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10 CFR 50.90
10 CFR 50.54(q)

TM-20-029

November 4, 2020

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

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Three Mile Island Nuclear Station, Unit 2
Possession Only License No. DPR-73
NRC Docket No. 50-320

Subject: Supplemental Information Regarding License Amendment Request - Proposed Changes to the Three Mile Island Emergency Plan and Emergency Action Level Scheme for the Permanently Defueled Condition

References:

1. Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission – "License Amendment Request - Proposed Changes to the Three Mile Island Emergency Plan for Permanently Defueled Emergency Plan and Emergency Action Level Scheme," dated July 1, 2019, TM-19-041 (Accession No. ML19182A182)
2. Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission – "Supplement to Request for Exemptions from Portions of 10 CFR 50.47 and 10 CFR Part 50, Appendix E and License Amendment Request for Proposed Changes to the Three Mile Island Emergency Plan for Permanently Defueled Emergency Plan and Emergency Action Level Scheme," dated October 9, 2019 (Accession No. ML19282C285)
3. Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission – "Response to Request for Additional Information Related to License Amendment Request for Proposed Changes to the Three Mile Island Nuclear Station Permanently Defueled Emergency Plan and Emergency Action Level Scheme," dated February 19, 2020 (Accession No. ML20050N441)

By letter dated July 1, 2019, as supplemented by letters dated October 19, 2019 and February 19, 2020 (References 1, 2 and 3, respectively), Exelon Generation Company, LLC (Exelon) submitted a License Amendment Request (LAR) for changes to the site emergency plan (SEP) for the Three Mile Island Nuclear Station (TMI). The proposed amendment would revise the SEP and Emergency Action Level (EAL) scheme for the permanently defueled condition.

During telephone conversations with the U.S. Nuclear Regulatory Commission (NRC) and Exelon on October 16, 2020 and October 23, 2020, Exelon discussed a recently identified discrepancy regarding the threshold values for Abnormal Radiation Levels / Radiological Effluents EALs [PD-RA1 and PD-RU1]. As discussed during those calls Exelon is providing supplemental information to correct the discrepancy in the identified EALs submitted in the LAR (Reference 1).

Exelon is providing information to supplement the LAR in Attachment 1 to this submittal. The changes submitted in Enclosures 5 and 6 to this letter supersede in their entirety the corresponding sections identified in the Reference 1, Attachments 3 and 4.

Exelon has reviewed the information supporting a finding of No Significant Hazards Consideration and the Environmental Consideration provided to the NRC in Reference 1. The additional information provided in this submittal does not affect the previously stated bases in Reference 1 for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

On October 29, 2020, Exelon provided the Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection (PDEP-BRP) a draft copy of this proposed supplement addressing the changes to the EALs PD-RA1 and PD-RU1 for comment. PDEP-BRP provided a letter dated October 30, 2020, stating they have reviewed the draft supplement and currently had no comments. Attachment 2 provides a copy of the referenced correspondence from the PDEP-BRP.

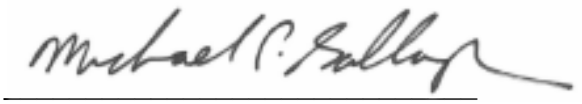
In accordance with 10 CFR 50.91, "Notice for public comment; State consultation," paragraph (b), Exelon is notifying the Commonwealth of Pennsylvania by transmitting a copy of this supplemental information to the designated State Official.

The enclosed changes have been reviewed by the Three Mile Island Safety Review Committee, in accordance with the requirements of the Exelon Decommissioning Quality Assurance Program.

If you have any questions concerning this submittal, please contact Leslie Holden at (630) 657-2524.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 4th day of November 2020.

Respectfully,



Michael P. Gallagher
Vice President, License Renewal & Decommissioning
Exelon Generation Company, LLC

Attachment 1: Supplemental Information Regarding License Amendment Request - Proposed Changes to the Three Mile Island Emergency Plan and Emergency Action Level Scheme for the Permanently Defueled Condition

- Enclosure 1: EP-EAL-0609, Revision 4, Criteria for Choosing Radiological Gaseous Effluent EAL Threshold Value, Three Mile Island Unit 1 (TMI-1)
- Enclosure 2: Three Mile Island Transmittal of Design Information # 5971-2020-009
- Enclosure 3: Marked-Up Pages for Attachment 3 of Original Submittal
- Enclosure 4: Marked-Up Pages for Attachment 4 of Original Submittal
- Enclosure 5: Clean Pages for Attachment 3 of Original Submittal
- Enclosure 6: Clean Pages for Attachment 4 of Original Submittal

Attachment 2: Correspondence from Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection

cc: w/Attachment

NRC Regional Administrator, Region I
NRC Project Manager, NRR – Three Mile Island Nuclear Station – Unit 1
NRC Project Manager, NMSS/DUWP/RDB – Three Mile Island – Units 1 & 2
Director, Bureau of Radiation Protection - PA Department of Environmental Protection

ATTACHMENT 1

SUPPLEMENTAL INFORMATION REGARDING LICENSE AMENDMENT REQUEST - PROPOSED CHANGES TO THE THREE MILE ISLAND EMERGENCY PLAN AND EMERGENCY ACTION LEVEL SCHEME FOR THE PERMANENTLY DEFUELED CONDITION

SUMMARY

By letter dated July 1, 2019, as supplemented by letters dated October 19, 2019 and February 19, 2020 (References A1, A2 and A3, respectively), Exelon Generation Company, LLC (Exelon) submitted a License Amendment Request (LAR) for changes to the site emergency plan (SEP) for the Three Mile Island Nuclear Station (TMI). The proposed amendment would revise the SEP and Emergency Action Level (EAL) scheme for the permanently defueled condition, herein referred to as the Post-Defueled Emergency Plan (PDEP).

During telephone conversations with the U.S. Nuclear Regulatory Commission (NRC) and Exelon on October 16, 2020 and October 23, 2020, Exelon discussed a recently identified a discrepancy regarding the threshold values for Abnormal Radiation Level / Radiological Effluents EALs PD-RA1 and PD-RU1. As discussed during those conversations Exelon is providing supplemental information to address the discrepancy in the identified EALs submitted in the LAR (Reference A1).

Specifically, EALs PD-RU1, Threshold 1, and PD-RA1, Threshold 2, as provided in the EAL matrices in Attachment 3 of Reference A1 are being revised as follows, where ~~strikeout~~ is used to represent deleted items and ***bold italics*** represent added items:

ALERT		UNUSUAL EVENT
Abnormal Rad Levels / Radiological Effluents		
Radiological Effluents	**PD-RA1** Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mRem TEDE or 50 mRem thyroid CDE. **Emergency Action Level (EAL):** **<…>** 1. Readings on **RM-A-8GH (Station Vent) >** ~~3.23 E+03~~ ***1.43E+03*** cpm for **≥ 15 minutes**. **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER**: a. **> 10 mRem TEDE** **OR** b. **> 50 mRem CDE Thyroid** **<…>** **OR** 4 Field survey results at or beyond the site boundary indicate **EITHER**: a. Gamma (closed window) dose rates **> 10 mR/hr** are expected to continue for **≥ 60 minutes** **OR** b. Analyses of field survey samples indicate **> 50 mRem CDE Thyroid** for **60 minutes** of inhalation.	**PD-RU1** Release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer. **Emergency Action Level (EAL):** **<…>** 1. Reading on discharge permit specified effluent monitors **> 2 times alarm setpoint** established by a current radioactive release discharge permit for **≥ 60 minutes**. **OR** 2. Readings on **RM-A-8G~~H~~ (Station Vent) >** ~~7.15 E+01~~ ***9.5 E+05*** cpm for **≥ 60 minutes**. **OR** 3. Confirmed sample analyses for gaseous or liquid releases indicates a concentration or release rates **> 2 times ODCM Limit** with a release duration of **≥ 60 minutes**.

BASIS FOR CHANGE

During an internal review, Exelon recently identified that the radiation monitoring threshold limits for RM-A-8GH (Vent Stack High Range Gas Monitor) presented in the PDEP EALs PD-RA1 and PD-RU1 contained a discrepancy, based on a change to the isotopic mix due to radioactive decay following the permanent shutdown of TMI, Unit 1 (TMI-1). The isotopic mix in a decommissioned facility significantly changes as fuel in the spent fuel pool decays. Most of the radioactive noble gases present during operation of the reactor have a short half-life (days) such that they no longer contribute to the isotopic mix after one year of decay. Krypton 85 (Kr-85), with a half-life of approximately 10.7 years is the major contributor in the post-shutdown isotopic mix. The EAL thresholds for PD-RA1 and PD-RU1 provided in Reference A1, were derived as provided in Exelon's calculation EP-EAL-0609, "Criteria for Choosing Radiological Gaseous Effluent EAL Threshold Values Three Mile Island, Unit 1" (Reference A4). The purpose of EP-EAL-0609 is to document the logic and assumptions used in choosing the EAL initiating conditions (threshold) values for gaseous effluent monitoring readings. Following identification of the discrepancy, EP-EAL-0609 was revised to reflect that Kr-85 would be sole contributor to the isotopic mix. EP-EAL-0609 is provided as Enclosure 1 of this Attachment.

The remaining gaseous release path at TMI-1 in decommissioning is through the Station Vent Stack which takes the common effluent of the Fuel Handling Building and Auxiliary Building ventilation systems. The exhaust stream is sampled through two isokinetic sample nozzles such that sample line flow velocity is equal to system flow velocity, preventing discrimination against various sized particles.

The sample flow is monitored by two radiation monitors, a low range gas monitor (RM-A-8G) and an extended high range gas monitor (RM-A-8GH).

- The low range monitor, RM-A-8G (Victoreen Model 843-20, Serial 110), is a beta scintillation detector, with a range of 10 to 1E+06 cpm. The instrument is calibrated to Xe-133 with a sensitivity of 3.96E+07CPM/uCi/cc and the monitor has a response rate for Kr-85 of 1.98.
- The high range monitor, RM-A-8GH (Victoreen Model 909660, Serial H0105), is a Geiger-Muller detector with a range of 10 to 1E+06 cpm. The instrument is calibrated to Xe-133 with a sensitivity of 1.08E+03CPM/uCi/cc and the monitor has a response rate for Kr-85 of 0.011.

During the review of the Victoreen Technical Manual it was recently discovered that there was no data for RM-A-8GH efficiency and sensitivity for Kr-85, and it was initially believed that RM-A-8GH would not be able to detect Kr-85. Plant procedures listed the Kr-85 response data for RM-A-8GH of 0.011 as calibrated to Xe-133 based on an original Battelle Calibration Report. This response factor has been used in historical calculations and provided the basis to show that the instrument can respond accurately for determination of the EAL "Alert" threshold (PD-RA1.1). The original vendor, Victoreen, was approached to provide an independent verification of the Kr-85 response value. Enclosure 2 provides the Three Mile Island Transmittal of Design Information # 5971-2020-009 from Victoreen, used to compare the instrument response factor for Kr-85 with reference response to Xe-133. This product was considered an order of magnitude comparison. Victoreen engineering provided an approximate response indicating that RM-A-8GH would respond to Kr-85 at approximately 0.68% (0.0068) of the Xe-133 efficiency, which supports continued use of historical instrument response value of 0.011.

As a result of the calculation revision to correct for the isotopic gas mix for the decommissioned facility, the "Alert" EAL threshold for the Station Vent is revised from 3.23E+03 cpm to 1.43E+03 cpm, as measured on RM-A-8GH. However, for the Notice of Unusual Event (NOUE) EAL threshold, RM-G-8GH cannot be used as the calculated threshold would be below the RM-A-8GH monitor background count of 35 cpm. Exelon proposes to use the RM-A-8G (low range gas monitor), in lieu of the RM-A-8GH. The

methodology for determination of gaseous monitor setpoints limits is provided in the Offsite Dose Calculation Manual (ODCM). ODCM methodology is applied to develop maximum setpoint limits that corresponds directly to the 500 mrem/yr whole body and/or 3000 mrem/yr skin dose limits for unrestricted areas, and that are based on a fixed noble gas isotopic mix and appropriately conservative effluent flowrate assumptions. The calculated EAL NOUE threshold value corresponding to two times the ODCM limit value is 5.43E+06 cpm, which is greater than the scale for RM-A-8G, so consistent with the guidance in NEI 99-01, "Development of Emergency Action Levels for Non-Passive Reactors," Revision 6 (Reference A5), the threshold value will be established at 95% of the full range of RM-A-8G (9.5E+05 cpm).

A review of Attachment 4 of the original submittal (Reference A1) was conducted. Attachment 4 was the comparison between the proposed EAL scheme with the industry EAL standard provided in NEI-99-01, Revision 6. Changing the values or monitors, as described above, constitutes adding plant-specific information and does not change the original conclusion that the proposed change is a difference and not a deviation.

Exelon is providing in the enclosures to this submittal the following revisions to the Reference A1 Attachments as follows:

- Enclosure 3: Marked-Up pages for Attachment 3, Three Mile Island Nuclear Station Permanently Defueled Emergency Action Levels and Bases Document, EP-TM-1001 Addendum 1 - pages 12, 18, 20 and 21;
- Enclosure 4: Marked-Up pages for Attachment 4, Three Mile Island Nuclear Station, Comparison Matrix for Permanently Defueled EALs Based on NEI 99-01, "Development of Emergency Action Levels for Non-Passive Reactors" - pages 8 of 29, 10 of 29, and page 12 of 29;
- Enclosure 5: Clean pages for Attachment 3, Three Mile Island Nuclear Station Permanently Defueled Emergency Action Levels and Bases Document, EP-TM-1001 Addendum 1 – replaced in its entirety; and
- Enclosure 6: Clean pages for Attachment 4, Three Mile Island Nuclear Station, Comparison Matrix for Permanently Defueled EALs Based on NEI 99-01, "Development of Emergency Action Levels for Non-Passive Reactors," Revision 6 — replaced in its entirety.

Exelon has reviewed the information supporting a finding of No Significant Hazards Consideration and the Environmental Consideration provided to the NRC in Reference A1 submittal. The additional information provided in this submittal does not affect the previously stated bases in Reference A1 for concluding that the proposed license amendment does not involve a significant hazards consideration. In addition, the information provided in this submittal does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

REFERENCES

A1. Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission – "License Amendment Request - Proposed Changes to the Three Mile Island Emergency Plan for Permanently Defueled Emergency Plan and Emergency Action Level Scheme," dated July 1, 2019, TM-19-041 (Accession No. ML19182A182)

A2. Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission – "Supplement to Request for Exemptions from Portions of 10 CFR 50.47 and 10 CFR Part 50, Appendix E and License Amendment Request for Proposed Changes to the Three Mile Island Emergency Plan for Permanently Defueled Emergency Plan and Emergency Action Level Scheme," dated October 9, 2019 (Accession No. ML19282C285)

A3. Letter from Michael P. Gallagher (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission – "Response to Request for Additional Information Related to License Amendment Request for Proposed Changes to the Three Mile Island Nuclear Station Permanently Defueled Emergency Plan and Emergency Action Level Scheme," dated February 19, 2020 (Accession No. ML20050N441)

A4. EP-EAL-0609, Revision 4, Criteria for Choosing Radiological Gaseous Effluent EAL Threshold Values Three Mile Island, Unit 1

A5. Nuclear Energy Institute (NEI) 99-01, Revision 6, "Development of Emergency Action Levels for Non-Passive Reactors," dated November 2012 (ADAMS Accession No. ML 12326A805)

ENCLOSURE 1:
EP-EAL-0609, REVISION 4, CRITERIA FOR CHOOSING RADIOLOGICAL GASEOUS EFFLUENT EAL THRESHOLD VALUE,
THREE MILE ISLAND UNIT 1 (TMI-1)
(47 pages)

Criteria for Choosing Radiological Gaseous Effluent EAL Threshold Values

Three Mile Island, Unit 1 (TMI-1)

Date: 10/23/2020

(Document ID #: EP-EAL-0609, Rev. 4)

Author:	Per attached e-mail	11/03/2020
	M. Robinson	**Date**
Reviewer:	Per attached e-mail	11/03/2020
	P. Holland	**Date**
Reviewer:	Per attached e-mail	11/03/2020
	T. Barton	**Date**
Third Party Reviewer:	Per attached e-mail	11/03/2020
	J. Cavanaugh	**Date**
Site EP Manager:	Per attached e-mail	11/03/2020
	Gamaliel Rodriguez	**Date**
Approval:	Per attached e-mail	11/03/2020
	J. L. Baker	**Date**

1. **Purpose**

   The purpose of this calculation is to determine the Unusual Event (UE) and Alert Table R-1 Emergency Action Level (EAL) thresholds for the Station Vent at Three Mile Island (TMI).

   Note that the calculations outlined in this document were performed using the spreadsheets documented in Attachments 8.k, 8.l and 8.m.

2. **Background**

   To support the implementation of NEI 99-01 Revision 6 methodology for development of EALs for Exelon stations, it was deemed beneficial to provide additional technical documentation describing the methodology for determining the Table R-1 Effluent Radiation Monitor Readings.

   The generic guidance provided in NEI 99-01, Revision 6, is not intended to be used by the plant "as is". The generic guidance is intended to give the logic for developing site specific IC/EALs (Section 5.3 of NEI 99-01). Plant Specific wording and values must be developed. If specific guidance provided in NEI 99-01 Revision 6 cannot be used as presented, documentation must be provided to show how Exelon Corporation implemented the intent of the guidance.

3. **Assumptions**

   a. *Unusual Event (UE) Threshold*

      i. Per Reference 7.a, the UE dose limit at or beyond the site boundary is equal to "2 times the site-specific effluent release controlling document limits" (see Attachment 8.a). In this case, the site-specific effluent release controlling document is the Offsite Dose Calculation Manual (ODCM) (Reference 7.b). Thus, the assumed UE dose rate limits used in this calculation are derived from the whole body and skin dose limits of 500 mrem/year and 3000 mrem/year from Reference 7.b, respectively. Therefore, making the UE dose rate limits 1000 mrem/year and 6000 mrem/year, respectively.

      ii. To remain consistent with Reference 7.a and Assumption 3.a.i, Equation 5.1.1.1 of Reference 7.b was used in determining the EAL threshold based on whole body dose and Equation 5.1.1.2 was used in determining the EAL threshold based on skin dose.

      iii. Also, to remain consistent with Reference 7.b, only noble gases were assumed in the source term.

      iv. Spent fuel core inventories were taken from Table 1-1 of NUREG-1940 (Reference 7.c). Note that only the noble gases deemed important to

emergency response, listed in Table 2.2 of NUREG-1228 (Reference 7.d), were used in this calculation.

v. Isotopic half-lives used in this calculation were taken from Reference 7.h.

vi. This calculation assumes that one full core has been offloaded and now resides in the spent fuel pool.

vii. The Kr-85 Gamma Total Body Dose (K_i), Beta Skin Dose (L_i) and Gamma Air Dose (M_i) Factors of 1.61E+01 (mrem/yr)/(μCi/m^3), 1.34E+03 (mrem/yr)/(μCi/m^3), and 1.72E+01 (mrad/yr)/(μCi/m^3) from Table 4.3 of Reference 7.b are the assumed dose conversion factors used in this calculation.

viii. The highest sector annual average gaseous dispersion factor (X/Q at or beyond the unrestricted area boundary, 1.23E-06 s/m^3, listed in Table 4.4 of Reference 7.b is the assumed dispersion factor used in this calculation.

ix. A vent flowrate of 110,000 cfm (or 1.10E+05 cfm), taken from Reference 7.e, is assumed in this calculation.

x. Reference 7.e lists the Xe-133 sensitivity for the Low Range Vent Monitor (RM-A-8G) as 3.96E+07 cpm/(μCi/cc). Reference 7.f lists the RM-A-8G individual nuclide response factor for Kr-85 as 1.98. Thus, the isotopic response factor (or sensitivity) for Kr-85, which can be determined by multiplying the Xe-133 sensitivity by the Kr-85 nuclide response factor, for the RM-A-8G monitor is 7.84E+07 cpm/(μCi/cc). Thus, 7.84E+07 cpm/(μCi/cc) is the assumed low range monitor (RM-A-8G) response factor used in this calculation.

xi. Reference 7.e lists the Xe-133 sensitivity for the High Range Vent Monitor (RM-A-8GH) as 1.08E+03 cpm/(μCi/cc). Reference 7.f lists the RM-A-8GH individual nuclide response factor for Kr-85 as 0.011. Thus, the isotopic response factor (or sensitivity) for Kr-85, which can be determined by multiplying the Xe-133 sensitivity by the Kr-85 nuclide response factor, for the RM-A-8GH monitor is 1.19E+01 cpm/(μCi/cc). Thus, 1.19E+01 cpm/(μCi/cc) is the assumed high range monitor (RM-A-8GH) response factor used in this calculation.

b. *Alert Threshold*

i. Per Reference 7.a, the Alert level dose limits at or beyond the site boundary are 10 mrem TEDE and 50 mrem CDE Thyroid. Thus, 10 mrem TEDE and 50 mrem CDE Thyroid are the assumed Alert level dose limits used in this calculation.

ii. Spent fuel core inventories were taken from Table 1-1 of NUREG-1940 (Reference 7.c). Note that only the isotopes deemed important to

emergency response, listed in Table 2.2 of NUREG-1228 (Reference 7.d), were used in this calculation.

iii. This calculation assumes the fuel in the Spent Fuel Pool is fully submerged.

iv. The Cold Gap Fuel Release Fractions from Table 2-1 of Reference 7.c are the assumed Fuel Pool Release fractions used in this calculation.

v. This calculation assumes any effluent released from the Spent Fuel Pool will pass through High Efficiency Particulate Air (HEPA) filters prior to reaching the environment. It also assumes the HEPA filters to be 99% efficient at filtering particulates. Thus, this calculation uses a Particulate Filtration Reduction Factor of 0.01.

vi. This calculation assumes that one full core has been offloaded and now resides in the spent fuel pool.

vii. A release duration of 1 hour is assumed in this calculation. Thus, based on the assumed release duration and Assumption 3.b.i, the Alert level dose rate limits used in this calculation are 10 mrem/hr TEDE and 50 mrem/hr CDE Thyroid, or 0.01 rem/hr and 0.05 rem/hr, respectively.

viii. The Kr-85 Dose Conversion Factor of 1.3E+00 rem/(μCi*cm^{-3}*hr), from Table 5-1 of Reference 7.g, is the assumed dose conversion factor used in this calculation. Note that the Alert level dose limits in Assumption 3.b.i are a fraction of the Protective Action Guidelines of 1 Rem TEDE and 5 Rem CDE Thyroid from Reference 7.g. Thus, it is appropriate to utilize a dose conversion factor from Reference 7.g in this document.

ix. The highest sector annual average gaseous dispersion factor (X/Q at or beyond the unrestricted area boundary, 1.23E-06 s/m^3, listed in Table 4.4 of Reference 7.b is the assumed dispersion factor used in this calculation.

x. A vent flowrate of 110,000 cfm (or 1.10E+05 cfm), taken from Reference 7.e, is assumed in this calculation.

xi. Reference 7.e lists the Xe-133 sensitivity for the Low Range Vent Monitor (RM-A-8G) as 3.96E+07 cpm/(μCi/cc). Reference 7.f lists the RM-A-8G individual nuclide response factor for Kr-85 as 1.98. Thus, the isotopic response factor (or sensitivity) for Kr-85, which can be determined by multiplying the Xe-133 sensitivity by the Kr-85 nuclide response factor, for the RM-A-8G monitor is 7.84E+07 cpm/(μCi/cc). Thus, 7.84E+07 cpm/(μCi/cc) is the assumed low range monitor (RM-A-8G) response factor used in this calculation.

xii. Reference 7.e lists the Xe-133 sensitivity for the High Range Vent Monitor (RM-A-8GH) as 1.08E+03 cpm/(μCi/cc). Reference 7.f lists the RM-A-8GH individual nuclide response factor for Kr-85 as 0.011. Thus, the isotopic response factor (or sensitivity) for Kr-85, which can be determined by

multiplying the Xe-133 sensitivity by the Kr-85 nuclide response factor, for the RM-A-8GH monitor is 1.19E+01 cpm/(μCi/cc). Thus, 1.19E+01 cpm/(μCi/cc) is the assumed high range monitor (RM-A-8GH) response factor used in this calculation.

xiii. Isotopic half-lives used in this calculation were taken from Reference 7.h.

