a 10 year cycle
- Communication Equipment (including Line Tuners and Wave Traps) — Tested concurrently with control schemes on a 10 year cycle.
- Bus Inspection/Disconnect Switches — Tested concurrently with control schemes on a 10 year cycle
- Backup AC Generators — Biannual inspections, includes annual load testing
- Ground Mat Integrity — Tested every 15 years
- Lightning Surge Arresters – Infrared thermal scan annually. Power factor tested during bus inspections and/or relay control scheme testing on a 10 year cycle

Monitoring, maintenance and testing of the switchyard protection will be performed under North American Electric Reliability Corporation (NERC) Standard PRC-005-1, "Transmission and Generation Protection System Maintenance and Testing."

Attachment 4
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3868 Revision 1)

RAI Question No. 08.02-17

NRC RAI 08.02-17

In RAI 08.02-07, the staff requested that the applicant describe how low voltage power, control, and instrumentation cables that are expected to be partially or continuously submerged in manholes, trenches, and duct banks are specified and qualified. The staff also asked the applicant to provide the design features and/or in-situ monitoring programs that will be implemented to avoid or arrest the degradation of cable insulation from the effects of moisture. Include cables traversing the switchyard, as well as those from the switchyard to the EF3 unit.

In their response to the RAI, the applicant stated that periodic monitoring of cable insulation for underground medium voltage cable will be conducted to detect potential cable insulation degradation from moisture intrusion. The applicant also stated that medium voltage cables will be monitored in a manner similar to that described in the Fermi 2 Electrical Cable Monitoring Program based on the recommendations of the EPRI Cable Task Force. Experience from this program will be used to establish testing frequencies and to specify testing methods for medium voltage underground cables at Fermi 3. The NRC reviewed the Fermi 2 Electrical Cable Monitoring Program in conjunction with Detroit Edison' response to Generic Letter (GL) 2007-01 and found that the Fermi 2 response adequately addressed the concern in GL 2007-01 for power cables within the scope of 10 CFR 50.65. Regarding low voltage power, control or instrumentation cables in underground circuits, the applicant stated that they believed that a testing program was not necessary.

The staff's review of Detroit Edison response to Generic Letter (GL) 2007-01 found that the three failed cables they identified at Fermi 2 were low voltage (480VAC and 260 VDC) cables. Additionally, the staff noted that, for Fermi 2, Detroit Edison committed to inspecting, testing, and monitoring of all power cables, not the medium voltage cables only. Therefore, based on the operating experience with low voltage underground cables and the earlier commitment with Fermi 2, indicate why a program for inspecting, testing and monitoring low voltage underground power cables is not required for Fermi 3.

NOTE: This is a supplemental to the original RAI# 2168 that was issued in RAI Letter #6, ML091890740

Response

Detroit Edison's response to GL 2007-01 for Fermi 2 was transmitted by DTE Energy letter to the NRC, NRC-07-0017 dated May 4, 2007.

The Detroit Edison Fermi 2 response to GL 2007-01 stated that baseline inspections of the cable vaults were planned to assess the health of important power cables and form a bases for a preventive maintenance program and the foundation of an inspection program. The program would be developed through benchmarking and would be consistent with EPRI Cable Task Force recommendations. The program was expected to include the following:

- Formal implementation of a cable monitoring program.
- Establishment of preventive maintenance activities for periodic inspection/testing of cables and the cable vaults.
- The benchmarking of a wide range of plants.

No commitment to inspect, test, and monitor all power cables was made by Detroit Edison for Fermi 2 in the response to GL 2007-01.

Detroit Edison Fermi 2 currently has an electrical cable monitoring program. The program's purpose is "...to detect and trend the degradation of significant cables and connections located in challenged environments" and that by monitoring those cables the program helps to protect the safe shutdown capability of the plant, increases equipment reliability, and ensures compliance with the appropriate EQ Maintenance and Surveillance letters for cables. The scope of the program regarding cables in a wet environment such as underground raceway inspects significant medium voltage cables in those areas, as well as monitoring of underground raceway manholes for cable submergence and overall condition such as the condition of supports and dewatering equipment.

Detroit Edison's response to RAI 08.02-7 provided a proposed change to the Fermi 3 FSAR adding information regarding the periodic monitoring of cable insulation for underground medium voltage cables to detect potential cable degradation from moisture intrusion. This proposed change is consistent with the monitoring approach currently followed at Fermi 2.

Detroit Edison does not believe that a monitoring program for Fermi 3 which is beyond the Fermi 2 program described above is necessary. Detroit Edison concludes that no further action is required for this RAI.

Proposed COLA Revision

None

Attachment 5
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-1

NRC RAI 09.02.01-1

Tier 1 of the ESBWR DCD Revision 6, Section 4.1, specifies as a COL interface requirement that the plant-specific Plant Service Water System (PSWS) be capable of removing $2.02x10^7$ MJ ($1.92x10^{10}$ BTU) over a period of seven days without active makeup and must ensure that PSWS have sufficient available net positive suction head at the pump suction (NPSH).

Part 10 of the Fermi-3 COL application, Section 2.4.2, proposes the Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) specifying a cooling tower basin water inventory requirement as a way of demonstrating that the heat removal capability specified by the DCD has been satisfied. While the water inventory is an important factor that must be addressed by the ITAAC, the staff found the water inventory alone is not sufficient to demonstrate that the cooling towers are capable of dissipating the specified heat load. The capability of cooling towers to dissipate heat is dependent upon a number of "other factors" that should be taken into consideration, such as cooling tower design attributes; the capability to satisfy the PSWS pump minimum NPSH requirements (Question 09.02.01-2) for the most limiting cooling tower basin water level, temperature, and flow conditions; the maximum allowed PSWS water supply temperature; and the most limiting meteorological assumptions that pertain to the site. The capability analyses for the cooling tower need take these factors into consideration (including margin for expected degradation and operating flexibility), and confirmatory testing are usually necessary in order to adequately demonstrate that cooling tower performance satisfies the specified heat removal requirement. In addition, the extent and basis for using the combined normal power heat sink (NPHS) and auxiliary heat sink (AHS) cooling tower basin inventories for Trains A and B need to be addressed.

The applicant is requested to address the above "other factors" such that the specified cooling tower performance capability is adequately demonstrated for both defense-in-depth and regulatory treatment of non-safety systems (RTNSS) functions, and the Final Safety Analysis Report (FSAR) and ITAAC need to be revised accordingly to describe the plant licensing basis in this regard.

Response

The capability of the PSWS cooling towers is based on the typical design attributes associated with the design of nonsafety-related cooling systems utilizing cooling towers. The minimum heat duty for each tower is 2.98 x 10^8 BTU/hr and the design uses ambient wet bulb temperature (73°F), approach temperature (15°F), and cold water (supply) temperature of 88°F. The system's normal loads are from the RCCWS and TCCWS and the system is designed as a nonsafety-related system to perform a cooldown assuming a Loss of Preferred Power (LOPP) and single train operation. Initial testing of the system includes performance testing of the cooling towers for conformance with design heat loads and water flows. This information is incorporated by reference from the DCD in FSAR Section 9.2.1, with necessary supplements.

During a postulated event where PSWS functions as a RTNSS Criterion C (Low Regulatory Oversight) System, the normal makeup water to the cooling towers is not qualified as a RTNSS

function and is considered to be unavailable. The cooling tower basin must have a sufficient volume of water to allow the tower to perform its cooling function without active makeup. The DCD Tier 1 Interface Requirement and ITAAC specify the heat to be removed over seven days to allow a calculation of the amount of water that is needed to support this cooling function without active makeup. The heat load from the components and systems requiring cooling during the seven days indicated by the interface requirement is much less than the design minimum heat duty of each PSWS cooling tower. This reduced load is used to analyze the water loss from the system due to evaporation and drift. The ITAAC in COLA Part 10, Table 2.4-1, will be revised to reflect the interface requirements in DCD Tier 1, Section 4.1, Revision 6 to show the following:

1. A revised design commitment and acceptance criteria that confirms the volume of water in the PSWS heat sink is sufficient to remove 2.02×10^7 MJ (1.92×10^{10} BTU) over a period of seven days without active makeup.

2. A new design commitment and acceptance criteria that confirms there is sufficient available net positive suction head at the PSWS pump suction location for the lowest probable water level of the heat sink.

Additionally, COLA ITAAC 2.4.2 will be revised to reflect the latest text in DCD Tier 1, Interface Requirement 4.1, Plant Service Water System, Revision 6.

Therefore, the ITAAC in COLA Part 10, Table 2.4 -1 meets the intent of the PSWS interface requirement stated in DCD Tier 1, Section 4.1. This ITAAC, in combination with the design and testing requirements described in the FSAR, adequately demonstrates PSWS performance for both defense-in-depth and RTNSS functions as a Criterion C, Low Regulatory Oversight, Maintenance Rule support system.

Regarding the use of the Normal Power Heat Sink (NPHS) and Auxiliary Heat Sink (AHS) cooling tower basin inventories, only the AHS inventory is used to meet the ITAAC. The NPHS is only used during normal power operation, and during the postulated event, active makeup from the NPHS is unavailable.

Proposed COLA Revision

Proposed markup of COLA Part 10, Section 2.4.2 and Table 2.4-1 are attached.

Markup of Detroit Edison COLA
(following 4 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

2.4.2 ITAAC FOR PLANT SERVICE WATER SYSTEM (PORTION OUTSIDE THE SCOPE OF THE CERTIFIED DESIGN)

Design Description

The Plant Service Water System (PSWS) is the heat sink for the Reactor Component Cooling Water System. The PSWS does not perform any safety-related function. There is no interface with any safety-related component.

The PSWS cooling towers and basins are not within the scope of the certified design. A specific design for this portion of the PSWS is described in FSAR Subsection 9.2.1. Interface requirements are necessary for supporting the post-72-hour cooling function of the PSWS. The plant-specific portion of the PSWS shall meet the following interface requirement:

~~The PSWS is required to remove 2.02×10^7 MJ (1.92×10^{10} BTU) over a period of 7 days without active makeup.~~ "Insert 1"

Inspections, Test, Analyses and Acceptance Criteria

Table 2.4-1 provides a definition of the inspections, tests, and/or analyses, together with associated acceptance criteria for the PSWS.

Table 2.4-1
ITAAC For Plant Service Water Reserve Storage Capacity

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The PSWS contains an inventory of cooling water sufficient for RCCWS cooling from hour zero (0) through day 7 (2.02×10^7 MJ (1.92×10^{10} BTU)) without active makeup.	1. Inspection of the as-built PSWS cooling tower basin and pump forebay will be conducted.	1. Report(s) document that the usable water volume in the cooling tower basins (Trains A and B) and associated pump forebay, defined as the volume above the pump minimum submergence water level and below the minimum normal operating level, is a minimum of 2.4 million gallons.

"Insert 2"

"Insert 1"

The volume of water shall be sufficient such that no active makeup shall be necessary to remove 2.02×10^7 MJ (1.92×10^{10} BTU) over a period of seven days. Additionally, the PSWS pumps must have sufficient available net positive suction head at the pump suction location for the lowest probable water level of the heat sink.

"Insert 2"

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The volume of water in the PSWS basin shall be sufficient such that:		
a. No active makeup shall be necessary to remove 2.02×10^7 MJ (1.92×10^{10} BTU) over a period of seven days.	Inspections and analysis will be performed of the PSWS basin and cooling towers.	A report exists and concludes that the volume of water in the PSWS basin is sufficient such that no active makeup is necessary to remove 2.02×10^7 MJ (1.92×10^{10} BTU) over a period of seven days.
b. The PSWS pumps must have sufficient available net positive suction head at the pump suction location for the lowest probable water level of the heat sink.	Inspections and analysis will be performed of the PSWS basin.	A report exists and concludes that the PSWS pumps have sufficient available net positive suction head at the pump suction location for the lowest probable water level of the heat sink.

Attachment 6
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-2

NRC RAI 09.02.01-2

Tier 1 of the ESBWR DCD Revision 6, Section 4.1, specifies a COL interface requirement that the plant-specific Plant Service Water System (PSWS) must have sufficient available net positive suction head at the pump suction (NPSH). The Fermi-3 FSAR and ITAAC need to be revised to address the NPSH interface requirement.

Response

As part of the response to NRC RAI 09.02.01-1, the ITAAC in COLA Part 10, Table 2.4- 1 will be revised to reflect the interface requirements in DCD Tier 1, Section 4.1, Revision 6, to show the following:

1. A revised design commitment and acceptance criteria that confirms the volume of water in the PSWS heat sink is sufficient to remove 2.02×10^7 MJ (1.92×10^{10} BTU) over a period of seven days without active makeup.

