PMFermiCOLPEm Resource

From: LaShawn G Green [greenl@dteenergy.com]
Sent: Wednesday, August 26, 2009 3:02 PM
To: Tonacci, Mark; Hale, Jerry
Subject: RAI Letter 7
Attachments: NRC3-09-0021.pdf

Hello Mark and Jerry,

Here is a courtesy copy of RAI letter 7. It was mailed out yesterday afternoon via the US Postal Service.

(See attached file: NRC3-09-0021.pdf)

Thank you,

LaShawn Green
DTE Energy
Nuclear Development-Licensing
313-235-8459
greenl@dteenergy.com

Hearing Identifier: Fermi_COL_Public
Email Number: 549

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From: LaShawn G Green

Created By: greenl@dteenergy.com

Recipients:
"Tonacci, Mark" <Mark.Tonacci@nrc.gov>
Tracking Status: None
"Hale, Jerry" <Jerry.Hale@nrc.gov>
Tracking Status: None

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

10 CFR 52.79

August 25, 2009
NRC3-09-0021

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

References: 1) Fermi 3
Docket No. 52-033
2) Letter from Jerry Hale (USNRC) to Peter W. Smith (Detroit Edison), "Request for Additional Information Letter No. 7 Related to the SRP Sections 03.07.01-1, 12.03-12.04-3, 05.03.01-1, 03.07.01-2, 03.07.02-1, 12.02-3, and 12.02-4 for the Fermi 3 Combined License Application," dated June 23, 2009

Subject: Detroit Edison Company Response to NRC Request for Additional Information Letter No. 7

In the referenced letter, the NRC requested additional information to support the review of certain portions of the Fermi 3 Combined License Application (COLA). The responses to the following Requests for Additional Information (RAIs) are provided as Attachments 1 through 7 of this letter:

- RAI Question 03.07.01-1 — Seismic Design Parameters
- RAI Question 12.03-12.04-3 — Radiation Protection Design Features
- RAI Question 05.03.01-1 — Reactor Vessel Materials
- RAI Question 03.07.01-2 — Seismic Design Parameters
- RAI Question 12.02-3 — Radiation Sources
- RAI Question 03.07.02-1 — Seismic System Analysis
- RAI Question 12.02-4 — Radiation Sources

Information contained in these responses will be incorporated into a future COLA submission as described in the RAI response.

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

I state under penalty of perjury that the foregoing is true and correct. Executed on the 25th day of August 2009.

Sincerely,

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

Attachments:
1) Response to RAI Letter No. 7 (Question No. 03.07.01-1)
2) Response to RAI Letter No. 7 (Question No. 12.03-12.04-3)
3) Response to RAI Letter No. 7 (Question No. 05.03.01-1)
4) Response to RAI Letter No. 7 (Question No. 03.07.01-2)
5) Response to RAI Letter No. 7 (Question No. 12.02-3)
6) Response to RAI Letter No. 7 (Question No. 03.07.02-1)
7) Response to RAI Letter No. 7 (Question No. 12.02-4)

cc: Jack M. Davis, Senior Vice President and Chief Nuclear Officer
Mark Tonacci, NRC Fermi 3 Project Manager
Stephen Lemont, NRC Fermi 3 Environmental Project Manager
Fermi 2 Resident Inspector
NRC Region III Regional Administrator
NRC Region II Regional Administrator
Supervisor, Electric Operators, Michigan Public Service Commission
Michigan Department of Environmental Quality
Radiological Protection and Medical Waste Section

Attachment 1
NRC3-09-0021

Response to RAI Letter No. 7
(eRAI Tracking No. 2651)

RAI Question No. 03.07.01-1

NRC RAI 03.07.01-1

10 CFR 50 Appendix S requires that the Safe Shutdown Earthquake (SSE) Ground Motion for the site be characterized by both horizontal and vertical free-field ground motion response spectra at the free ground surface. For application to engineering designs, site-specific GMRS determined at the foundation level of seismic category I structures are bounded by CSDRS. However, a site-specific SSE should be established as free-field ground motion response spectra that would be used to determine whether the plant shutdown would be required following a seismic event. The NRC staff requests that the applicant specify in FSAR Section 3.7.1 both the site-specific SSE and the corresponding OBE which would be required for operating the plant and setting up the seismic instrumentation as required in FSAR Section 3.7.4.

Response

The Fermi 3 site specific Ground Motion Response Spectra (GMRS) for free-field ground motion is shown in FSAR, Revision 1, Figure 2.5.2-288, "Fermi 3 GMRS (5% damping)." The site specific GMRS was used to generate building specific Foundation Input Response Spectra (FIRS). These FIRS are fully enveloped by the Certified Seismic Design Response Spectra (CSDRS) in both the horizontal and vertical directions as illustrated in FSAR, Revision 1, Figures 2.0-201 through 2.0-204. The site specific Safe Shutdown Earthquake (SSE) is less severe than the CSDRS SSE the plant is designed to; therefore it is acceptable to use the CSDRS SSE to develop a free field GMRS that would be used to determine if plant shutdown would be required following a seismic event.

The Operating Basis Earthquake (OBE) seismic levels that are used to determine if a plant shutdown would be required following a seismic event are relative to the SSE levels used to design the plant. Fermi 3 is designed using the CSDRS which fully envelopes the site specific seismic levels. ESBWR DCD Tier 2, Revision 5, Table 3.7-2 provides the CSDRS. In accordance with ESBWR DCD, Tier 2, Revision 5, Section 3.7, the OBE will be "one-third of the (CSDRS) ground motion."