4. **Unusual Event (UE) Threshold Discussion**

To determine the source term to be used in calculating the EAL threshold values based on whole body and skin dose, the isotopic core inventory from Assumption 3.a.iv was decay corrected 9,576 hours (from September 20th, 2019, the date TMI was permanently shut down, to October 23rd, 2020, the day this calculation was written). These decayed core inventories can be found in Table 4.1.

The fraction of each noble gas in the source term was then determined by dividing each noble gas's decayed inventory by the total decayed noble gas inventory. Note that this value was then multiplied by 100 to express this fraction as a percentage in Table 4.1 below.

Table 4.1 – Unusual Event Source Term Determination

Isotope	Half Life (hrs)	Isotopic Core Inventory from NUREG-1940 [Ci/MW_{th}]	Decayed Inventory [Ci/MW_{th}]	Fraction
Kr-85	94322.16	2.78E+02	2.59E+02	100%
Kr-85m	4.48	6.17E+03	0.00E+00	0%
Kr-87	1.27	1.23E+04	0.00E+00	0%
Kr-88	2.84	1.70E+04	0.00E+00	0%
Xe-131m	285.6	3.65E+02	2.94E-08	0%
Xe-133	125.832	5.43E+04	6.70E-19	0%
Xe-133m	52.56	1.72E+03	2.46E-52	0%
Xe-135	9.1	1.42E+04	0.00E+00	0%
Xe-138	0.5875	4.56E+04	0.00E+00	0%
Total	-	-	2.59E+02	100%

Based on the table above, the noble gas source term is now entirely comprised of Kr-85. As such, the UE EAL threshold calculations based on whole body and skin dose will both be calculated solely using Kr-85.

a. *UE EAL Threshold Based on Whole Body Dose*

The following is Equation 5.1.1.1 of Reference 7.b:

$$Dose\ Rate_{tb} = \sum_i K_i * D_v * Q_i \qquad \text{Eq. 1}$$

Where:

$Dose\ Rate_{tb}$ = instantaneous total body dose rate limit at the site boundary in mrem/year

K_i = Total body dose factor due to gamma emissions for noble gas i in (mrem/year)/(μCi/m³)

D_v = Highest sector annual average gaseous dispersion factor (X/Q) at or beyond the unrestricted area boundary in s/m³

Q_i = Release rate of noble gas i in μCi/s

The release rate from the station vent equating to the UE whole body dose rate limit from Assumption 3.a.i can be determined using the Gamma Total Body Dose Factor from Assumption 3.a.vii, the X/Q value from Assumption 3.a.viii and the UE whole body dose rate limit from Assumption 3.a.i. In doing so, Equation 1 from above becomes:

$$1000\ \frac{mrem}{yr} = \left(1.61E+01\ \frac{mrem/yr}{\mu Ci/m^3}\right) * \left(1.23E-06\ \frac{s}{m^3}\right) * Q_i \qquad \text{Eq. 2}$$

Solving for Q_i, the following value is obtained:

$$Q_i = 5.05E+07\ \frac{\mu Ci}{s} \qquad \text{Eq. 3}$$

In order to obtain the station vent monitor readings equating to the UE whole body dose rate limit, the concentration at the monitors must first be obtained using the following equation:

$$C = \frac{Q_i}{F*\left(472\frac{cc/s}{cfm}\right)} \qquad \text{Eq. 4}$$

Where:

C = the concentration of Kr-85 at the station vent monitors in μCi/cc

Q_i = the release rate of Kr-85 from the station vent (calculated in Equations 2 and 3) in μCi/s

F = the station vent flowrate in cfm

472 = conversion factor from cfm to cc/s

Using the flowrate from Assumption 3.a.ix and the release rate calculated in Equations 2 and 3, Equation 4 becomes:

$$C = \frac{5.05E+07\ \frac{\mu Ci}{s}}{(1.10E+05\ cfm)*\left(472\frac{cc/s}{cfm}\right)} = 9.73E-01\ \frac{\mu Ci}{cc} \qquad \text{Eq. 5}$$

The Low Range Monitor (RM-A-8G) response can be determined using the concentration calculated above and the Kr-85 monitor response factor for the Low Range Monitor from Assumption 3.a.x.

$$MR_{Lo} = C * RF_{Lo} \qquad \text{Eq. 6}$$

$$MR_{Lo} = \left(9.73E-01\ \frac{\mu Ci}{cc}\right) * \left(7.84E+07\ \frac{cpm}{\mu Ci/_{cc}}\right) \qquad \text{Eq. 7}$$

$$MR_{Lo} = 7.63E+07\ cpm \qquad \text{Eq. 8}$$

Similarly, the High Range Monitor (RM-A-8GH) response can be determined using the concentration from Equation 5 and the Kr-85 monitor response factor from Assumption 3.a.xi.

$$MR_{Hi} = C * RF_{Hi} \qquad \text{Eq. 9}$$

$$MR_{Hi} = \left(9.73E-01\ \frac{\mu Ci}{cc}\right) * \left(1.19E+01\ \frac{cpm}{\mu Ci/_{cc}}\right) \qquad \text{Eq. 10}$$

$$MR_{Hi} = 1.16E+01\ cpm \qquad \text{Eq. 11}$$

b. *UE EAL Threshold Based on Skin Dose*

The following is Equation 5.1.1.2 of Reference 7.b:

$$Dose\ Rate_{sk} = \sum_i (L_i + 1.1M_i) * D_v * Q_i \qquad \text{Eq. 12}$$

Where:

$Dose\ Rate_{sk}$ = instantaneous skin dose rate limit at the site boundary in mrem/year

L_i = Skin dose factor due to beta emissions for noble gas i in (mrem/year)/(µCi/m^3)

1.1 = Conversion factor from air dose to skin dose in mrem/mrad

M_i = Air dose factor due to gamma emissions for noble gas i in (mrad/year)/(µCi/m^3)

D_v = Highest sector annual average gaseous dispersion factor (X/Q) at or beyond the unrestricted area boundary in s/m^3

Q_i = Release rate of noble gas i in µCi/s

Substituting the appropriate values from the assumptions listed in Section 4.a, above, Equation 12 becomes:

$$6000\ \frac{mrem}{yr} = \left(1.34E+03\ \frac{mrem/_{yr}}{\mu Ci/_{m^3}} + (1.1)\left(1.72E+01\frac{mrad/_{yr}}{\mu Ci/_{m^3}}\right)\right) * \left(1.23E-06\ \frac{s}{m^3}\right) * Q_i \quad \text{Eq. 13}$$

Solving for Q_i:

$$Q_i = 3.59E+06\ \frac{\mu Ci}{s} \quad \text{Eq. 14}$$

The concentration at the vent monitors can then be obtained using Equation 4, the release rate determined above and the station vent flowrate from Assumption 3.a.ix.

$$C = \frac{3.59E+06\ \frac{\mu Ci}{s}}{(1.10E+05\ cfm)*\left(472\frac{cc/_s}{cfm}\right)} = 6.91E-02\ \frac{\mu Ci}{cc} \quad \text{Eq. 15}$$

The Low Range Monitor (RM-A-8G) response can then be determined using the concentration calculated in Equation 15, the Kr-85 monitor response factor for the Low Range Monitor from Assumption 3.a.x and Equation 6, above.

$$MR_{Lo} = \left(6.91E-02\ \frac{\mu Ci}{cc}\right) * \left(7.84E+07\ \frac{cpm}{\mu Ci/_{cc}}\right) \quad \text{Eq. 16}$$

$$MR_{Lo} = 5.42E+06\ cpm \quad \text{Eq. 17}$$

Similarly, the High Range Monitor (RM-A-8GH) response can be determined using the concentration from Equation 15, the Kr-85 monitor response factor from Assumption 3.a.xi and Equation 9, above.

$$MR_{Hi} = \left(6.91E-02\ \frac{\mu Ci}{cc}\right) * \left(1.19E+01\ \frac{cpm}{\mu Ci/_{cc}}\right) \quad \text{Eq. 18}$$

$$MR_{Hi} = 8.21E-01\ cpm \quad \text{Eq. 19}$$

5. **Alert Threshold Discussion**

Though it is assumed that the spent fuel considered in the calculation is comprised of the isotopic spent fuel core inventories discussed in Assumption 3.b.ii, it is not assumed that these are the isotopic core inventories available for release to the environment. To determine the core inventories available for the release to the environment, one must consider the effects of spent fuel submersion, particulate filtration and radioactive decay. Thus, the isotopic fuel pool release fractions from Assumption 3.b.iv and isotopic particulate filtration reduction factors from Assumption 3.b.v were applied to the core inventories from Assumption 3.b.ii to obtain the isotopic inventories available for release prior to considering radioactive decay:

$$I_{Ai} = I_i * F_i * R_i \qquad \text{Eq. 20}$$

Where:

- I_{Ai} = Inventory of isotope i available for release from the station (without considering decay) in Ci/MW_{th}
- I_i = Spent fuel core inventory for isotope i from Assumption 3.b.ii in Ci/MW_{th}
- F_i = Fuel pool release fraction from Assumption 3.b.iv
- R_i = Particulate Filtration Reduction Factor from Assumption 3.b.v

As noted above, the isotopic inventories calculated using Equation 20 do not consider the effects of radioactive decay. Therefore, these isotopic inventories were then decay corrected 9,576 hours (from September 20th, 2019, the date TMI was permanently shut down, to October 23rd, 2020, the day this calculation was written). These decayed core inventories, as well as the values used and calculated in Equation 20, can be found in Attachment 8.h.

The fraction of each isotope in the source term was then determined by dividing each isotope's decayed inventory by the total decayed inventory. Note that this value was then multiplied by 100 to express this fraction as a percentage in Attachment 8.h.

As displayed in Attachment 8.h, the isotopic mix considered in the Alert EAL thresholds is comprised solely of Kr-85. Thus, the Alert EAL thresholds will be driven by the whole body, or TEDE, dose limits. Therefore, only the Alert EAL thresholds based on TEDE dose limits are calculated in this document.

The release rate from the station vent can now be determined using the following equation:

$$Q_i = \frac{D * 10^6 \frac{cm^3}{m^3}}{DCF * \frac{\chi}{Q}} \qquad \text{Eq. 21}$$

Where:

- Q_i = Release rate of Kr-85 i in µCi/s
- D = Alert level dose rate limit from Assumption 3.b.vii in rem/hr
- 10^6 = Conversion factor from m^3 to cm^3 in cm^3/m^3
- DCF = Kr-85 dose conversion factor from Assumption 3.b.viii in $rem/(\mu Ci*cm^{-3}*hr)$

X/Q = Highest sector annual average gaseous dispersion factor (X/Q) at or beyond the unrestricted area boundary from Assumption 3.b.iv in s/m^3

Note that the Alert level dose limit from Assumption 3.b.i is 1% of the 1 Rem TEDE Protective Action Guideline (PAG) from Reference 7.g. Thus, the selection of the dose conversion factor outlined in Assumption 3.b.viii, which was also taken from Reference 7.g, is appropriate. Also note that this assumption is acceptable per Reference 7.a and aligns the Alert threshold with both Reference 7.a and Reference 7.g.

Substituting the appropriate variable from Section 3.b above, Equation 21 becomes:

$$Q_i = \frac{\left(0.01\frac{rem}{hr}\right)*\left(10^6\frac{cm^3}{m^3}\right)}{\left(1.30E{+}00\frac{rem}{\mu Ci*cm^{-3}*hr}\right)*\left(1.23E{-}06\frac{s}{m^3}\right)} = 6.25E+09\ \frac{\mu Ci}{s} \qquad \text{Eq. 22}$$

The concentration at the vent monitors can then be obtained using Equation 4, the release rate determined above and the station vent flowrate from Assumption 3.b.x.

$$C = \frac{6.25E{+}09\frac{\mu Ci}{s}}{(1.10E{+}05\ cfm)*\left(472\frac{cc/s}{cfm}\right)} = 1.20E+02\ \frac{\mu Ci}{cc} \qquad \text{Eq. 23}$$

The Low Range Monitor (RM-A-8G) response can then be determined using the concentration calculated in Equation 23, the Kr-85 monitor response factor for the Low Range Monitor from Assumption 3.b.xi and Equation 6, above.

$$MR_{Lo} = \left(1.20E+02\ \frac{\mu Ci}{cc}\right) * \left(7.84E+07\ \frac{cpm}{\mu Ci/cc}\right) \qquad \text{Eq. 24}$$

$$MR_{Lo} = 9.44E+09\ cpm \qquad \text{Eq. 25}$$

Similarly, the High Range Monitor (RM-A-8GH) response can be determined using the concentration from Equation 23, the Kr-85 monitor response factor from Assumption 3.b.xii and Equation 9, above.

$$MR_{Hi} = \left(1.20E+02\ \frac{\mu Ci}{cc}\right) * \left(1.19E+01\ \frac{cpm}{\mu Ci/cc}\right) \qquad \text{Eq. 26}$$

$$MR_{Hi} = 1.43E+03\ cpm \qquad \text{Eq. 27}$$

6. **Conclusion**

From Section 4, it is clear to see that the UE EAL Threshold values correlating to the skin dose limits are more restrictive. Thus, the UE EAL Threshold values will be based on skin dose. However, per References 7.i and 7.j, the calculated value of 5.42E+06 cpm for the Low Range Monitor (RM-A-8G) is off-scale high and the calculated value of 8.21E-01 cpm for the High Range Monitor (RM-A-8GH) is off-scale low.

Reference 7.a provides the following guidance:

"It is recognized that the condition described by this IC may result in a radiological effluent value beyond the operating or display range of the installed effluent monitor. In those cases, EAL values should be determined within a margin sufficient to ensure that an accurate monitor reading is available. For example, an EAL monitor reading may be set at 90% to 95% of the highest accurate monitor reading."

As such, the UE EAL threshold value will be set to 95% of RM-A-8G's maximum detectable reading of 1.00E+06 cpm (per Reference 7.i). Thus, the UE EAL Threshold will be 9.50E+05 cpm using RM-A-8G, as documented in Table 6.1 below.

Section 5 calculates an Alert EAL threshold value of 9.44E+09 cpm on the low range monitor (RM-A-8G) and 1.43E+03 cpm on the high range monitor (RM-A-8GH). Per Reference 7.i, the value calculated in Section 5 for the low range monitor is outside of its detection capabilities. Thus, the high range monitor will be used to determine the Alert EAL threshold, as documented in Table 6.1 below.

Table 6.1 – EAL Threshold Summary

Threshold	Monitor Reading (cpm)	As Detected by
Unusual Event (UE)	9.50E+05	RM-A-8G
Alert	1.43E+03	RM-A-8GH

7. **References**
   a. NEI 99-01, Revision 6, *Development of Emergency Action Levels for Non-Passive Reactors*
   b. CY-TM-170-300, *Offsite Dose Calculation Manual (ODCM)*, Revision 6
   c. NUREG-1940, *RASCAL 4: Description of Models and Methods*, December 2012
   d. NUREG-1228, *Source Term Estimation During Incident Response to Severe Nuclear Power Plant Accidents*, October 1988
   e. 1101-2.1, *Radiation Monitoring System Setpoints*, Revision 88
   f. 6610-PLN-4200.02, *TMI Emergency Dose Calculation Manual (EDCM)*, Revision 14
   g. EPA-400-R-92-001, *Manual of Protective Action Guides and Protective Actions for Nuclear Incidents*
   h. *Nuclides and Isotopes – Chart of the Nuclides*, Seventeenth Edition
   i. EP-AA-120-F-08, PD-RU1
   j. EP-AA-120-F-08, PD-RA1

8. **Attachments**
   a. Pertinent Extracted Pages from NEI 99-01, Rev. 6

b. Pertinent Extracted Pages from CY-TM-170-300
c. Pertinent Extracted Pages from NUREG-1940
d. Pertinent Extracted Pages from NUREG-1228
e. Pertinent Extracted Pages from 1101-2.1
f. Pertinent Extracted Pages from 6610-PLN-4200.02
g. Pertinent Extracted Pages from EPA-400
h. Alert Threshold Source Term Determination
i. EP-AA-120-F-08, PD-RU1
j. EP-AA-120-F-08, PD-RA1
k. UE Threshold Based on Whole Body Dose
l. UE Threshold Based on Skin Dose
m. Alert Threshold Calculation

Attachment 8.a

Pertinent Extracted Pages from NEI 99-01, Rev. 6

Table PD-1: Recognition Category "PD" Initiating Condition Matrix

UNUSUAL EVENT	ALERT
PD-AU1 Release of gaseous or liquid radioactivity greater than 2 times the (site-specific effluent release controlling document) limits for 60 minutes or longer. *Op. Modes: Not Applicable*	**PD-AA1** Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mrem TEDE or 50 mrem thyroid CDE. *Op. Modes: Not Applicable*
PD-AU2 UNPLANNED rise in plant radiation levels. *Op. Modes: Not Applicable*	**PD-AA2** UNPLANNED rise in plant radiation levels that impedes plant access required to maintain spent fuel integrity. *Op. Modes: Not Applicable*
PD-SU1 UNPLANNED spent fuel pool temperature rise. *Op. Modes: Not Applicable*	
PD-HU1 Confirmed SECURITY CONDITION or threat. *Op. Modes: Not Applicable*	**PD-HA1** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat within 30 minutes. *Op. Modes: Not Applicable*
PD-HU2 Hazardous event affecting SAFETY SYSTEM equipment necessary for spent fuel cooling. *Op.* Modes*: Not Applicable*	
PD-HU3 Other conditions exist which in the judgment of the Emergency Director warrant declaration of a (NO)UE. *Op. Modes: Not Applicable*	**PD-HA3** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an Alert. *Op. Modes: Not Applicable*

Table intended for use by EAL developers. Inclusion in licensee documents is not required.

For EAL #1 - Values in this EAL should be 2 times the setpoint established by the radioactivity discharge permit to warn of a release that is not in compliance with the specified limits. Indexing the value in this manner ensures consistency between the EAL and the setpoint established by a specific discharge permit.

Developers should research radiation monitor design documents or other information sources to ensure that 1) the EAL value being considered is within the usable response and display range of the instrument, and 2) there are no automatic features that may render the monitor reading invalid (e.g., an auto-purge feature triggered at a particular indication level).

It is recognized that the condition described by this IC may result in a radiological effluent value beyond the operating or display range of the installed effluent monitor. In those cases, EAL values should be determined with a margin sufficient to ensure that an accurate monitor reading is available. For example, an EAL monitor reading might be set at 90% to 95% of the highest accurate monitor reading. This provision notwithstanding, if the estimated/calculated monitor reading is greater than approximately 110% of the highest accurate monitor reading, then developers may choose not to include the monitor as an indication and identify an alternate EAL threshold.

Indications from a real-time dose projection system are not included in the generic EALs. Many licensees do not have this capability. For those that do, the capability may not be within the scope of the plant Technical Specifications. A licensee may request to include an EAL using real-time dose projection system results; approval will be considered on a case-by-case basis.

Indications from a perimeter monitoring system are not included in the generic EALs. Many licensees do not have this capability. For those that do, these monitors may not be controlled and maintained to the same level as plant equipment, or within the scope of the plant Technical Specifications. In addition, readings may be influenced by environmental or other factors. A licensee may request to include an EAL using a perimeter monitoring system; approval will be considered on a case-by-case basis.

ECL Assignment Attributes: 3.1.1.B

Attachment 8.b

Pertinent Extracted Pages from CY-TM-170-300

2.2.1.4 Liquid Holdup Tanks

CONTROL

The quantity of radioactive material contained in each of the following tanks shall be limited to less than or equal to 10 curies, excluding tritium and dissolved or entrained noble gases.

a. Outside temporary tank

APPLICABILITY: At all times.

ACTION:

a. With the quantity of radioactive material in any of the above listed tanks exceeding the above limit, immediately suspend all additions of radioactive material to the tank and within 48 hours reduce the tank contents to within the limit.

BASES

Restricting the quantity of radioactive material contained in the specified tanks provides assurance that in the event of an uncontrolled release of the tanks' contents, the resulting concentrations would be less than the limits of 10 CFR Part 20.1001-20-20.2401, Appendix B, Table 2, Column 2, at the nearest potable water supply and the nearest surface water supply in an unrestricted area.

2.2.2 Gaseous Effluent Controls

2.2.2.1 Gaseous Effluent Dose Rate

CONTROL:

The dose rate due to radioactive materials released in gaseous effluent from the site shall be limited to the following:

a. For noble gases: less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin, and

b. For I-131, I-133, tritium and all radionuclides in particulate form with half lives greater than 8 days: less than or equal to 1500 mrem/yr to any organ.

APPLICABILITY: At all times

TABLE 4.3
Dose Factors for Noble Gases and Daughters*

Radionuclide	Gamma Total Body Dose Factor(a) K_i (mrem/yr per $\mu Ci/m^3$)	Beta Skin Dose Factor(b) L_i (mrem/yr per $\mu Ci/m^3$)	Gamma Air Dose Factor M_i (mrad/yr per $\mu Ci/m^3$)	Beta Air Dose Factor N_i (mrad/yr per $\mu Ci/m^3$)
Kr-83m	7.56E-02**	---	1.93E+01	2.88E+02
Kr-85m	1.17E+03	1.46E+03	1.23E+03	1.97E+03
Kr-85	1.61E+01	1.34E+03	1.72E+01	1.95E+03
Kr-87	5.92E+03	9.73E+03	6.17E+03	1.03E+04
Kr-88	1.47E+04	2.37E+03	1.52E+04	2.93E+03
Kr-89	1.66E+04	1.01E+04	1.73E+04	1.06E+04
Kr-90	1.56E+04	7.29E+03	1.63E+04	7.83E+03
Xe-131m	9.15E+01	4.76E+02	1.56E+02	1.11E+03
Xe-133m	2.51E+02	9.94E+02	3.27E+02	1.48E+03
Xe-133	2.94E+02	3.06E+02	3.53E+02	1.05E+03
Xe-135m	3.12E+03	7.11E+02	3.36E+03	7.39E+02
Xe-135	1.81E+03	1.86E+03	1.92E+03	2.46E+03
Xe-137	1.42E+03	1.22E+04	1.51E+03	1.27E+04
Xe-138	8.83E+03	4.13E+03	9.21E+03	4.75E+03
Ar-41	8.84E+03	2.69E+03	9.30E+03	3.28E+03

* Dose factors are for immersion exposure in uniform semi-infinite cloud of noble gas radionuclides that may be detected in gaseous effluents. Dose factor values are taken from Regulatory Guide 1.109 (Rev. 1), Table B-1.

** 7.56E-02 = 7.56×10^{-2}.

(a) Total body dose factor for gamma penetration depth of 5 cm into the body.

(b) Skin dose factor at a tissue depth or tissue density thickness of 7 mg/cm^2.