2. A new design commitment and acceptance criteria that confirms there is sufficient available net positive suction head at the PSWS pump suction location for the lowest probable water level of the heat sink.

Additionally, COLA ITAAC 2.4.2 will be revised to reflect the latest text in DCD Tier 1, Interface Requirement 4.1, Plant Service Water System, Revision 6.

Proposed COLA Revision

See response to RAI 09.02.01-1 for proposed COLA revisions to Part 10.

Attachment 7
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-3

NRC RAI 09.02.01-3

In response to COL Information Item 9.2.1-1-A, "Material Selection," the applicant proposes to use fiberglass reinforced polyester pipe (FRPP) in locations where the Plant Service Water System (PSWS) pipe is buried to preclude long-term corrosion. The review criteria specified by the SRP relative to pipe failure is based on the use of metal pipe. In order to assure that the use of nonmetallic pipe will not adversely impact safety-related structures, systems, and components (SSCs) or those that satisfy the RTNSS criteria, the following additional information needs to be reflected in the applicable sections of the FSAR and plant-specific ITAAC as appropriate:

a) *The criteria and limitations for using FRPP.*

b) *An evaluation of the impact of using FRPP on PSWS reliability and availability assumptions, especially during seismic events and water hammer transients that can occur.*

c) *Describe how operating experience, where as buried fiberglass materials have been utilized in a similar application such as water service with similar piping size, pressure and temperatures, will be addressed in the selection of the buried fiberglass materials.*

d) *Describe if ASME B31.1 "Non-mandatory Appendix III, Rules for Non-metallic Piping and Piping Lines with Nonmetals," will be utilized for the fiberglass design and installation, In addition, describe any material standard/classification, for example American Society for Testing and Materials or American Water Works Association that better defines the piping and fitting standards to be utilized.*

e) *Describe the quality assurance requirement in the RTNSS environment, and provide details of the buried fiberglass application including the following:*

- *piping size, wall thickness, and piping lengths*
- *design and operating pressure and temperature*
- *location with respect to high traffic areas and if it will be necessary to sleeve the fiberglass for protection*
- *material handling and storage, installation, qualification and testing*
- *programs for the piping and fittings related to installation personnel*
- *in-service inspection and accessibility*
- *details of initial cyclic pressure testing plus hold times*
- *information to support FRP seismic design acceptability as seismic category NS for RTNSS piping applications.*

Response

The above requested information is provided below.

(a) Criteria and limitations for using FRPP are specified in the FSAR by incorporating DCD Chapter 3, Sections 9.2.1.1 and 19A, and Table 19A-4. Specifically:

- DCD Chapter 3, "Design of Structures, Components, Equipment, and Systems," and DCD Section 9.2.1.1, "Plant Service Water System Design Bases," specify

the criteria and limitations that PSWS must meet to satisfy ESBWR standard plant design requirements.

- DCD Section 9.2.1.1 also defines PSWS as a nonsafety-related system that does not interface with any safety-related systems. Rather, it is categorized as a Regulatory Treatment of Non-Safety Systems (RTNSS) Criterion C, Low Regulatory Oversight, Maintenance Rule, system that supports the Reactor Component Cooling Water System (RCCWS).
- Section 19A.8.3 and Table 19A-4 of DCD Revision 6 specify design criteria pertaining to flood protection, wind speed, wind-generated missiles, and seismic requirements for RTNSS Criterion C systems.

PSWS components, including FRPP, are designed and fabricated to meet the general design requirements for the system and the special requirements prescribed for RTNSS Criterion C systems that have been specified in the FSAR by incorporation of the DCD. Also, as a Maintenance Rule system, PSWS is monitored under the Maintenance Rule program and any degradation addressed.

(b) FRPP meets the design requirements specified for PSWS, as described in the response to Item (a) above. These requirements include design for a safe shutdown earthquake (SSE) to International Building Code (IBC) requirements. As stated in Section 19A.8.3 of DCD Revision 6:

> "RTNSS C systems and components are designed to the seismic requirements of IBC-2003 consistent with the above SSE ground motion."

With "the above SSE ground motion" defined earlier in Section 19A.8.3 as

> "...seismically designed using dynamic analysis method with the SSE ground input motion equal to two-thirds of the Certified Seismic Design Spectra taken from Figures 2.0-1 and 2.0-2 adjusted as required to their bases."

Consequently, the use of FRPP will not have a negative impact on PSWS reliability or availability assumptions. Rather, the choice of FRPP is expected to enhance the reliability and availability of PSWS due to its long-term corrosion resistance and extended design life.

Water hammer impacts are addressed in DCD Section 9.2.1.1 which states:

> "The PSWS meets the intent of the acceptance criteria of GDC 4 with respect to dynamic effects associated with water hammer. The PSWS is vented at components and high points vents and operation and maintenance procedures are used to assure sufficient measures are taken to avoid water hammer."

Further, in DCD Section 9.2.1.2, the next to last paragraph of the Detailed System Description subsection states:

"The potential for water hammer is mitigated through the use of various system design and layout features, such as automatic air release/vacuum valves installed at high points in system piping and at the pump discharge, proper valve actuation times to minimize water hammer, procedural requirements ensuring proper line filling prior to system operation and after maintenance operations, and the use of a check valve at each pump discharge to prevent backflow into the pump.

These sections were incorporated by reference to the FSAR. The detailed design layout of the PSWS piping for Fermi 3 will take water hammer into consideration and the appropriate mitigation methods will be used.

(c) Applicable operating experience (OE) with the use of fiberglass reinforced polyester (FRP) pipe (composite pipe) in industrial applications was reviewed in reaching the determination that this piping material is acceptable for use in the PSWS below-grade application. Applicable OE continues to be reviewed as the PSWS design progresses in order to determine appropriate design, manufacturing and installation lessons-learned and best practices in the application of this material.

Based on review of recent applications of FRP pipe, it was concluded that this material has been successfully used in a variety of industrial applications, including:

- Cooling water for power and industrial plants
- Feed lines and penstock for hydroelectric plants
- Sanitary sewer projects (gravity and pressure systems)
- Pipeline rehabilitation (slip-lining)
- Drinking water projects (raw and potable)
- Irrigation systems

These applications included pipe sizes up to 160 inch diameter, operating pressures to 460 psi, and temperatures up to 150°F.

The review also identified that the composite pipe material industry experienced challenges in the 1970s stemming from excessive deflection and strain corrosion during installation and in-service, as well as problems with pipe joint effectiveness, that resulted in poor piping performance. To address these issues, the industry developed and/or improved design, manufacture, and installation standards. ASME B3 1.1, Power Piping, Non-Mandatory Appendix III, Rules for Nonmetallic Piping and Piping Lines with Nonmetals was developed to provide minimum requirements for the design, materials, fabrication, erection, testing, examination, and inspection of nonmetallic piping. Nonmetallic material and product standards related to FRP pipe, incorporated into the Code, include:

- AWWA C950: Standard for Glass-Fiber-Reinforced Thermosetting-Resin Pressure Pipe
- ASTM D1694: Standard Specification for Threads 60° (Stub) for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

- ASTM D2992: Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
- ASTM D2996: Standard Specification for Filament-Wound "Fiberglass" (GlassFiber-Reinforced Thermosetting-Resin) Pipe
- ASTM D3839: Standard Guide for Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

A review of industry literature indicates that long term reliability of FRP pipes has been proven for the last 30 years with more than 37,000 miles of pipe in operation internationally. In addition, the use of large diameter FRP pipe in industrial applications continues to expand worldwide. Due to its inherent corrosion resistant properties, FRP pipe has been established as an excellent low maintenance alternative to steel and concrete piping.

A review of OE related to U.S. nuclear power plant service identified two FRP pipe failures that occurred at Perry Nuclear Generation Plant (Perry) on December 22, 1991, and on March, 26, 1993. These failures resulted in long plant shutdowns on both occasions. Perry installed FRP for the underground portions of its Circulating Water System (CWS), Service Water System (SWS) and Fire Protection System (FPS).

Perry performed investigations of these FRP pipe failures and concluded that:

a. Large bore FRP for CWS and SWS suffered much damage/abuse during installation. Heavy equipment was used to install the piping. This caused impact and deflection damage.
b. Impact damage was repaired, if it was identified.
c. Deflection damage also occurred when soil was backfilled around/over the piping. The deflection damage resulted in bending the piping out-of-round into egg shape cross-section at certain locations.
d. The piping was of marginal design and was poorly manufactured.

The above deficiencies that jointly caused failures of the FRP at Perry can be readily attributed to the following:

a. Impact and deflection damage - Poor work practices and procedures
b. Impact damage identification/repair - Poor quality control
c. Damage during installation - Poor work practices/procedures - Lack of standards
d. Marginal design and poor manufacturing - Lack of adequate standards and poor quality control resulting in noncompliance with the existing standards.

Perry received its construction permit on May 3, 1977, and began commercial operation in 1987. The underground piping for the CWS and SWS is typically installed very early in the construction cycle. At Perry, the underground FRP was installed in the mid to late 1970s and the piping was manufactured and procured much earlier. At that time, available FRP piping codes and standards were either not available or limited in scope and detail compared to

steel piping standards. In addition, these early standards for FRP pipe did not have the benefit of the experience accumulated over time that the present day codes and standards incorporate.

The overall conclusion drawn from the review of industry operating experience and industrial application of FRP pipe is that the work practices and quality standards associated with this material have improved considerably since the 1970s. In consideration of the FRP pipe resistance to corrosion in the below-grade environment and the vast recent positive experience with its application in industrial pressurized water systems, including the incorporation of the material into the ASME B31.1 Power Piping Code and the promulgation of industry standards for design, manufacture, installation, and testing, Detroit Edison concludes that FRP pipe is the optimal material for use in the RTNSS Category C PSWS below-grade application.

(d) PSWS fiberglass pressure pipe will meet the requirements of ASME B31.1 Non-Mandatory Appendix III, Rules for Nonmetallic Piping and Piping Lines with Nonmetals, including the applicable ASTM and AWWA standards for FRP pipe that have been incorporated into the Code. FSAR Section 9.2.1 will be revised to commit to using this appendix.

(e) The PSWS design pressure and temperature are expected to be less than 150 psi and 140°F, respectively, and the buried PSWS fiberglass pressure pipe is expected to be between 30 and 40 inches. The exact location of the buried fiberglass pressure pipe for PSWS has not been determined. The design conditions, pipe size, pipe lengths and locations with respect to loading will be provided to a supplier at a later date. The piping supplier will then determine the wall thickness required using the guidance of ASME B31.1 Non-Mandatory Appendix III, Rules for Nonmetallic Piping and Piping Lines with Nonmetals, including the applicable ASTM and AWWA standards for fiberglass pressure pipe that have been incorporated into the Code.

The installation, storage, handling, and testing of fiberglass pressure pipe in PSWS shall be consistent with the guidelines of ASTM standards. As noted in item (c) of this response, the previous industry problems were a result of lacking standards. Since that time numerous standards have been developed and industry practices have been modified to prevent damage to fiberglass pressure pipe. Furthermore, the RTNSS portion of the PSWS piping has been classified as Quality Group "D" and Safety-Related Classification "S" per DCD Revision 6, Table 3.2-1. DCD Revision 6, Table 3.2-3 indicates that Quality Group D piping is to be designed to ASME B31.1. The Safety-Related Classification S indicates Note 5i, which states:

"Nonsafety-related structures, systems and components assigned to RTNSS criteria other than Criterion B that are required to be designed in accordance with RTNSS requirements as specified in Appendix 19A."

DCD Revision 6, Section 19A.8.2 states:

> "All RTNSS systems shall be in the scope of the Design Reliability Assurance Program, as directed by Section 17.4, which will be incorporated into the Maintenance Rule program.

> Quality assurance controls for RTNSS SSCs are addressed in Subsection 17.1.22, which states that nonsafety-related structures, systems and components (SSCs) that perform safety significant functions have quality assurance requirements applied commensurate with the importance of the items function. The identification of nonsafety-related structures, systems and components and their quality classification is shown in Table 3.2-1."

DCD Revision 6, Section 19A.8.3, discusses the augmented design standards for RTNSS systems and the seventh and eighth paragraphs state:

> "Systems that meet RTNSS Criteria A, C, D, or E do not require augmented design standards described above, but must incorporate the defense-in-depth principles of redundancy and physical separation to ensure adequate reliability and availability.
>
> RTNSS C systems do not require augmented seismic design criteria."