To summarize, the OBE seismic levels that would be used to determine if a plant shutdown is required are determined as follows:

$$OBE = N * 1/3$$

Where: $N = S_a$ (g) at the given Frequency (Hz) from ESBWR DCD, Tier 2, Revision 5, Table 3.7-2

Proposed COLA Revision

None

Attachment 2
NRC3-09-0021

Response to RAI Letter No. 7
(eRAI Tracking No. 2658)

RAI Question No. 12.03-12.04-3

NRC RAI 12.03-12.04-3

Section 12.4 of the EF3 COLA refers to the EF3 Environmental report for dose to Construction Workers. Upon reviewing the Construction Worker Dose, as reported in Section 4.5 of the EF3 Environmental report, it was noted that additional information should be included in Section 12.4 of the COL:

Provide the basis and rationale for using 2001 data for thyroid and whole body dose calculations.

Provide information to address these needs:

- *specific construction activities and the number of workers used in construction worker dose calculations.*
- *effects of future decommissioning activities of Fermi 1 on Fermi 3 construction worker dose.*
- *plans for radiological monitoring of the Fermi 3 construction site to verify construction worker dose calculations.*

Some of the information requested above is also being requested by the Environmental Review team under RAIs 4.5-1 and 4.5-3.

Response

Basis and rationale for radiological values used in whole-body dose calculations.

Historical radiation information from 1999 to 2006 was used to develop representative radiation dose levels for construction workers at the Fermi 3 site. For conservatism, the highest annual doses for thyroid and whole body were combined with the highest annual dose measured by the thermoluminescent dosimeters (TLDs). For the purpose of developing the representative dose, the highest doses did not need to occur in the same year.

The annual doses from gaseous effluent releases from Fermi 2 for 1999 to 2006 are provided in ER Table 4.5-2. The highest dose from gaseous effluent releases from Fermi 2 corresponds to year 2001 and was used in the whole body dose calculations.

Examining the Fermi 3 site plan arrangement, ER Figure 4.5-1, and the location of the monitoring TLDs for Fermi 2, ER Figure 4.5-2, shows that there are three TLDs locations that could be used to obtain exposure rates for use in whole body dose calculations for Fermi 3. TLDs T47, T48, T54, Fermi 2 and Fermi 3 are shown together on Figure 1 of this response (see Figure 1 of attached Enclosure 1). TLDs T47, T48, and T54 are outside the Fermi 2 secure operating area, monitor areas accessible during construction activities at the power block portion of the site, and would conservatively represent exposure rates for construction activities at the south end of the site.

Of the three, TLD 48 was selected to represent dose levels for construction activities. TLD T54 is the farthest location from Fermi 2 and as such it would not be conservative to use the TLD T54 exposure rate as representative for whole body dose calculations for the power block construction site. Although the dose rate for TLD T47 is the highest of the group, its location is just outside of the Fermi 2 protected area and well removed from the eventual location of the Fermi 3 structures. Further it is not reasonable to assume that power block construction workers would spend significant periods of time in this area as it is well removed from the Fermi 3 power block construction area.

TLD T48 is closest to the Fermi 3 power block construction area, and is also located at one of the shortest distances between Fermi 2 and the Fermi 3 power block construction site. Therefore, TLD T48 provides a reasonable location to develop a representative dose for the Fermi 3 site construction workers.

The TLD annual exposures from Fermi 2 for 1999 to 2006 are provided in ER Table 4.5-1. For TLDs T47 and T48 the highest annual exposure was measured in 2004. For TLD T54 the highest measured annual exposure was measured in 2000. As described in ER Section 4.5, the representative annual dose at TLD T48 is well below the federal standard for the general public and supports that monitoring individual construction workers would not be required. However, a monitoring program will be in place during the construction activities at the Fermi 3 site to ensure that the doses to construction workers remain within the expected ranges and within the federal limits for the general public.

- **Specific construction activities and number of workers**

For determination of the limiting dose to any one construction worker, it is assumed that work activities occur at the monitored location that results in the highest annual exposure, T48 being representative of this exposure. The annual collective dose to the construction work force is determined by multiplying this limiting dose to any one construction worker by the total number of construction workers expected during the periods of peak construction. This methodology provides conservative collective dose projections that bound actual expected construction activities. Based on estimates of construction work force during peak periods of construction (see COLA Part 3 (Environmental Report) Table 4.4-2), a value of 2900 workers is used in the determination of annual collective dose.

- **Effects of future decommissioning activities of Fermi 1 on Fermi 3 construction worker dose**

The annual exposure measured by TLDs T47, T48 and T54 includes the contribution from Fermi 1 during the periods from 1999 through 2006. The ongoing decommissioning of Fermi 1 continues to reduce the contribution of Fermi 1 to the annual exposure measured by TLDs T48 and T54. TLD T48 is approximately the same distance from the Fermi 1 site as the power block construction site. Thus the contribution of Fermi 1 to the Fermi 3 power block construction site dose would be included in the collective dose calculations through the use of the highest TLD T48 exposure measurements in the whole body dose calculations.

By Detroit Edison letter to the NRC, NRC-09-0017, dated March 25, 2009, Detroit Edison submitted a proposed license amendment to add a license condition approving the License Termination Plan (LTP) for Fermi 1 using the criteria established in 10 CFR 20.1402, "Radiological Criteria for Unrestricted Use" which states:

> A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a (Total Effective Dose Equivalent) TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA).

Fermi 3 construction workers will not be working within Fermi 1 structures although the activities occurring near the Fermi 1 site during the construction of Fermi 3 would include: 1) construction of the station water intake structure, 2) barge unloading, and 3) concrete batch plant operation (the current location of Fermi 1 coincides with the proposed location for the concrete batch plant). For Fermi 1's determination of residual levels of radioactive material that are authorized to remain after decommissioning subject to the limits established in 10 CFR 20.1402, these activities associated with Fermi 3 occurring near the Fermi 1 site would be best represented by the resident farmer scenario. This scenario provides a conservative estimate of the TEDE to an "average member of the critical group" in that it includes contributions from internal dose from ingestion of plant foods grown on the Fermi 1 site, consumption of meat and milk produced on the Fermi 1 site, drinking water from wells at the Fermi 1 site, and eating fish from a pond containing residual radioactivity on the Fermi 1 site. A Fermi 3 construction worker would not be exposed to the above mentioned pathways and thus would receive less than the estimated 25 mrem per year. As provided in ER Table 4.5-5 the projected dose to the construction worker of 26 mrem per year is well within the dose limits for the members of the public with the inclusion of the conservative 25 mrem per year due to residual radioactivity from Fermi 1.