TABLE 4.4
Atmospheric Dispersion Factors for Three Mile Island

STATION VENT — DISTANCE (IN METERS)

SECTOR AVERAGE X/Q (IN SEC/M3) — ANNUAL

SECTOR	610	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	2.12E-07	7.30E-07	4.35E-07	2.56E-07	1.84E-07	8.12E-08	3.22E-08	1.65E-08	1.07E-08	7.71E-09
NNE	3.19E-07	1.23E-06	6.02E-07	3.37E-07	2.13E-07	9.12E-08	3.45E-08	1.76E-08	1.14E-08	8.23E-09
NE	2.08E-07	3.87E-07	2.73E-07	3.76E-07	2.45E-07	1.08E-07	4.08E-08	2.08E-08	1.34E-08	9.68E-09
ENE	1.18E-07	4.36E-07	6.10E-07	3.33E-07	2.16E-07	1.08E-07	4.21E-08	2.14E-08	1.38E-08	9.96E-09
E	2.56E-07	3.80E-07	3.28E-07	3.74E-07	2.59E-07	1.11E-07	4.15E-08	2.10E-08	1.35E-08	9.70E-09
ESE	7.92E-07	5.47E-07	5.71E-07	3.47E-07	2.19E-07	9.24E-07	3.42E-08	1.72E-08	1.09E-08	7.85E-09
SE	9.50E-07	8.69E-07	6.06E-07	3.23E-07	2.06E-07	9.07E-08	3.72E-08	1.87E-08	1.20E-08	8.60E-09
SSE	4.82E-07	7.12E-07	5.00E-07	2.77E-07	1.85E-07	9.02E-08	3.38E-08	1.71E-08	1.10E-08	7.89E-09
S	8.33E-08	8.20E-08	3.05E-07	1.64E-07	1.06E-07	5.30E-08	1.99E-08	1.00E-08	6.41E-09	4.61E-09
SSW	2.61E-08	4.97E-08	2.38E-07	1.25E-07	7.96E-08	3.47E-08	1.37E-08	6.90E-09	4.42E-09	3.17E-09
SW	2.98E-08	1.78E-07	2.64E-07	1.46E-07	9.13E-08	3.92E-08	1.45E-08	7.24E-09	4.62E-09	3.31E-09
WSW	7.49E-08	4.55E-07	2.85E-07	1.51E-07	9.59E-08	4.05E-08	1.50E-08	7.51E-09	4.78E-09	3.43E-09
W	1.17E-07	2.80E-07	3.15E-07	1.82E-07	1.28E-07	6.02E-08	2.25E-08	1.14E-08	7.30E-09	5.26E-09
WNW	2.01E-07	2.70E-07	3.83E-07	2.67E-07	1.67E-07	7.13E-08	2.68E-08	1.36E-08	8.79E-09	6.35E-09
NW	1.48E-07	5.78E-07	3.83E-07	2.11E-07	1.37E-07	6.85E-08	2.66E-08	1.43E-08	9.25E-09	6.70E-09
NNW	9.13E-08	5.81E-07	3.54E-07	1.98E-07	1.34E-07	6.58E-08	2.52E-08	1.29E-08	8.33E-09	6.04E-09

STATION VENT — DISTANCE (IN METERS)

SECTOR AVERAGE D/Q (IN M2) — ANNUAL

SECTOR	610	2413	4022	5631	7240	12067	24135	40225	56315	72405
N	8.19E-09	1.62E-09	6.74E-10	4.88E-10	3.59E-10	1.29E-10	4.14E-11	1.72E-11	9.25E-12	5.75E-12
NNE	1.34E-08	2.84E-09	1.38E-09	6.89E-10	4.03E-10	1.42E-10	4.35E-11	1.78E-11	9.55E-12	5.93E-12
NE	7.28E-09	1.29E-09	4.55E-10	6.84E-10	4.03E-10	1.48E-10	4.55E-11	1.85E-11	9.95E-12	6.19E-12
ENE	3.69E-09	8.45E-10	7.16E-10	3.51E-10	2.19E-10	1.20E-10	3.95E-11	1.61E-11	8.68E-12	5.40E-12
E	8.16E-09	1.91E-09	7.04E-10	8.28E-10	5.35E-10	1.91E-10	5.87E-11	2.39E-11	1.30E-11	8.09E-12
ESE	2.48E-08	4.51E-09	2.47E-09	1.33E-09	7.69E-10	2.72E-10	8.33E-11	3.40E-11	1.84E-11	1.14E-11
SE	2.98E-08	4.85E-09	2.44E-09	1.14E-09	6.67E-10	2.55E-10	8.79E-11	3.57E-11	1.93E-11	1.20E-11
SSE	1.58E-08	2.51E-09	1.08E-09	5.97E-10	4.28E-10	1.94E-10	5.95E-11	2.45E-11	1.32E-11	8.20E-12
S	2.94E-09	6.13E-10	6.48E-10	3.08E-10	1.84E-10	8.81E-11	2.74E-11	1.13E-11	6.10E-12	3.79E-12
SSW	8.48E-10	2.80E-10	4.72E-10	2.20E-10	1.28E-10	4.72E-11	1.64E-11	6.68E-12	3.60E-12	2.24E-12
SW	1.51E-09	5.68E-10	5.89E-10	2.93E-10	1.67E-10	6.11E-11	1.87E-11	7.59E-12	4.09E-12	2.54E-12
WSW	2.58E-09	8.26E-10	6.63E-10	3.09E-10	1.83E-10	6.47E-11	1.99E-11	8.17E-12	4.40E-12	2.73E-12
W	5.46E-09	1.20E-09	6.34E-10	3.55E-10	2.64E-10	1.06E-10	3.28E-11	1.33E-11	7.16E-12	4.44E-12
WNW	7.60E-09	1.51E-09	8.91E-10	6.25E-10	3.57E-10	1.27E-10	3.87E-11	1.57E-11	8.46E-12	5.25E-12
NW	5.19E-09	1.02E-09	5.49E-10	2.64E-10	1.62E-10	8.34E-11	2.64E-11	1.14E-11	6.11E-12	3.79E-12
NNW	3.32E-09	7.92E-10	4.85E-10	2.32E-10	1.59E-10	7.50E-11	2.35E-11	9.63E-12	5.18E-12	3.22E-12

DATA FROM 2010 – 2015 USED IN CALCULATIONS

5.0 GASEOUS EFFLUENT DOSE ASSESSMENT

5.1 Gaseous Effluents - Instantaneous Release Limits

5.1.1 Noble Gases

For noble gases, the following equations apply for total body and skin dose rate at the unrestricted area boundary:

5.1.1.1 Total Body

$$\textbf{Dose Rate}_{tb} = \sum_{i} (K_i) \times (Dv) \times (Q_i) \qquad \text{(eq 5.1.1.1)}$$

Where:

Dose Rate b = instantaneous total body dose rate limit, at the site boundary, in mrem/yr.

K_i = total body dose factor due to gamma emissions for each identified noble gas radionuclide, in mrem/yr per $\mu Ci/m^3$ from Table 4.3.

Dv = highest sector annual average gaseous dispersion factor (X/Q) at or beyond the unrestricted area boundary, in sec/m^3, from Table 4.4 for station vent releases; and Table 4.5 for all other releases (Condenser Off Gas, ESF FHB, and ground releases). Maximum values presently in use are 1.23E-6 sec/m^3 at sector NNE for station vent, and 1.30E-5 sec/m^3 for all other releases at sector E.

Q_i = Release rate of radionuclide, i, in $\mu Ci/sec$ as determined by sampling and analysis. Calculated using the concentration of noble gas radionuclide, i, in $\mu Ci/cc$, times the release pathway flow rate, in cc/second.

5.1.1.2 Skin

$$\textbf{Dose Rate}_{sk} = \sum_{i} (L_i + 1.1\ M_i)\ X\ (Dv)\ X\ (Q_i) \qquad \text{(eq 5.1.1.2)}$$

Where:

Dose Rate_{sk} = instantaneous mrem/year skin dose rate limit, at the site boundary, in mrem/yr.

L_i = skin dose factor due to beta emissions for each identified noble gas radionuclide, in mrem/yr per $\mu Ci/m^3$ from Table 4.3.

M_i = air dose factor due to gamma emissions for each identified noble gas radionuclide, in mrad/yr per $\mu Ci/m^3$ from Table 4.3.

1.1 = mrem skin dose per mrad air dose. Converts air dose to skin dose.

Q_i = release rate of radionuclide, i, in $\mu Ci/sec$, as determined by sampling and analysis. Calculated using the concentration of noble gas radionuclide, i, in $\mu Ci/cc$, times the release pathway flow rate, in cc/second.

Dv = highest sector annual average gaseous dispersion factor (X/Q) at or beyond the unrestricted area boundary, in sec/m^3, from Table 4.4 for station vent releases; and Table 4.5 for all other releases (Condenser Off Gas, ESF FHB, and ground releases). Maximum values presently in use are 1.23E-6 sec/m^3 at sector NNE for station vent, and 1.30E-5 sec/m^3 for all other releases at E.

Attachment 8.c

Pertinent Extracted Pages from NUREG-1940

Table 1-1 Assumed Core Inventory during Operation for Low-Enriched Uranium Fuel

NUCLIDE	CORE INVENTORY (Ci/MWt)	NUCLIDE	CORE INVENTORY (Ci/MWt)	NUCLIDE	CORE INVENTORY (Ci/MWt)
Ba-139	4.74E+04	La-141	4.33E+04	Te-127	2.36E+03
Ba-140	4.76E+04	La-142	4.21E+04	Te-127m	3.97E+02
Ce-141	4.39E+04	Mo-99	5.30E+04	Te-129	8.26E+03
Ce-143	4.00E+04	Nb-95	4.50E+04	Te-129m	1.68E+03
Ce-144*	3.54E+04	Nd-147	1.75E+04	Te-131m	5.41E+03
Cm-242	1.12E+03	Np-239	5.69E+05	Te-132	3.81E+04
Cs-134	4.70E+03	Pr-143	3.96E+04	Xe-131m	3.65E+02
Cs-136	1.49E+03	Pu-241	4.26E+03	Xe-133	5.43E+04
Cs-137*	3.25E+03	Rb-86	5.29E+01	Xe-133m	1.72E+03
I-131	2.67E+04	Rh-105	2.81E+04	Xe-135	1.42E+04
I-132	3.88E+04	Ru-103	4.34E+04	Xe-135m	1.15E+04
I-133	5.42E+04	Ru-105	3.06E+04	Xe-138	4.56E+04
I-134	5.98E+04	Ru-106*	1.55E+04	Y-90	2.45E+03
I-135	5.18E+04	Sb-127	2.39E+03	Y-91	3.17E+04
Kr-83m	3.05E+03	Sb-129	8.68E+03	Y-92	3.26E+04
Kr-85	2.78E+02	Sr-89	2.41E+04	Y-93	2.52E+04
Kr-85m	6.17E+03	Sr-90	2.39E+03	Zr-95	4.44E+04
Kr-87	1.23E+04	Sr-91	3.01E+04	Zr-97*	4.23E+04
Kr-88	1.70E+04	Sr-92	3.24E+04		
La-140	4.91E+04	Tc-99m	4.37E+04		

RASCAL 4 adjusts the inventory of radionuclides that have half-lives that exceed 1 year to account for burnup. Equation 1-1 is used to calculate the inventory for the core-average burnup, I_{ACTUAL}, for nuclides with half-lives of more than 1 year. Inventories of nuclides with half-lives of less than 1 year are not adjusted for burnup because the activities for these nuclides are more closely related to reactor power than they are to burnup.

$$I_{ACTUAL} = \mathrm{I}_{38,585} \times \frac{\mathrm{BURNUP_{ACTUAL}}}{38{,}585\ \mathrm{MWd/MTU}} \tag{1-1}$$

If the user specifies the spent fuel involved in the accident in terms of "batches," RASCAL 4 calculates the batch inventories by dividing the core inventories by 3. (The code assumes that the batch is one-third of a core.)

The user must define how long ago the fuel was removed from the reactor. RASCAL 4 then calculates the inventories at the time of the accident by correcting the discharge inventory for radiological decay and ingrowth since the last irradiation. The code uses the methods described in Section 1.7 to calculate the decay and ingrowth.

2.3 Fractions of Inventory Available for Release in Spent Fuel Accidents

Table 2-1 shows the fractions of the radionuclide inventories that are available for release during an accident (AF_i).

Table 2-1 Fuel Release Fractions Used in Spent Fuel Accidents*

NUCLIDE GROUP	RELEASE FRACTIONS BY RELEASE TYPE		
	COLD GAP (immediate)	HOT GAP	CLAD BURNING (over 24 hours)
Noble gases (Xe, Kr)	0.4	0.4	1.0
Halogens (I, Br)	3E-3	3E-2	0.7
Alkali metal (Cs, Rb)	3E-3	3E-2	0.3
Tellurium group (Te, Sb, Se)	1E-4	1E-3	6E-3
Barium, strontium (Ba, Sr)	6E-7	6E-6	6E-4
Noble metals (Ru, Rh, Pd, Mo, Tc, Co)	6E-7	6E-6	6E-6
Cerium group (Ce, Pu, Np) and Lanthanides (La, Zr, Nd, Eu, Nb, Pm, Pr, Sm, Y, Cm, Am)	6E-7	6E-6	2E-6

*Source: The information in Table 2-1 is from Table 3.2 in NUREG/CR-6451, rounded to one significant figure. The zirconium clad burning release fractions are the geometric mean of the high and low fractions.

2.3.1 Spent Fuel Pool Water Drained

Spent fuel in a spent fuel pool must remain covered with water or otherwise cooled to remove decay heat, or the zirconium cladding may heat up and undergo rapid oxidation or "burning" that will propagate and eventually spread to all assemblies in the pool. Thus, the inventory I_i used to calculate the release is the entire inventory in the pool.

The user specifies the number of batches that are in the pool (the default is 10). In addition, the user specifies the date on which the most recent batch of spent fuel was last irradiated. By assuming a refueling interval of 1.5 years, RASCAL 4 can set the ages of each batch and apply a radiological decay correction to each one separately.

The calculated radionuclide release is not sensitive to the refueling time interval. Iodines and noble gases have essentially disappeared from all batches except possibly the last batch out of the reactor. For the older batches, the cesium-137 (Cs-137) is by far the most significant radionuclide, and it decays very

Attachment 8.d

Pertinent Extracted Pages from NUREG-1228

Table 2.2 Fission product inventories (Ci/MWe)

Fission product	Inventory (Ci/MWe)
Kr-85	560
Kr-85m	24,000
Kr-87	47,000
Kr-88	68,000
Sr-89	94,000
Sr-90	3,700
Sr-91	110,000
Y-91	120,000
Mo-99	160,000
Ru-103	110,000
Ru-106	25,000
Te-129m	5,300
Te-131m	13,000
Te-132	120,000
Sb-127	6,100
Sb-129	33,000
I-131	85,000
I-132	120,000
I-133	170,000
I-134	190,000
I-135	150,000
Xe-131m	1,000
Xe-133	170,000
Xe-133m	6,000
Xe-135	34,000
Xe-138	170,000
Cs-134	7,500
Cs-136	3,000
Cs-137	4,700
Ba-140	160,000
La-140	160,000
Ce-144	85,000
Np-239	1.64×10^6

Source: WASH-1400

gases will be included in the list of radionuclides to consider in source term estimation.

The importance of the various radioactive elements in terms of contribution to bone marrow dose can be seen in Figure 2.1. This figure shows the contribution assuming the most serious accident (e.g., BWR/PWR-1).

Attachment 8.e

Pertinent Extracted Pages from 1101-2.1

RM-A8 (Gas)

Location: Auxiliary and Fuel Handling Building Ventilation Duct

Sensitivity: 3.96E7 CPM/μCi/cc (based on Xe-133)

HIGH ALARM SETPOINT: 2E5 CPM

Basis: Equation 4.1.1, 4.1.2, in the Offsite Dose Calculation Manual (ODCM)

$$C_{TB} \leq \frac{500 \text{mrem/year}}{F * K * X/Q} \qquad C_{skin} \leq \frac{3000 \text{ mrem/year}}{[(L+1.1M) * X/Q * F]}$$

C_{TB} = Concentration limit based on whole body exposure

c_{skin} = Concentration limit based on skin exposure.

F = Effluent flow rate at monitor (cc/sec)

K = Total Body Dose factor (mrem-m^3/μCi-yr)

X/Q = Max. Annual Ave. dispersion factor for unrestricted area (sec/m^3)

L = Skin Beta Dose factor (mrem-m^3/μCi-yr)

M = Air Gamma Dose factor (mrem-m^3/μCi-yr)

500 = Annual Whole Body dose rate limit for unrestricted areas (mrem/yr)

3000 = Annual Skin dose rate limit for unrestricted areas (mrem/year)

F = 110,000 CFM = 5.19E7 cc/sec

K = 2.94E2

X/Q = 1.23E-6 ALSO USING FOR RM-A8 HIGH

L = 3.06E2

M = 3.53E2

$c_{TB} \leq$ 2.66E-2 μCi/cc $c_{skin} \leq$ 6.77E-2 μCi/cc

Therefore; C_{TB} = smallest concentration allowable based on whole body exposure.

55862

RM-A8 (Gas) High - Auxiliary and Fuel Handling Building Ventilation Exhaust Accident Monitor

Location: Inside RM-A8/RM-A9 Building. The detector is installed in the lead sampler of the radiation monitor RM-A8 (Gas).

Sensitivity: 1.08E3 CPM/μCi/cc

HIGH ALARM SETPOINT: 2000 CPM

ALERT SETPOINT: 70 CPM

References:
1. Battelle Calibration Report
2. TMI-1 Tech Spec.

SEE RM-A8 FOR FLOW RATE AND χ/Q

57862

Attachment 8.f

Pertinent Extracted Pages from 6610-PLN-4200.02

The I_n ' s for the various RMS detectors are listed as follows:
Individual Mixture Response Factors (I_n)

Nuclide	Scintillation Detectors RM-G-26 & 27 (Threshold set to exclude Xe-133 at 80 keV)	Ion Chamber RM-G-24 RM-G-25 (cal isotope is Kr-85)	GM Tubes RM-A-5Hi, RM-A-8Hi, RM-A-9Hi (cal isotope is Xe-133) (values for RM-A5Hi will be 4X, except for Xe-133)	Beta Scint. Detectors RM-A-2Lo, RM-A-4Lo RM-A-5Lo, RM-A-6Lo. RM-A-8Lo, RM-A-9Lo RM-A-15Lo, RM-A-14Lo (cal isotope is Xe-13o)
KR-85m	70.7	212.2	2.35	1.92
Kr-85	1.0	1.0	0.011	1.98
Kr-87	356	324.39	3.59	9.12
Kr-88	1160	334.15	3.70	2.78
Xe-131m	9.01	4.88	0.054	0.0
Xe-133m	18.6	35.15	0.378	0.0
Xe-133	0.0 (<80keV)	90.24	1.0	1.0
Xe-135m	193	195.12	2.16	0.0
Xe-135	111	221.95	2.54	2.59
Xe-138	1560	939.02	10.41	4.62
I-131	172	240	2.66	*
I-132	1030	747.8	8.286	*
I-133	274	219.51	2.432	*
I-134	1180	542.44	6.011	*
I-135m	706	341.46	3.784	*

The derivation of the values in this table was from normalized responses of the given detectors based on shielding code calculations, independent of geometry and shielding. The values were normalized to either Xe-133 or Kr-85 depending on the calibration gas.

A test with MicroShield was run by experts on 11/04/05. The information from the original Battelle Calibration Report, dated February 1983, was used in the MicroShield tests that showed close correlation (factor of 2X) to the values above. This indicates that the values were derived through a similar engineering code calculation, most likely IsoShield. Although the sources for the response functions above were not identified, the values do not appear unreasonable based on the MicroShield test.

Attachment 8.g

Pertinent Extracted Pages from EPA-400

Table 5-1 Dose Conversion Factors (DCF) and Derived Response Levels (DRL) for Combined[a] Exposure Pathways During the Early Phase of a Nuclear Incident[b]

Radionuclide	DCF rem per $\mu Ci \cdot cm^{-3} \cdot h$	DRL[c] $\mu Ci \cdot cm^{-3} \cdot h$
H-3	7.7E+01	1.3E-02
C-14	2.5E+03	4.0E-04
Na-22	1.9E+04	5.3E-05
Na-24	7.3E+03	1.4E-04
P-32	1.9E+04	5.4E-05
P-33	2.8E+03	3.6E-04
S-35	3.0E+03	3.4E-04
Cl-36	2.6E+04	3.8E-05
K-40	1.6E+04	6.5E-05
K-42	2.0E+03	5.1E-04
Ca-45	8.0E+03	1.3E-04
Sc-46	4.4E+04	2.3E-05
Ti-44	1.2E+06	8.2E-07
V-48	2.4E+04	4.2E-05
Cr-51	5.5E+02	1.8E-03
Mn-54	1.2E+04	8.5E-05
Mn-56	1.8E+03	5.7E-04
Fe-55	3.2E+03	3.1E-04
Fe-59	2.3E+04	4.4E-05
Co-58	1.7E+04	5.7E-05
Co-60	2.7E+05	3.7E-06
Ni-63	7.6E+03	1.3E-04
Cu-64	5.9E+02	1.7E-03
Zn-65	2.7E+04	3.7E-05
Ge-68	6.2E+04	1.6E-05
Se-75	1.2E+04	8.3E-05
Kr-85	1.3E+00	7.8E-01
Kr-85m	9.3E+01	1.1E-02
Kr-87	5.1E+02	2.0E-03
Kr-88	1.3E+03	7.8E-04

Attachment 8.h
Alert Threshold Source Term Determination

Isotope	Half Life (hrs)	Isotopic Core Inventory from NUREG-1940 [Ci/MW_{th}]	Fuel Pool Release Fraction	Particulate Filtration Reduction Factor	Inventory Available for Release [Ci/MW_{th}]	Decayed Inventory [Ci/MW_{th}]	Fraction
Kr-85	94322.16	2.78E+02	0.4	1	1.11E+02	1.04E+02	100%
Kr-85m	4.48	6.17E+03	0.4	1	2.47E+03	0.00E+00	0%
Kr-87	1.27	1.23E+04	0.4	1	4.92E+03	0.00E+00	0%
Kr-88	2.84	1.70E+04	0.4	1	6.80E+03	0.00E+00	0%
Xe-131m	285.6	3.65E+02	0.4	1	1.46E+02	1.18E-08	0%
Xe-133	125.832	5.43E+04	0.4	1	2.17E+04	2.68E-19	0%
Xe-133m	52.56	1.72E+03	0.4	1	6.88E+02	9.83E-53	0%
Xe-135	9.1	1.42E+04	0.4	1	5.68E+03	0.00E+00	0%
Xe-138	0.5875	4.56E+04	0.4	1	1.82E+04	0.00E+00	0%
I-131	192.552	2.67E+04	3.00E-03	1	8.01E+01	8.57E-14	0%
I-132	2.283	3.88E+04	3.00E-03	1	1.16E+02	0.00E+00	0%
I-133	20.8	5.42E+04	3.00E-03	1	1.63E+02	4.18E-137	0%
I-134	0.876667	5.98E+04	3.00E-03	1	1.79E+02	0.00E+00	0%
I-135	6.57	5.18E+04	3.00E-03	1	1.55E+02	0.00E+00	0%
Cs-134	18101.79	4.70E+03	3.00E-03	0.01	1.41E-01	9.77E-02	0%
Cs-136	314.4	1.49E+03	3.00E-03	0.01	4.47E-02	3.03E-11	0%
Cs-137	263593.6	3.25E+03	3.00E-03	0.01	9.75E-02	9.51E-02	0%
Sr-89	1214.64	2.41E+04	6.00E-07	0.01	1.45E-04	6.12E-07	0%
Sr-90	252460.8	2.39E+03	6.00E-07	0.01	1.43E-05	1.40E-05	0%
Sr-91	9.5	3.01E+04	6.00E-07	0.01	1.81E-04	6.58E-308	0%
Y-91	1404	3.17E+04	6.00E-07	0.01	1.90E-04	1.68E-06	0%
Mo-99	65.9424	5.30E+04	6.00E-07	0.01	3.18E-04	6.13E-48	0%
Ru-103	942.48	4.34E+04	6.00E-07	0.01	2.60E-04	2.28E-07	0%
Ru-106	8915.022	1.55E+04	6.00E-07	0.01	9.30E-05	4.42E-05	0%
Te-129m	806.4	1.68E+03	1.00E-04	0.01	1.68E-03	4.47E-07	0%
Te-131m	32.64	5.41E+03	1.00E-04	0.01	5.41E-03	2.61E-91	0%
Te-132	76.8	3.81E+04	1.00E-04	0.01	3.81E-02	1.11E-39	0%
Sb-127	92.16	2.39E+03	1.00E-04	0.01	2.39E-03	1.26E-34	0%
Sb-129	4.4	8.68E+03	1.00E-04	0.01	8.68E-03	0.00E+00	0%
Ba-140	306	4.76E+04	6.00E-07	0.01	2.86E-04	1.08E-13	0%
La-140	40.272	4.91E+04	6.00E-07	0.01	2.95E-04	7.75E-76	0%
Ce-144	6830.4	3.54E+04	6.00E-07	0.01	2.12E-04	8.04E-05	0%
Np-239	0.098167	5.69E+05	6.00E-07	0.01	3.41E-03	0.00E+00	0%
Total	-	-	-	-	-	1.04E+02	100%

EMERGENCY ACTION LEVEL (EAL) NUMERICAL CHANGE

This form shall be included as part of the 54q Evaluation documentation package for ALL Emergency Action Level numerical changes.

Station __Three Mile Island__

EAL Number: __PD-RU1_____ EAL Value: ___9.50 E+05 cpm____

Instrument Nomenclature / Number: __RM-A-8 LO__

Instrument Range: 1E+01 to 1E+06 cpm

Instrument / Range verified by: Gamaliel Rodriguez (Print) / per attached e-mail (Signature)

Source Documents: Vitcoreen Post Accident Radiation Monitoring System VM-TM-0223

TQ-TM-104-661, Radiation Monitoring System

Corporate Approval for use: T. Barton (Print) / per attached e-mail (Signature)

EMERGENCY ACTION LEVEL (EAL) NUMERICAL CHANGE

This form shall be included as part of the 54q Evaluation documentation package for ALL Emergency Action Level numerical changes.