These statements in the DCD confirm that the design standards identified in DCD Chapter 3 are those to be used in the design of RTNSS C systems such as PSWS. As stated earlier, DCD Tables 3.2-1 and 3.2-3 show that PSWS piping is to be designed to ASME B31.1, and as indicated in the response to item (d) of this RAI, PSWS fiberglass pressure pipe will meet the requirements of ASME B31.1 Nonmandatory Appendix III, Rules for Nonmetallic Piping and Piping Lines with Nonmetals, including the applicable ASTM and AWWA standards for FRP pipe that have been incorporated into the Code.

DCD Revision 6, Sections 17.1.22 and 17.4.2 both state that RTNSS components have quality assurance requirements identified in GE Hitachi Nuclear Energy, "NP-2010 COL Demonstration Project Quality Assurance Program," NEDO-33 181, Revision 6, August 2009. The quality assurance requirements for the PSWS fiberglass pressure piping with the RTNSS classification will have the same quality assurance standards as other RTNSS C components.

Detroit Edison believes that design of the PSWS piping using ASME B31.1 and incorporation of the quality assurance requirements of the DCD is in compliance with the requirements of the DCD.

Proposed COLA Revision

See response to NRC RAI 09.02.01-4 for proposed revisions to FSAR Section 9.2.1.

Attachment 8
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-4

NRC RAI 09.02.01-4

DCD Tier 2 COL Information Item 9.2.1-1-A, "Material Selection," indicates that the applicant needs to specify plant-specific Plant Service Water System (PSWS) material selections based on water quality analysis in order to preclude long-term corrosion and fouling. In Fermi-3 FSAR EF3 COL 9.2.1-1-A, the applicant in response to this COL Information Item only addressed material selection for buried piping but did not provide material specifications for any other parts of the PSWS, including those for the cooling towers [normal power heat sink (NPHS)/auxiliary heat sink (AHS) and related components. Additional information is needed to specify and explain the material selections that pertain to the rest of the PSWS.

Response

The response to COL Item 9.2.1-1-A in FSAR Section 9.2.1.2 states that appropriate chemical treatment is added to the PSWS basin to preclude long-term corrosion and fouling of the PSWS based on site water quality analysis. This statement applies to all PSWS components, not just buried piping. Material selection for PSWS components will take into consideration PSWS water quality, a viable water treatment option to meet nutrient discharge limits for Lake Erie, economic considerations, and DCD-related RTNSS criteria.

Water used for the PSWS system is from Lake Erie. The water quality of Lake Erie has been evaluated and results are provided in COLA Part 3, Environmental Report (ER), Subsection 2.3.3.

PSWS basin water is treated for biofouling, scaling, and suspended matter with biocides, anti-scalants, and dispersants, respectively. In addition, the anti-scalants and/or dispersants contain corrosion inhibitors, as appropriate. As stated in the supplemental text added to the end of the second paragraph under Operation in DCD Section 9.2.1.2, the makeup water for the PSWS basin is dependant on the cooling tower being used for heat rejection (See response to NRC RAI 09.02.01-8 for proposed markup). Because of the interconnection between the PSWS Auxiliary Heat Sink (AHS) and Normal Power Heat Sink (NPHS), the chemical injection is expected to be performed by the circulating water chemical feed system. This system is described in FSAR Section 10.4.5.2.2.1 CIRC Chemical Injection. Using the circulating water chemical feed system allows for consistent water quality between the AHS basin and NPHS basin. This water treatment regime mitigates the long-term effects of fouling and corrosion within the PSWS.

Carbon steel that meets ASTM standards is used as the pipe material for above grade portions of the PSWS. Based on the selected water treatment regime, more corrosion resistant materials and valve hard seats are not needed.

Fiberglass reinforced polyester pipe (FRP pipe) that meets ASTM and AWWA standards, as allowed by Appendix III of the ASME B31.1 code, is used as the pipe material for the below grade piping. FRP pipe is not susceptible to internal corrosion from the chemically treated water or to external corrosion from ground contact.

Proposed COLA Revision

Proposed revisions to FSAR Section 9.2.1.2, item EF3 COL 9.2.1-1-A are attached.

Markup of Detroit Edison COLA
(following 2 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

9.1-5-A **Handling of Heavy Loads**

STD COL 9.1-5-A This COL item is addressed in Subsection 9.1.5.6, Subsection 9.1.5.8, and Subsection 9.1.5.9.

9.2 Water Systems

9.2.1 Plant Service Water System

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

9.2.1.2 System Description

Summary Description

Replace the Summary Description with the following information.

EF3 CDI The Plant Service Water System (PSWS) rejects heat from nonsafety-related RCCWS and TCCWS heat exchangers to the environment. The source of cooling water to the PSWS is from either the normal power heat sink (NPHS) or the auxiliary heat sink (AHS). A natural draft cooling tower is utilized for the NPHS and mechanical draft cooling towers are utilized for the AHS with a crosstie line to permit routing of the plant service water to either heat sink. Table 9.2-201 provides information on the PSWS cooling tower design characteristics.

EF3 CDI A simplified diagram of the PSWS is shown in DCD Figure 9.2-1.

Detailed System Description

Replace the eighth sentence in the sixth paragraph with the following.

EF3 COL 9.2.1-1-A ~~Fiberglass reinforced polyester pipe is used for buried PSWS piping to preclude long term corrosion. Appropriate chemical treatment is added to the PSWS basin to preclude long-term corrosion and fouling of the PSWS components based on site water quality analysis. PSWS materials are compatible with the PSWS water treatment regime.~~

"Insert 1"

Analysis of routine PSWS basin grab samples will detect RCCWS leakage, which may contain low levels of radioactivity, into the PSWS.

"Insert 1"

PSWS basin water is treated for biofouling, scaling, and suspended matter with biocides, anti-scalants, and dispersants, respectively. In addition, the anti-scalants and/or dispersants contain corrosion inhibitors as appropriate. This water treatment regime mitigates the long-term effects of fouling and corrosion within the PSWS.

PSWS materials are compatible with the PSWS water treatment regime. Based on the selected regime, carbon steel that meets ASTM standards is used as the pipe material for above-grade portions of the PSWS.

Fiberglass pressure pipe that meets the requirements of ASME B31.1, Power Piping Code, Nonmandatory Appendix III, Rules for Nonmetallic Piping and Piping Lined with Nonmetals, including applicable ASTM and AWWA standards, is used for below-grade piping. Fiberglass pressure pipe is not susceptible to internal corrosion from the chemically treated water or to external corrosion from ground contact.

Attachment 9
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-5

NRC RAI 109.02.01-5

Tier 2 of the DCD, Section 9.2.1.6, "COL Information," specifies in part that the COL applicant needs to establish provisions to preclude long-term corrosion and fouling based on site water quality analysis. The FSAR does not explain what specific vulnerabilities are considered to be pertinent based upon operational experience that applies and why chemical treatment alone is sufficient for addressing these vulnerabilities. Chemical treatment is a common practice and suitable for addressing service water system corrosion and fouling problems to some extent, but it is usually implemented as part of a more comprehensive program (or collection of programs) to address service water system vulnerabilities. For example, considerations for precluding long-term corrosion and fouling of service water systems typically include: (i) establishing a program of surveillance and control techniques (such as chemical treatment) to prevent flow blockage problems due to bio-fouling; (ii) establishing a routine inspection and maintenance program to assure that corrosion, erosion, protective coating failure, silting, bio-fouling and others that are applicable cannot degrade defense-in-depth and RTNSS cooling functions that are credited; and (iii) establishing a test program to verify (initially and periodically) the heat transfer capability of heat exchangers that are important to safety has not degraded over time.

Additional information needs to be included in the FSAR to: a) describe corrosion and fouling mechanisms and vulnerabilities that are anticipated based on industry operating experience and the plant-specific location, and b) describe programmatic controls that will be implemented to address these considerations and to assure that PSWS performance (including NPHS and AHS cooling towers) will not degrade over time.

Response

The Plant Service Water System (PSWS) is a closed system with makeup water treated to preclude long-term corrosion and fouling, based on the site water quality analysis. Generic Letter 89-13 and its supplements are not applicable because the ESBWR has no safety-related service water (reference DCD Table 1C-1). The approach to maintaining the PSWS against its site-specific vulnerabilities reflects Detroit Edison's experience with Fermi 2. The PSWS is a nonsafety-related system that is designated as RTNSS, Criterion C, Low Regulatory Oversight, Maintenance Rule support system. As a Maintenance Rule system, system operation will be monitored for degradation and deficiencies addressed.

The Auxiliary Heat Sink (AHS) basin water chemical addition is expected to be accomplished by the circulating water chemical feed system described in FSAR Section 10.4.5.2.2.1. The circulating water chemical feed system can inject chemicals into the makeup water lines, cooling tower basin, or the Circulating Water System directly.

Based on the operation of Fermi 2, Detroit Edison has developed significant knowledge of the operating environment and the degradation mechanisms of the service water system. The water chemistry, inspections, trending, and maintenance activities address potential problems with algae, mollusks, bacteria, zebra mussels, and general steel corrosion. The specific water treatment is strongly influenced by the characteristics of Lake Erie. For Fermi 3, use of cooling towers, water treatment, and material selection mitigate these site specific mechanisms. Under the plant chemistry program, periodic analysis assures that the desired chemical balance is maintained in

PSWS. Additionally, monitoring and trending of system operating parameters of PSWS as a Maintenance Rule system are used to assess the ongoing effectiveness of the water treatment program. The RTNSS functions only rely on the performance of the AHS cooling towers; therefore any degradation of the Normal Power Heat Sink (NPHS) cooling tower over time would not impact the RTNSS functions of PSWS.

Consistent with ESBWR DCD, Revision 6, Table 19A-2, the PSWS (including the AHS cooling towers) is a nonsafety-related system that is designated as a RTNSS Criterion C, Low Regulatory Oversight, Maintenance Rule support system. The PSWS is subject to reliability and availability controls in accordance with the Maintenance Rule Program requirements. In addition, as stated in DCD Section 19A.8.2, all RTNSS systems are in the scope of the Design Reliability Assurance Program (D-RAP), as described in FSAR Section 17.4. Further, as described in FSAR Section 17.4.1, structures, systems, and components (SSCs) that are in the scope of the D-RAP are initially classified as high safety significant (HSS) for the Maintenance Rule Program, with any exceptions requiring expert panel review. The PSWS is initially classified as HSS.

The implementation of the requirements of Maintenance Rule Program (10 CFR 50.65) is addressed as an operational program by Item 17 in FSAR Table 13.4-201 with an implementation schedule of prior to fuel load authorization. Maintenance Rule Program (10 CFR 50.65) implementation is discussed in FSAR Section 17.6, which incorporates by reference NEI Technical Report 07-02A, Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52.

As discussed in NEI 07-02A, safety significance classifications, e.g., high safety significance (HSS) or low safety significance (LSS), are determined using processes consistent with Section 9.3.1 of NUMARC 93-01, Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants. They include determination of risk significance criteria and appropriate consideration of operating experience, generic failure data, component reliability information, probabilistic risk assessment (PRA) insights, and the recommendations of an expert panel. The expert panel is established in accordance with NUMARC 93-01 prior to fuel load authorization and utilizes operating, maintenance and systems expertise, PRA insights, and other applicable information to update and maintain SSC classifications.

Proposed COLA Revision

None

Attachment 10
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-6

NRC RAI 09.02.01-6

FSAR Table 9.2-201 provides supplemental plant-specific information that specifies a basin reserve storage capacity of 9.08x103 m^3 (2.4 million gallons). This capacity is less than the capacity of 2.6 million gallons being specified in the RCOL (North Anna, Unit 3). The FSAR does not have any discussion on how the value was established. The applicant is requested to discuss how the water capacity of 2.4 million gallons was established including the assumptions and methodology being used.