- **Plans for radiological monitoring of the Fermi 3 construction site to verify construction worker dose calculations.**

Before construction begins, Detroit Edison will develop the necessary programs (e.g. radiation protection program, ALARA program, etc.) as required to monitor the dose of Fermi 3 construction workers.

Proposed COLA Revision

Replace the current text of FSAR SECTION 12.4.7.1 (EF3 SUP 12.4-1) with the following text:

Doses to construction workers are addressed in Section 4.5 of the Environmental Report (ER) contained in COLA Part 3 and associated impacts are determined to be SMALL. As described in Section 4.5 of the ER, the dose estimates are determined based on the following.

- The dose to the construction worker includes dose due to operation of Fermi 2 and estimated dose from the planned Fermi Independent Spent Fuel Storage Installation (ISFSI).

- External dose estimates are determined based on TLD readings that are located closest to the Fermi 3 power block construction area relative to Fermi 2. Conservative TLD readings used are based on several years of data.

- Effluent release data for Fermi 2 used for dose calculations is based on several years of data as reported in the Fermi 2 Annual Radioactive Effluent Release Reports. Conservative values are used based on several years of data.

- The estimated peak number of construction workers is 2900.

The resultant projected maximum dose estimate for an individual construction worker is less than the limits for public dose specified in 10 CFR 20.1301.

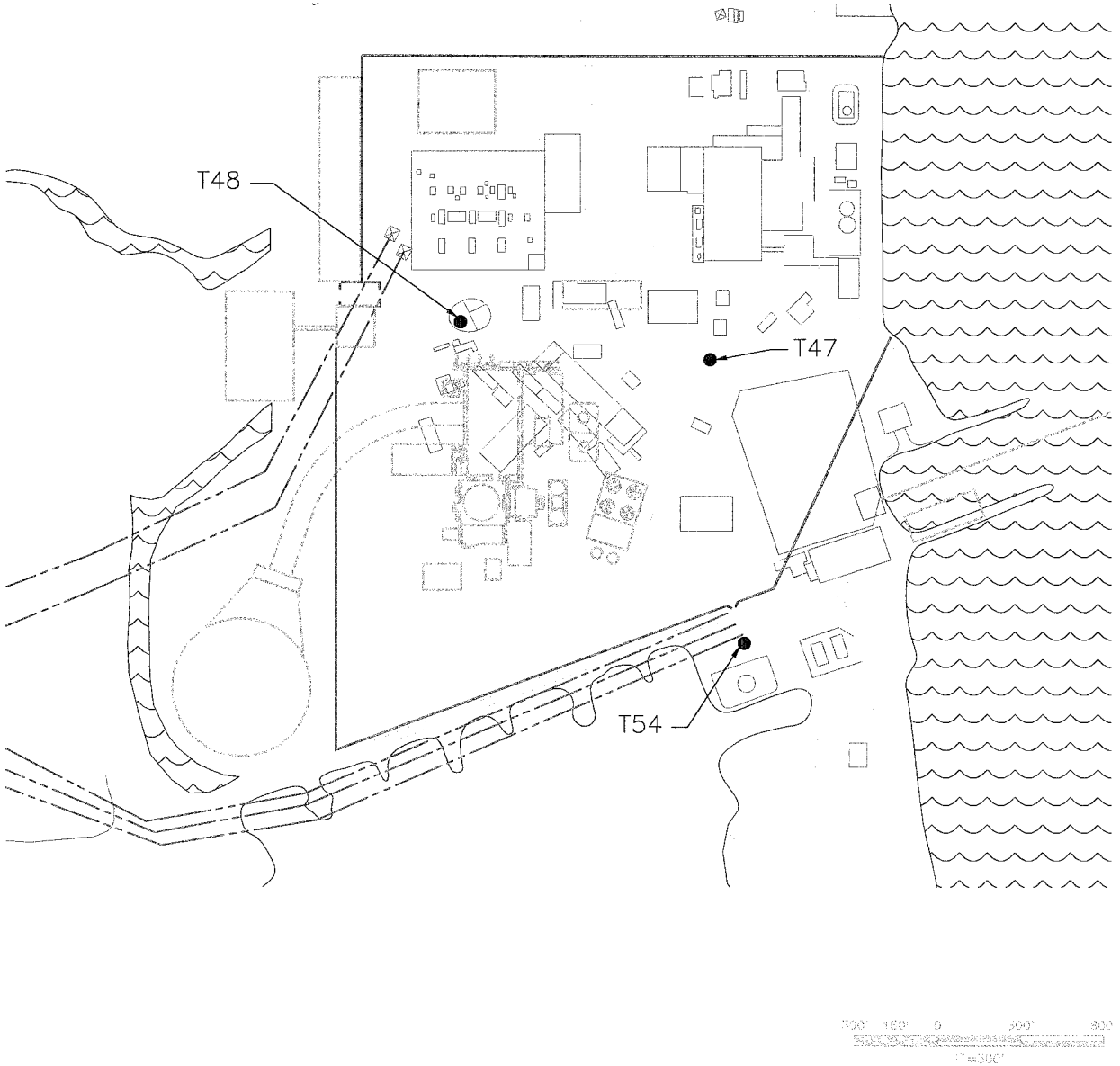
There are also some contributions to dose for Fermi 3 construction workers from the decommissioned Fermi 1 site. To meet the limits established in 10 CFR 20.1402, the maximum dose to a construction worker from the decommissioned Fermi 1 must not exceed 25 mrem per year. Conservatively including this additional dose with the dose estimated in ER Section 4.5 still results in estimated construction worker dose that is well within the limits for the members of the public.