Station __Three Mile Island__

EAL Number: __PD-RA1_____ EAL Value: ___1.43 E+03 cpm___

Instrument Nomenclature / Number: __RM-A-8 HI__

Instrument Range: 1E+01 to 1E+06 cpm

Instrument / Range verified by: Gamaliel Rodriguez (Print) / per attached e-mail (Signature)

Source Documents: Vitcoreen Post Accident Radiation Monitoring System VM-TM-0223

TQ-TM-104-661, Radiation Monitoring System

Corporate Approval for use: T. Barton (Print) / per attached e-mail (Signature)

Attachment 8.k
UE Threshold Based on Whole Body Dose

ODCM Dose Limit (mrem/year):	500
UE Dose Limit (mrem/year):	1000
Gamma Total Body Dose Factor [(mrem/yr)/(uCi/m^3)]:	1.61E+01
SB Concentration [uCi/m^3]:	6.21E+01
Highest Annual Average X/Q Value [sec/m^3]:	1.23E-06
Release Rate from Vent [uCi/s]:	5.05E+07
Vent Flowrate [cfm]:	1.10E+05
Vent Concentration [uCi/cc]:	9.73E-01
Xe-133 Sensitivity [cpm/(uCi/cc)]:	3.96E+07
Relative Response Fraction for Kr-85:	1.98
Isotopic Response Factor for Kr-85 [cpm/(uCi/cc)]:	7.84E+07
UE Threshold Value [cpm]:	7.63E+07

High Range Monitor	
Xe-133 Sensitivity [cpm/(uCi/cc)]:	1.08E+03
Relative Response Fraction for Kr-85:	0.011
Isotopic Response Factor for Kr-85 [cpm/(uCi/cc)]:	1.19E+01
UE Threshold Value [cpm]:	1.16E+01

Attachment 8.l
UE Threshold Based on Skin Dose

ODCM Dose Limit (mrem/year):	3000
UE Dose Limit (mrem/year):	6000
Beta Skin Dose Factor [(mrem/year)/(uCi/m^3)]:	1.34E+03
Gamma Air Dose Factor [(mrad/yr)/(uCi/m^3)]:	1.72E+01
Conversion Factor (mrem/mrad):	1.1
Total Effective Dose Conversion Factor [(mrem/year)/(uCi/m^3)]:	1.36E+03
SB Concentration [uCi/m^3]:	4.42E+00
Highest Annual Average X/Q Value [sec/m^3]:	1.23E-06
Release Rate from Vent [uCi/s]:	3.59E+06
Vent Flowrate [cfm]:	1.10E+05
Vent Concentration [uCi/cc]:	6.91E-02
Xe-133 Sensitivity [cpm/(uCi/cc)]:	3.96E+07
Relative Response Fraction for Kr-85:	1.98
Isotopic Response Factor for Kr-85 [cpm/(uCi/cc)]:	7.84E+07
UE Threshold Value [cpm]:	5.42E+06

High Range Monitor	
Xe-133 Sensitivity [cpm/(uCi/cc)]:	1.08E+03
Relative Response Fraction for Kr-85:	0.011
Isotopic Response Factor for Kr-85 [cpm/(uCi/cc)]:	1.19E+01
UE Threshold Value [cpm]:	8.21E-01

Attachment 8.m
Alert Threshold Calculation

Alert Dose Limit (mrem):	1.00E+01
Assumed Release Duration (hours):	1.00E+00
Alert Dose Rate Limit (mrem/hr):	1.00E+01
EPA-400 Table 5-1 Kr-85 Dose Conversion Factor [rem/(µCi*cm^{-3}*hr)]:	1.30E+00
SB Concentration [uCi/cm^3]:	7.69E-03
Highest Annual Average X/Q Value [sec/m^3]:	1.23E-06
Release Rate from Vent [uCi/s]:	6.25E+09
Vent Flowrate [cfm]:	1.10E+05
Vent Concentration [uCi/cc]:	1.20E+02
Xe-133 Sensitivity [cpm/(uCi/cc)]:	3.96E+07
Relative Response Fraction for Kr-85:	1.98
Isotopic Response Factor for Kr-85 [cpm/(uCi/cc)]:	7.84E+07
Alert Threshold Value [cpm]:	9.44E+09

<<< Low Range monitor is off-scale high, so need to perform conversion for High Range monitor. (see conversion to the right)

High Range Monitor	
Xe-133 Sensitivity [cpm/(uCi/cc)]:	1.08E+03
Relative Response Fraction for Kr-85:	0.011
Isotopic Response Factor for Kr-85 [cpm/(uCi/cc)]:	1.19E+01
Alert Threshold Value [cpm]:	1.43E+03

Robinson, Meagan M:(Exelon Nuclear)

From: Rodriguez Jr, Gamaliel J:(Exelon Nuclear)
Sent: Tuesday, November 3, 2020 1:36 PM
To: Robinson, Meagan M:(Exelon Nuclear)
Subject: I Approve both EP-AA-120-F-08, PD-RA1 and EP-AA-120-F-08, PD-RU1: EP-AA-120-F-08, PD-RA1 and EP-AA-120-F-08, PD-RU1 Review

Robinson, Meagan M:(Exelon Nuclear)

From: Barton, Timothy J.:(Exelon Nuclear)
Sent: Tuesday, November 3, 2020 12:02 PM
To: Robinson, Meagan M:(Exelon Nuclear)
Subject: I Approve both EP-AA-120-F-08, PD-RA1 and EP-AA-120-F-08, PD-RU1: EP-AA-120-F-08, PD-RA1 and EP-AA-120-F-08, PD-RU1 Review

Robinson, Meagan M:(Exelon Nuclear)

From: Robinson, Meagan M:(Exelon Nuclear)
Sent: Tuesday, November 3, 2020 12:30 PM
To: Robinson, Meagan M:(Exelon Nuclear)
Subject: I approve EP-EAL-0609: EP-EAL-0609 Review/Approval

Robinson, Meagan M:(Exelon Nuclear)

From: Holland, Paul E:(Exelon Nuclear)
Sent: Tuesday, November 3, 2020 12:36 PM
To: Robinson, Meagan M:(Exelon Nuclear)
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Robinson, Meagan M:(Exelon Nuclear)

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Robinson, Meagan M:(Exelon Nuclear)

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Robinson, Meagan M:(Exelon Nuclear)

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ENCLOSURE 2:
THREE MILE ISLAND TRANSMITTAL OF DESIGN INFORMATION
 # 5971-2020-009
(4 pages)

THREE MILE ISLAND
TRANSMITTAL OF DESIGN INFORMATION

☐ SAFETY RELATED ☒ AUGMENTED ☐ NON SAFETY RELATED	Originating Organization **TMI Engineering**	ID# 5971-2020-009 Revision **0** Page 1 of 4

To: **Fisher-Jones, Steve**
Engineering Manager
Fluke (Victoreen)

Subject: TMI-1 RM-A-8GHi (Geiger Mueller Channel) Kr-85 Sensitivity (approximate)

Steve Fisher-Jones	Steve Fisher-Jones	10/28/2020
Prepared by	Signature	Date
Hunter Browning-Smith	Hunter Browning-Smith	10/28/2020
Reviewed by	Signature	Date
Hunter Browning-Smith	Hunter Browning-Smith	10/28/2020
Approved by	Signature	Date

Status of Information:
☐ Verified
☐ Unverified
☒ Engineering Judgement

Action Tracking # for Method and Schedule of Verification for Unverified DESIGN INFORMATION : N/A

Description of Information:

Engineering Approximation of TMI Radiation Monitor RM-A-8G(High) Channel sensitivity to Noble Gas Kr-85 as compared to the Channel Sensitivity to Noble Gas Xe-133.

Measurement Equipment Description

a. Channel RM-A-8GHI is an off-line noble gas monitor with Victoreen 841-3 shielded noble gas sampler
    i. Active volume for sampled gas is a cylinder, 6.4 inch inner diameter, 7 inch deep
b. The detector is a Victoreen model 909660 beta-gamma detector with an Amperex 18550 or TGM N117 thin-walled GM tube.
    i. The Victoreen 909660 has no energy compensation foils but does have the GM tube covered with heat shrink material and inserted into a ½-inch diameter phenolic tube.
    ii. The phenolic tube specifications are estimated to be a phenolic paper X grade with specific gravity 1.36 (+/- 0.4).
    iii. The phenolic tube thickness is not specified on the drawing. 1/16" thick wall is typical, which results in a surface (areal) density of 216 mg/cm2.
        1. 1/32" thick is the thinnest that is typically available, which would have a surface (areal) density of 108 mg/cm2. If original calibrated were based on 1/32" design, then still none of the detection efficiency for Xe was based on betas, but Kr-85 would have some additional beta detection efficiency.

2. If original design were 3/32" or 1/8" thick tubes, original calibration for Xe included attenuated gammas, which Kr-85 having less gamma attenuation.

iv. The detector is inserted into the sampler by approximately 2-3 inches.

v. GM tubes give a fixed voltage spike for each count, regardless of whether caused by gamma or beta.

c. The detector is connected to a 99664 preamplifier, which will amplify the full discharge pulse from the GM tube to a fixed voltage pulse that the ratemeter will count.
   i. It plays no role in the energy response affecting the calibration.

d. The ratemeter is an 842-11 is set up with low level discriminator at 300 mV, and high level discriminator at 1.6 V.
   i. Ratemeter's measurement response is uniform for different energy gammas or betas that cause the GM tube to create a count.

Purpose of Information:

The purpose of the information provided and documented per this TODI is to be utilized to compare to instrument response factor for Kr-85 Noble Gas with reference response to Xe-133. Technical Manual data originally supplied from Victoreen did not provide the sensitivity of the instrument to Kr-85. This is considered to be an order of Magnitude comparison.

Approximated Kr-85 instrument response vs. Xe-133 response.

1. Measured Radiation
   a. Xe-133's significant decay radiation are specified in Reference (f):
      i. Significant gamma: 80.9979 (+/- 0.0011) keV photon with 36.9 % yield.
      ii. Significant beta: 346.4 (+/- 2.4) keV end point and 98.5 (+/- 1.3) % yield.
      iii. All betas: 100.3 (+/- 2.1) keV mean, 99.9 (+/- 1.4) % yield.
   b. Kr-85's significant decay radiation are specified in Reference (g):
      i. Significant gamma: 513.997 (+/- 0.005) keV with 0.434 % yield.
      ii. Significant beta: 687.0 (+/- 2.0) keV end point and 99.563 (+/- 0.010) % yield.
      iii. All betas: 250.70 (+/- 0.09) keV mean, 99.997 (+/- 0.014) % yield.
2. Analysis of Change in Channel's Measurement Efficiency
   a. Overall Approach
      i. The channel's measurement efficiency CPM/(uCi/cc) for Xe-133 is known and documented and not the subject of this analysis.
      ii. The channel's measurement efficiency fraction for Kr-85 relative to that for Xe-133 (EffKr/EffXe) will be computed based on the yield fraction ratio, the air transmission (within sampler gas volume) fraction ratio, the phenolic wall transmission fraction ratio and the GM detector response fraction ratio (which includes both wall penetration and probability to interact with the gas). The overall measurement response for gammas and betas (if any) will be summed.
   b. Detailed Analysis
      i. Measurement efficiency fraction for 514 keV gamma vs. 81 keV gamma
         1. Yield fraction ratio, Kr/Xe = 0.434% / 36.9% = 1.176%
         2. Air Transmission fraction ratio, Kr/Xe
            a. The maximum direct path distance in the sampler from any gas to reach the detector is 6 inches, though the typical distance contributing to the overall efficiency is approximately 3 inches.

b. Transmitted fraction in 6 inches of air at 81 keV (mass attenuation coefficient 1.662E-1 cm2/g per reference (h)) is 99.7%.
c. Transmitted fraction in 6 inches of air at 514 keV (mass attenuation coefficient 8.712E-2 cm2/g per reference (h)) is 99.8%.
d. Relative Transmitted fraction Kr/Xe is 100.1%.

3. Wall Transmission fraction ratio, Kr/Xe
   a. Transmitted fraction in 1/16 inches of phenolic (e.g. Bakelite) at 81 keV (mass attenuation coefficient 1.707E-1 cm2/g per reference (h)) is 96.4%.
   b. Transmitted fraction in 1/16 inches of phenolic (e.g. Bakelite) at 514 keV (mass attenuation coefficient 9.210E-2 cm2/g per reference (h)) is 98.0%.
   c. Relative Transmitted fraction Kr/Xe is 101.7%.
4. Detector Response fraction ratio, Kr/Xe
   a. The Amperex 18550 has a FeCr wall, with surface density of 36 +/-4 mg/cm2, Ne-A (halogen) fill gas {Reference (c), p. 10}. GM tube manufacturers provide a cross-reference tables that show that the Phillips/Amperex 18550, TGM Detectors N117-1/C1320, LND 713, Centronics ZP1320 and Mullard MX164 are equivalent to each other {Reference (a)}. LND 713 GM tube has stainless steel (Fe-Cr) wall, 30 mg/cm2, Ne-Halogen fill gas {Reference (d)}. LND 713 GM tube has gamma energy response shown in Reference (e), normalized to Cs-137 reference. Despite minor differences in construction and quench gas, Fluke considers the LND 713's energy response to be a conservative estimation of the energy response, especially since its less dense wall will increase low energy response where photoelectric deposition predominates.
   b. From reference (e), GM tube's measurement response relative for Xe-133's 81 keV gamma relative to that for Cs-137 gamma is 6.8 (+/-0.4).
   c. From reference (e), GM tube's measurement response relative for Kr-85's 514 keV gamma relative to that for Cs-137 gamma is 1.0 (+/- 0.05).
   d. Relative Detector Response Ratio Kr/Xe is 14.7%.
5. **Overall gamma measurement fraction Kr/Xe for 1/16" phenolic tube is 1.176% x 100.1% x 101.7% x 14.7% = 0.1762%, or 1 part in 568 parts.**
   a. Repeating calculation with 1/32" thick phenolic tube results in 0.1747%.
   b. Repeating calculation with 3/32" thick phenolic tube results in 0.1777%.
   c. Repeating calculation with 1/8" thick phenolic tube results in 0.1792%.

ii. Measurement efficiency fraction for 687 keV endpoint beta vs. 81 keV gamma
1. A similar calculation using beta attenuation parameters in NIST's ESTAR database was not found.

2. Kr beta's wall penetration of 0.2% (99.8% attenuation) was estimated for 1/32" thick phenolic case with 140 mg/cm2 total (108 mg/cm2 phenolic and 30 mg/cm2 for GM Tube using Reference (c) page 12.
    a. Phenolic thicknesses of 1/16" add additional 108 mg/cm2 to get 248 mg/cm2, where beta attenuation is much greater than 99.99%, so that the beta analysis results are negligible.
3. Xe 346 keV betas have no significant penetration of 1/32" phenolic (Reference (c) page 12), significantly less than Kr beta. Therefore, overall efficiency for Xe is effectively only due to the 81 keV gamma.
4. Yield fraction is 99.56% for Kr beta and 36.90% for Xe gamma.
5. Effective Volume % of Actual Volume is estimated at 90% for Kr beta and 105% for Xe gamma.
    a. Some detector probe structure shields betas compared to gammas
    b. Some of Xe gammas reflect off lead shield towards detector.
6. Air penetration % for Kr beta is estimated at 98%, while Xe gammas was previously calculated at 99.85%.
7. Wall penetration % for Kr beta was 0.2% (see above) while Xe gammas was 99.01% (see above).
8. Detector interaction % for Kr beta at attenuated energies is estimated to be 100% through coulomb slowing, while Xe gammas estimated at 90%.
9. Overall product of these % (steps 4-8 of this section) for Kr betas is 0.176% and for Xe gammas is 34.47%.
10. Ratio Kr betas / Xe gammas is 0.51%.
11. **If 1/32" thick phenolic, Kr response will be 0.1747% Kr gamma/Xe gamma + 0.51% Kr beta/Xe gamma, or 0.68% total ratio of Xe calibration factor.**

References:

a) LND Cross Reference Chart to Other Mfg. Products https://www.lndinc.com/product-category/geiger-mueller-tubes/cross-reference-chart-to-other-mfg-products/
b) Amperex Electron Tubes catalog, March 1963 http://elektronikjk.pl/elementy_czynne/lampy-katalogi/Electron_Tubes_Amperex.pdf
c) Amperex Scientific Products catalog, approx. 1973 http://www.r-type.org/pdfs/xp1114.pdf
d) LND 713 specifications, https://www.lndinc.com/products/geiger-mueller-tubes/713/
e) RG&E (R.E. Ginna) letter to NRC, June 6, 2003, with Photon Energy Response of "Thin-Walled" [LND] 713 GM Tube on page 8, https://www.nrc.gov/docs/ML0316/ML031690033.pdf
f) Xe-133, Decay Radiation Information, Dataset #2, https://www.nndc.bnl.gov/nudat2/decaysearchdirect.jsp?nuc=133XE&unc=nds
g) Kr-85, Decay Radiation Information, Dataset #3, https://www.nndc.bnl.gov/nudat2/decaysearchdirect.jsp?nuc=85KR&unc=nds
h) X-Ray Mass Attenuation Coefficients, NIST Standard Reference Database 126 https://physics.nist.gov/PhysRefData/XrayMassCoef/ComTab/air.html

ENCLOSURE 3:
MARKED-UP PAGES FOR ATTACHMENT 3 OF ORIGINAL SUBMITTAL
(4 pages)

Attachment 1 - EALs Matrices

ALERT	UNUSUAL EVENT
Abnormal Rad Levels / Radiological Effluents	
Radiological Effluents **PD-RA1** Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mRem TEDE or 50 mRem thyroid CDE. **Emergency Action Level (EAL):** **Notes:** • The Emergency Director should declare the ALERT promptly upon determining that the applicable time has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 15 minutes. • Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes. • The pre-calculated effluent monitor values presented in EAL #1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available. 1. Readings on **RM-A-8GH (Station Vent) > ~~3.23~~*1.43* E+03 cpm** for **≥ 15 minutes**. **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER**: a. **> 10 mRem TEDE** **OR** b. **> 50 mRem CDE Thyroid** **OR** 3. Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than **EITHER** of the following at or beyond the site boundary a. **10 mRem** TEDE for **60 minutes** of exposure **OR** b. **50 mRem** CDE Thyroid for **60 minutes** of exposure **OR** 4 Field survey results at or beyond the site boundary indicate **EITHER**: a. Gamma (closed window) dose rates **> 10 mR/hr** are expected to continue for **≥ 60 minutes** **OR** b. Analyses of field survey samples indicate **> 50 mRem CDE Thyroid** for **60 minutes** of inhalation.	**PD-RU1** Release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer. **Emergency Action Level (EAL):** **Notes:** • The Emergency Director should declare the UNUSUAL EVENT promptly upon determining that 60 minutes has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 60 minutes. • Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes. 1. Reading on discharge permit specified effluent monitors **> 2 times alarm setpoint** established by a current radioactive release discharge permit for **≥ 60 minutes**. **OR** 2. Readings on **RM-A-8G~~H~~ (Station Vent) > ~~7.15 E+01~~ *9.5 E+05* cpm** for **> 60 minutes**. **OR** 3. Confirmed sample analyses for gaseous or liquid releases indicates a concentration or release rates **> 2 times ODCM Limit** with a release duration of **≥ 60 minutes**.

PD-RA1

Initiating Condition:

Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mRem TEDE or 50 mRem thyroid CDE.

Emergency Action Level (EAL):

Notes:

- The Emergency Director should declare the ALERT promptly upon determining that the applicable time has been exceeded, or will likely be exceeded.
- If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 15 minutes.
- Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.
- The pre-calculated effluent monitor values presented in EAL #1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

1. Readings on **RM-A-8GH (Station Vent)** > ~~3.23~~***1.43*** **E+03 cpm** for **≥ 15 minutes**.

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER**:

   a. **> 10 mRem TEDE**

   OR

   b. **> 50 mRem CDE Thyroid**

   OR

3. Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than **EITHER** of the following at or beyond the site boundary

   a. **10 mRem** TEDE for **60 minutes** of exposure

   OR

   b. **50 mRem** CDE Thyroid for **60 minutes** of exposure

   OR

PD-RU1

Initiating Condition:

Release of gaseous or liquid radioactivity greater than 2 times the ODCM limits for 60 minutes or longer.

Emergency Action Level (EAL):

Notes:

- The Emergency Director should declare the UNUSUAL EVENT promptly upon determining that 60 minutes has been exceeded, or will likely be exceeded.
- If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 60 minutes.
- Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.

1. Reading on discharge permit specified monitor **> 2 times alarm setpoint** established by a current radioactive release discharge permit for **≥ 60 minutes:**

   OR

2. Readings on **RM-A-8G~~H~~** > ~~7.15 E+01~~ ***9.5 E+05*** **cpm** for **≥ 60 minutes**:

   OR

3. Confirmed sample analyses for gaseous or liquid releases indicate a concentration or release rates **> 2 times ODCM Limit** with a release duration of **≥ 60 minutes**.

Basis:

This IC addresses a potential decrease in the level of safety of the facility as indicated by a low-level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous or liquid radiological release, monitored or un-monitored, including those for which a radioactivity discharge permit is normally prepared.

PD-RU1 (cont)

TMI-1 incorporated design features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, and to control and monitor intentional releases. The occurrence of an extended, uncontrolled radioactive release to the environment is indicative of degradation in these features and/or controls.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of facility conditions alone. The inclusion of both facility condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

Releases should not be prorated or averaged. For example, a release exceeding 4 times release limits for 30 minutes does not meet the EAL.

EAL #1 addresses radioactivity releases that cause effluent radiation monitor readings to exceed 2 times the limit established by a radioactivity discharge permit. This EAL will typically be associated with planned batch releases from non-continuous release pathways (e.g., radwaste, waste gas).

The declaration criteria will be based on the monitor and monitor setpoints specified in the Discharge Permit.

EAL #2 addresses normally occurring continuous radioactivity releases from monitored gaseous effluent pathways. For the defueled condition the only remaining release path is through the Station Vent and is monitored by RM-A-8G~~H~~.

EAL #3 addresses uncontrolled gaseous or liquid releases that are detected by sample analyses or environmental surveys, particularly on unmonitored pathways (e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.).

Escalation of the emergency classification level would be via IC PD-RA1.