Response

The value of 2.4 million gallons was established by determining the evaporation rate for the Auxiliary Heat Sink (AHS) using the heat load of 1.92×10^{10} BTU over a 7 day period as defined in the DCD Revision 6. The evaporation rate can be calculated by using the standard cooling tower evaporation approximation provided in "Cooling Tower Fundamentals," The Marley Cooling Tower Company, as shown:

$E = V \times \Delta T \times 0.0008$

Where: E = Evaporation (in gpm)
V = flow rate (in gpm)
ΔT = cooling range (°F)

By rearranging the first law of thermodynamics, the cooling tower range can be determined as shown:

$Q = m \times Cp \times \Delta T \times t$ rearranged to $\Delta T = Q/(m \times Cp \times t)$

Where: Q = PSWS heat duty over 7 days
m = mass flow rate of PSWS
Cp = specific heat of water
ΔT = cooling tower range
t = time

A margin of 25% was added to the evaporation rate calculated using the approximation method described above. The cooling tower drift was also calculated using a standard approximation provided in "Cooling Tower Fundamentals", The Marley Cooling Tower Company, as shown:

$D = 0.0002 \times V$

Where: D = drift rate (in gpm)
V = flow rate (in gpm)

The resulting total volume required for evaporation and drift losses of the 7 day period is 2.4 million gallons. The evaporative cooling losses were calculated using elevated water temperatures beyond the 1% exceedence value for the entire 7 day duration. The AHS mechanical draft cooling tower (MDCT) is also a plume abated tower, as noted in FSAR Table 9.2-201; which would result in a lower evaporation rate. The volume calculated is conservative based on the inputs used and margins added.

For comparison, in the Grand Gulf 3 COLA response letter to Letter No. 14, (ML083330152), the response to RAI Question 09.02.01-1, shows the method used by Grand Gulf 3 to determine the AHS reserve basin volume. This method is similar to that used by Detroit Edison, and resulted in a similar volume of 2.39 million gallons before adding margin.

As part of the response to NRC RAI 09.02.01-1, the ITAAC for PSWS in COLA Part 10 ITAAC, Table 2.4-1, will be revised to remove a specific volume number from the acceptance criteria, and replace it with the requirement that a report exists or concludes that the volume in the AHS basin is sufficient for removal of 1.92×10^{10} BTU over seven days without active makeup.

Proposed COLA Revision

See response to RAI 09.02.01-1 for proposed COLA revisions to Part 10.

Attachment 11
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-7

NRC RAI 09.02.01-7

Tier 2 of the DCD, Section 9.2.1.2, indicates that the heat rejection facilities are dependent upon actual site conditions and provides conceptual design information (CDI) for the standard plant design. Section 9.2.1.2 of the Fermi-3 FSAR replaced the CDI with plant-specific information (EF3 CDI), indicating that the heat rejection facility for Fermi 3 consists of natural draft and mechanical draft cooling towers.

In order for the NRC to determine if the cooling towers are capable of performing their defense-in-depth and RTNSS functions, the Fermi-3 CDI needs to include cooling tower design attributes that are credited (such as minimum number of fans needed); the minimum net positive suction head (NPSH) requirement for the PSWS pumps and available margin based on the most limiting cooling tower basin water level, temperature, and flow conditions; the maximum allowed PSWS water supply temperature; the most limiting meteorological assumptions that pertain to the site for determining: (a) heat dissipation capability, and (b) water inventory requirements; and cooling tower performance considerations related to proximity of structures and other cooling towers. The Fermi-3 CDI also needs to describe plant- specific vulnerabilities and degradation mechanisms that are anticipated based on operational experience and site location, potential impacts of postulated cooling tower failures and other interactions on safety-related SSCs, and how these considerations are addressed. In addition to explaining bounding conditions and limiting assumptions, the Fermi-3 CDI needs to describe programmatic controls being implemented to assure that the functional capability of the cooling towers will be maintained over the life of the plant.

Response

Design attributes, vulnerabilities, degradation mechanism and programmatic controls

The information requested by the subject RAI is the type of information normally provided for a safety-related service water system. PSWS is not a safety-related system. Failure of the system does not compromise any safety-related SSC nor prevent safe shutdown. PSWS is not credited in any safety analysis. FSAR Section 9.2.1.1 defines the PSWS as a nonsafety-related system that does not interface with any safety-related system. It is a RTNSS Criterion C, Low Regulatory Oversight, Maintenance Rule system that supports the RCCWS. As a Maintenance Rule system, PSWS performance is monitored and trended under the Maintenance Rule Program and adverse indications or trends are addressed and corrected.

Sufficient information is provided in the Detailed Design Description subsection of FSAR Section 9.2.1.2, with its referenced tables, to demonstrate that the PSWS is capable, of meeting its RTNSS functions. For example, maximum allowed PSWS water supply temperature (cold leg temperature), limiting meteorological assumptions (ambient wet bulb temperature), heat dissipation capability, and water inventory requirements are listed in Table 9.2-201. The minimum net positive suction head for the PSWS pumps is ensured by maintaining the required water inventory above pump minimum submergence. The minimum water inventory requirements are met by maintaining the level at or above the minimum operating level in the cooling tower basin. Each PSWS cooling tower has a heat rejection capacity much greater than the RTNSS

heat load; therefore, each tower is capable of meeting the system's RTNSS function to support cooling of RCCWS. Preoperational and startup testing is conducted to demonstrate that the PSWS can perform its intended functions. Those testing requirements are described in DCD Sections 14.2.8.1.51 and 14.2.8.2.18, respectively. Operational functionality is assured by the normal operation and monitoring of the system.

Performance considerations of the Auxiliary Heat Sink (AHS) mechanical draft cooling towers (MDCT) related to proximity of structures and other cooling towers is not a concern. The natural draft cooling tower (NDCT) is approximately 600 ft high, and the discharge heat from the NDCT would not impact the AHS MDCTs. The AHS MDCTs are also located such that other structures will not obstruct air flow.

The specific vulnerabilities and degradation mechanisms that are anticipated, based on operational experience and site location, are long-term corrosion and fouling. Section 9.2.1.2 of the FSAR states that PSWS water is chemically treated to preclude long-term corrosion and fouling of the PSWS based on site water quality analysis. Please refer to the response to NRC RAI 09.02.01-4 for additional details on material selection and water quality.

Potential impacts of postulated cooling tower failures and other interactions on safety- related SSCs.

The PSWS is a RTNSS Criterion C, Low Regulatory Oversight, Maintenance Rule system that is designed to applicable seismic requirements. Passive failure of components is not considered credible. However, the failure of cooling tower components will not cause the potential for any adverse impacts on the intended design functions of the safety-related SSCs. Water from a postulated PSWS cooling tower riser break will drain eastward and southward away from any power block structures because of the slope of the elevated plateau the power block structures are to be built on. The effect of water being released from other cooling tower components is bounded by the failure of a cooling tower riser, due to the larger size of the riser. Most of the water escaping from, a failed cooling tower component would drop into and be contained in the respective basin below. The cooling tower basin for each train is located below grade. The maximum water level in the basin is also located below grade. Thus, during any failure of the cooling tower basin, the water in the basin would remain below grade and adverse impact to any safety-related SSC is precluded.

Proposed COLA Revision

None

Attachment 12
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-8

NRC RAI 09.02.01-8

Section 9.2.1.2 (under Operation) specifies that during operation, PSWS flow is directed either to the normal power heat sink (NPHS) cooling tower or the auxiliary heat sink (AHS) cooling tower where heat removed from the RCCWS and TCCWS is rejected. During this mode of operation using NPHS, the NPHS basin provides makeup to the AHS basin. During the mode of operation using AHS, makeup to the AHS basin is provided from the Station Water System (SWS).

In reviewing the above supplemental information, it is not clear to the staff what the different "modes" of power operation are. This is especially confusing because the term "mode" has a specific meaning in the Technical Specifications, and specific modes of power operation are not assigned for when the NPHS or the AHS should be used. The applicant is asked to revise the FSAR to eliminate this confusion and to better explain when the NPHS vs. AHS will be used for various operating, transient, and accident conditions.

Response

The FSAR section in question provides additional text to the end of the second paragraph under *Operation* in ESBWR DCD Revision 6, Section 9.2.1.2. In order to clarify the discussion, the composite paragraph will be revised to read as follows (revisions to the text are clearly identified):

> "During normal power operation, the cross-tie valves in the PSWS pump discharge header are open, allowing two of the four 50% capacity PSWS pumps to supply water to both PSWS trains. Heat removed from the RCCWS and TCCWS is rejected to the normal power heat sink or to the auxiliary heat sink. During normal power operation, PSWS flow is directed to either the NPHS cooling tower or the AHS cooling towers where heat removed from the RCCWS and TCCWS is rejected. ~~During the mode of operation using~~When PSWS uses the NPHS, the NPHS basin provides makeup to the AHS basin. ~~During the mode of operation using~~When PSWS uses the AHS, makeup to the AHS basin is provided from the Station Water System (SWS)."

Proposed COLA Revision

Proposed revisions to FSAR Section 9.2.1.2 are shown in the attached markups.

Markup of Detroit Edison COLA
(following 1 page)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

This provides the action required by NRC Inspection and Enforcement Bulletin No. 80-10.

Replace the eighth paragraph with the following information.

EF3 CDI

Fermi 3 design heat loads are shown in DCD Table 9.2-1.The PSWS component design characteristics are shown in Table 9.2-201.

Delete the last paragraph.

Operation

normal power

Add the following text to the end of the second paragraph of this section.

When PSWS uses

During operation, PSWS flow is directed to either the NPHS cooling tower or the AHS cooling towers where heat removed from the RCCWS and TCCWS is rejected. ~~During the mode of operation using~~ the NPHS, the NPHS basin provides makeup to the AHS basin. ~~During the mode of operation using~~ the AHS, makeup to the AHS basin is provided from the Station Water System (SWS).

9.2.1.6 **COL Information**

9.2.1-1-A **Material Selection**

EF3 COL 9.2.1-1-A

This COL item is addressed in Subsection 9.2.1.2.

9.2.2 **Reactor Component Cooling Water System**

This section of the referenced DCD is incorporated by reference with no departures or supplements.

9.2.3 **Makeup Water System**

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

9.2.3.2 **System Description**

Replace the introductory text and the Demineralization Subsystem portions of this section with the following.

EF3 CDI

The MWS consists of two subsystems: 1) the demineralization subsystem and 2) the storage and transfer subsystem. The makeup water transfer pumps and the demineralization subsystem are sized to

Attachment 13
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3900 Revision 1)

RAI Question No. 09.02.01-9

NRC RAI 09.02.01-9

Although the initial plant test program specified by Tier 2 of the DCD for PSWS is incorporated by reference, the test program does not verify that performance of the PSWS (including NPHS/AHS) satisfies design specifications for the various configurations and heat loads. The applicant is requested to provide additional information to describe how the design capability of the PSWS will be verified by initial plant test program.

Response

Preoperational and startup testing requirements for the Plant Service Water System (PSWS), which includes the CDI portion of the PSWS (including Alternate Heat Sink (AHS)), are described in DCD Sections 9.2.1.4, 14.2.8.1.51, and 14.2.8.2.18. The DCD is incorporated by reference into the COLA FSAR.

The normal power heat sink (NPHS) is the heat sink for RCCWS and TCCWS heat loads during normal power operation when conditions allow. The AHS is the heat sink for the Reactor Component Cooling Water System (RCCWS) and the Turbine Component Cooling Water System (TCCWS) heat loads for all other operational conditions including RTNSS functions. The two mechanical draft cooling towers in the AHS are specific to Fermi 3 but are an integral part of the PSWS. Preoperational and startup testing of the AHS will occur during the initial test program for the PSWS. Such testing will demonstrate proper functioning of the PSWS and its components, including the AHS, under various operational configurations.

As described in the portion of DCD Section 14.2.8.1.51 which is incorporated by reference, due to insufficient heat loads during the preoperational test phase, RCCWS and TCCWS heat exchanger performance testing is deferred until the startup phase. The PSWS startup test description in DCD Section 14.2.8.2.18 addresses RCCWS and TCCWS heat exchanger performance testing under expected reactor power operation load conditions. Because the AHS is part of the PSWS, this testing will also include performance testing of the AHS, as described in the attached markup of FSAR Section 14.2.8.2.18.

DCD Section 9.2.1.2, "Detailed System Description," describes design and layout features to mitigate the potential for water hammer in the PSWS. To implement these features at Fermi 3, a detailed hydrodynamic analysis of the PSWS will be performed. This analysis will consider site specific features of the PSWS, e.g., AHS configuration, piping lengths, elevation changes, etc. Each design feature to be implemented will be tested for proper functioning during preoperational testing, e.g., vent valves function as intended, valves actuate within prescribed time limits, etc. This testing and the initial startup testing of the entire PSWS will demonstrate that the potential for water hammer is adequately addressed.