Figure 1
NRC3-09-0012

RAI Question 12.03-12.04-3

Figure 1 – TLD Locations on Fermi Site
(following 1 page)

Figure 1: Approximate TLD locations for TLD T-47, T-48, and T-54



Markup of Detroit Edison COLA
(following 3 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.

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.

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.~~

Place Insert #1 Here

Insert #1

Doses to construction workers are addressed in Section 4.5 of the Environmental Report (ER) contained in COLA Part 3 and associated impacts are determined to be SMALL. As described in Section 4.5 of the ER, the dose estimates are determined based on the following.

- The dose to the construction worker includes dose due to operation of Fermi 2 and estimated dose from the planned Fermi Independent Spent Fuel Storage Installation (ISFSI).

- External dose estimates are determined based on TLD readings that are located closest to the Fermi 3 power block construction area relative to Fermi 2. Conservative TLD readings used are based on several years of data.

- Effluent release data for Fermi 2 used for dose calculations is based on several years of data as reported in the Fermi 2 Annual Radioactive Effluent Release Reports. Conservative values are used based on several years of data.

- The estimated peak number of construction workers is 2900.

The resultant projected maximum dose estimate for an individual construction worker is less than the limits for public dose specified in 10 CFR 20.1301.

There are also some contributions to dose for Fermi 3 construction workers from the decommissioned Fermi 1 site. To meet the limits established in 10 CFR 20.1402, the maximum dose to a construction worker from the decommissioned Fermi 1 must not exceed 25 mrem per year. Conservatively including this additional dose with the dose estimated in ER Section 4.5 still results in estimated construction worker dose that is well within the limits for the members of the public.

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:

Attachment 3
NRC3-09-0021

Response to RAI Letter No. 7
(eRAI Tracking No. 2698)

RAI Question No. 05.03.01-1

NRC RAI 05.03.01-1

The purpose of the reactor vessel surveillance capsule program (RVSP), as described in ASTM E 185, is to monitor radiation effects on RV materials under operating conditions. Section C.III.1, Chapter 5, C.I.5.3.1.6 of Regulatory Guide (RG) 1.206 states, "because the material surveillance program is an operational program, as discussed in SECY-05-0197, the applicant must describe the program and its implementation in sufficient scope and level of detail for the staff to make a reasonable assurance finding on its acceptability." ESBWR DCD Section 5.3.1.6 "Material Surveillance" provides general information about the RVSP. The Fermi 3 COL FSAR Section 5.3.1.8,"COL Information for Reactor Vessel Material Surveillance Program," contains some information on this program. To enable the staff to complete its review of the adequacy of the RVSP, please provide amplifying information as follows:

a. *Provide the detailed locations of the capsules in the core beltline region and their associated lead factors.*

b. *Describe in detail the process for preparing the capsule specimens (i.e., how ASTM E 185 be implemented).*

c. *Specify the number and type of specimens in each capsule.*

Response

This Request for Additional Information (RAI) is identical to the Reference Combined License Application (R-COLA) RAI 05.03.01-1. Dominion provided a response to R-COLA RAI 05.03.01-1 in letter dated September 3, 2008 (NA3-08-088R).

On October 10, 2008, Dominion submitted a table (NA3-08-119) that identified those RAI responses for the R-COLA that are considered to be standard for ESBWR COLAs. The table lists each R-COLA RAI response and identifies it as either standard (STD) or site-specific (SS). R-COLA RAI 05.03.01-1 was identified as a STD response.

On February 16, 2009, Detroit Edison provided the NRC with a letter (NRC3-09-0002) which evaluated each of the R-COLA RAI STD responses, and identified those which it adopted for Fermi 3. R-COLA RAI 05.03.01-1 response was adopted for Fermi 3 in this letter.

No COLA changes were identified in the R-COLA response.

Proposed COLA Revison

None

Attachment 4
NRC3-09-0021

Response to RAI Letter No. 7
(eRAI Tracking No. 2783)

RAI Question No. 03.07.01-2

NRC RAI 03.07.01-2

FSAR Section 3.7.1.1, Design Ground Motion, lists a supplemental information item EF3 SUP 3.7-2, which states: 3.7.1.1.5 Site-Specific Design Ground Motion Time History EF3 SUP 3.7-2. The site-specific earthquake ground motion time history is described in Subsection 2.5.4. The staff review appears to indicate that such information is not included in Section 2.5.4. Please identify the appropriate FSAR texts and associated figures in Section 2.5.4 that describe the site-specific earthquake ground motion time history.

Response

The site-specific earthquake ground motion time history is described in FSAR Subsection 2.5.2. The supplemental item EF3 SUP 3.7-2 incorrectly listed FSAR Subsection 2.5.4 in Revision 0, September 2008. In FSAR Revision 1 dated March 2009, supplemental item EF3 SUP 3.7-2 was corrected to state the site-specific earthquake ground motion time history is in FSAR Subsection 2.5.2.

Proposed COLA Revision

None

Attachment 5
NRC3-09-0021

Response to RAI Letter No. 7
(eRAI Tracking No. 2884)

RAI Question No. 12.02-3

NRC RAI 12.02-3

Fermi 3, FSAR Subsection 12.2.2.2 is used to show compliance with dose criteria for members of the public due to gaseous effluent releases under Appendix I to Part 50. As described in the FSAR, the reported doses cannot be independently verified by the staff without access to site specific factors used by the applicant. The applicant is requested to provide the input and output files or data used in GASPAR II computer code analyses in generating dose estimates to members of the public associated with the operation of Fermi 3. Specifically, describe all assumptions and basis for the use of factors that are different than default values noted in Regulatory Guide 1.109 and/or GASPAR II code. Note that the response to this RAI should be consistent with the information requested under related RAI No. 5.4.2-1, submitted by the Environmental Review team.

Response

Electronic files used in GASPAR II dose calculations were provided to the NRC in Detroit Edison letter to the NRC dated July 29, 2009 (NRC3-09-0019).

The input values and bases are identified in the table below. For the GASPAR analyses, default values were used where site specific values were not available.