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-AU1
2. OP 1101-2.1 Radiation Monitoring System Setpoints
3. DSAR Section 4.4 Radiation Monitoring System
4. Offsite Dose Calculation (ODCM)
5. OP-TM-MAP-C0101, Radiation Level HI
6. EP-EAL-0609, Criteria for Choosing Radiological Gaseous Effluent EAL Threshold Values, Three Mile Island Unit-1 (TMI-1)

ENCLOSURE 4:
MARKED-UP PAGES FOR ATTACHMENT 4 OF ORIGINAL SUBMITTAL
(3 pages)

NEI99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
(1) Reading on **ANY** effluent radiation monitor greater than 2 times the alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer. (2) Sample analysis for a gaseous or liquid release indicates a concentration or release rate greater than 2 times the (site-specific effluent release controlling document) limits for 60 minutes or longer.	1. Reading on discharge permit specified monitor **> 2 times alarm setpoint** established by a current radioactive release discharge permit for **> 60 minutes**. **OR** 2. Readings on **RM-A-8G~~H~~ (Station Vent) > ~~7.15~~*9.5* E+~~01~~ *05* cpm** for **≥ 60 minutes**. **OR** 3. Confirmed sample analyses for gaseous or liquid releases indicates a concentration or release rates **> 2 times ODCM Limit** with a release duration of **≥ 60 minutes**.	☐ No Change ☒ Difference ☐ Deviation • Removed "radiation" from monitor notation. • EAL 1: Specified that the effluent monitors are the "discharge permit specified monitor." • EAL 1. Did not include list of site-specific effluent radiation monitors since they may change throughout decommissioning. Releases will be controlled through approved discharge permits which will specify monitors and monitor setpoints prior to release. • Added "OR" to reflect the EAL conditions that represent entry into the classification. • Added EAL 2 Station Vent monitor as the remaining permanently monitored effluent pathway to determine entry threshold. • EAL 3 renumbered (NEI 99-01 EAL 2) Provided additional provisions for using sample analysis results of a gaseous or liquid release as an action level.
Basis: This IC addresses a potential decrease in the level of safety of the plant as indicated by a low-level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous or liquid radiological release, monitored or un-monitored, including those for which a radioactivity discharge permit is normally prepared.	**TMI Basis:** This IC addresses a potential decrease in the level of safety of the facility as indicated by a low-level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous or liquid radiological release, monitored or un-monitored, including those for which a radioactivity discharge permit is normally prepared.	☐ No Change ☒ Difference ☐ Deviation • Added TMI-specific basis information. • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
EAL #2 - This EAL addresses uncontrolled gaseous or liquid releases that are detected by sample analyses or environmental surveys, particularly on unmonitored pathways (e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.). Escalation of the emergency classification level would be via IC PD-AA1.	The declaration criteria will be based on the monitor and monitor setpoints specified in the Discharge Permit. EAL #2 normally occurring continuous radioactivity releases from monitored gaseous effluent pathways. For the defueled condition the only remaining release path is through the Station Vent and is monitored by RM-A-8G~~H~~. EAL #3 addresses uncontrolled gaseous or liquid releases that are detected by sample analyses or environmental surveys, particularly on unmonitored pathways (e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.). Escalation of the emergency classification level would be via IC PD-RA1.	☐ No Change ☒ Difference ☐ Deviation • Added clarification that the EAL criteria are based on the setpoints in the Discharge permit which would signify a release above expected levels for that discharge. • List of site-specific effluent radiation monitors were not included since they may change throughout decommissioning. Releases will be controlled through approved discharge permits which will specify monitors and monitor setpoints prior to release. • Replaced "AA1" with "RA1" to better describe escalation pathway.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
(1) Reading on ANY of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site-specific monitor list and threshold values) (2) Dose assessment using actual meteorology indicates doses greater than 10 mrem TEDE or 50 mrem thyroid CDE at or beyond (site-specific dose receptor point). (3) Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than 10 mrem TEDE or 50 mrem thyroid CDE at or beyond (site-specific dose receptor point) for one hour of exposure. (4) Field survey results indicate **EITHER** of the following at or beyond (site-specific dose receptor point): • Closed window dose rates greater than 10 mR/hr expected to continue for 60 minutes or longer. • Analyses of field survey samples indicate thyroid CDE greater than 50 mrem for one hour of inhalation.	1. Readings on **RM-A-8GH (Station Vent) > ~~3.23~~*1.43* E+03 cpm** for **≥ 15 minutes**. **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER**: a. **> 10 mRem TEDE** **OR** b. **> 50 mRem CDE Thyroid** **OR** 3. Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than **EITHER** of the following at or beyond the site boundary a. **> 10 mRem TEDE** for **60 minutes** of exposure **OR** b. **> 50 mRem CDE** Thyroid for **60 minutes** of exposure **OR** 4. Field survey results at or beyond the site boundary indicate **EITHER**: a. Gamma (closed window) dose rates **> 10 mR/hr** are expected to continue for **≥ 60 minutes**. **OR** b. Analyses of field survey samples indicate **> 50 mRem CDE Thyroid** for **60 minutes** of inhalation.	☐ No Change ☒ Difference ☐ Deviation • Added appropriate installed radiation monitor. • Added "site boundary" as the site-specific dose receptor point. • Added "OR" to reflect the EAL conditions that represent entry into the classification.

ENCLOSURE 5:
CLEAN PAGES FOR ATTACHMENT 3 OF ORIGINAL SUBMITTAL
(38 pages)

EXELON GENERATION

THREE MILE ISLAND STATION
PERMANENTLY DEFUELED
EMERGENCY ACTION LEVELS
AND TECHNICAL BASES

REVISION HISTORY

Rev. 0,		

TABLE OF CONTENTS

1.0 PURPOSE

This document provides the detailed set of Emergency Action Levels (EALs) applicable to the Three Mile Island Nuclear Station (TMI) and the associated Technical Bases using the EAL development methodology found in NEI 99-01, "Development of Emergency Action Levels for Non-Passive Reactors," Revision 6 (NEI 99-01, Rev. 6). As a permanently defueled facility, TMI will use the Recognition Category "PD" (Permanently Defueled) to provide a site-specific emergency classification scheme including a set of Initiating Conditions (ICs) and EALs associated with the permanently defueled condition and a Recognition Category "E" IC/EAL for the Independent Spent Fuel Storage Installation (ISFSI). Permanently defueled station ICs and EALs are addressed in Appendix C of NEI 99-01, Rev. 6. All recommendations for changes to this document or associated implementing procedures are reviewed in accordance with 10 CFR 50.54(q).

This document should be used to facilitate review of the TMI EALs, provide historical documentation for future reference, and serve as a resource for training. Individuals responsible for the classification of events will refer to the ICs and EALs contained in the matrix of this document. They may use the information in the associated "Basis" and "Notes" sections as a reference in support of EAL interpretation. An EAL matrix may be provided as a user aid.

Emergency classifications are to be made as soon as conditions are present and recognizable for the classification in accordance with the applicable EALs; but within 30 minutes in all cases after the availability of indications to operators that an EAL threshold has been reached. Use of this document for assistance is not intended to delay the emergency classification.

2.0 DISCUSSION

2.1 Permanently Defueled Facility

NEI 99-01, Appendix C, Rev. 6, provides guidance for an emergency classification scheme applicable to a permanently defueled facility. This is a facility that generated spent fuel under a 10 CFR Part 50 license, has permanently ceased operations and will store the spent fuel onsite for an extended period of time. The emergency classification levels applicable to permanently defueled facility are consistent with the requirements of 10 CFR Part 50 and NUREG-0654/FEMA-REP-1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, Rev. 1" (NUREG-0654).

In order to relax the emergency plan requirements applicable to an operating station, the owner of a permanently defueled station must demonstrate that no credible event can result in a significant radiological release beyond the site boundary. Exelon has confirmed that the source term and motive force available in the permanently defueled condition are insufficient to warrant classifications of a Site Area Emergency or General Emergency.

Therefore, the generic ICs and EALs applicable to a permanently defueled facility may only result in either a Notification of UNUSUAL EVENT (UNUSUAL EVENT) or ALERT classification.

2.2 Independent Spent Fuel Storage Installation

Selected guidance in NEI 99-01, Rev. 6, is applicable to licensees electing to use their 10 CFR Part 50 emergency plan to fulfill the requirements of 10 CFR 72.32 for a stand-alone Independent Spent Fuel Storage Installation (ISFSI). The emergency classification levels applicable to an ISFSI are consistent with the requirements of 10 CFR Part 50. The initiating conditions germane to a 10 CFR 72.32 emergency plan (as described in NUREG-1567, "Spent Fuel Dry Storage Facilities") are subsumed within the classification scheme for a 10 CFR 50.47 emergency plan.

The analysis of potential onsite and offsite consequences of accidental releases associated with the operation of an ISFSI is contained in NUREG-1140, "A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees" (NUREG-1140). NUREG-1140 concluded that the postulated worst-case accident involving an ISFSI has insignificant consequences to public health and safety. This evaluation shows that the maximum offsite dose to a member of the public due to an accidental release of radioactive materials would not exceed 1 Rem Total Effective Dose Equivalent.

Regarding the above information, the expectations for an offsite response to an ALERT classified under a 10 CFR 72.32 emergency plan are generally consistent with those for an UNUSUAL EVENT in a 10 CFR 50.47 emergency plan (e.g., to provide assistance if requested). Also, the licensee's Emergency Response Organization (ERO) required for 10 CFR 72.32 emergency plan is different from that prescribed for a 10 CFR 50.47 emergency plan (e.g., there is no emergency technical support function required).

3.0 KEY TERMINOLOGY USED

There are several key terms that appear throughout the NEI 99-01, Rev. 6, methodology. These terms are introduced in this section to support understanding of subsequent material.

3.1 Emergency Classification Levels (ECLs)

One of a set of names or titles established by the U.S. Nuclear Regulatory Commission (NRC) for grouping off-normal events or conditions according to (1) potential or actual effects or consequences, and (2) resulting onsite and offsite response actions. The ECLs that remain applicable to TMI, in ascending order of severity, are:

3.1.1 UNUSUAL EVENT (UE)

Events are in progress or have occurred which indicate a potential degradation of the level of safety of the facility or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs.

Purpose: The purpose of this classification is to assure that the first step in future response has been carried out, to bring the operations staff to a state of readiness, and to provide systematic handling of UNUSUAL EVENT information and decision-making.

3.1.2 ALERT

Events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility or a security event that involves probable life-threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guides (PAG) exposure levels.

Purpose: The purpose of this classification is to assure that emergency personnel are readily available to respond if the situation becomes more serious or to perform confirmatory radiation monitoring, if required, and provide offsite authorities current information on facility status and parameters.

3.2 Initiating Condition (IC)

An event or condition that aligns with the definition of one of the two ECLs by virtue of the potential or actual effects or consequences.

Discussion: An IC describes an event or condition, the severity or consequences of which meets the definition of an ECL. An IC can be expressed as a continuous, measurable parameter (e.g., radiation monitor readings) or an event (e.g., an earthquake).

Appendix 1 of NUREG-0654 does not contain example EALs for each ECL, but rather ICs (i.e., conditions that indicate that a radiological emergency, or events that could lead to a radiological emergency, have occurred). NUREG-0654 states that the ICs form the basis for establishment by a licensee of the specific facility instrumentation readings (as applicable) which, if exceeded, would initiate the emergency classification. Thus, it is the specific instrument readings that would be the EALs.

3.3 Emergency Action Level (EAL)

A pre-determined, site-specific, observable threshold for an IC that, when met or exceeded, places the facility in a given ECL.

Discussion: EAL statements may utilize a variety of criteria including instrument readings and status indications, observable events, results of calculations and analyses, entry into particular procedures, and the occurrence of natural phenomena.

4.0 GUIDANCE ON MAKING EMERGENCY CLASSIFICATIONS

4.1 General Considerations

When making an emergency classification, the Emergency Director must consider all information having a bearing on the proper assessment of an IC. This includes the EAL plus Notes and the informing Basis information.

All emergency classification assessments should be based upon valid indications, reports or conditions. A valid indication, report, or condition is one that has been verified through appropriate means such that there is no doubt regarding the indicator's operability, the condition's existence, or the report's accuracy. For example, validation could be accomplished through an instrument channel check, response on related or redundant

indicators, or direct observation by personnel. The validation of indications should be completed in a manner that supports timely emergency declaration.

For ICs and EALs that have a stipulated time duration (e.g., 15 minutes, 60 minutes, etc.), the Emergency Director should not wait until the applicable time has elapsed but should declare the event as soon as it is determined that the condition has exceeded, or will likely exceed, the applicable time. If an ongoing radiological release is detected and the release start time is unknown, it should be assumed that the release duration specified in the IC/EAL has been exceeded, absent data to the contrary.

A planned work activity that results in an expected event or condition which meets or exceeds an EAL does not warrant an emergency declaration provided that 1) the activity proceeds as planned and 2) the facility remains within the limits imposed by the operating license. Such activities include planned work to test, manipulate, repair, maintain, or modify a system or component. In these cases, the controls associated with the planning, preparation, and execution of the work will ensure that compliance is maintained with all aspects of the operating license provided that the activity proceeds and concludes as expected. Events or conditions of this type may be subject to the reporting requirements of 10 CFR 50.72.

The assessment of some EALs is based on the results of analyses that are necessary to ascertain whether a specific EAL threshold has been exceeded (e.g., gaseous and liquid effluent sampling, etc.); the EAL and/or the associated basis discussion will identify the necessary analysis. In these cases, the declaration period starts with the availability of the analysis results that show the threshold to be exceeded (i.e., this is the time that the EAL information is first available).

While the EALs have been developed to address a full spectrum of possible events and conditions which may warrant emergency classification, a provision for classification based on operator/management experience and judgment is still necessary. The NEI 99-01, Rev. 6, scheme provides the Emergency Director with the ability to classify events and conditions based upon judgment using EALs that are consistent with the ECL definitions (refer to PD-HU3 and PD-HA3). The Emergency Director will need to determine if the effects or consequences of the event or condition reasonably meet or exceed a particular ECL definition.

4.2 Classification Methodology

To make an emergency classification, the user will compare an event or condition (i.e., the relevant facility indications and reports) to an EAL(s) and determine if the EAL has been met or exceeded. The evaluation of an EAL(s) must be consistent with the related Notes. If an EAL has been met or exceeded, then the IC is considered met and the associated ECL is declared in accordance with facility procedures.

When assessing an EAL that specifies a time duration for the off-normal condition, the EAL time duration runs concurrently with the emergency classification time duration.

4.3 Classification of Multiple Events and Conditions

When multiple emergency events or conditions are present, the user will identify all met or exceeded EALs. The highest applicable ECL identified during this review is declared. For example:

- If an UNUSUAL EVENT EAL and an ALERT EAL are met, an ALERT should be declared.

There is no "additive" effect from multiple EALs meeting the same ECL. For example:

- If two UNUSUAL EVENT EALs are met, an UNUSUAL EVENT should be declared.

Related guidance concerning classification of rapidly escalating events or conditions is provided in Regulatory Issue Summary (RIS) 2007-02, "Clarification of NRC Guidance for Emergency Notifications During Quickly Changing Events."

4.4 Classification of Imminent Conditions

Although EALs provide specific thresholds, the Emergency Director must remain alert to events or conditions that could lead to meeting or exceeding an EAL within a relatively short period of time (i.e., a change in the ECL is IMMINENT). If, in the judgment of the Emergency Director, meeting an EAL is IMMINENT, the emergency classification should be made as if the EAL has been met. While applicable to all ECLs, this approach is particularly important at the higher ECL since it provides additional time for implementation of protective measures.

4.5 Emergency Classification Level Upgrading and Termination

An ECL may be terminated when the event or condition that meets the IC and EAL no longer exists. Events will not be downgraded.

As noted above, guidance concerning classification of rapidly escalating events or conditions is provided in RIS 2007-02.

4.6 Classification of Short-Lived Events

Event-based ICs and EALs define a variety of specific occurrences that have potential or actual safety significance. By their nature, some of these events may be short-lived and, thus, over before the emergency classification assessment can be completed. If an event occurs that meets or exceeds an EAL, the associated ECL must be declared regardless of its continued presence at the time of declaration. Examples of such events would be an earthquake or explosion.

4.7 Classification of Transient Conditions

It is important to stress that the emergency classification assessment period is not a "grace period" during which a classification may be delayed to allow the performance of a corrective action that would obviate the need to classify the event; emergency classification assessments must be deliberate and timely, with no undue delays.

4.8 After-the-Fact Discovery of an Emergency Event or Condition

In some cases, an EAL may be met but the emergency classification was not made at the time of the event or condition. This situation can occur when personnel discover that an

event or condition existed which met an EAL, but no emergency was declared, and the event or condition no longer exists at the time of discovery. This may be due to the event or condition not being recognized at the time or an error that was made in the emergency classification process.

In these cases, no emergency declaration is warranted; however, the guidance contained in NUREG-1022, "Event Report Guidelines 10 CFR 50.72 and 50.73," is applicable. Specifically, the event should be reported to the NRC in accordance with 10 CFR 50.72 within one hour of the discovery of the undeclared event or condition. The licensee should also notify appropriate State and local agencies in accordance with the agreed upon arrangements.

4.9 Retraction of an Emergency Declaration

Guidance on the retraction of an emergency declaration reported to the NRC is discussed in NUREG-1022.

4.10 Response to a TMI-2 Emergency

TMI-2 alarms will be monitored on a 24-hour a day basis remotely from Unit 1 or by another appropriate location in the event of a failure of the remote monitoring system. For failures of specific local alarm capabilities, local conditions will be monitored in accordance with the applicable procedures.

A TMI-2 related emergency will be reported to the TMI-1 Control Room. TMI-1 Control Room personnel will assess and evaluate the situation; classify the event as required based on impact to TMI-1 and the site per the EALs; and provide the appropriate response. When direct monitoring is in effect the individual may leave the monitoring point in order to provide direct assistance to the TMI response team provided that he/she does not leave the monitoring point unattended in excess of one hour for any single event.

5.0 REFERENCES

5.1 Developmental

5.1.1 NEI 99-01 Revision 6, Development of Emergency Action Levels for Non-Passive Reactors, November 2012

5.1.2 10 CFR Part 50, Domestic Licensing of Production and Utilization Facilities

5.1.3 RIS 2007-02, Clarification of NRC Guidance for Emergency Notifications During Quickly Changing Events, February 2007

5.1.4 NUREG-1022, Event Reporting Guidelines 10 CFR 50.72 and 50.73

5.1.5 10 CFR 50.72, Immediate Notification Requirements for Operating Nuclear Power Reactors

5.1.6 NUREG-0654/FEMA-REP-1, Rev. 1, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants

5.1.7 10 CFR 72.32, Emergency Plan

5.1.8 NUREG-1567, Spent Fuel Dry Storage Facilities

5.1.9 10 CFR 50.47, Emergency Plans

5.1.10 NUREG-1140, A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licensees

5.1.11 NSIR/ISG-02, Interim Staff Guidance, Emergency Planning Exemption Requests for Decommissioning Nuclear Power Plants

5.2 Implementing

5.2.1 EP-TM-1001, Permanently Defueled Emergency Plan

5.2.2 EP-TM-1001, Addendum 1, Emergency Action Levels and Technical Bases

5.3 Commitments

None

6.0 ACRONYMS & DEFINITIONS

6.1 Acronyms

AOP ..... Abnormal Operating Procedure
CDE ..... Committed Dose Equivalent
CFR ..... Code of Federal Regulations
cpm ..... Counts per Minute
EAL ..... Emergency Action Level
ECL ..... Emergency Classification Level
EPA ..... Environmental Protection Agency
FAA ..... Federal Aviation Administration
FBI ..... Federal Bureau of Investigation
FEMA ..... Federal Emergency Management Agency
ISFSI ..... Independent Spent Fuel Storage Installation
IC..... Initiating Condition
mRem ..... milli-Roentgen Equivalent Man
NEI ..... Nuclear Energy Institute
NORAD ..... North American Aerospace Defense Command
NPP .....Nuclear Power Plant
NRC ..... Nuclear Regulatory Commission
ODCM ..... Off-site Dose Calculation Manual
PAG ..... Protective Action Guide
PD ..... Permanently Defueled
Rem ..... Roentgen Equivalent Man
TEDE ..... Total Effective Dose Equivalent
µCi/cc..... micro Curies per Cubic Centimeter
UFSAR/DSAR ..... Updated Final/Defueled Safety Analysis Report

6.2 Definitions

NOTE: Selected terms used in IC and EAL statements are set in all capital letters (e.g., ALL CAPS).

ALERT: Refer to Section 3.1.2.

CONFINEMENT BOUNDARY: The irradiated fuel dry storage cask barrier(s) between areas containing radioactive substances and the environment.

Emergency Action Level (EAL): Refer to Section 3.3.

Emergency Classification Level (ECL): Refer to Section 3.1.

Initiating Condition (IC): Refer to Section 3.2.

EXPLOSION: A rapid, violent and catastrophic failure of a piece of equipment due to combustion, chemical reaction or overpressurization. A release of steam (from high

energy lines or components) or an electrical component failure (caused by short circuits, grounding, arcing, etc.) should not automatically be considered an explosion. Such events may require a post-event inspection to determine if the attributes of an explosion are present.

FIRE: Combustion characterized by heat and light. Sources of smoke such as slipping drive belts or overheated electrical equipment do not constitute fire. Observation of flame is preferred but is NOT required if large quantities of smoke and heat are observed.

HOSTAGE: A person(s) held as leverage against the station to ensure that demands will be met by the station.

HOSTILE ACTION: An act toward a Nuclear Power Plant (NPP) or its personnel that includes the use of violent force to destroy equipment, take HOSTAGES, and/or intimidate the licensee to achieve an end. This includes attack by air, land, or water using guns, explosives, PROJECTILEs, vehicles, or other devices used to deliver destructive force. Other acts that satisfy the overall intent may be included. HOSTILE ACTION should not be construed to include acts of civil disobedience or felonious acts that are not part of a concerted attack on the NPP. Non-terrorism-based EALs should be used to address such activities (i.e., this may include violent acts between individuals in the owner controlled area).

HOSTILE FORCE: Any individuals who are engaged in a determined assault, overtly or by stealth and deception, equipped with suitable weapons capable of killing, maiming, or causing destruction.

IMMINENT: The trajectory of events or conditions is such that an EAL will be met within a relatively short period of time regardless of mitigation or corrective actions.

INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI): A complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage.

NORMAL LEVELS: As applied to radiological IC/EALs, the highest reading in the past twenty-four hours excluding the current peak value.

OWNER CONTROLLED AREA (OCA): The property associated with the station and owned by the company. Access is normally limited to persons entering for official business.

PROJECTILE: An object directed toward a NPP that could cause concern for its continued operability, reliability, or personnel safety.

PROTECTED AREA: An area that normally encompasses all controlled areas within the security protected area fence.

SECURITY CONDITION: Any Security Event as listed in the approved security contingency plan that constitutes a threat/compromise to site security, threat/risk to site personnel, or a potential degradation to the level of safety of the plant. A SECURITY CONDITION does not involve a HOSTILE ACTION.

UNPLANNED: A parameter change or an event that is not 1) the result of an intended evolution or 2) an expected plant response to a transient. The cause of the parameter change or event may be known or unknown.

UNUSUAL EVENT (UE): Refer to Section 3.1.1

VISIBLE DAMAGE: Damage to a component or structure that is readily observable without measurements, testing, or analysis. The visual impact of the damage is sufficient to cause concern regarding the operability or reliability of the affected component or structure.

7.0 ATTACHMENTS

Attachment 1: EAL Matrices

Attachment 2: EAL Bases

Attachment 1 - EALs Matrices

Table PD-1: Recognition Category "PD" Initiating Condition Matrix

UNUSUAL EVENT	ALERT
PD-RU1 Release of gaseous or liquid radioactivity greater than 2 times the ODCM limits for 60 minutes or longer.	**PD-RA1** Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mRem TEDE or 50 mRem thyroid CDE.
PD-RU2 UNPLANNED rise in facility radiation levels.	**PD-RA2** UNPLANNED rise in facility radiation levels that impedes facility access required to maintain spent fuel integrity.
PD-MU1 UNPLANNED spent fuel pool temperature rise.	
PD-HU1 Confirmed SECURITY CONDITION or threat.	**PD-HA1** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat within 30 minutes.
PD-HU2 Hazardous Event affecting equipment necessary for spent fuel cooling.	
PD-HU3 Other conditions exist which in the judgment of the Emergency Director warrant declaration of an UNUSUAL EVENT.	**PD-HA3** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an ALERT.

Table E-1: Recognition Category "E" Initiating Condition Matrix

UNUSUAL EVENT
E-HU1 Damage to a loaded cask CONFINEMENT BOUNDARY.

Attachment 1 - EALs Matrices

ALERT	UNUSUAL EVENT
Abnormal Rad Levels / Radiological Effluents	
Radiological Effluents **PD-RA1** Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mRem TEDE or 50 mRem thyroid CDE. **Emergency Action Level (EAL):** **Notes:** • The Emergency Director should declare the ALERT promptly upon determining that the applicable time has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 15 minutes. • Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes. • The pre-calculated effluent monitor values presented in EAL #1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available. 1. Readings on **RM-A-8GH (Station Vent) > 1.43 E+03 cpm** for **≥ 15 minutes**. **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER**: a. **> 10 mRem TEDE** **OR** b. **> 50 mRem CDE Thyroid** **OR** 3. Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than **EITHER** of the following at or beyond the site boundary a. **10 mRem** TEDE for **60 minutes** of exposure **OR** b. **50 mRem** CDE Thyroid for **60 minutes** of exposure **OR** 4 Field survey results at or beyond the site boundary indicate **EITHER**: a. Gamma (closed window) dose rates **> 10 mR/hr** are expected to continue for **≥ 60 minutes** **OR** b. Analyses of field survey samples indicate **> 50 mRem CDE Thyroid** for **60 minutes** of inhalation.	**PD-RU1** Release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limit for 60 minutes or longer. **Emergency Action Level (EAL):** **Notes:** • The Emergency Director should declare the UNUSUAL EVENT promptly upon determining that 60 minutes has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 60 minutes. • Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes. 1. Reading on discharge permit specified effluent monitors **> 2 times alarm setpoint** established by a current radioactive release discharge permit for **≥ 60 minutes**. **OR** 2. Readings on **RM-A-8G (Station Vent) > 9.5 E+05 cpm** for **≥ 60 minutes**. **OR** 3. Confirmed sample analyses for gaseous or liquid releases indicates a concentration or release rates **> 2 times ODCM Limit** with a release duration of **≥ 60 minutes**.