Performance testing of the PSWS using the NPHS is not required because of the operational conditions in which the NPHS is allowed to be used. When the NPHS is used in conjunction with PSWS during normal power operation, the AHS cooling towers are not in use. In this operational configuration, water is transferred from the NPHS basin to the AHS basin. The water is then pumped from the AHS basin by the PSWS pumps to the RCCWS and TCCWS

heat exchangers, but instead of being returned to the AHS basin, the water is directed to the Circulating Water System (CIRC) return lines and cooled via the Natural Draft Cooling Tower (NDCT). However, because PSWS requires water to be supplied at or below 88°F to the RCCWS and TCCWS heat exchangers, the NDCT must be able to cool the water from the Circulating Water System to 88°F or less when the NPHS is used. If the NPHS temperature cannot be maintained at or below 88°F, then the AHS must be used. Since the design capability of PSWS is dependent on the PSWS cold leg water temperature, performance testing done using the AHS is sufficient.

Proposed COLA Revision

Proposed revisions to FSAR Chapter 14 are shown in the attached markups.

Markup of Detroit Edison COLA
(following 2 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

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.

"Insert 1"

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

"Insert 1"

	14.2.8.1.51 **Plant Service Water System Preoperational Test Purpose**
	Replace the first paragraph with the following.
EF3 SUP 14.2-4	The objective of this test is to verify proper operation of the PSWS including the AHS and its ability to supply design quantities of cooling water to the RCCWS and TCCWS heat exchangers.
	General Test Methods and Acceptance Criteria
	Add the following after the last bullet.
EF3 SUP 14.2-4	• Proper operation of control interlocks and equipment protective devices in AHS fans, motors and valves; • Proper operation of the AHS fans, motors, and valves in all design operating modes; • Automatic transfer between PSWS trains and components in response to Anticipated Operational Occurrences (AOOs); and • Proper operation of water hammer mitigating design features.
	Replace the second sentence of the last paragraph with the following.
EF3 SUP 14.2-4	However, due to insufficient heat loads during the preoperational test phase, the heat exchanger and the AHS performance verification is deferred until the startup phase.
	14.2.8.2.18 **Plant Service Water System Performance Test Purpose**
	Replace the first paragraph with the following.
EF3 SUP 14.2-5	The objective of this test is to verify performance of the PSWS including the AHS along with the RCCWS, and the TCCWS under expected reactor power operation load conditions.
	Description
	Replace the second sentence with the following.
EF3 SUP 14.2-5	Pertinent parameters shall be monitored in order to provide a verification of proper system flow balancing and heat exchanger and AHS performance under near design or special conditions, as appropriate.

Attachment 14
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3823 Revision 1)

RAI Question No. 10.04.05-1

NRC RAI 10.04.05-1

In FSAR Section 10.4.5.2.1, "General Description," the applicant described that the circulating water system (CWS) consists of one natural draft cooling tower (NDCT). Also, in FSAR Section 10.4.5.8, "Normal Power Heat Sink," the applicant described that the site-specific NDCT is located at least a distance equal to its height away from Seismic Category (SC) I and II structures. Therefore, any structural failure of the cooling tower would not affect or damage safety-related structures, systems, or components (SSCs). Further, in FSAR Revision 1 mark-ups, the applicant described that the NDCT is relocated and is much closure to Fermi 3 power block structures than previous location. Additionally, a new Section 10.4.5.6, "Flood Protection," has been added to Revision 1, where the applicant provided few details regarding the site grading and stated that the NDCT is located lower that the power block structures. Therefore, the applicant stated that there are no potential flooding concerns to the power block structures from a failure in the CWS (including the NDCT basin) in the yard.

According to the Standard Review Plan (SRP), Section 10.4.5, "Circulating Water System," SRP Acceptance Criteria, the requirements of General Design Criteria 4 (GDC 4) are met when the CWS design includes provisions to accommodate the effects of discharging water that may result from a failure of a component or piping in the CWS. The NRC staff reviewed the information provided by the applicant in Revision 0 and Revision 1 (mark-up) of the FSAR. The staff also reviewed the GDC 4 and the SRP guidance with respect to flooding due to failure of the CWS structures or components. Failure of the cooling tower or CWS piping (including the yard piping) could be potential sources for flooding. Therefore, the staff requests that the applicant provide additional details regarding the Fermi 3 site grading and drainage systems to ensure that the discharge water due to a failure of the tower or the CWS piping will flow away from and not effect the safety-related systems or equipment that are located in the SC I and SC II structures.

Response

Detroit Edison provided a response to RAI 10.04.05-1 as part of the response to RAI 02.04.02-3 contained in Detroit Edison Letter to the NRC, NRC3-09-0035, dated November 20, 2009. (ML093280179)

Proposed COLA Revision

None

Attachment 15
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 4053 Revision 1)

RAI Question No. 11.04-2 Supplement 1

NRC RAI 11.04-2 Supplement 1

In your response to RAI 11.04-2, dated April 8, 2009 (ADAMS Accession No. ML090680443), you stated in part:

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

As of November 19, 2009, the staff responsible for review of your response was unaware of the schedule for development of the clarifying information referred to in your response.

Please provide a schedule for when the staff may expect a complete response, and include a consideration of recent developments relevant to the original request, including but not limited to how your response will be affected by recent changes to the design source term as described in Revision 6 to the ESBWR Tier 2 FSAR.

Response

Detroit Edison plans to submit a complete response to RAI 11.04-2 by February 15, 2010.

Proposed COLA Revision

None

Attachment 16
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 4037 Revision 1)

RAI Question No. 12.02-5

NRC RAI 12.02-5

Question 1:
FSAR Subsection 12.2.2.2 presents compliance with 10 CFR 50 Appendix I, 10 CFR 20 Appendix B, and 10 CFR 20.1301 and 20.1302 based on the airborne release quantities in ESBWR DCD Revision 5 Table 12.2-16, "Annual Airborne Releases for Offsite Dose Evaluations (MBq)." ESBWR DCD Revision 6 presented revised annual airborne releases, showing higher release quantities of iodine isotopes. This change requires reevaluation of offsite doses presented in FSAR Subsection 12.2.2.2. Accordingly, provide an updated offsite dose evaluation and demonstrate compliance with the applicable regulations.

Question 2:
FSAR Subsection 12.2.2.4 presents compliance with 10 CFR 50 Appendix I, 10 CFR 20 Appendix B, and 10 CFR 20.1301 and 20.1302 based on liquid effluent release quantities in ESBWR DCD Revision 5 Table 12.2-19b, "Average Annual Liquid Releases." ESBWR DCD Revision 6, presented revised annual liquid effluent releases. This change requires reevaluation of offsite doses presented in FSAR Subsection 12.2.2.4. Accordingly, provide an updated offsite liquid effluent dose evaluations and demonstrate compliance with the applicable regulations.

Response

DCD Revision 6 revised source terms for airborne release and liquid effluent releases. An updated analysis was conducted for both the gaseous and liquid effluent release. Revised values are in compliance with limits identified in 10 CFR 50 Appendix I, 10 CFR 20 Appendix B, and 10 CFR 20.1301 and 20.1302 as shown in the attached proposed revisions to FSAR Chapter 12 tables.

Note that the Detroit Edison response to RAI 02.03.05-1 provided a mark-up for FSAR Table 12.2-17R to reflect airborne concentrations based on a change to X/Q values. The attached markup to Table 12.2-17R supersedes the markups in the response to RAI 02.03.05-1 since this response includes those changes as well as the DCD Revision 6 source term changes for iodine isotopes, I-13 1 and I-133.

Changes to FSAR Table 12.2-204 also impact the cost benefit analysis determination. Therefore, affected sections in Chapter 11 and 12 of the FSAR are updated to reflect the new values.

Proposed COLA Revision

FSAR Chapter 11 and 12 sections affected by revised FSAR Table 12.2-204.

FSAR Table 12.2-17R is revised to update the Fermi 3 airborne annual release for I-13 1 and I-133. Changes from the response to RAI 02.03.05-1 are also included.

FSAR Table 12.2-18bR is revised to identify changes to total body and thyroid doses for gaseous pathway to the MEI.

FSAR Table 12.2-20bR is revised to identify changes to total body, thyroid, and bone doses for liquid pathway from Fermi 3 for MEI at Lake Erie.

FSAR Table 12.2-20 1 is revised to update total body and thyroid annual doses to the MEI from gaseous effluents.

FSAR Table 12.2-202 is revised to update total body, thyroid, and bone annual doses to the MEI from liquid effluents.

FSAR Table 12.2-203 is revised to update total body, thyroid, and bone dose site totals to the MEI from liquid and gaseous effluents.

FSAR Table 12.2-204 is revised to update the collective total body doses within 50 miles from liquid and gaseous effluents.

Markup of Detroit Edison COLA
(following 26 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

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.

gpm cartridge

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.

30.07

6.014

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

connected to radioactive or potentially radioactive portions of process LWMS, 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 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.

12.3

STD COL 11.2-2-A Section ~~12.6~~ discusses how 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 radioactive waste processing system. Operating procedures for LWMS process systems required by Section ~~12.4~~, Section ~~12.5~~, and Section address the requirements of 10 CFR 20.1406.

12.3

12.3

12.4

12.5

11.2.6 COL Information

11.2-1-A Implementation of IE Bulletin 80-10

STD COL 11.2-1-A This COL item is addressed in Subsection 11.2.2.3.

11.2-2-A Implementation of Part 20.1406

STD COL 11.2-2-A This COL item is addressed in Subsection 11.2.2.3.

11.2.7 References

11.2-201 OMB Circular A-94, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs," October 29, 1992, Office of Management and Budget.

11.3 Gaseous Waste Management System

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

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.

24.1

$24,100

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~~ $24,100 for person-rem/year thyroid dose and $4500 person-rem/year 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~~ 24.1 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.

$24,100

These values all exceed ~~$23,500~~ for person-rem/year thyroid dose and $4500 person-rem/year 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~~ $34,792 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.

$24,100

These values all exceed ~~$23,500~~ for person-rem/year thyroid dose and $4500 person-rem/year 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~~ $24,100 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.

Conclusion

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

Table 11.3-201 HEPA Filter Locations and Costs [EF3 SUP 11.3-1]

HVAC Subsystem	Flow (l/s)	No. of 15,000-cfm HEPA filters needed	Total Annual Cost per 15,000-cfm HEPA filter	Total Annual Cost for Augment
FBGAVS	13,550	2	$27,952	$55,904
FBFPVS	15,790	3	$27,952	$83,856
RWGAVS	25,000	4	$27,952	$111,808
REPAVS	32,000	5	$27,952	$139,760
CONAVS	~~19,950~~ 20,010	3	$27,952	$83,856
TBE	52,800	8	$17,167	$137,336

Acronyms from ESBWR DCD:

FBGAVS – Fuel Building General Area HVAC Subsystem

FBFPVS – Fuel Building Fuel Pool Area HVAC Subsystem

RWGAVS – Radwaste Building General Area HVAC Subsystem

REPAVS – Reactor Building Refueling and Pool Area HVAC Subsystem

CONAVS – Reactor Building Contaminated Area HVAC Subsystem

TBE – Turbine Building Exhaust

Table 11.3-202 HEPA Filter Annual Costs [EF3 SUP 11.3-1]

HVAC Subsystem	Flow (l/s)	No. and Type of Filters Used (1)	Total Annual Cost per Charcoal/HEPA filter	Total Annual Cost for Augment
FBGAVS	13,550	1x30,000	$57,578	$57,578
FBFPVS	15,790	1x30,000	$57,578	$90,502
		4x1000	$8231	
RWGAVS	25,000	2x30,000	$57,578	$115,156
REPAVS	32,000	2x30,000	$57,578	$149,948
		1x15,000	$34,792	
CONAVS	~~19,950~~ 20,010	1x30,000	$57,578	$92,370
		1x15,000	$34,792	
TBE	52,800	4x30,000	$54,958	$219,832

(1) Filter flow in cfm.