GASPAR Input Values

Input #	Input Description	Input Value	Bases
1	Fraction of Year that Leafy Vegetables are Grown	0.33	NUREG/CR-4653, Figure 2.2
2	Fraction of max individual's vegetable intake from own garden	0.76	RG 1.109, Table E-15
3	Fraction of year milk cows are on pasture	0.58	NUREG/CR-4653, Figure 2.2
4	Fraction of milk-cow feed intake from pasture while on pasture	1	NUREG/CR-4653 Conservative Assumption
5	Fraction of year goats are on pasture	0.67	NUREG/CR-4653, Figure 2.2
6	Fraction of goat feed intake from pasture while on pasture	1	NUREG/CR-4653 Conservative Assumption
7	Fraction of year meat cows are on pasture	0.58	NUREG/CR-4653, Figure 2.2
8	Fraction of meat cow feed intake from pasture while on pasture	1	NUREG/CR-4653 Conservative Assumption

9	Individual Consumption Rates	RG 1.109, Table E-5	RG 1.109, Table E-5
10	Population distribution with 50 mile radius	Values are taken from ER Section 2.5	Noted ER Section
11	Data for agricultural production (milk, vegetables, grain, beef, goat meat)	Values are taken from ER, Section 2.2	Noted ER Section
12	Distances and Directions to Receptors and associated atmospheric dispersion and deposition factors	Values are taken from ER Section 2.7.6	Noted ER Section
13	Average absolute humidity	10.98 g/cm^3	Average value based on dry bulb temperature, relative humidity and station pressure recorded at Detroit Metro Airport.
14	Gaseous Source Term	ESBWR DCD Table 12.2-16	ESBWR DCD

Proposed COLA Revision

None

Attachment 6
NRC3-09-0021

Response to RAI Letter No. 7
(eRAI Tracking No. 2785)

RAI Question No. 03.07.02-1

NRC RAI 03.07.02-1

FSAR Section 3.7.2.8, Interaction of Non-Category I Structures with Seismic Category I Structures, incorporates by reference the ESBWR DCD with supplement EF3 SUP 3.7-5. EF3 SUP 3.7-5 references Figure 2.1-204 for the locations of structures. The staff review identified that neither Section 3.7.2.8 nor Figure 2.1-204 includes all the information identified in Regulatory Guide 1.206 (C.I.3.7.2.8) to verify protection of seismic Category I structures from failure of non-seismic Category I structures as a result of seismic effects. Please provide identification and location of each seismic Category I, II, and non-seismic structure, including the distance between structures and the height of each structure.

Response

DCD Section 3.7.2.8 establishes design criteria that protect seismic Category I structures from the failure of non-Category I structures as a result of seismic effects. These criteria are applicable to structures that are within the ESBWR Standard Plant design and to structures that are site specific.

Information regarding the heights and actual distances between Category I, II, and non-seismic structures that are within the scope of the ESBWR Standard Plant design. FSAR Figure 2.1-204 (updated based on revised site plan) and ESBWR DCD Tier 2, Revision 5, Figure 1.1-1 include the names and locations of Category I, II, and non-seismic structures for Fermi 3.

The heights of Fermi 3 plant-specific structures, which are non-seismic, and distances to the closest seismic Category I structure are provided in Table 1of this response. The table shows the height of each plant specific structure is less than the distance to the nearest seismic Category I structure. The information contained in this table may change as the detailed design is completed. Any changes however will continue to meet the DCD criteria to protect seismic Category I structures from the failure of Non-Category I structures as a result of seismic effects.

The Natural Draft Cooling Tower (NDCT) has a height of 600 feet, and is the tallest structure on the Fermi 3 site. Any structure that is more than 600 feet from any seismic Category I structure is acceptable and therefore not listed on the attached table. Only structures that are within 600 feet of Category I structures are listed, with the exception of the NDCT.

During the development of the response to this RAI, it was determined that the Service Water/Water Treatment (SW/WT) structure needed to be moved to increase the distance to the Fire Water Tanks and Pumps. The need to increase the distance was identified after a review of more recent vendor information related to the height of the service water mechanical draft cooling tower. The distance from the SW/WT to the Fire Water Tanks and pumps was increased by re-orienting the SW/WT structure (placing the cooling towers on the north side of the structure) and moving the SW/WT structure to the east by approximately 60 feet. The revised location of the SW/WT structure is reflected on the revised site plan which is being submitted under separate cover.

Table 1

Plant-Specific Structure	Height Above Grade (feet)	Closest Seismic Category I (SCI) Structure	Distance Between Plant-Specific Structure and Closest SCI Structure (feet)
Diesel Fuel Oil Storage Tank	< 50	Fire Water Tank and Pumps	> 60
Water Treatment/Service Water Building	< 80	Fire Water Tank and Pumps	> 80
Service Water Cooling Tower	< 100	Fire Water Tank and Pumps	> 100
Water Storage Tanks	< 50	Fuel Building	> 100
NPHS Cooling Tower	600	Fuel Building	> 700
PAP/VIB	< 150	Reactor Building	> 550

Proposed COLA Revision

None

Attachment 7
NRC3-09-0021

Response to RAI Letter No. 7
(eRAI Tracking No. 2885)

RAI Question No. 12.02-4

NRC RAI 12.02-4

Fermi 3, FSAR Subsection 12.2.2.4 is used to show compliance with dose criteria for members of the public due to liquid effluent releases under Appendix I to Part 50. As described in the FSAR, the reported doses cannot be independently verified by the staff without access to site specific factors used by the applicant. The applicant is requested to provide the input and output files or data used in LADTAP II computer code analyses in generating dose estimates to members of the public associated with the operation of Fermi 3. Specifically:

a. *provide justification for transit times and dilution factors used in LADTAP II code dose calculations for liquid effluent discharges for different intake locations (commercial fish and invertebrate catch locations, drinking water intake locations. Also, provide a discussion describing the impact of thermal variations on applied dilution factors.*

b. *provide estimates of the amount of invertebrate stocks caught from waters within 50 miles downstream of the facility's radwaste discharge line that is consumed locally and regionally.*

c. *provide discussions describing local wildlife game, plants, agricultural practices, game harvests, and food processing operations having the potential to contribute 10 percent or more to either individual or population doses in areas affected by liquid effluents, such as irrigation, livestock watering, and food-processing operations, involving local and regional water use.*

d. *describe all assumptions and basis for the use of factors that are different than the default values noted in Regulatory Guide 1.109 and/or LADTAP II code.*

Note that the response to this RAI should be consistent with the information requested under related RAI No. 5.4.1-1, 5.4.1-2, 5.4.1-3, and 5.4.2-1, submitted by the Environmental Review team.