Attachment 1 - EALs Matrices

ALERT	UNUSUAL EVENT
Abnormal Rad Levels / Radiological Effluents	
Area Rad Levels **PD-RA2** UNPLANNED rise in facility radiation levels that impedes facility access required to maintain spent fuel integrity. **Emergency Action Level (EAL):** 1. UNPLANNED dose rate **> 15 mR/hr** in **ANY** of the following areas required for continuous occupancy to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity: • Control Room • Central Alarm Station (by survey) 2. UNPLANNED Area Radiation Monitor readings or survey results indicate a rise of **> 100 mR/hr** over NORMAL LEVELS that impedes access to **ANY** of the following areas needed to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity: • Fuel Handling Building Operating Floor • SFP Cooling Pump /Heat Exchanger Area • NSCCW Pump / Heat Exchanger Areas	**PD-RU2** UNPLANNED rise in facility radiation levels. **Emergency Action Level (EAL):** 1. a. UNPLANNED water level drop in the Spent Fuel Pool as indicated by **ANY** of the following: • Spent Fuel Pool water level **< 342' 6"** (**23.167'** on SF-LI-1219A/B) • Indication or report of an UNPLANNED drop in water level. **AND** b. UNPLANNED Area Radiation Monitor reading rise on **RM-G-9** FHB Bridge radiation monitor. **OR** 2. Area radiation monitor reading or survey result indicates an UNPLANNED rise of **25 mR/hr** over NORMAL LEVELS.

ALERT	UNUSUAL EVENT
System Malfunctions	
Spent Fuel Pool	**PD-MU1** UNPLANNED Spent Fuel Pool temperature rise. **Emergency Action Level (EAL):** 1. UNPLANNED Spent Fuel Pool temperature rise to **> 160°F**.

ALERT		UNUSUAL EVENT
Hazards and Other Conditions Affecting Facility Safety		
Security	**PD-HA1** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat within 30 minutes. **Emergency Action Level (EAL):** 1. A validated notification from NRC of an aircraft attack threat **< 30 minutes** from the site. **OR** 2. Notification by the Security Force that a HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA.	**PD-HU1** Confirmed SECURITY CONDITION or threat. **Emergency Action Level (EAL):** 1. Notification of a credible security threat directed at the site as determined per SY-AA-101-132, Security Assessment and Response to Unusual Activities. **OR** 2. A validated notification from the NRC providing information of an aircraft threat. **OR** 3. Notification by the Security Force of a SECURITY CONDITION that does **not** involve a HOSTILE ACTION.
Hazardous Event		**PD-HU2** Hazardous Event affecting equipment necessary for spent fuel cooling. **Emergency Action Level (EAL):** 1. a) The occurrence of **ANY** of the following hazardous events: • Seismic event (earthquake) • Internal or external flooding event • High winds or tornado strike • FIRE • EXPLOSION • Other events with similar hazard characteristics as determined by the Shift Manager **AND** b) The event has damaged at least one train of a system needed for Spent Fuel Cooling **AND** c) The damaged train(s) **cannot**, or potentially **cannot**, perform its design function based on **EITHER**: • Indications of degraded performance • VISIBLE DAMAGE

ALERT	UNUSUAL EVENT
Hazards and Other Conditions Affecting Facility Safety	
Emergency Director Judgment **PD-HA3** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an ALERT. **Emergency Action Level (EAL):** Other conditions exist which, in the judgment of the Emergency Director, indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility or a security event that involves probable life-threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.	**PD-HU3** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an UNUSUAL EVENT. **Emergency Action Level (EAL):** Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the facility or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of equipment required for spent fuel cooling occurs.

ALERT	UNUSUAL EVENT
ISFSI Malfunction	
ISFSI	**E-HU1** Damage to a loaded cask CONFINEMENT BOUNDARY. **Emergency Action Level (EAL):** Damage to a loaded cask CONFINEMENT BOUNDARY as indicated by a radiation reading **> 2 times** the ISFSI Technical Specification allowable levels.

Attachment 2 - EAL Bases

Recognition Category PD EAL Basis

Recognition Category PD provides a stand-alone set of ICs/EALs for a Permanently Defueled nuclear facility to consider for use in developing a site-specific emergency classification scheme. For development, it was assumed that the plant had operated under a 10 CFR Part 50 license and that the operating company has permanently ceased plant operations. Further, the company intends to store the spent fuel within the plant for some period of time.

When in a permanently defueled condition, the plant licensee typically receives approval from the NRC for exemption from specific emergency planning requirements. These exemptions reflect the lowered radiological source term and risks associated with spent fuel pool storage relative to reactor at-power operation. Source terms and accident analyses associated with plausible accidents are documented in the station's Final Safety Analysis Report (FSAR), as updated. As a result, each licensee will need to develop a site-specific emergency classification scheme using the NRC-approved exemptions, revised source terms, and revised accident analyses as documented in the station's FSAR.

Recognition Category PD uses the same ECLs as operating reactors; however, the source term and accident analyses limit the ECLs to an UNUSUAL EVENT and ALERT. The UNUSUAL EVENT ICs provide for an increased awareness of abnormal conditions while the ALERT ICs are specific to actual or potential impacts to spent fuel. The source terms and release motive forces associated with a permanently defueled facility would not be sufficient to require declaration of a Site Area Emergency or General Emergency.

A permanently defueled facility is essentially a spent fuel storage facility with the spent fuel stored in a pool of water that serves as both a cooling medium (i.e., removal of decay heat) and shield from direct radiation. These primary functions of the spent fuel storage pool are the focus of the Recognition Category PD ICs and EALs. Radiological effluent IC and EALs were included to provide a basis for classifying events that cannot be readily classified based on an observable events or facility conditions alone.

In NEI 99-01, Rev. 6, appropriate ICs and EALs from Recognition Categories A [R], C, F, H, and S [M] were modified and included in Recognition Category PD to address a spectrum of the events that may affect a spent fuel pool. The Recognition Category PD ICs and EALs reflect the relevant guidance in this document (e.g., the importance of avoiding both over-classification and under-classification). TMI has developed this emergency classification scheme using the NRC-approved exemptions, and site-specific source terms, and accident analyses. Security-related events are also included.

The following table, Table PD-1: Recognition Category "PD" Initiating Condition Matrix, provides a summary of initiating conditions associated with Recognition Category PD.

Recognition Category E EAL Basis

Recognition Category E provides an IC/EAL for an ISFSI. An ISFSI is a complex that is designed and constructed for the interim storage of spent nuclear fuel and other radioactive materials associated with spent fuel storage. A significant amount of the radioactive material contained within a cask must escape its packaging and enter the

atmosphere for there to be a significant environmental effect resulting from an accident involving the dry storage of spent nuclear fuel. Formal offsite planning is not required because the postulated worst-case accident involving an ISFSI has insignificant consequences to the public health and safety.

PD-RA1

Initiating Condition:

Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mRem TEDE or 50 mRem thyroid CDE.

Emergency Action Level (EAL):

Notes:

- The Emergency Director should declare the ALERT promptly upon determining that the applicable time has been exceeded, or will likely be exceeded.
- If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 15 minutes.
- Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.
- The pre-calculated effluent monitor values presented in EAL #1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.

1. Readings on **RM-A-8GH (Station Vent) > 1.43 E+03 cpm** for **≥ 15 minutes**.

   OR

2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER**:

   a. **> 10 mRem TEDE**

   OR

   b. **> 50 mRem CDE Thyroid**

   OR

3. Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than **EITHER** of the following at or beyond the site boundary

   a. **10 mRem** TEDE for **60 minutes** of exposure

   OR

   b. **50 mRem** CDE Thyroid for **60 minutes** of exposure

   OR

PD-RA1 (cont)

Emergency Action Level (EAL) (cont):

4. Field survey results at or beyond the site boundary indicate **EITHER**:

   a. Gamma (closed window) dose rates **> 10 mR/hr** are expected to continue for **≥ 60 minutes**

   OR

   b. Analyses of field survey samples indicate **> 50 mRem CDE Thyroid** for **60 minutes** of inhalation.

Basis:

This IC addresses a release of gaseous or liquid radioactivity that results in projected or actual offsite doses greater than or equal to 1% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude represent an actual or potential substantial degradation of the level of safety of the facility as indicated by a radiological release that significantly exceeds regulatory limits (e.g., a significant uncontrolled release).

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of facility conditions alone. The inclusion of both facility condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

The TEDE dose is set at 1% of the EPA PAG of 1000 mRem while the 50 mRem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-AA1
2. OP 1101-2.1 Radiation Monitoring System Setpoints
3. DSAR Section 4.4 Radiation Monitoring System
4. OP-TM-MAP-C0101, Radiation Level HI
5. EP-EAL-0609, Criteria for Choosing Radiological Gaseous Effluent EAL Threshold Values, Three Mile Island Unit-1 (TMI-1)
6. EP-EAL-0616, Three Mile Island Criteria for Choosing Radiological Liquid Effluent EAL Threshold Values

PD-RU1

Initiating Condition:

Release of gaseous or liquid radioactivity greater than 2 times the ODCM limits for 60 minutes or longer.

Emergency Action Level (EAL):

Notes:

- The Emergency Director should declare the UNUSUAL EVENT promptly upon determining that 60 minutes has been exceeded, or will likely be exceeded.
- If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 60 minutes.
- Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.

1. Reading on discharge permit specified monitor **> 2 times alarm setpoint** established by a current radioactive release discharge permit for **≥ 60 minutes:**

   OR

2. Readings on **RM-A-8G > 9.5 E+05 cpm** for **≥ 60 minutes**:

   OR

3. Confirmed sample analyses for gaseous or liquid releases indicate a concentration or release rates **> 2 times ODCM Limit** with a release duration of **≥ 60 minutes**.

Basis:

This IC addresses a potential decrease in the level of safety of the facility as indicated by a low-level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous or liquid radiological release, monitored or un-monitored, including those for which a radioactivity discharge permit is normally prepared.

PD-RU1 (cont)

TMI-1 incorporated design features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, and to control and monitor intentional releases. The occurrence of an extended, uncontrolled radioactive release to the environment is indicative of degradation in these features and/or controls.

Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of facility conditions alone. The inclusion of both facility condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions.

Releases should not be prorated or averaged. For example, a release exceeding 4 times release limits for 30 minutes does not meet the EAL.

EAL #1 addresses radioactivity releases that cause effluent radiation monitor readings to exceed 2 times the limit established by a radioactivity discharge permit. This EAL will typically be associated with planned batch releases from non-continuous release pathways (e.g., radwaste, waste gas).

The declaration criteria will be based on the monitor and monitor setpoints specified in the Discharge Permit.

EAL #2 addresses normally occurring continuous radioactivity releases from monitored gaseous effluent pathways. For the defueled condition the only remaining release path is through the Station Vent and is monitored by RM-A-8G.

EAL #3 addresses uncontrolled gaseous or liquid releases that are detected by sample analyses or environmental surveys, particularly on unmonitored pathways (e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.).

Escalation of the emergency classification level would be via IC PD-RA1.

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-AU1
2. OP 1101-2.1 Radiation Monitoring System Setpoints
3. DSAR Section 4.4 Radiation Monitoring System
4. Offsite Dose Calculation (ODCM)
5. OP-TM-MAP-C0101, Radiation Level HI
6. EP-EAL-0609, Criteria for Choosing Radiological Gaseous Effluent EAL Threshold Values, Three Mile Island Unit-1 (TMI-1)

PD-RA2

Initiating Condition:

UNPLANNED rise in facility radiation levels that impedes facility access required to maintain spent fuel integrity.

Emergency Action Level (EAL):

1. UNPLANNED dose rate **> 15 mR/hr** in **ANY** of the following areas required for continuous occupancy to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity:
    - Control Room
    - Central Alarm Station (by survey)

OR

2. UNPLANNED Area Radiation Monitor readings or survey results indicate a rise of **> 100 mR/hr** over NORMAL LEVELS that impedes access to **ANY** of the following areas needed to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity:
    - Fuel Handling Building Operating Floor
    - SFP Cooling Pump /Heat Exchanger Area
    - NSCCW Pump / Heat Exchanger Areas

Basis:

This IC addresses increased radiation levels that impede necessary access to areas containing equipment that must be operated manually or that requires local monitoring, in order to maintain systems needed to maintain spent fuel integrity. As used here, 'impede' includes hindering or interfering, provided that the interference or delay is sufficient to significantly threaten necessary facility access. It is this impaired access that results in the actual or potential substantial degradation of the level of safety of the facility.

This IC does not apply to anticipated temporary increases due to planned events.

This IC addresses elevated radiation levels in certain facility rooms/areas sufficient to preclude or impede personnel from performing actions necessary to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity. As such, it represents an actual or potential substantial degradation of the level of safety of the facility.

Assuming all facility equipment is operating as designed, normal operation is capable from the Control Room (CR). The areas listed in EAL #2 are facility areas that contain equipment which require a manual/local action necessary when moving fuel or manipulating SFP cooling equipment.

PD-RA2 (cont)

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-AA2

PD-RU2

Initiating Condition:

UNPLANNED rise in facility radiation levels.

Emergency Action Level (EAL):

1. a. UNPLANNED water level drop in the Spent Fuel Pool as indicated by **ANY** of the following:
   - Spent Fuel Pool water level **< 342' 6"** (**23.167'** on SF-LI-1219A/B)
   - Indication or report of an UNPLANNED drop in water level.

   AND

   b. UNPLANNED Area Radiation Monitor reading rise on **RM-G-9** FHB Bridge radiation monitor.

   OR

2. Area radiation monitor reading or survey result indicates an UNPLANNED rise of **25 mR/hr** over NORMAL LEVELS.

Basis:

This IC addresses a loss in water level above irradiated fuel sufficient to cause elevated radiation levels. This condition could be a precursor to a more serious event and is also indicative of a minor loss in the ability to control radiation levels within the facility. It is therefore a potential degradation in the level of safety of the facility

EAL #1 Basis:

A water level loss will be primarily determined by indications from available level instrumentation. Other sources of level indications may include reports from facility personnel (e.g., from a refueling crew) or video camera observations (if available) or from any other temporarily installed monitoring instrumentation. A significant drop in the water level may also cause a rise in the radiation levels of adjacent areas that can be detected by Spent Fuel Bridge Radiation monitor (RM-G-9).

Spent Fuel Pool (SFP) water level of 342'6" (mean sea level), is the entry condition for OP-TM-AOP-035, Loss of Spent Fuel Pool Cooling, and is lower than the SFP low level alarm at 343'6". The IC level corresponds to 23.167' above the top of fuel assemblies and is read on SF-LI-1219A/B.

The effects of planned evolutions should be considered. Note that EAL #1 is applicable only in cases where the elevated reading is due to an UNPLANNED water level drop.

EAL #2 Basis:

This excludes radiation level increases that result from planned activities such as use of radiographic sources and movement of radioactive waste materials.

Escalation of the emergency classification level would be via IC PD-RA1 OR PD-RA2.

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-AU2
2. OP-TM-AOP-035, “Loss of Spent Fuel Pool Cooling”
3. PLB, “Panel Left Annunciator B”, Alarms PLB-2-9 “Spent Fuel Pool A Level Low” and PLB-2-10 “Spent Fuel Pool B Level Low”
4. RP-AA-203 Exposure Control and Authorization
5. NRC Order EA-12-051
6. NEI 12-02

PD-MU1

Initiating Condition:

UNPLANNED spent fuel pool temperature rise.

Emergency Action Level (EAL):

1. UNPLANNED Spent Fuel Pool temperature rise to **> 160°F**.

Basis:

This IC addresses a condition that is a precursor to a more serious event and represents a potential degradation in the level of safety of the facility. If uncorrected, boiling in the pool will occur, and result in a loss of pool level and increased radiation levels.

Whenever irradiate fuel is stored in the spent fuel pool, the pool water temperature shall be maintained below 160°F (Reference 2). This is the entry point into OP-TM-AOP-035, Loss of Spent Fuel Pool Cooling. Operators will provide initial mitigation for a loss of SFP Cooling based on SFP high temperature alarm set at 130 °F. Based on Calculations in the Decom SFP Thermal Hydraulic Analysis (Reference 4) for a loss of SFP Cooling at 488 days after shutdown the heat up rate in the SFP would be approximately 1.35 °F/Hr. Using the Entry Condition for the Loss of Spent Fuel Pool Cooling Procedure as the EAL provides the precursor for additional action and still provides approximately 70 hours to mitigate before SFP boiling were to occur.

Escalation of the emergency classification level would be via PD-RA1 or PD-RA2.

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-SU1
2. OP-TM-AOP-035, Loss of Spent Fuel Pool Cooling
3. PLB, “Panel Left Annunciator B”, Alarms PLB-3-9 “Spent Fuel Pool A Hi Temp” and PLB-3-10 “Spent Fuel Pool B Hi Temp”
4. C-1101-202-E410-476, “DECOM Spent Fuel Pool TH Analysis - CMT 614944

PD-HA1

Initiating Condition:

HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat within 30 minutes.

Emergency Action Level (EAL):

1. A validated notification from NRC of an aircraft attack threat **< 30 minutes** from the site.

   OR

2. Notification by the Security Force that a HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA.

Basis:

This IC addresses the notification of an aircraft attack threat or an occurrence of a HOSTILE ACTION within the OWNER CONTROLLED AREA. This event will require rapid response and assistance due to the possibility of the attack progressing to the PROTECTED AREA, or the need to prepare the facility and staff for a potential aircraft impact.

Timely and accurate communications between Security Shift Supervision and the Control Room is essential for proper classification of a security-related event.

Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program]*.

As time and conditions allow, these events require a heightened state of readiness by the facility staff and implementation of onsite protective measures (e.g., evacuation, dispersal or sheltering). The ALERT declaration will also heighten the awareness of Offsite Response Organizations (ORO), allowing them to be better prepared should it be necessary to consider further actions.

This IC does not apply to incidents that are accidental events, acts of civil disobedience, or otherwise are not a HOSTILE ACTION perpetrated by a HOSTILE FORCE. Examples include the crash of a small aircraft, shots from hunters, physical disputes between employees, etc. Reporting of these types of events is adequately addressed by other EALs, or the requirements of 10 CFR § 73.71 or 10 CFR § 50.72.

PD-HA1 (cont)

Basis (cont):

EAL #1 Basis:

The EAL addresses the threat from the impact of an aircraft on the facility, and the anticipated arrival time is within 30 minutes. The intent of this EAL is to ensure that threat-related notifications are made in a timely manner so that facility personnel and OROs are in a heightened state of readiness. This EAL is met when the threat-related information has been validated in accordance with OP-TM-AOP-008, Security Threat/Intrusion.

The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of the plane may be provided by NORAD through the NRC.

In some cases, it may not be readily apparent if an aircraft impact within the OWNER CONTROLLED AREA was intentional (i.e., a HOSTILE ACTION). It is expected, although not certain, that notification by an appropriate Federal agency to the site would clarify this point. In this case, the appropriate federal agency is intended to be NORAD, FBI, FAA or NRC. The emergency declaration, including one based on other ICs/EALs, should not be unduly delayed while awaiting notification by a Federal agency.

EAL #2 Basis:

This EAL is applicable for any HOSTILE ACTION occurring, or that has occurred, in the OWNER CONTROLLED AREA. This includes any action directed against an ISFSI that is located outside the facility PROTECTED AREA.

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-HA1
2. Station Security Plan – Appendix C
3. OP-TM-AOP-008, Security Threat / Intrusion

PD-HU1

Initiating Condition:

Confirmed SECURITY CONDITION or threat.

Emergency Action Level (EAL):

1. Notification of a credible security threat directed at the site as determined per SY-AA-101-132, Security Assessment and Response to Unusual Activities.

   OR

2. A validated notification from the NRC providing information of an aircraft threat.

   OR

3. Notification by the Security Force of a SECURITY CONDITION that does **not** involve a HOSTILE ACTION.

Basis:

This IC addresses events that pose a threat to facility personnel or spent fuel cooling system equipment, and thus represent a potential degradation in the level of facility safety. Security events which do not meet one of these EALs are adequately addressed by the requirements of 10 CFR § 73.71 or 10 CFR § 50.72. Security events assessed as HOSTILE ACTIONS are classifiable under ICs PD-HA1.

Timely and accurate communications between Security Shift Supervision and the Control Room is essential for proper classification of a security-related event. Classification of these events will initiate appropriate threat-related notifications to facility personnel and OROs.

Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program]*.

EAL #1 Basis:

Addresses the receipt of a credible security threat. The credibility of the threat is assessed in accordance with SY-AA-101-132.

EAL #2 Basis:

Addresses the threat from the impact of an aircraft on the facility. The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of the plane may also be provided by NORAD through the NRC. Validation of the threat is performed in accordance with OP-TM-AOP-008, Security Threat/Intrusion.

PD-HU1 (cont)

Basis (cont):

EAL #3 Basis:

References Security Force because these are the individuals trained to confirm that a security event is occurring or has occurred. Training on security event confirmation and classification is controlled due to the nature of Safeguards and 10 CFR § 2.39 information.

Escalation of the emergency classification level would be via IC PD-HA1.

Basis Reference(s):

1. NEI 99-01 Rev 6, PD-HU1
2. Station Security Plan – Appendix C
3. OP-TM-AOP-008, Security Threat / Intrusion
4. SY-AA-101-132, Security Assessment and Response to Unusual Activities

PD-HU2

Initiating Condition:

Hazardous Event affecting equipment necessary for spent fuel cooling.

Emergency Action Level (EAL):

1. a) The occurrence of ANY of the following hazardous events:
    - Seismic event (earthquake)
    - Internal or external flooding event
    - High winds or tornado strike
    - FIRE
    - EXPLOSION
    - Other events with similar hazard characteristics as determined by the Shift Manager

    AND

    b) The event has damaged at least one train of a system needed for Spent Fuel Cooling

    AND

    c) The damaged train(s) **cannot**, or potentially **cannot**, perform its design function based on **EITHER**:
    - Indications of degraded performance
    - VISIBLE DAMAGE

Basis:

This IC addresses a hazardous event that causes damage to at least one train of a system needed for spent fuel cooling. The damage must be of sufficient magnitude that the system(s) train cannot, or potentially cannot, perform its design function. This condition reduces the margin to a loss or potential loss of the fuel clad barrier, and therefore represents a potential degradation of the level of safety of the facility.

For the first bullet in EAL 1.c, indications of degraded performance apply to in service/operating systems or components that are needed for spent fuel cooling.

PD-HU2 (cont)

For the second bullet in EAL 1.c, VISIBLE DAMAGE applies to equipment needed for spent fuel cooling that is not in service/operating or readily apparent through indications alone. Operators will make this determination based on the totality of available event and damage report information. This is intended to be a brief assessment not requiring lengthy analysis or quantification of the damage.

Escalation of the emergency classification level could, depending upon the event, be based on any of the ALERT ICs: PD-RA1, PD-RA2, PD-HA1 or PD-HA3.

Basis Reference(s):

1. NEI 99-01, Rev 6, PD-HU2
2. OP-TM-AOP-001, Fire
3. OP-TM-AOP-002, Flood
4. OP-TM-AOP-003, Earthquake
5. OP-TM-AOP-004, Tornado/High Winds

PD-HA3

Initiating Condition:

Other conditions exist which in the judgment of the Emergency Director warrant declaration of an ALERT.

Emergency Action Level (EAL):

Other conditions exist which, in the judgment of the Emergency Director, indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility or a security event that involves probable life-threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels.

Basis:

This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Director to fall under the emergency classification level description for an ALERT.

Basis Reference(s):

1. NEI 99-01, Rev 6, PD-HA3

PD-HU3

Initiating Condition:

Other conditions exist which in the judgment of the Emergency Director warrant declaration of an UNUSUAL EVENT.

Emergency Action Level (EAL):

Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the facility or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of equipment required for spent fuel cooling occurs.

Basis:

This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Director to fall under the emergency classification level description for an UNUSUAL EVENT.

Basis Reference(s):

1. NEI 99-01, Rev 6, PD-HU3

E-HU1

Initiating Condition

Damage to a loaded cask CONFINEMENT BOUNDARY.

Emergency Action Level (EAL):

Damage to a loaded cask CONFINEMENT BOUNDARY as indicated by a radiation reading **> 2 times the ISFSI Technical Specification allowable levels**.