Acronyms from ESBWR DCD:

FBGAVS – Fuel Building General Area HVAC Subsystem

FBFPVS – Fuel Building Fuel Pool Area HVAC Subsystem

RWGAVS – Radwaste Building General Area HVAC Subsystem

REPAVS – Reactor Building Refueling and Pool Area HVAC Subsystem

CONAVS – Reactor Building Contaminated Area HVAC Subsystem

TBE – Turbine Building Exhaust

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 4.5 person-rem/yr as shown in Table 12.2-204. The thyroid dose is ~~23.5~~ 24.1 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~~ 14.9 person-rem/yr as shown in Table 12.2-204. The thyroid dose is ~~21.4~~ 30.1 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 12.2-17R 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-	[illegible]	3.6E-12	5.00E-05	7.2E-08
Kr-85m	6.6E+05	1.8E+01	1.1E-	[illegible]	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

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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	[illegible]	[illegible]E-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

Add Insert #1 here

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	[illegible]	[illegible]	2.00E-10	3.6E-06
Sr-90	1.0E+00	2.7E-05	1.7E-08	[illegible]	[illegible]	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

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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	[illegible]	[illegible]E-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

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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+0	Add Insert #1 here	9E-09		1.9E-01

Replace Table 12.2-17R with the following 5 pages of information.
(Sheet 1 of 5)

Insert 1:

	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	1.7E-06	4.6E-17	3.6E-12	5.0E-05	7.2E-08
Kr-85m	6.6E+05	1.8E+01	1.4E-02	3.9E-13	1.4E-10	1.0E-07	1.4E-03
Kr-85	5.2E+06	1.4E+02	1.1E-01	3.1E-12	2.2E-11	7.0E-07	3.2E-05
Kr-87	1.4E+06	3.9E+01	3.2E-02	8.6E-13	3.2E-12	2.0E-08	1.6E-04
Kr-88	2.1E+06	5.6E+01	4.6E-02	1.2E-12	5.4E-11	9.0E-09	6.0E-03
Kr-89	1.4E+07	3.7E+02	7.0E-01	1.9E-11	9.8E-11	1.0E-09	9.8E-02
Xe-131m	1.5E+05	4.1E+00	3.3E-03	8.9E-14	5.8E-12	2.0E-06	2.9E-06
Xe-133m	1.9E+02	5.2E-03	3.8E-06	1.0E-16	2.4E-12	6.0E-07	4.0E-06
Xe-133	4.1E+07	1.1E+03	4.0E+00	1.1E-10	1.1E-09	5.0E-07	2.1E-03
Xe-135m	2.2E+07	6.0E+02	7.8E+00	2.1E-10	2.1E-10	4.0E-08	5.3E-03
Xe-135	2.8E+07	7.5E+02	4.5E+00	1.2E-10	1.4E-10	7.0E-08	2.1E-03
Xe-137	2.8E+07	7.6E+02	1.8E+00	4.8E-11	7.1E-11	1.0E-09	7.1E-02
Xe-138	2.3E+07	6.3E+02	5.4E-01	1.5E-11	1.1E-10	2.0E-08	5.7E-03
I-131	8.7E+03	2.3E-01	4.0E-04	1.1E-14	2.2E-14	2.0E-10	1.1E-04
I-132	5.8E+04	1.6E+00	3.1E-03	8.3E-14	1.8E-13	2.0E-08	9.2E-06

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Replace Table 12.2-17R with the following 5 pages of information.
(Sheet 2 of 5)

	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-133	4.3E+04	1.2E+00	2.3E-03	6.1E-14	1.4E-13	1.0E-09	1.4E-04
I-134	1.1E+05	3.0E+00	5.6E-03	1.5E-13	3.4E-13	6.0E-08	5.7E-06
I-135	5.9E+04	1.6E+00	3.2E-03	8.6E-14	2.0E-13	6.0E-09	3.3E-05
H-3	2.8E+06	7.6E+01	5.5E-02	1.5E-12	1.6E-12	1.0E-07	1.6E-05
C-14	5.3E+05	1.4E+01	1.2E-02	3.2E-13	3.2E-13	3.0E-09	1.1E-04
Na-24	5.4E+00	1.5E-04	1.1E-07	2.9E-18	2.9E-18	7.0E-09	4.1E-10
P-32	1.3E+00	3.5E-05	2.6E-08	7.0E-19	7.0E-19	5.0E-10	1.4E-09
Ar-41	1.4E+03	3.8E-02	3.1E-05	8.3E-16	8.3E-16	1.0E-08	8.3E-08
Cr-51	1.8E+02	4.7E-03	1.4E-05	3.8E-16	3.8E-16	3.0E-08	1.3E-08
Mn-54	1.5E+02	4.1E-03	6.2E-05	1.7E-15	1.7E-15	1.0E-09	1.7E-06
Mn-56	1.1E+01	3.0E-04	2.2E-07	5.9E-18	5.9E-18	2.0E-08	2.9E-10
Fe-55	4.7E+01	1.3E-03	9.3E-07	2.5E-17	2.5E-17	3.0E-09	8.4E-09
Fe-59	2.0E+01	5.4E-04	4.8E-06	1.3E-16	1.3E-16	5.0E-10	2.6E-07
Co-58	4.0E+01	1.1E-03	3.8E-06	1.0E-16	1.0E-16	1.0E-09	1.0E-07
Co-60	3.2E+02	8.7E-03	1.1E-04	3.0E-15	3.0E-15	5.0E-11	6.0E-05
Ni-63	4.7E-02	1.3E-06	9.3E-10	2.5E-20	2.5E-20	1.0E-09	2.5E-11

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Replace Table 12.2-17R with the following 5 pages of information.
(Sheet 3 of 5)

	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**	
Cu-64	6.9E+00	1.9E-04	1.4E-07	3.7E-18	3.7E-18	3.0E-08	1.2E-10
Zn-65	3.2E+02	8.6E-03	1.1E-05	3.0E-16	3.0E-16	4.0E-10	7.4E-07
Rb-89	2.0E-01	5.4E-06	4.0E-09	1.1E-19	1.1E-19	2.0E-07	5.4E-13
Sr-89	1.5E+02	3.9E-03	3.2E-06	8.6E-17	7.4E-16	2.0E-10	3.7E-06
Sr-90	1.0E+00	2.7E-05	2.2E-08	5.9E-19	5.0E-17	6.0E-12	8.3E-06
Y-90	8.1E-02	2.2E-06	1.6E-09	4.3E-20	4.3E-20	9.0E-10	4.8E-11
Sr-91	6.7E+00	1.8E-04	1.3E-07	3.6E-18	1.4E-14	5.0E-09	2.8E-06
Sr-92	4.6E+00	1.2E-04	9.1E-08	2.5E-18	2.2E-14	9.0E-09	2.4E-06
Y-91	1.7E+00	4.6E-05	3.4E-08	9.1E-19	9.1E-19	2.0E-10	4.6E-09
Y-92	3.7E+00	1.0E-04	7.3E-08	2.0E-18	2.0E-18	1.0E-08	2.0E-10
Y-93	7.2E+00	1.9E-04	1.4E-07	3.9E-18	3.9E-18	3.0E-09	1.3E-09
Zr-95	4.4E+01	1.2E-03	1.3E-05	3.4E-16	3.5E-16	4.0E-10	8.7E-07
Nb-95	2.4E+02	6.5E-03	4.8E-06	1.3E-16	1.3E-16	2.0E-09	6.5E-08
Mo-99	1.7E+03	4.5E-02	3.3E-05	9.0E-16	5.5E-15	2.0E-09	2.8E-06
Tc-99m	2.2E+00	5.9E-05	4.4E-08	1.2E-18	5.7E-14	2.0E-07	2.9E-07
Ru-103	1.0E+02	2.8E-03	2.0E-06	5.5E-17	5.9E-17	9.0E-10	6.5E-08
Rh-103m	3.5E-03	9.5E-08	6.9E-11	1.9E-21	1.9E-21	2.0E-06	9.4E-16
Ru-106	1.4E-01	3.8E-06	2.8E-09	7.5E-20	7.5E-20	2.0E-11	3.8E-09

insert 1 continued

Replace Table 12.2-17R with the following 5 pages of information.
(Sheet 4 of 5)

	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	8.9E-14	2.4E-24	2.4E-24	1.0E-09	2.4E-15
Ag-110m	1.0E-01	2.8E-06	2.0E-09	5.5E-20	5.5E-20	1.0E-10	5.5E-10
Sb-124	5.3E+00	1.4E-04	1.2E-06	3.1E-17	3.1E-17	3.0E-10	1.0E-07
Te-129m	1.6E+00	4.3E-05	3.2E-08	8.6E-19	8.6E-19	3.0E-10	2.9E-09
Te-131m	5.5E-01	1.5E-05	1.1E-08	2.9E-19	2.9E-19	1.0E-09	2.9E-10
Te-132	1.4E-01	3.8E-06	2.8E-09	7.5E-20	1.0E-15	9.0E-10	1.1E-06
Cs-134	1.8E+02	4.9E-03	3.8E-05	1.0E-15	1.1E-15	2.0E-10	5.4E-06
Cs-136	1.5E+01	4.0E-04	3.0E-07	8.2E-18	3.1E-17	9.0E-10	3.5E-08
Cs-137	2.7E+02	7.3E-03	6.4E-05	1.7E-15	1.8E-15	2.0E-10	8.9E-06
Cs-138	8.5E-01	2.3E-05	1.7E-08	4.6E-19	3.1E-14	8.0E-08	3.9E-07
Ba-140	7.8E+02	2.1E-02	1.6E-05	4.4E-16	2.3E-15	2.0E-09	1.2E-06
La-140	1.3E+01	3.5E-04	2.6E-07	7.0E-18	7.0E-18	2.0E-09	3.5E-09
Ce-141	2.6E+02	7.1E-03	5.8E-06	1.6E-16	1.7E-16	8.0E-10	2.1E-07
Ce-144	1.3E-01	3.5E-06	2.6E-09	7.0E-20	7.3E-18	2.0E-11	3.6E-07
Pr-144	1.6E-04	4.3E-09	3.2E-12	8.6E-23	8.6E-23	2.0E-07	4.3E-16
W-187	1.3E+00	3.5E-05	2.6E-08	7.0E-19	7.0E-19	1.0E-08	7.0E-11
Np-239	8.3E+01	2.2E-03	1.6E-06	4.5E-17	4.9E-14	3.0E-09	1.6E-05
Total (w/ H-3)	1.7E+08	4.6E+03	2.0E+01	5.3E-10	1.9E-09		1.9E-01

insert 1 continued

Replace Table 12.2-17R with the following 5 pages of information.
(Sheet 5 of 5)

	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**	
Total (w/o H-3)	1.7E+08	4.5E+03	2.0E+01	5.3E-10	1.9E-09		1.9E-01

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

Location	Pathway	Fermi 3 Total Body	Fermi 3 Thyroid	Fermi 3 Skin
		Annual Dose (mrem/year)		
Site Boundary (1131 m [0.7 mi] SSE)	Plume	1.05E-01	1.05E-01	2.53E-01
	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
Site Boundary (SB) (~~919 m~~ [0.57 mi] WNW)				
In direction of Residence, Garden, Meat Cow, Goat Milk, and Cow Milk (WNW)	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

1.37E-01
1.73E-03
1.76E-03
9.28E-04
8.44E-03
1.43E-02
2.43E-02
4.81E-03
6.89E-03
2.38E-02
5.09E-01
5.36E-01
6.66E-01

4.50E+00
6.24E+00
1.21E+01
1.66E-01
1.22E-01
1.89E-01
1.47E-01
1.91E-01
2.34E-01
2.13E-01
3.25E-01
5.15E-01
1.03E+00
2.49E+00
2.63E-01
4.17E-01
8.31E-01
2.02E+00
5.76E+00
7.85E+00
1.47E+01
5.08E+00

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	**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

5.41E-03	2.19E-03	8.27E-02
5.71E-04	1.88E-04	4.49E-03
6.05E-04	2.63E-02	5.92E-04
1.01E-04	1.01E-04	1.01E-04
6.48E-03	2.63E-02	8.77E-02

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
Total Body (mrem/yr)	Site Boundary (1131 m [0.70 mi] SSE)	~~6.65E-01~~ 6.66E-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~~ 1.47E+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]

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

6.48E-03
2.63E-02
8.77E-02

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
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

Liquid	Gaseous	Total	Site Total
0.006 0.026 0.088	0.67 14.7	0.68 14.7 1.90	5.36 17.39 1.95

Table 12.2-204 Collective Total Body (Population) Doses Within 50 Miles [EF3 COL 12.2-2-A] [EF3 COL 12.2-3-A]

Units in person-rem/yr

	Fermi 3	
Total Body (Liquid)	~~17.7~~	14.9
Bone (Liquid)	~~124.7~~	104.2
Thyroid (Liquid)	~~21.1~~	30.1
Total Body (Gaseous)	4.5	
Max Organ – Thyroid (Gaseous)	~~23.5~~	24.1

1 rem = 0.01 Sv

Attachment 17
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 4038 Revision 1)

RAI Question No. 12.03-12.04-4

NRC RAI 12.03-12.04-4

Question 1:
ESBWR DCD Revision 6 revised Section 12.3 and adds Subsection 12.3.1.5, "Minimization of Contamination and Radioactive Waste Generation." This subsection eliminated the need for Section 12.6, and the ESBWR DCD Revision 5 Section 12.6 was deleted as part of Revision 6. Subsection 12.3.1.5 added COL Item 12.3-4-A:

"The COL Applicant will address the operational and post-construction objectives of Regulatory Guide 4.21 (COL 12.3-4-A)."