Response

(a) Transit Time for Drinking Water - The transit time for the closest drinking water intake consists of two factors: 1) the time of transit from the point of effluent release to the intake location and 2) the transit time through the water purification plant and distribution system. The transit time from the effluent release to the intake is a function of the velocity and the distance to be traveled. The ambient lake currents that affect the mixing of the plume as well as the direction of movement are described in subsection to ER Section 5.3.2.1.1.3, *Ambient Lake Currents* with the monthly current velocities provided in Table 5.3-6 such that a mean velocity of 0.04 m sec^{-1} (0.13 ft sec^{-1}) was used. The closest drinking water intake, the Monroe Water System, is provided in the Fermi 3 Environmental Report in Table 2.3-39 as approximately 1609 meters (1 mile) although the conservative value of 1530 meters (0.95 mile) was used in the modeling (See Table 5.4-1). This mean velocity and transit distance combine to provide for a transit time of 10.6 hours. The transit time through the water purification plant and distribution system is taken as 12 hours as per Regulatory Guide 1.109, Appendix A, Section 2.a, *Potable*

Water. The total transit time for the closest drinking water pathway uses 22.6 hours as given in Table 5.4-1.

Dilution Factor for Drinking Water – As discussed in ER Section 5.4.1.1 dilution consists of two factors: 1) dilution due to mixing of the liquid effluent in the normal CIRC blowdown and 2) dilution in Lake Erie.

CIRC Blowdown – A dilution factor of 115 (see Table 5.4-1) is credited based upon dilution of the maximum Radwaste Discharge (Liquid Radwaste Loss) flow of 105 gpm given in ER Figure 3.3-1 (specifically sheet 2) by the cooling tower blowdown flow rates provided in Table 3.4-1.

Dilution in Lake Erie for Drinking Water Intake Locations –A dilution factor of 67, see Table 5.4-1, was used for the closest drinking water intake, the Monroe Water System. The 67 dilution factor was developed using the CORMIX model described in ER Section 5.3.2.1.1 using the distance of 1600 meters (1 mile) and included the various sensitivity analyses performed to examine the impact of anticipated variation in the effluent flow and temperature as well as known variations in Lake Erie water temperature, current velocity and water depth. Specifically, separate model runs were performed for each month in order to consider monthly variations in the Lake Erie water and effluent temperatures as well as the Lake Erie water flow direction as shown in ER, Table 5.3-6 and included:

1) Low ambient water temperature with extreme Lake Erie water ambient high velocity,
2) Low ambient water temperature with extreme Lake Erie water ambient low velocity,
3) High ambient water temperature with extreme Lake Erie water ambient high velocity, and
4) High ambient water temperature with extreme Lake Erie water ambient low velocity.

The dilution factor of 67 does not bound for CORMIX cases with the minimum low Lake Erie water velocity. Combining that both of the drinking water intake locations identified in Table 2.3-39 are south of the point of effluent release and that the general flow direction of flow is away from these drinking water intakes from October to February, the specific CIRC blowdown dilution factor for each period, and the Lake Erie dilution factor determined by CORMIX for the conditions for a given month when the flow is generally towards the drinking water intake locations shows that the use of the 67 dilution factor when combined with the CIRC blowdown of 115 does remain bounding for the annual dose evaluation in LADTAP II as illustrated in Table 1 below.

Table 1 – Overall Dilution Factor for Drinking Water Intake

Month	Blowdown Dilution Factor	Lake Erie Dilution (CORMIX) Factor	Total Dilution Factor
Jan	114	Note 1	
Feb	117	Note 1	
March	126	55	6,930
April	137	56	7,672
May	148	58	8,584
June	156	58	9,204
July	160	64	10,240
August	160	61	9,760
September	154	65	10,010
October	142	Note 1	
November	132	Note 1	
December	120	Note 1	
Average			**8,914**
LADTAP Input	**115**	**67**	**7,705**

Notes: 1) General flow for this period is away from the closest drinking water intake Table 5.3-6

Transit Time for Fish and Invertebrate Harvest - The transit time for fish and invertebrate harvesting consists of two factors: 1) the time of transit from the point of effluent release to the intake location and 2) the transit time through the food chain as well as during food preparation. The transit time from the effluent release to the intake is not taken, or zero. The transit time through the food chain as well as during food preparation is taken as 24 hours as per Regulatory Guide 1.109, Appendix A, Section 2.b, *Aquatic Foods*. The total transit time for fish and invertebrate is 24 hours as give in Table 5.4-1.

Dilution Factor for Fish and Invertebrate Harvest – As discussed in ER Section 5.4.1.1 dilution consists of two factors: 1) dilution due to mixing of the liquid effluent in the normal CIRC blowdown and 2) dilution in Lake Erie.

CIRC Blowdown – A dilution factor of 115, see Table 5.4-1 is credited based upon dilution of the maximum Radwaste Discharge (Liquid Radwaste Loss) flow of 105 gpm given in ER Figure 3.3-1 (specifically sheet 2) by the cooling tower blowdown flow rates provided in Table 3.4-1.