Basis:

This IC addresses an event that results in damage to the CONFINEMENT BOUNDARY of a storage cask containing spent fuel. It applies to irradiated fuel that is licensed for dry storage beginning at the point that the loaded storage cask is sealed. The word cask, as used in this EAL, refers to the storage container in use at the site for dry storage of irradiated fuel. The issues of concern are the creation of a potential or actual release path to the environment, degradation of any fuel assemblies' due to environmental factors, and configuration changes which could cause challenges in removing the cask or fuel from storage.

The existence of "damage" is determined by radiological survey. The cask technical specification multiple of "2 times" which is also used in Recognition Category R IC PD-RU1, is used here to distinguish between non-emergency and emergency conditions. The emphasis for this classification is the degradation in the level of safety of the spent fuel cask and not the magnitude of the associated dose or dose rate. It is recognized that in the case of extreme damage to a loaded cask, the fact that the "on-contact" dose rate limit is exceeded may be determined based on measurement of a dose rate at some distance from the cask.

Security-related events for ISFSIs are covered under ICs PD-HU1 and PD-HA1.

Basis Reference(s):

1. NEI 99-01, Rev 6, E-HU1
2. Certificate of Compliance 72.1031 NAC MAGNASTOR® Canister

ENCLOSURE 6:
CLEAN PAGES FOR ATTACHMENT 4 OF ORIGINAL SUBMITTAL
(29 pages)

COMPARISON DOCUMENT FOR PERMANENTLY DEFUELED EALS BASED UPON NUCLEAR ENERGY INSTITUTE (NEI) 99-01, "METHODOLOGY FOR DEVELOPMENT OF EMERGENCY ACTION LEVELS," REVISION 6

Description of the Permanently Defueled EAL Technical Basis Document

The following provides a description of the Three Mile Island Nuclear Station (TMI) Emergency Action Level (EAL) Technical Bases Document (provided as Attachment 3 to this submittal). Differences between the TMI Permanently Defueled (PD) EALs Technical Bases Document and NEI 99-01, "Development of Emergency Action Levels for Non-Passive Reactors," Revision 6 (herein referred to as "NEI 99-01") are discussed herein. Also included are the results of a comparison of the TMI EAL matrix against the corresponding information contained in NEI 99-01.

1.0 Purpose

The TMI EAL Technical Bases Document includes reference to the Recognition Category "PD" based on the facility's permanently shut down and defueled condition, providing a stand-alone set of Initiating Conditions (ICs)/EALs for a permanently defueled (PD) nuclear power facility and a Recognition Category "E" IC/EAL for the Independent Spent Fuel Storage Installation (ISFSI). A comparison between the "Purpose" section in Attachment 3 and NEI 99-01 was not made.

2.0 Discussion

The "Discussion" section in Attachment 3 was developed based on information contained in NEI 99-01, Section 1, "Regulatory Background." This section provides specific criteria for an ISFSI as it pertains to other regulations as well as guidance in NEI 99-01.

NEI 99-01, Section 1.1, "Operating Reactors," was excluded as it pertains to operating reactors. By September 30, 2019, TMI-1 will cease operations and fuel will be permanently removed from the reactor vessel and placed in the spent fuel pool. Pursuant to 10 CFR 50.82(a)(2), the 10 CFR Part 50 license for TMI-1 will no longer authorize operation of the reactor or emplacement or retention of fuel in the reactor vessel. The TMI PD EALs will be implemented after Exelon has certified to the U.S. Nuclear Regulatory Commission (NRC) that TMI-1 has permanently ceased power operations and all fuel has been permanently moved to the spent fuel pool. Three Mile Island, Unit 2 (TMI-2), has a possession only license and is currently maintained in accordance with the NRC approved SAFSTOR condition (method in which a nuclear facility is placed and maintained in a condition that allows it to be safely stored and subsequently decontaminated) known as Post-Defueling Monitored Storage (PDMS). All fuel assemblies have been removed from the TMI-2 reactor and spent fuel pool. Therefore, NEI 99-01 Section 1.1 is not applicable to TMI.

NEI 99-01, Section 1.2, "Permanently Defueled Station," is addressed in Section 2.1 of Attachment 3. Inclusion of this discussion is appropriate because as discussed in detail in Attachment 1 of this submittal, analyses have been completed that demonstrate that no credible event can result in a significant radiological release beyond the site boundary.

NEI 99-01, Section 1.3, "Independent Spent Fuel Storage Installation (ISFSI)," is addressed in Section 2.2 of Attachment 3. Inclusion of this discussion is appropriate because an ISFSI is under construction at TMI-1 and scheduled for completion by early 2021.

NEI 99-01, Section 1.4, "NRC Order EA-12-051," was excluded because the recommendation applies to EALs IC AA2, and new ICs AS2 and AG2, which are only applicable to operating plants and have not been recommended to be include in the permanently defueled EALs. The guidance for the spent fuel pool EALs is applied from Appendix C, which address a permanently defueled condition. Therefore, the discussion of Section 1.4 has not been included.

NEI 99-01, Section 1.5, "Applicability to Advanced and Small Modular Reactor Designs," was excluded because TMI is not an Advanced or Small Modular Reactor Design.

3.0 Key Terminology Used

This section in Attachment 3 was developed based on information contained in NEI 99-01, Section 2, "Key Terminology Used in NEI 99-01." Differences between the TMI PD EALs Technical Bases Document and NEI 99-01 are discussed below.

- References to Site Area Emergency and General Emergency were removed throughout. Emergency Classification Levels (ECLs) only include Unusual Event (Notification of Unusual Event) and Alert. EALs were developed using NEI 99-01, Appendix C, for the Permanently Defueled Station ICs/EALs and Section 8 for Independent Spent Fuel Storage Installation (ISFSI).
- References to "plant" have been revised to "facility" to indicate that TMI is no longer an operating nuclear power plant.
- In Attachment 3, Section 3.2, "Initiating Condition (IC)" (Section 2.2 of NEI 99-01), references to Reactor Coolant System (RCS) Leakage and fission product barriers were removed. Upon permanent removal of fuel from the TMI-1 reactor, the RCS and Containment will no longer be considered fission product barriers because the reactor will be permanently defueled and Containment integrity is not needed for the spent fuel pool.
- NEI 99-01, Section 2.4, "Fission Product Barrier Threshold," was excluded for reasons previously identified related to fission product barriers.

4.0 Guidance on Making Emergency Classifications

This section in Attachment 3 was developed based on information contained in NEI 99-01, Section 5, "Guidance on Making Emergency Classifications." Differences between the TMI PD EAL Technical Bases Document and NEI 99-01 are discussed below.

- In Section 4.1 (Section 5.1 of NEI 99-01), references to fission product barrier thresholds were removed as the RCS and Containment no longer serve as fission product barriers. Reference to Operating Mode Applicability was removed because Operating Modes are not applicable in a permanently defueled facility.
- In Section 4.1 (Section 5.1 of NEI 99-01), the second paragraph of NEI 99-01 stating "regulations require the licensee to establish and maintain the capability to assess,

classify and declare an emergency condition within 15 minutes," was excluded. As detailed in Interim Staff Guidance NSIR/DPR-ISG-02, "Emergency Planning Exemption Requests for Decommissioning Plants," "…the staff concludes that a decommissioning power reactor is not required to assess, classify, and declare an emergency condition within 15 minutes." TMI will maintain the ability to assess, classify, and declare an emergency within 30 minutes. An emergency declaration is required to be made as soon as conditions warranting classification are present and recognizable in accordance with the EALs, but within 30 minutes in all cases after the availability of indications to operators that an EAL threshold has been reached.

- With respect to the notification of an emergency declaration to state authorities, as discussed in Attachment 1 of this submittal, no design basis accident or reasonably conceivable beyond design basis accident will be expected to result in radioactive releases that will exceed Environmental Protection Agency (EPA) Protective Action Guides (PAGs) beyond the site boundary. Exelon will maintain EPA PAGs as specified in the current and proposed TMI Emergency Plan. In the permanently defueled condition, the rapidly developing scenarios associated with events initiated during reactor power operation are no longer credible. The radiological consequences resulting from the only remaining events (e.g., loss of SFP cooling) develop over a significantly longer period. As such, a 15-minute notification requirement is unnecessarily restrictive. A notification time of thirty (30) minutes after declaring an emergency has been negotiated with the Commonwealth of Pennsylvania and provides a reasonable amount of time to notify the state governmental authorities.
- In Section 4.2 (Section 5.2 in NEI 99-01), reference to Operating Mode Applicability was removed because Operating Modes are not applicable in a permanently defueled facility.
- In Section 4.3 (Section 5.3 of NEI 99-01), references to two units were removed because TMI is treated as a single unit site.
- NEI 99-01, Section 5.4 was excluded because mode changes during classification are not applicable to a permanently defueled facility.
- In Section 4.4 (Section 5.5 of NEI 99-01), the word "levels" was changed to "level" because there is only one higher emergency classification level (ECL) above an Unusual Event for a permanently defueled facility.
- In Section 4.5 (Section 5.6 of NEI 99-01), references to Site Area Emergency and General Emergency were removed. Site Area Emergency and General Emergency are no longer credible emergency classifications because analyses have been developed indicting that, 488 days after shutdown, no credible accident at TMI-1 will result in radiological releases requiring offsite protective actions. TMI-1 will not downgrade events.
- In Section 4.6 (Section 5.7 of NEI 99-01) references to an operating plant short-lived event (e.g., reactor trip) were removed and replaced with verbiage applicable to a permanently defueled facility. Example was changed to an "explosion" since the example given in NEI 99-01, "failure of the reactor protection system to automatically

scram/trip the reactor followed by a successful manual scram/trip" is not possible in a permanently defueled facility.

- In Section 4.7 (Section 5.8 of NEI 99-01) the discussion for classifying an event occurring during transient conditions was removed because such a case occurring is unlikely and Exelon would prefer the Emergency Director classify the event than rely on engineering judgement. The example was removed because an emergency declaration associated with an ATWS or the potential loss of both the fuel clad and RCS is no longer credible at TMI. The reference to the 15-minute emergency classification was excluded for reasons presented above.
- Section 4.10 is site-specific information pertaining to TMI-2. No corresponding section is included in NEI 99-01. The wording has been carried over from Section 1.8 of the current TMI Emergency Action Levels and Technical Bases document.

5.0 References

This section in Attachment 3 was added to provide Developmental and Implementing References applicable to the TMI EAL Technical Bases Document. No corresponding section is included in NEI 99-01.

6.0 Acronyms & Definitions

This section in Attachment 3 was developed based on the information presented in Appendices A and B of NEI 99-01. The section incorporates only those acronyms and definitions used in the TMI EAL Technical Bases Document.

- The following definitions, included in NEI 99-01, were excluded because they are not used in the TMI PD EAL Technical Bases Document:
  - General Emergency
  - Site Area Emergency
- The following key term necessary for overall understanding of the NEI 99-01 emergency classification scheme was excluded because it is not used in the TMI PD EAL Technical Bases Document:
  - Fission Product Barrier Threshold
- The key term, Initiating Condition (IC), was revised to change "four emergency classification levels" to "two emergency classification levels because Site Area Emergency and General Emergency are not used in the TMI PD EAL Technical Bases Document.
- The key term, Emergency Classification Level, was revised to exclude reference to Site Area Emergency and General Emergency because they are not used in the TMI PD EAL Technical Bases Document.

Selected terms used in Initiating Condition and Emergency Action Level statements are set in all capital letters (e.g., ALL CAPS). These words are defined terms that have specific meanings as used in NEI 99-01. Definitions not used in the TMI PD EAL Technical Bases Document were excluded.

7.0 TMI to NEI 99-01 EAL Cross-Reference

The table below facilitates association and location of the TMI EAL with the corresponding NEI 99-01 IC/EAL. Further information regarding the development of the TMI EALs based on the NEI guidance can be found in the EAL Comparison Matrix.

TMI Permanently Defueled IC/EALs	**NEI 99-01, Rev. 6, Appendix C – Permanently Defueled Station ICs/EALs**
PD-RU1	PD-AU1
PD-RA1	PD-AA1
PD-RU2	PD-AU2
PD-RA2	PD-AA2
PD-HU1	PD-HU1
PD-HA1	PD-HA1
PD-HU2	PD-HU2
PD-HU3	PD-HU3
PD-HA3	PD-HA3
PD-MU1	PD-SU1
TMI ISFSI ICs/EAL	**NEI 99-01, Rev. 6, Section 8 – ISFSI ICs/ EALs**
E-HU1	E-HU1

8.0 Attachments

8.1 Attachment 1, EAL Matrices

- References to Operating Modes were removed from Table PD-1.
- The EALs were developed using Appendix C and Section 8 of NEI 99-01.

8.2 Attachment 2, EAL Bases

- Attachment 2 of the TMI EAL Technical Bases provides the Permanently Defueled and ISFSI IC/EALs and incorporates Appendix C and Section 8 of NEI 99-01.
- Reference to Section 3 of NEI 99-01 was excluded since the section was not included and references made to this section was removed.
- The table below provides a comparison of the TMI PD EALs against the corresponding information contained in NEI 99-01.
- Reference to Operating Mode was removed from Table E-1 because Operating Modes are not applicable in a permanently defueled facility.

- The table below provides a comparison of the TMI ISFSI EALs against the corresponding information contained in NEI 99-01.

NEI 99-01 Sections Not Included

The following sections of NEI 99-01 were not included and references made to these sections were also removed:

- Section 3, "Design of the NEI 99-01 Emergency Classification Scheme"
- Section 4, "Site-Specific Scheme Development Guidance"

The following sections of NEI 99-01 were removed from the TMI PD EAL matrix as these do not apply to a permanently defueled facility:

- Section 6, Abnormal Rad Levels/Radiological Effluent ICs/EALs,
- Section 7, Cold Shutdown/Refueling System Malfunction ICs/EALs,
- Section 9, Fission Product Barrier ICs/EALs,
- Section 10, Hazards and Other Conditions Affecting Plant Safety ICs/EALs, and
- Section 11, System Malfunction ICs/EALs.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-AU1 **ECL:** Notification of Unusual Event **Initiating Condition:** Release of gaseous or liquid radioactivity greater than 2 times the (site-specific effluent release controlling document) limits for 60 minutes or longer. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1 or 2) **Notes:** • The Emergency Director should declare the Unusual Event promptly upon determining that 60 minutes has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 60 minutes. • If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.	**PD-RU1** **Category:** R - Abnormal Rad Levels/ Radiological Effluent **PD-RU1** Release of gaseous or liquid radioactivity to the environment greater than 2 times the ODCM limits for 60 minutes or longer. **Emergency Action Level (EAL):** **Notes:** • The Emergency Director should declare the UNUSUAL EVENT promptly upon determining that 60 minutes has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 60 minutes. • Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.	☐ No Change ☒ Difference ☐ Deviation • "AU1" is replaced with "RU1" to better signify a radiological event and to maintain continuity with the previous TMI emergency action level scheme. • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Inserted ODCM as the site-specific effluent release controlling document. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Provided additional provision for classification based on effluent monitor readings. Changed format of EALs to separate EALs 1 and 2 into distinct EALs.

NEI99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
(1) Reading on **ANY** effluent radiation monitor greater than 2 times the alarm setpoint established by a current radioactivity discharge permit for 60 minutes or longer. (2) Sample analysis for a gaseous or liquid release indicates a concentration or release rate greater than 2 times the (site-specific effluent release controlling document) limits for 60 minutes or longer.	1. Reading on discharge permit specified monitor **> 2 times alarm setpoint** established by a current radioactive release discharge permit for **> 60 minutes**. **OR** 2. Readings on **RM-A-8G (Station Vent) > 9.5 E+05 cpm** for **≥ 60 minutes**. **OR** 3. Confirmed sample analyses for gaseous or liquid releases indicates a concentration or release rates **> 2 times ODCM Limit** with a release duration of **≥ 60 minutes**.	☐ No Change ☒ Difference ☐ Deviation • Removed "radiation" from monitor notation. • EAL 1: Specified that the effluent monitors are the "discharge permit specified monitor." • EAL 1. Did not include list of site-specific effluent radiation monitors since they may change throughout decommissioning. Releases will be controlled through approved discharge permits which will specify monitors and monitor setpoints prior to release. • Added "OR" to reflect the EAL conditions that represent entry into the classification. • Added EAL 2 Station Vent monitor as the remaining permanently monitored effluent pathway to determine entry threshold. • EAL 3 renumbered (NEI 99-01 EAL 2) Provided additional provisions for using sample analysis results of a gaseous or liquid release as an action level.
Basis: This IC addresses a potential decrease in the level of safety of the plant as indicated by a low-level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous or liquid radiological release, monitored or un-monitored, including those for which a radioactivity discharge permit is normally prepared.	**TMI Basis:** This IC addresses a potential decrease in the level of safety of the facility as indicated by a low-level radiological release that exceeds regulatory commitments for an extended period of time (e.g., an uncontrolled release). It includes any gaseous or liquid radiological release, monitored or un-monitored, including those for which a radioactivity discharge permit is normally prepared.	☐ No Change ☒ Difference ☐ Deviation • Added TMI-specific basis information. • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
Nuclear power plants incorporate design features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, and to control and monitor intentional releases. The occurrence of an extended, uncontrolled radioactive release to the environment is indicative of degradation in these features and/or controls. Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions. Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes. Releases should not be prorated or averaged. For example, a release exceeding 4 times release limits for 30 minutes does not meet the EAL. EAL #1 - This EAL addresses radioactivity releases that cause effluent radiation monitor readings to exceed 2 times the limit established by a radioactivity discharge permit. This EAL will typically be associated with planned batch releases from non-continuous release pathways (e.g., radwaste, waste gas).	TMI-1 incorporate design features intended to control the release of radioactive effluents to the environment. Further, there are administrative controls established to prevent unintentional releases, and to control and monitor intentional releases. The occurrence of an extended, uncontrolled radioactive release to the environment is indicative of degradation in these features and/or controls. Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of facility conditions alone. The inclusion of both facility condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions. Releases should not be prorated or averaged. For example, a release exceeding 4 times release limits for 30 minutes does not meet the EAL. EAL #1 addresses radioactivity releases that cause effluent radiation monitor readings to exceed 2 times the limit established by a radioactivity discharge permit. This EAL will typically be associated with planned batch releases from non-continuous release pathways (e.g., radwaste, waste gas).	☐ No Change ☒ Difference ☐ Deviation • Moved paragraph describing "Classification based on effluent monitoring readings…" to be in the EAL Notes. • Split the explanation of NEI 99-01 EAL #1 into two separate EAL criteria EAL #1 and EAL #2 and added "**OR**" thus providing additional provisions for using sample analysis results of a gaseous or liquid release as an action level. • Renumbered NEI 99-01 EAL #2 into EAL #3.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
EAL #2 - This EAL addresses uncontrolled gaseous or liquid releases that are detected by sample analyses or environmental surveys, particularly on unmonitored pathways (e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.). Escalation of the emergency classification level would be via IC PD-AA1.	The declaration criteria will be based on the monitor and monitor setpoints specified in the Discharge Permit. EAL #2 normally occurring continuous radioactivity releases from monitored gaseous effluent pathways. For the defueled condition the only remaining release path is through the Station Vent and is monitored by RM-A-8G. EAL #3 addresses uncontrolled gaseous or liquid releases that are detected by sample analyses or environmental surveys, particularly on unmonitored pathways (e.g., spills of radioactive liquids into storm drains, heat exchanger leakage in river water systems, etc.). Escalation of the emergency classification level would be via IC PD-RA1.	☐ No Change ☒ Difference ☐ Deviation • Added clarification that the EAL criteria are based on the setpoints in the Discharge permit which would signify a release above expected levels for that discharge. • List of site-specific effluent radiation monitors were not included since they may change throughout decommissioning. Releases will be controlled through approved discharge permits which will specify monitors and monitor setpoints prior to release. • Replaced "AA1" with "RA1" to better describe escalation pathway.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-AA1 **ECL:** Alert **Initiating Condition:** Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mrem TEDE or 50 mrem thyroid CDE. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1 or 2 or 3 or 4) **Notes:** • The Emergency Director should declare the Alert promptly upon determining that the applicable time has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 15 minutes. • If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes. • The pre-calculated effluent monitor values presented in EAL #1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.	**PD-RA1** **Category:** R - Abnormal Rad Levels/ Radiological Effluents **PD-RA1:** Release of gaseous or liquid radioactivity resulting in offsite dose greater than 10 mRem TEDE or 50 mRem thyroid CDE. **Emergency Action Level (EAL):** **Notes:** • The Emergency Director should declare the Alert promptly upon determining that the applicable time has been exceeded, or will likely be exceeded. • If an ongoing release is detected and the release start time is unknown, assume that the release duration has exceeded 15 minutes. • Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes. • The pre-calculated effluent monitor values presented in EAL #1 should be used for emergency classification assessments until the results from a dose assessment using actual meteorology are available.	☐ No Change ☒ Difference ☐ Deviation • "AA1" is replaced with "RA1" to better signify a radiological event and to maintain continuity with the previous TMI action level scheme. • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Modified EAL numbering and separated EALs 1, 2, 3 and 4 into EAL flowchart format. • Provided additional provision for classification based on effluent monitor readings. Moved information from bases to Notes.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
(1) Reading on ANY of the following radiation monitors greater than the reading shown for 15 minutes or longer: (site-specific monitor list and threshold values) (2) Dose assessment using actual meteorology indicates doses greater than 10 mrem TEDE or 50 mrem thyroid CDE at or beyond (site-specific dose receptor point). (3) Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than 10 mrem TEDE or 50 mrem thyroid CDE at or beyond (site-specific dose receptor point) for one hour of exposure. (4) Field survey results indicate **EITHER** of the following at or beyond (site-specific dose receptor point): • Closed window dose rates greater than 10 mR/hr expected to continue for 60 minutes or longer. • Analyses of field survey samples indicate thyroid CDE greater than 50 mrem for one hour of inhalation.	1. Readings on **RM-A-8GH (Station Vent) > 1.43 E+03 cpm** for **≥ 15 minutes**. **OR** 2. Dose assessment using actual meteorology indicates doses at or beyond the site boundary of **EITHER**: a. **> 10 mRem TEDE** **OR** b. **> 50 mRem CDE Thyroid** **OR** 3. Analysis of a liquid effluent sample indicates a concentration or release rate that would result in doses greater than **EITHER** of the following at or beyond the site boundary a. **> 10 mRem TEDE** for **60 minutes** of exposure **OR** b. **> 50 mRem CDE** Thyroid for **60 minutes** of exposure **OR** 4. Field survey results at or beyond the site boundary indicate **EITHER**: a. Gamma (closed window) dose rates **> 10 mR/hr** are expected to continue for **≥ 60 minutes**. **OR** b. Analyses of field survey samples indicate **> 50 mRem CDE Thyroid** for **60 minutes** of inhalation.	☐ No Change ☒ Difference ☐ Deviation • Added appropriate installed radiation monitor. • Added "site boundary" as the site-specific dose receptor point. • Added "OR" to reflect the EAL conditions that represent entry into the classification.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
Basis: This IC addresses a release of gaseous or liquid radioactivity that results in projected or actual offsite doses greater than or equal to 1% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude represent an actual or potential substantial degradation of the level of safety of the plant as indicated by a radiological release that significantly exceeds regulatory limits (e.g., a significant uncontrolled release). Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of plant conditions alone. The inclusion of both plant condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions. The TEDE dose is set at 1% of the EPA PAG of 1,000 mrem while the 50 mrem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE. Classification based on effluent monitor readings assumes that a release path to the environment is established. If the effluent flow past an effluent monitor is known to have stopped due to actions to isolate the release path, then the effluent monitor reading is no longer valid for classification purposes.	**TMI Basis:** This IC addresses a release of gaseous or liquid radioactivity that results in projected or actual offsite doses greater than or equal to 1% of the EPA Protective Action Guides (PAGs). It includes both monitored and un-monitored releases. Releases of this magnitude represent an actual or potential substantial degradation of the level of safety of the facility as indicated by a radiological release that significantly exceeds regulatory limits (e.g., a significant uncontrolled release). Radiological effluent EALs are also included to provide a basis for classifying events and conditions that cannot be readily or appropriately classified on the basis of facility conditions alone. The inclusion of both facility condition and radiological effluent EALs more fully addresses the spectrum of possible accident events and conditions. The TEDE dose is set at 1% of the EPA PAG of 1000 mRem while the 50 mRem thyroid CDE was established in consideration of the 1:5 ratio of the EPA PAG for TEDE and thyroid CDE.	☐ No Change ☒ Difference ☐ Deviation • Replaced "plant" with "facility." • Moved last paragraph to Notes