Question 2:
DCD Revision 6 also removed COL 12.3-3-H, and consolidated those considerations with COL Item 12.5-3-A:

"The COL Applicant will provide a description of the operational radiation protection program to the level of detail provided in Regulatory Guide 1.206. The radiation protection program will consider special shielding features (such as lead blankets, lead curtains, etc.) and include a description of access controls to Very High Radiation Areas (Subsections 12.3.1.3 and 12.5.3)."

Accordingly, please provide updates of affected FSAR sections and demonstrate compliance with 10 CFR 20.1406. In preparing your response, please address the specific COL Items noted above.

Response

Question 1:
ESBWR DCD Revision 6 revised Section 12.3 and added Subsection 12.3.1.5 with a new COL Item 12.3-4-A: "The COL Applicant will address the operational and post- construction objectives of Regulatory Guide 4.21 (COL 12.3-4-A)."

FSAR Section 12.3 will be revised to address COL 12.3-4-A and provide measures to meet operational and post-construction objectives identified in Regulation Guide 4.21.

Question 2:
COL 12.3-3-H was deleted from the FSAR and consolidated with COL Item 12.5-3-A. FSAR COL 12.3-3-H addressed access to "Very High Radiation Areas". DCD Revision 6 identifies that transient conditions may result in short-term high radiation area, such as spent fuel transfer activities.

During transient activities that could result in short-term high and very high radiation areas, control measures identified in FSAR Appendix 12BB will be in place. FSAR Appendix 12BB will be revised to indicate access control to very high radiation areas will include temporary areas as well as permanent areas.

Proposed COLA Revision

FSAR Table 1.9-203 revised to delete reference to Section 12.6.

FSAR Table 1.10-201 revised to delete COL 12.3-3-H and add COL 12.3-4-A.

FSAR Chapter 12 – various sections revised.

Markup of Detroit Edison COLA
(following 8 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

Table 1.9-203 Conformance with the FSAR Content Guidance in RG 1.206 (Sheet 25 of 39) [EF3 COL 1.9-3-A]

Section	Section Title	Conformance Evaluation
C.III.1 11.2.1(8)	Design Bases	Conforms
C.III.1 11.2.1(9)	Design Bases	Conforms. Addressed in DCD Section 11.2.2 and in Section 11.2.
C.III.1 11.2.2(1)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.2(2)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.2(3)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.2(4)	System Description	Conforms. Addressed in DCD Section 11.2.2.
C.III.1 11.2.3(1)	Radioactive Effluent Releases	Conforms. Addressed in DCD Sections 11.2 and 12.2, and in Section 12.2.
C.III.1 11.2.3(2)	Radioactive Effluent Releases	Conforms. Addressed in DCD Sections 11.2 and 12.2, and in Section 12.2.
C.III.1 11.3.1(1)	Gaseous Waste Management Systems: Design Bases	Addressed in DCD Section 11.3. Conforms with the following exception: No discussion is provided regarding the capability of and requirements for using portable processing equipment for refueling outages.
C.III.1 11.3.1(2)	Design Bases	Conforms. Addressed in DCD Section 11.3.
C.III.1 11.3.1(3)	Design Bases	Conforms. Addressed in DCD Section 11.3.
C.III.1 11.3.1(4)	Design Bases	Conforms. Quality Assurance Program requirements are addressed in Chapter 17.
C.III.1 11.3.1(5)	Design Bases	Conforms. Addressed in DCD Section 11.3.5.
C.III.1 11.3.1(6)	Design Bases	Conforms. Addressed in DCD Section ~~12.6 and in Section 12.6~~. 12.3.1.5
C.III.1 11.3.1(7)	Design Bases	Conforms. Addressed in DCD Section 11.3.
C.III.1 11.3.2(1)	System Description	Conforms. Addressed in DCD Section 11.3.2.
C.III.1 11.3.2(2)	System Description	Conforms. Addressed in DCD Section 11.3.2.
C.III.1 11.3.2(3)	System Description	Conforms. Addressed in DCD Section 11.3.2.
C.III.1 11.3.2(4)	System Description	Conforms. Addressed in DCD Sections 11.3.2, 11.3.3, and 9.4.
C.III.1 11.3.3	Radioactive Effluent Releases	Conforms. Addressed in DCD Section 11.3 and 12.2, and in Section 12.2.
C.III.1 11.4.1(1)	Solid Waste Management System: Design Bases	Conforms. Addressed in DCD Section 11.4 and in Section 11.4.
C.III.1 11.4.1(2)	Design Bases	Conforms. Addressed in DCD Section 11.4 and in Section 11.4.
C.III.1 11.4.1(3)	Design Bases	Conforms. Addressed in DCD Section 11.4 and in Section 11.4.

Table 1.10-201 Summary of FSAR Sections Where DCD COL Items Are Addressed (Sheet 5 of 6) [EF3 SUP 1.10-1]

Item No.	Subject/Description of Item	FSAR Section
11.5-4-A	Site Specific Offsite Dose Calculation	11.5.4.8
11.5-5-A	Instrument Sensitivities	11.5.4.9
12.1-1-A	Regulatory Guide 8.10	Appendix 12BB
12.1-2-A	Regulatory Guide 1.8	Appendix 12BB
12.1-3-A	Operational Considerations	Appendix 12BB
12.1-4-A	Regulatory Guide 8.8	Appendix 12BB
12.2-2-A	Airborne Effluents and Doses	12.2.2.1, 12.2.2.2, and Table 2.0-201
12.2-3-A	Liquid Effluents and Doses	12.2.2.4
12.2-4-A	Other Contained Sources	12.2.1.5
12.3-2-A	Operational Considerations	12.3.4
~~12.3-3-H~~	~~Controlled Access~~	~~12.3.1.3~~
12.5-1-A	Equipment, Instrumentation, and Facilities	Appendix 12BB
12.5-2-A	Compliance with 10 CFR Part 50.34(f)(2)(xxvii) and NUREG-0737 Item III.D.3.3	Appendix 12BB
12.5-3-A	Radiation Protection Program	Appendix 12BB
13.1-1-A	Organizational Structure	9.5.1.15.3, 13.1.1 through 13.1.3, and Appendix 13AA
13.2-1-A	Reactor Operator Training	13.2.1 and Appendix 13BB
13.2-2-A	Training for Non-Licensed Plant Staff	13.2.2 and Appendix 13BB
13.3-1-A	Identification of OSC and Communication Interfaces with Control Room and TSC	13.3 and COLA Part 5, Sections II.F and II.H
13.3-2-A	Identification of EOF and Communication Interfaces with Control Room and TSC	13.3 and COLA Part 5, Sections II.F and II.H
13.3-3-A	Decontamination Facilities	13.3 and COLA Part 5, Section II.J
13.4-1-A	Operation Programs	13.4
13.4-2-A	Implementation Milestones	13.4
13.5-1-A	Administrative Procedures Development Plan	13.5.1
13.5-2-A	Plant Operating Procedures Development Plan	13.5.2
13.5-3-A	Emergency Procedures Development	13.5.2
12.3-4-A	Compliance with 10 CFR 20.1406	12.3.1.5

12.3 Radiation Protection

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

~~12.3.1.3 **Radiation Zoning**~~

~~Replace the last sentence with the following.~~

~~**STD COL 12.3-3-H**~~ ~~Access to "Very High Radiation Areas" is discussed in Section 12.5.~~

Add Insert #1 here

12.3.4 Area Radiation and Airborne Radioactivity Monitoring Instrumentation

Replace the last bullet with the following.

STD COL 12.3-2-A The radiation instrumentation that monitors airborne radioactivity is classified as nonsafety-related. Airborne radiation monitoring operational considerations, such as the procedures for operation and calibration of the monitors, as well as the placement of the portable monitors, are discussed in Section 12.5.

12.3.7 COL Information

12.3-2-A **Operational Considerations**

STD COL 12.3-2-A This COL item is addressed in Subsection 12.3.4.

~~12.3-3-H **Controlled Access**~~

~~**STD COL 12.3-3-H**~~ ~~This COL item is addressed in Subsection 12.3.1.3.~~

12.4 Dose Assessment

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

12.4.7.1 Annual Doses to Construction Workers

EF3 SUP 12.4-1 Doses to construction workers are addressed in Section 4.5 of the Environmental Report contained in COLA Part 3.

STD COL 12.3-4-A **12.3-4-A Compliance with 10 CFR 20.1406**
This COL item is addressed in Subsection 12.3.1.5.2

12.3.1.5 Minimization of Contamination and Radioactive Waste Generation

STD COL 12.3-4-A Replace the second sentence in the second paragraph with the following.

Section 12.3.1.5.2 describes operational procedures and program concepts associated with the Regulatory Position.

12.3.1.5.2 Operational/Programmatic Considerations

Replace this section with the following.

STD COL 12.3-4-A Operational programs and procedures that address the requirements of 10 CFR 20.1406 are necessary adjuncts to the design features. The operational and post-construction objectives in Regulatory Guide 4.21 Positions C.1 through C.4 are addressed as follows:

- Operational practices are periodically reviewed to ensure operating procedures reflect the installation of new or modified equipment, personnel qualification and training are kept current, and facility personnel are following the operating procedures.
- Future decommissioning is facilitated by maintenance of records relating to facility design and construction, facility design changes, site conditions before and after construction, onsite waste disposal and contamination and results of radiological surveys.
- A conceptual site model (based on site characterization and facility design and construction) that aids in the understanding of the interface with environmental systems and the features that control the movement of contamination in the environment is maintained.
- The final site configuration will be evaluated after construction to assist in preventing the migration of radionuclides offsite via unmonitored pathways.
- An onsite contamination monitoring program is implemented along the potential pathways from the release sources to the receptor points. Measures are implemented in operating procedures to minimize contamination. Appendix 12BB establishes contamination control measures to ensure compliance with 10 CFR 20.1406. Practical measures to prevent the spread of contamination are employed, including:

- Engineering controls, such as portable ventilation or filtration units to reduce concentrations of radioactivity in air or fluids, are used where practical.
- Criteria for selecting tools, material, and equipment for use in contaminated areas include minimizing the use of porous or other materials that are difficult to decontaminate.
- Leaks and spills are contained promptly and repaired or cleaned up as soon as practical.
- Containments, caches, and enclosures are used during maintenance, repairs, and testing, when practical, to contain spills or releases.
- Contaminated tools and equipment are segregated from clean tools and equipment .
- Potentially contaminated systems, equipment, and components are surveyed for the presence of contamination when opened or prior to removal.
- Procedures ensure that equipment performs and is operated in accordance with the design requirements.
- Temporary and permanent design modifications require compensatory measures be taken to prevent and limit the spread of contamination.

12.5 Operational Radiation Protection Program

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

12.5.3 Operational Considerations

Replace this section with the following.

STD COL 12.5-1-A
STD COL 12.5-2-A
STD COL 12.5-3-A

The operational program for radiation protection is addressed in Appendix 12BB.

12.5.4 COL Information

12.5-1-A Equipment, Instrumentation, and Facilities

STD COL 12.5-1-A

This COL item is addressed in Appendix 12BB.

12.5-2-A Compliance with 10 CFR 50.34(f)(2)(xxvii) and NUREG-0737 Item III.D.3.3

STD COL 12.5-2-A

This COL item is addressed in Appendix 12BB.

12.5-3-A Radiation Protection Program

STD COL 12.5-3-A

This COL item is addressed in Appendix 12BB.

12.6 Minimization of Contamination and Radwaste Generation

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

12.6.1 Minimization of Contamination to Facilitate Decommissioning

Add the following at the end of this section.