Dilution in Lake Erie for Fish and Invertebrate Harvest –A dilution factor of 100, see Table 5.4-1, was used for fish and invertebrate harvest. The report "Status of Fisheries in Michigan Waters of Lake Erie and Lake St. Clair, 2006," dated March 22, 2007 (Reference 2.4-72 in

the ER) provides recreational fishing data that the majority of the fish are taken from Lake Erie and Lake St. Clair between the months of April through October. Using the ambient lake currents provided in Table 5.3-6, dilution factors were developed using the CORMIX model described in ER Section 5.3.2.1.1 and a distance of 1800 meters (1.1 mile), the distance to the closest, southern, boundary of the security zone prescribed for the Enrico Fermi 2 Nuclear Power Station in 33 CFR 165.915(a)(1) (see Figure 1 of attached Enclosure 1). The security boundary was used as it is the closet location that fish would be harvested (although the boundary is the closet point, the fish would be harvested from a variety of locations depending on several factors such as availability of the fish). Additionally, as described previously, various sensitivity analyses were performed to examine the impact of anticipated variation in the effluent flow and temperature as well as known variations in Lake Erie water temperature, current velocity and water depth. Specifically, separate model runs were performed for each month in order to consider monthly variations in the Lake Erie water and effluent temperatures as well as the Lake Erie water flow direction as shown in ER, Table 5.3-6 and included:

1) Low ambient water temperature with Lake Erie water ambient high velocity,
2) Low ambient water temperature with Lake Erie water ambient low velocity,
3) High ambient water temperature with Lake Erie water ambient high velocity, and
4) High ambient water temperature with Lake Erie water ambient low velocity.

The dilution factor of 100 does not bound for CORMIX cases with the minimum low Lake Erie water velocity. Combining that the majority of fish and invertebrate harvest is between the months of April through September, the specific CIRC blowdown dilution factor for each period during that interval, and the Lake Erie dilution factor determined by CORMIX for the conditions for a given month during that interval shows that the use of the 100 dilution factor when combined with the CIRC blowdown of 115 provides a reasonable estimate of the annual dose using LADTAP II as illustrated in Table 2 below.

Table 2 – Overall Dilution Factor for Fish and Invertebrate Harvest

Month	Blowdown Dilution Factor	Lake Erie Dilution (CORMIX) Factor	Total Dilution Factor
Jan	114	Note 1	
Feb	117	Note 1	
March	126	Note 1	
April	137	79	10,823
May	148	60	8,880
June	156	65	10,140
July	160	65	10,400
August	160	64	10,240
September	154	70	10,780
October	142	70	9,940
November	132	Note 1	
December	120	Note 1	
Average			**10,172**
LADTAP Input	**115**	**100**	**11,500**

Notes: 1) Minimal harvesting of fish or invertebrates during this period.

(b) For commercial and sport fish catch data, the information in ER Table 5.4-1 was developed based on information in ER Section 2.4.2.3. Similar information for invertebrates does not exist in the ER. Although there is currently no commercial fishery for invertebrates (shellfish) in the Great Lakes, it is conservatively assumed that the invertebrate catch is similar to that of a salt water site. Thus, for invertebrates, the harvest consumed within the 50 mile radius was developed based on the total population within the 50 mile radius, the age fractions of the population (LADTAP code default values), and the consumption values in NRC Regulatory Guide 1.109, Table E-5.

Input values to this determination are as follows:

Total Population within 50 mile radius = 7.71E6 individuals (estimated population at year 2060)

Table 1
Input Parameters for Derivation of Invertebrate Catch

Parameter	Child	Teen	Adult
Population Fraction	0.18	0.11	0.71
Annual Consumption (kg/yr)	1.7	3.8	5.0

The equation for this determination is as follows:

Total Invertebrate Consumption = 7.71E6[(0.18*1.7kg)+(0.11*3.8kg)+(0.71*5.0kg)]=3.3E7kg*

Thus, the total invertebrate consumption within the 50 mile radius is taken at 3.3E7 kg/yr in the LADTAP analysis.

(c) The principal aquatic species, including invertebrates, in Lake Erie are presented in ER Section 2.4.2.2.1. The basis for the quantities of invertebrates harvested and consumed by individuals used to estimate the radiation dose to individuals and the general population was presented in part (b) above. This estimate provides a very conservative estimate of the radiation dose from the consumption of invertebrates given that no known commercial invertebrate harvesting is conducted in the western basin of Lake Erie. This estimate would thus bound any recreational harvesting operations, such as harvesting for clams, lake grasses, etc., in the affected areas around the Fermi 3 discharge.

ER Section 2.3.2.1.2 describes the consumptive surface water usage in the local area and region. Specifically, Table 2.3-30 identifies that in 2004, 12.33 M gallons of water were withdrawn for the purpose of domestic supply (i.e. potable water) from Lake Erie. That same year, only 1.42 M gallons of water for irrigation and 1.56 M gallons of water for livestock were consumed from the entire Lake Erie, thus minimizing the regional potential for unusual activities contributing more than 10% or more to either the individual dose or the population dose regionally.

ER Table 2.3-34 describes the consumptive surface water usage in the local area of Monroe County. Locally, irrigation from the western basin of Lake Erie is not utilized on a reportable scale for irrigation or livestock and thus would not provide a significant means for contributing 10% or more to either the individual or the public dose due to local animals, plants agricultural practices and game harvests.

No food processing operations utilizing large quantities of water drawn from the western basin of Lake Erie in the immediate vicinity of the Fermi 3 site are known to exist.

(d) Electronic files used for LADTAP-II dose calculations were provided in Detroit Edison letter to the NRC (NRC3-09-0019).

The input values and bases are identified in the table below. For the LADTAP analyses, default values were used where site specific values were not available.