STD SUP 12.6-1

In addition to design features, measures are implemented in operating procedures to minimize contamination. Appendix 12BB establishes contamination control measures to ensure compliance with 10 CFR 20.1406. Practical measures to prevent the spread of contamination are employed, including:

- Engineering controls, such as portable ventilation or filtration units to reduce concentrations of radioactivity in air or fluids, are used where practical
- Criteria for selecting tools, material, and equipment for use in contaminated areas include minimizing the use of porous or other materials that are difficult to decontaminate
- Leaks and spills are contained promptly and repaired or cleaned up as soon as practical
- Containments, caches, and enclosures are used during maintenance, repairs, and testing, when practical, to contain spills or releases
- Contaminated tools and equipment are segregated from clean tools and equipment
- Potentially contaminated systems, equipment, and components are surveyed for the presence of contamination when opened or prior to removal
- Procedures ensure that equipment performs and is operated in accordance with the design requirements
- Temporary and permanent design modifications require compensatory measures be taken to prevent and limit the spread of contamination

Appendix 12A Calculation of Airborne Radionuclides

This section of the referenced DCD is incorporated by reference with no departures or supplements.

Appendix 12B Calculation of Airborne Releases

This section of the referenced DCD is incorporated by reference with no departures or supplements.

STD SUP 12.1-1

Appendix 12AA ALARA Program

NEI 07-08, Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA), which is currently under review by the NRC staff, is incorporated by reference. (Reference 12AA-201)

12AA.1 References

12AA-201 Nuclear Energy Institute (NEI), Generic FSAR Template Guidance for Ensuring that Occupational Radiation Exposures Are As Low As Is Reasonably Achievable (ALARA), NEI 07-08.

STD COL 12.1-1-A
STD COL 12.1-2-A
STD COL 12.1-3-A
STD COL 12.1-4-A
STD COL 12.5-1-A
STD COL 12.5-2-A
STD COL 12.5-3-A

Appendix 12BB Radiation Protection

NEI 07-03, Generic FSAR Template Guidance for Radiation Protection Program Description, which is currently under review by the NRC staff, is incorporated by reference with the following supplemental information. (Reference 12BB-201)

12.5.2.4 Radiation Protection Technicians

Delete the third paragraph.

12.5.3.1 Facilities

Delete the first and second paragraphs.

12.5.3.2 Monitoring Instrumentation and Equipment

Delete the third paragraph.

12.5.3.3 Personal Protective Clothing and Equipment

Delete the last sentence in the first paragraph.

12.5.4.2 Methods to Maintain Exposures ALARA

Delete the second paragraph.

12.5.4.4 Access Control

Isometric drawings of the Very High Radiation Areas (VHRA) are included in DCD Section 12.3.

Physical access controls include postings, barricades, physical barriers, and the use of locks that are keyed so only keys designated as VHRA can open the locks. Additionally, entry into a VHRA is allowed only with a specific (Special) radiation work permit.

for permanent and temporary areas

12.5.4.12 Quality Assurance

Replace the bracketed text in the first paragraph with Section 17.5.

Attachment 18
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3960 Revision 1)

RAI Question No. 14.02-2

NRC RAI 14.02-2

In response to RAI 14.02-03 Dominion added Appendix 14AA to the FSAR Tier 2 for North Anna Unit 3 (NA3) COL Application (R-COLA). Detroit Edison in the NRC3-09-0005 letter (dated September 30, 2009) agreed with the R-COLA response of NA3 as a standard and included an almost identical Appendix 14AA in Revision 1 of the Fermi 3 (EF3) COL Application (S-COLA). In Section 14AA.2.2.1, "Startup Group Manager," both NA3 and EF3 included a bullet stating the Startup Group Manager would act as the chairman of the JTG. In Figure 14AA-201 in the box "Manager in charge of Startup Group" EF3 labeled this manager as a "JTG Member," while NA3 again labeled the "Manager in charge of Startup Group" as the Chairman. The staff requests that EF3 clarify the difference.

Response

Upon review and comparison of the Detroit Edison Final Safety Analysis Report (FSAR) Tier 2, Section 14AA.2.2.1 and Figure 14AA-201, with the R-COLA, Detroit Edison will correct the labeling discrepancy to match the agreed upon labeling defined in the R-COLA response.

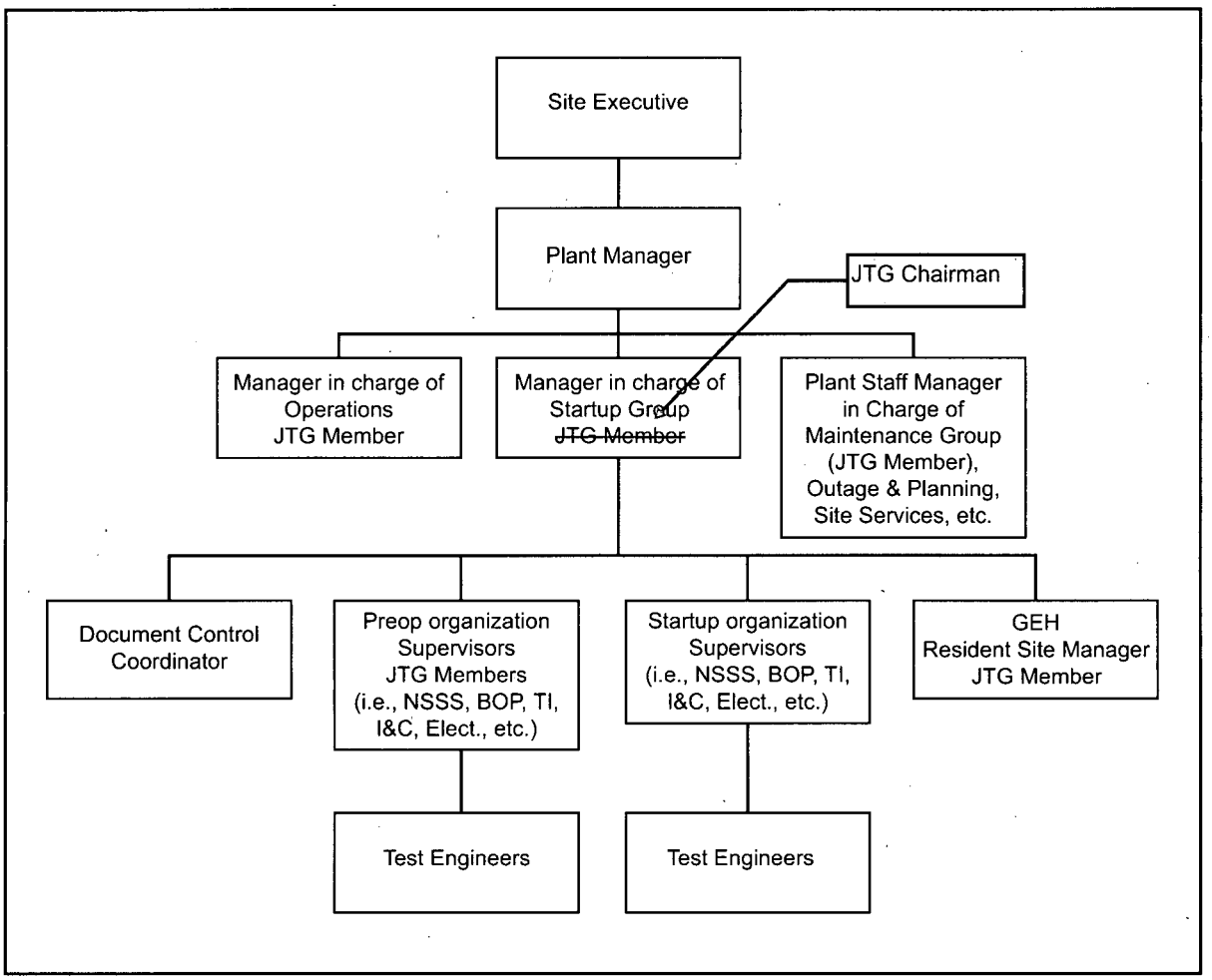
Proposed COLA Revision

See attached proposed markup to FSAR Figure 14AA-201.

Markup of Detroit Edison COLA
(following 1 page)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

Figure 14AA-201 Preoperational and Startup Test Organization (Typical)



Attachment 19
NRC3-10-0001

Response to RAI Letter No. 18
(eRAI Tracking No. 3962 Revision 1)

RAI Question No. 14.02-3

NRC RAI 14.02-3

In FSAR Tier 2, Section 14.2.10, "COL Information," the fourth item, 14.2-4-H, "Test Program Schedule and Sequence," is labeled "EF3 COL 14.2-4-H" and states the item is addressed in Section 14.2.7. However, in Section 14.2.7 the COL Item is labeled "STD COL 14.2-3-H." The staff requests this discrepancy to be corrected.

Response

Upon review of the Detroit Edison Final Safety Analysis Report (FSAR) Tier 2, Section 14.2.7 and Section 14.2.10, Revision 1, Detroit Edison will correct the labeling discrepancy as requested by the NRC Staff.

Proposed COLA Revision

See attached proposed markup to FSAR Section 14.2.7 and Section 14.2.10.

Markup of Detroit Edison COLA
(following 2 pages)

The following markup represents how Detroit Edison intends to reflect this RAI response in the next submittal of the Fermi 3 COLA Revision 2. 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.

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**~~
STD COL 14.2-4-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

14.2.10 COL Information

14.2-1-A Description – Initial Test Program Administration

STD COL 14.2-1-A This COL Item is addressed in Section 14.2.2.1 and Appendix 14AA

14.2-2-H Startup Administrative Manual

STD COL 14.2-2-H This COL Item is addressed in Section 14.2.2.1.

14.2-3-H Test Procedures

STD COL 14.2-3-H This COL Item is addressed in Section 14.2.2.2.

14.2-4-H Test Program Schedule and Sequence

STD COL 14.2-4-H
~~EF3 COL 14.2-4-H~~ This COL Item is addressed in Section 14.2.7.

14.2-5-A Site Specific Tests

EF3 COL 14.2-5-A This COL Item is addressed in Section 14.2.9.

14.2-6-H Site Specific Test Procedures

EF3 COL14.2-6-H This COL Item is addressed in Section 14.2.9

14.3 Inspections, Tests, Analysis, and Acceptance Criteria

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

14.3.8 Overall ITAAC Content for Combined License Applications

Replace the last paragraph with the following.

STD COL 14.3-1-A The requirements for inclusion of Emergency Planning ITAAC (EP-ITAAC) in a COLA are provided in 10 CFR 52.80(a). In SRM-SECY-05-0197, the NRC approved generic EP-ITAAC for use in COL and ESP applications. This set of EP-ITAAC was considered in the development of the plant-specific EP-ITAAC, which are tailored to the ESBWR design. The plant-specific EP-ITAAC are included in a separate part of the COLA.

Attachment 20
NRC3-10-0001

Supplemental Response to RAI Letter No. 15
(eRAI Tracking No. 3779)

RAI Question No. 02.04.05-2

NRC RAI 02.04.05-2

To meet the requirements of GDC 2, 10 CFR 52.17, and 10 CFR Part 100, and to support the staff's review of the application, estimates of the probable maximum storm surge are needed. Please provide a plan-view figure detailing the spatially distributed results of the STWAVE simulation from which the storm surge height of 3.14 m (10.3 ft) was derived. On the new figure, please note the locations of Fermi 3 and the point/model cell chosen to determine the storm surge height presented in the text.

Supplemental Response

This supplemental response corrects a units error and is intended to replace the original response in its entirety, which was previously provided in Detroit Edison Letter to the NRC, NRC3-09-0035, dated November 20, 2009 (ML093280179).

Storm surge was not calculated using the STWAVE model. The STWAVE model was used to calculate wave heights in Lake Erie associated with 100 mph winds. The Bretschneider method was used to calculate storm surge (FSAR Ref 2.4-257). Using this method storm surge or wind setup is a function of wind speed, fetch and water depth. The Bretschneider method includes a procedure to account for an irregular lake bottom, which was used in the analysis. The Bretschneider method uses straight line fetches across an enclosed water body. A transect that represented the longest straight line across the lake that ended at the Fermi site was used in the analysis. It was assumed that the calculated storm surge applied to all points along the shoreline at the Fermi site.

Figure 1 below indicates the straight line transect used in the calculations and the depths for each segment. The Fermi site is depicted on Figure 1, the water depths shown in the boxes are the average depth (meters) below the 100 year lake level.

Figure 1.
Transect Used in Bretschneider Method
(Water depth values in the boxes are the average depths (meters) below the 100 year lake level. The length of each segment is 17197.9197 meters, and the total of all segments is 154781.2768 meters.)

Propose COLA Revision

None