LADTAP Input Values

Input #	Input Description	Input Value	Bases
1	Site Water Type	Fresh Water Lake	Configuration
2	Effluent Discharge Rate	105 gpm (0.234 ft^3/sec)	ER Section 3.3 Conservative Assumption as ESBWR is designed for zero discharge
3	Blowdown Flow Rate	ER Section 3.4	ER Section 3.4
4	Population distribution with 50 mile radius	Values are taken from ER Section 2.5	Noted ER Section
5	Age Fractions of Total Population	Children (0-11 years) 0.18 Teens (11-17 years) 0.11 Adult (17+ years) 0.71	LADTAP Default Values
6	Type of shoreline (Shore Width Factor)	Discharge into Lake Erie (0.3)	
7	Drinking Water Location	1609.3 meters	ER Table 2.3-39
8	Dilution Factor at Effluent Discharge Location	115 (minimum)	Minimum Blowdown Flow Rate divided by Effluent Discharge Rate. It is conservative to use minimum blowdown flow rate. Refer to response to RAI HH5.4.1-1.
9	Dilution Factors and Transit Times	Refer to Response to RAI HH5.4.1-1	
10	Consumption and Usage Rates	RG 1.109, Table E-5	RG 1.109, Table E-5

Input #	Input Description	Input Value	Bases
11	Sport Fish Catch	11.45E6 kg/yr	Determined based on fish harvest information in ER Section 2.4.2. (Assumes that all harvest is consumed within the 50 mile radius, each fish weighs three pounds and that 60% of each fish is edible.)
12	Commercial Fish Catch	2.07E6 kg/year	Determined based on fish harvest information in ER Section 2.4.2
13	Invertebrate Catch (Total for Sport and Commercial)	3.30E7 kg/yr	Refer to response to RAI HH5.4.1-2
20	Swimming, Boating, Shoreline Usage Factors	450,000 individuals RG 1.109, Table E-4	450,000 individuals represents 50% of the population within 50 mile radius that lives in sectors near the shore of Lake Erie. Usage factors (hours per year) are taken from RG 1.109, Table E-4.
21	Data for Irrigated Agricultural Production	N/A	ER Section 2.3.2
22	Liquid Source Terms	ESBWR DCD Table 12.2-19b	ESBWR DCD

Proposed COLA Revision

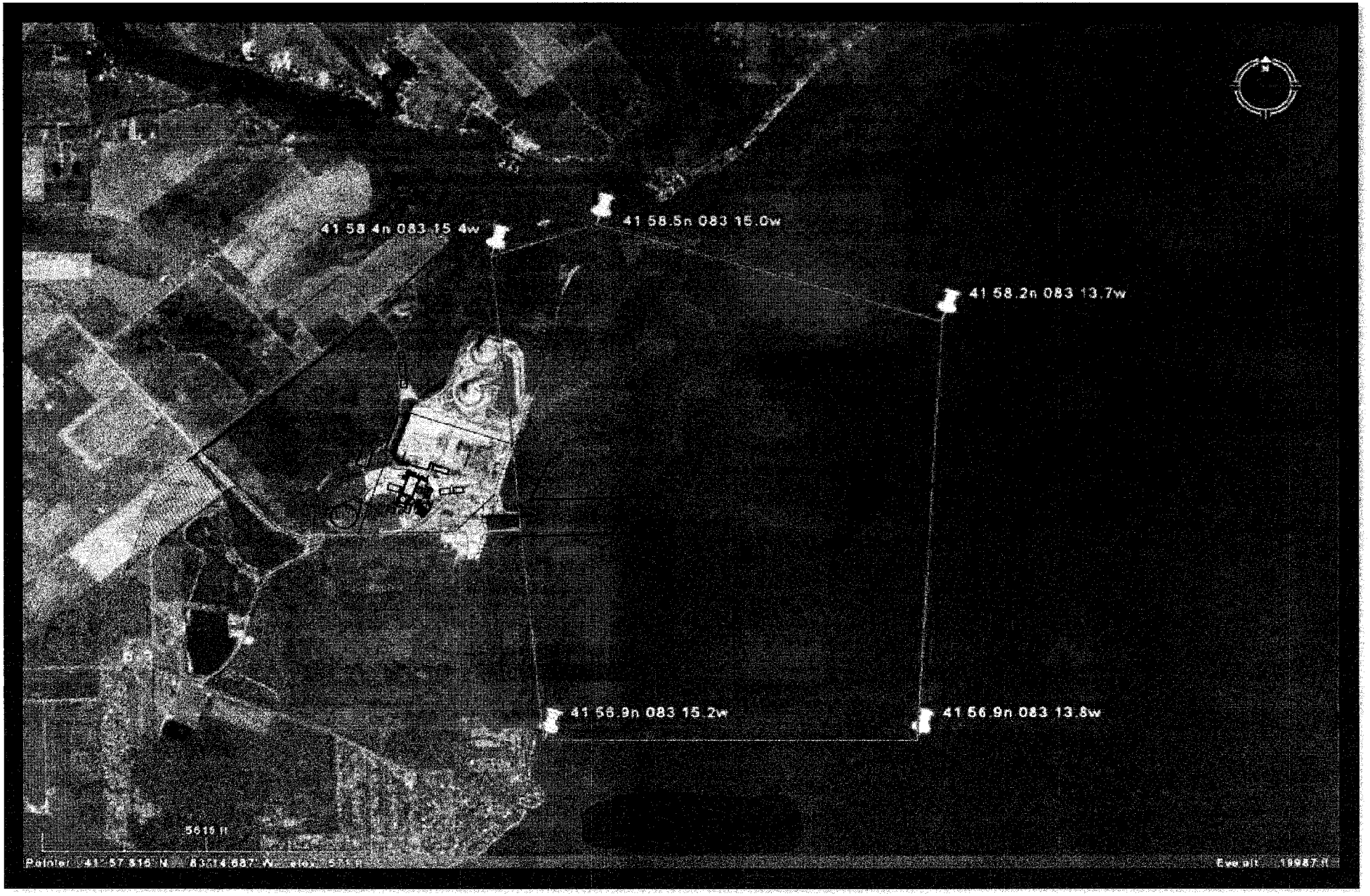
None

Enclosure 1
NRC3-09-0012

RAI Question 12.02-4(a)

Figure 1 – 33 CFR 165.915(a)(1) Boundaries
(following 1 page)

Figure #1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