NEI 99-01 REV 6 Appendix C - Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-AU2 **ECL:** Notification of Unusual Event **Initiating Condition:** UNPLANNED rise in plant radiation levels. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1 or 2) (1) a. UNPLANNED water level drop in the spent fuel pool as indicated by ANY of the following: (site-specific level indications). **AND** b. UNPLANNED rise in area radiation levels as indicated by **ANY** of the following radiation monitors. (site-specific list of area radiation monitors). (2) Area radiation monitor reading or survey result indicates an UNPLANNED rise of 25 mR/hr over NORMAL LEVELS.	**PD-RU2** **Category:** R - Abnormal Rad Levels/ Radiological Effluents **PD-RU2** UNPLANNED rise in facility radiation levels. **Emergency Action Level (EAL):** 1. a. UNPLANNED water level drop in the Spent Fuel Pool as indicated by **ANY** of the following: • Spent Fuel Pool water level **< 342' 6"** (**23.167'** on SF-LI-1219A/B) • Indication or report of an UNPLANNED drop in water level. **AND** b. UNPLANNED Area Radiation Monitor reading rise on **RM-G-9** FHB Bridge radiation monitor. **OR** 2. Area radiation monitor reading or survey result indicates an UNPLANNED rise of **25 mR/hr** over NORMAL LEVELS.	☐ No Change ☒ Difference ☐ Deviation • "AU2" is replaced with "RU2" to better signify a radiological event and to maintain continuity with the previous TMI action level scheme. • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Replaced "plant" with "facility." • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Modified EAL numbering and separated EALs 1 and 2 into EAL flowchart format. • Added "OR" to reflect the EAL conditions that represent entry into the classification. • Provided site-specific level indication that corresponds to fuel pool level entry condition into Spent Fuel Pool abnormal operating procedure. • Provided Area Radiation Monitoring for specific location.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
Basis: This IC addresses elevated plant radiation levels caused by a decrease in water level above irradiated (spent) fuel or other UNPLANNED events. The increased radiation levels are indicative of a minor loss in the ability to control radiation levels within the plant or radioactive materials. Either condition is a potential degradation in the level of safety of the plant. A water level decrease will be primarily determined by indications from available level instrumentation. Other sources of level indications may include reports from plant personnel or video camera observations (if available). A significant drop in the water level may also cause an increase in the radiation levels of adjacent areas that can be detected by monitors in those locations. The effects of planned evolutions should be considered. Note that EAL #1 is applicable only in cases where the elevated reading is due to an UNPLANNED water level drop. EAL #2 excludes radiation level increases that result from planned activities such as use of radiographic sources and movement of radioactive waste materials. Escalation of the emergency classification level would be via IC PD-AA1 or PD-AA2.	**TMI Basis:** This IC addresses a loss in water level above irradiated fuel sufficient to cause elevated radiation levels. This condition could be a precursor to a more serious event and is also indicative of a minor loss in the ability to control radiation levels within the facility. It is therefore a potential degradation in the level of safety of the facility. EAL #1 Basis: A water level loss will be primarily determined by indications from available level instrumentation. Other sources of level indications may include reports from facility personnel (e.g., from a refueling crew) or video camera observations (if available) or from any other temporarily installed monitoring instrumentation. A significant drop in the water level may also cause a rise in the radiation levels of adjacent areas that can be detected by Spent Fuel Bridge Radiation monitor (RM-G-9). Spent Fuel Pool (SFP) water level of 342’6" (mean sea level), is the entry condition for OP-TM-AOP-035, Loss of Spent Fuel Pool Cooling, and is lower than the SFP low level alarm at 343’ 6”. The IC level corresponds to 23.167' above the top of fuel assemblies and is read on SF-LI-1219A/B. The effects of planned evolutions should be considered. Note that EAL #1 is applicable only in cases where the elevated reading is due to an UNPLANNED water level drop. EAL #2 Basis: This excludes radiation level increases that result from planned activities such as use of radiographic sources and movement of radioactive waste materials. Escalation of the emergency classification level would be via IC PD-RA1 OR PD-RA2.	☐ No Change ☒ Difference ☐ Deviation • Wording in the TMI basis is modified to align with the previous wording in the TMI basis for EAL RU2, which is slightly different than the wording in NEI 99-01. • Replaced "plant" with "facility." • Added Basis for the site-specific level indication. • Replaced "AA1" and "AA2" with "RA1" and "RA2," respectively, to better describe escalation pathway.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-AA2 **ECL:** Alert **Initiating Condition:** UNPLANNED rise in plant radiation levels that impedes plant access required to maintain spent fuel integrity. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1 or 2) (1) UNPLANNED dose rate greater than 15 mR/hr in **ANY** of the following areas requiring continuous occupancy to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity: (site-specific area list) (2) UNPLANNED Area Radiation Monitor readings or survey results indicate a rise by 100 mR/hr over NORMAL LEVELS that impedes access to **ANY** of the following areas needed to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity. (site-specific area list)	**PD-RA2** **Category:** R - Abnormal Rad Levels/ Radiological Effluents **PD-RA2** UNPLANNED rise in facility radiation levels that impedes access required to maintain spent fuel integrity. **Emergency Action Level (EAL):** 1. UNPLANNED dose rate **> 15 mR/hr** in **ANY** of the following areas required for continuous occupancy to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity: • Control Room • Central Alarm Station (by survey) **OR** 2. UNPLANNED Area Radiation Monitor readings or survey results indicate a rise of **> 100 mR/hr** over NORMAL LEVELS that impedes access to **ANY** of the following areas needed to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity: • Fuel Handling Building Operating Floor • SFP Cooling Pump /Heat Exchanger Area • NSCCW Pump / Heat Exchanger Areas	☐ No Change ☒ Difference ☐ Deviation • "AA2" is replaced with "RA2" to better signify a radiological event and to maintain continuity with the previous TMI action level scheme. • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Replaced "plant" with "facility." • Changed format of EALs to separate EALs 1 and 2 into distinct EALs. • Added "OR" to reflect the EAL conditions that represent entry into the classification. • Added site-specific areas to EAL #1. • Added site-specific areas to EAL #2.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
Basis: This IC addresses increased radiation levels that impede necessary access to areas containing equipment that must be operated manually or that requires local monitoring, in order to maintain systems needed to maintain spent fuel integrity. As used here, 'impede' includes hindering or interfering, provided that the interference or delay is sufficient to significantly threaten necessary plant access. It is this impaired access that results in the actual or potential substantial degradation of the level of safety of the plant. This IC does not apply to anticipated temporary increases due to planned events	**TMI Basis:** This IC addresses increased radiation levels that impede necessary access to areas containing equipment that must be operated manually or that requires local monitoring, in order to maintain systems needed to maintain spent fuel integrity. As used here, 'impede' includes hindering or interfering, provided that the interference or delay is sufficient to significantly threaten necessary facility access. It is this impaired access that results in the actual or potential substantial degradation of the level of safety of the facility. This IC does not apply to anticipated temporary increases due to planned events. This IC addresses elevated radiation levels in certain facility rooms/areas sufficient to preclude or impede personnel from performing actions necessary to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity. As such, it represents an actual or potential substantial degradation of the level of safety of the facility. Assuming all facility equipment is operating as designed, normal operation is capable from the Control Room (CR). The areas listed in EAL #2 are facility areas that contain equipment which require a manual/local action necessary when moving fuel or manipulating SFP cooling equipment.	☐ No Change ☒ Difference ☐ Deviation • Replaced "plant" with "facility." • Maintained additional wording consistent with the previous wording in the basis for TMI EAL RA3, revised to reflect the defueled condition of the facility ("to maintain control of radioactive material or operation of systems needed to maintain spent fuel integrity").

NEI99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-SU1 **ECL:** Notification of Unusual Event **Initiating Condition:** UNPLANNED spent fuel pool temperature rise. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1) UNPLANNED spent fuel pool temperature rise to greater than (site-specific °F). **Basis:** This IC addresses a condition that is a precursor to a more serious event and represents a potential degradation in the level of safety of the plant. If uncorrected, boiling in the pool will occur, and result in a loss of pool level and increased radiation levels. Escalation of the emergency classification level would be via IC PD-AA1 or PD-AA2.	**PD-MU1** **Category:** S – System Malfunction Spent Fuel Pool **PD-MU1** UNPLANNED Spent Fuel Pool temperature rise. **Emergency Action Level (EAL):** 1. UNPLANNED Spent Fuel Pool temperature rise to **> 160°F**. **TMI Basis:** This IC addresses a condition that is a precursor to a more serious event and represents a potential degradation in the level of safety of the facility. If uncorrected, boiling in the pool will occur, and result in a loss of pool level and increased radiation levels. Whenever irradiate fuel is stored in the spent fuel pool, the pool water temperature shall be maintained below 160°F (Reference 2). This is the entry point into OP-TM-AOP-035, Loss of Spent Fuel Pool Cooling. Operators will provide initial mitigation for a loss of SFP Cooling based on SFP high temperature alarm set at 130°F. Based on Calculations in the Decom SFP Thermal Hydraulic Analysis (Reference 4) for a loss of SFP Cooling at 488 days after shutdown the heat up rate in the SFP would be approximately 1.35 °F/Hr. Using the Entry Condition for the Loss of Spent Fuel Pool Cooling Procedure as the EAL provides the precursor for additional action and still provides approximately 70 hours to mitigate before SFP boiling were to occur. Escalation of the emergency classification level would be via PD-RA1 or PD-RA2.	☐ No Change ☒ Difference ☐ Deviation • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • "SU1" is replaced with "MU-1." "AA2" is replaced with "RA2" to better signify a malfunction and to maintain continuity with the previous TMI action level scheme. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Added site-specific temperature for the Spent Fuel Pool and justification for 160°F in Basis. • Replaced "plant" with "facility." • Added site-specific information for the bases for the 160°F EAL threshold. • Replaced "AA1" with "RA1" and replaced "AA2" with "RA2" to better signify a radiological event and to maintain continuity with the previous TMI action level scheme.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	Proposed EAL Matrix for TMI	Comparison
PD-HU1 **ECL:** Notification of Unusual Event **Initiating Condition:** Confirmed SECURITY CONDITION or threat. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1 or 2 or 3) (1) A SECURITY CONDITION that does not involve a HOSTILE ACTION as reported by the (site-specific security shift supervision). (2) Notification of a credible security threat directed at the site. (3) A validated notification from the NRC providing information of an aircraft threat. **Basis:** This IC addresses events that pose a threat to plant personnel or the equipment necessary to maintain cooling of spent fuel, and thus represent a potential degradation in the level of plant safety. Security events which do not meet one of these EALs are adequately addressed by the requirements of 10 CFR § 73.71 or 10 CFR § 50.72. Security events assessed as HOSTILE ACTIONS are classifiable under IC PD-HA1. Timely and accurate communications between Security Shift Supervision and the Control Room is essential for proper classification of a security-related event. Classification of these events will initiate appropriate threat-related notifications to plant personnel and OROs.	**PD-HU1** **Category:** H – Hazards and Other Conditions Affecting Facility Safety **PD-HU1** Confirmed SECURITY CONDITION or threat. **Emergency Action Level (EAL):** 1. Notification of a credible security threat directed at the site as determined per SY-AA-101-132, Security Assessment and Response to Unusual Activities. **OR** 2. A validated notification from the NRC providing information of an aircraft threat. **OR** 3. Notification by the Security Force of a SECURITY CONDITION that does **not** involve a HOSTILE ACTION. **TMI Basis:** This IC addresses events that pose a threat to facility personnel or spent fuel cooling system equipment, and thus represent a potential degradation in the level of facility safety. Security events which do not meet one of these EALs are adequately addressed by the requirements of 10 CFR § 73.71 or 10 CFR § 50.72. Security events assessed as HOSTILE ACTIONS are classifiable under ICs PD-HA1. Timely and accurate communications between Security Shift Supervision and the Control Room is essential for proper classification of a security-related event. Classification of these events will initiate appropriate threat-related notifications to facility personnel and OROs.	☐ No Change ☒ Difference ☐ Deviation • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Changed format and order of EALs to separate EALs 1, 2, and 3 into distinct EAL ICs. • Added "OR" to reflect the EAL conditions that represent entry into the classification. • Added security procedure to aide determining the notification of a credible threat. • Security Force is provided as the site-specific security shift supervision. • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	Proposed EAL Matrix for TMI	Comparison
Basis (cont): Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program]*. EAL #1 references (site-specific security shift supervision) because these are the individuals trained to confirm that a security event is occurring or has occurred. Training on security event confirmation and classification is controlled due to the nature of Safeguards and 10 CFR § 2.39 information. EAL #2 addresses the receipt of a credible security threat. The credibility of the threat is assessed in accordance with (site-specific procedure). EAL #3 addresses the threat from the impact of an aircraft on the plant. The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of the plane may also be provided by NORAD through the NRC. Validation of the threat is performed in accordance with (site-specific procedure). Emergency plans and implementing procedures are public documents; therefore, EALs should not incorporate Security-sensitive information. This includes information that may be advantageous to a potential adversary, such as the particulars concerning a specific threat or threat location. Security-sensitive information should be contained in non-public documents such as the Security Plan. Escalation of the emergency classification level would be via IC PD-HA1.	**TMI Basis (cont):** Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan, Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program]*. EAL #1 Basis: Addresses the receipt of a credible security threat. The credibility of the threat is assessed in accordance with SY-AA-101-132. EAL #2 Basis: Addresses the threat from the impact of an aircraft on the facility. The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of the plane may also be provided by NORAD through the NRC. Validation of the threat is performed in accordance with OP-TM-AOP-008, Security Threat/Intrusion. EAL #3 Basis: References Security Force because these are the individuals trained to confirm that a security event is occurring or has occurred. Training on security event confirmation and classification is controlled due to the nature of Safeguards and 10 CFR § 2.39 information. Escalation of the emergency classification level would be via IC PD-HA1.	☐ No Change ☒ Difference ☐ Deviation • Paragraph regarding Security-sensitive information was not included based on it being more relevant for EAL Developers (same paragraph is in the Developer Notes) than end-users. • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-HA1 **ECL:** Alert **Initiating Condition:** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat within 30 minutes. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1 or 2) (1) A HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA as reported by the (site-specific security shift supervision). (2) A validated notification from NRC of an aircraft attack threat within 30 minutes of the site. **Basis:** This IC addresses the occurrence of a HOSTILE ACTION within the OWNER CONTROLLED AREA or notification of an aircraft attack threat. This event will require rapid response and assistance due to the possibility of the attack progressing to the PROTECTED AREA, or the need to prepare the plant and staff for a potential aircraft impact. Timely and accurate communications between Security Shift Supervision and the Control Room is essential for proper classification of a security-related event. Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan,*	**PD-HA1** **Category:** H – Hazards and Other Conditions Affecting Facility Safety **PD-HA1** HOSTILE ACTION within the OWNER CONTROLLED AREA or airborne attack threat within 30 minutes. **Emergency Action Level (EAL):** 1. A validated notification from NRC of an aircraft attack threat **< 30 minutes** from the site. **OR** 2. Notification by the Security Force that a HOSTILE ACTION is occurring or has occurred within the OWNER CONTROLLED AREA. **TMI Basis:** This IC addresses the notification of an aircraft attack threat or an occurrence of a HOSTILE ACTION within the OWNER CONTROLLED AREA. This event will require rapid response and assistance due to the possibility of the attack progressing to the PROTECTED AREA, or the need to prepare the facility and staff for a potential aircraft impact. Timely and accurate communications between Security Shift Supervision and the Control Room is essential for proper classification of a security-related event. Security plans and terminology are based on the guidance provided by NEI 03-12, *Template for the Security Plan, Training and Qualification Plan,*	☐ No Change ☒ Difference ☐ Deviation • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Changed format and order of EALs to separate EALs 1 and 2 into distinct EALs. • Added "OR" to reflect the EAL conditions that represent entry into the classification. • Security Force is provided as the site-specific security shift supervision. • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	Proposed EAL Matrix for TMI	Comparison
Basis (cont): *Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program]*. As time and conditions allow, these events require a heightened state of readiness by the plant staff and implementation of onsite protective measures (e.g., evacuation, dispersal or sheltering). The Alert declaration will also heighten the awareness of Offsite Response Organizations, allowing them to be better prepared should it be necessary to consider further actions. This IC does not apply to incidents that are accidental events, acts of civil disobedience, or otherwise are not a HOSTILE ACTION perpetrated by a HOSTILE FORCE. Examples include the crash of a small aircraft, shots from hunters, physical disputes between employees, etc. Reporting of these types of events is adequately addressed by other EALs, or the requirements of 10 CFR § 73.71 or 10 CFR § 50.72. EAL #1 is applicable for any HOSTILE ACTION occurring, or that has occurred, in the OWNER CONTROLLED AREA. This includes any action directed against an ISFSI that is located within the OWNER CONTROLLED AREA. EAL #2 addresses the threat from the impact of an aircraft on the plant, and the anticipated arrival time is within 30 minutes. The intent of this EAL is to ensure that threat-related notifications are made in a timely manner so that plant personnel and OROs are in a heightened state of readiness. This EAL is met when the threat-related information has been validated in accordance with (site-specific procedure). The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of	**TMI Basis (cont):** *Safeguards Contingency Plan [and Independent Spent Fuel Storage Installation Security Program*]. As time and conditions allow, these events require a heightened state of readiness by the facility staff and implementation of onsite protective measures (e.g., evacuation, dispersal or sheltering). The Alert declaration will also heighten the awareness of Offsite Response Organizations (ORO), allowing them to be better prepared should it be necessary to consider further actions. This IC does not apply to incidents that are accidental events, acts of civil disobedience, or otherwise are not a HOSTILE ACTION perpetrated by a HOSTILE FORCE. Examples include the crash of a small aircraft, shots from hunters, physical disputes between employees, etc. Reporting of these types of events is adequately addressed by other EALs, or the requirements of 10 CFR § 73.71 or 10 CFR § 50.72. EAL #1 Basis: The EAL addresses the threat from the impact of an aircraft on the facility, and the anticipated arrival time is within 30 minutes. The intent of this EAL is to ensure that threat-related notifications are made in a timely manner so that facility personnel and OROs are in a heightened state of readiness. This EAL is met when the threat-related information has been validated in accordance with OP-TM-AOP-008, Security Threat/Intrusion. The NRC Headquarters Operations Officer (HOO) will communicate to the licensee if the threat involves an aircraft. The status and size of.	☐ No Change ☒ Difference ☐ Deviation • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	Proposed EAL Matrix for TMI	Comparison
Basis (cont): the plane may be provided by NORAD through the NRC. In some cases, it may not be readily apparent if an aircraft impact within the OWNER CONTROLLED AREA was intentional (i.e., a HOSTILE ACTION). It is expected, although not certain, that notification by an appropriate Federal agency to the site would clarify this point. In this case, the appropriate federal agency is intended to be NORAD, FBI, FAA or NRC. The emergency declaration, including one based on other ICs/EALs, should not be unduly delayed while awaiting notification by a Federal agency. Emergency plans and implementing procedures are public documents; therefore, EALs should not incorporate Security-sensitive information. This includes information that may be advantageous to a potential adversary, such as the particulars concerning a specific threat or threat location. Security-sensitive information should be contained in non-public documents such as the Security Plan.	**TMI Basis (cont):** the plane may be provided by NORAD through the NRC In some cases, it may not be readily apparent if an aircraft impact within the OWNER CONTROLLED AREA was intentional (i.e., a HOSTILE ACTION). It is expected, although not certain, that notification by an appropriate Federal agency to the site would clarify this point. In this case, the appropriate federal agency is intended to be NORAD, FBI, FAA or NRC. The emergency declaration, including one based on other ICs/EALs, should not be unduly delayed while awaiting notification by a Federal agency. EAL #2 Basis: This EAL is applicable for any HOSTILE ACTION occurring, or that has occurred, in the OWNER CONTROLLED AREA. This includes any action directed against an ISFSI that is located outside the facility PROTECTED AREA.	☐ No Change ☒ Difference ☐ Deviation • Paragraph regarding Security-sensitive information was not included based on it being more relevant for EAL Developers (same paragraph is in the Developer Notes) than end-users. • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-HU2 **ECL:** Notification of Unusual Event **Initiating Condition:** Hazardous event affecting SAFETY SYSTEM equipment necessary for spent fuel cooling. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1) a. The occurrence of **ANY** of the following hazardous events: • Seismic event (earthquake) • Internal or external flooding event • High winds or tornado strike • FIRE • EXPLOSION • (site-specific hazards) • Other events with similar hazard characteristics as determined by the Shift Manager **AND** b. The event has damaged at least one train of a SAFETY SYSTEM needed for spent fuel cooling. **AND** c. The damaged SAFETY SYSTEM train(s) cannot, or potentially cannot, perform its design function based on **EITHER**: • Indications of degraded performance • VISIBLE DAMAGE	**PD-HU2** **Category:** H – Hazards and Other Conditions Affecting Facility Safety **PD-HU2** Hazardous Event affecting equipment necessary for spent fuel cooling. **Emergency Action Level (EAL):** 1. a) The occurrence of **ANY** of the following hazardous events: • Seismic event (earthquake) • Internal or external flooding event • High winds or tornado strike • FIRE • EXPLOSION • Other events with similar hazard characteristics as determined by the Shift Manager **AND** b) The event has damaged at least one train of a system needed for Spent Fuel Cooling **AND** c) The damaged train(s) **cannot**, or potentially **cannot**, perform its design function based on **EITHER**: • Indications of degraded performance • VISIBLE DAMAGE	☐ No Change ☒ Difference ☐ Deviation • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Removed "SAFETY SYSTEM" as the item is not applicable in the permanently shut down defueled condition. Revised to clarify that the EAL applies to systems, components or equipment that are needed for spent fuel cooling. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Changed numbering format of EALs. • Replaced "plant" with "facility." •

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	Proposed EAL Matrix for TMI	Comparison
Basis: This IC addresses a hazardous event that causes damage to at least one train of a SAFETY SYSTEM needed for spent fuel cooling. The damage must be of sufficient magnitude that the system(s) train cannot, or potentially cannot, perform its design function. This condition reduces the margin to a loss or potential loss of the fuel clad barrier, and therefore represents a potential degradation of the level of safety of the plant. For EAL 1.c, the first bullet addresses damage to a SAFETY SYSTEM train that is in service/operation since indications for it will be readily available. For EAL 1.c, the second bullet addresses damage to a SAFETY SYSTEM train that is not in service/operation or readily apparent through indications alone. Operators will make this determination based on the totality of available event and damage report information. This is intended to be a brief assessment not requiring lengthy analysis or quantification of the damage. Escalation of the emergency classification level could, depending upon the event, be based on any of the Alert ICs; PD-AA1, PD-AA2, PD-HA1 or PD-HA3.	**TMI Basis:** This IC addresses a hazardous event that causes damage to at least one train of a system needed for spent fuel cooling. The damage must be of sufficient magnitude that the system(s) train cannot, or potentially cannot, perform its design function. This condition reduces the margin to a loss or potential loss of the fuel clad barrier, and therefore represents a potential degradation of the level of safety of the facility. For the first bullet in EAL 1.c, indications of degraded performance apply to in service/operating systems or components that are needed for spent fuel cooling. For the second bullet in EAL 1.c, VISIBLE DAMAGE applies to equipment needed for spent fuel cooling that is not in service/operating or readily apparent through indications alone. Operators will make this determination based on the totality of available event and damage report information. This is intended to be a brief assessment not requiring lengthy analysis or quantification of the damage. Escalation of the emergency classification level could, depending upon the event, be based on any of the Alert ICs: PD-RA1, PD-RA2, PD-HA1 or PD-HA3.	☐ No Change ☒ Difference ☐ Deviation • Replaced "plant" with "facility." • Removed "SAFETY SYSTEM" as the item is not applicable in the permanently shut down defueled condition. Revised to clarify that the EAL applies to systems, components or equipment that are needed for spent fuel cooling. • Clarified discussion of Basis discussion for EAL 1.c to more closely represent the wording in the EAL. • Replaced "AA1" with "RA1" and replaced "AA2" with "RA2" to better signify a radiological event and to maintain continuity with the previous TMI action level scheme.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-HU3 **ECL:** Notification of Unusual Event **Initiating Condition:** Other conditions exist which in the judgment of the Emergency Director warrant declaration of a (NO)UE. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1) Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the plant or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs. **Basis:** This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Director to fall under the emergency classification level description for a NOUE.	**PD-HU3** **Category:** H – Hazards and Other Conditions Affecting Facility Safety **PD-HU3** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an UNUSUAL EVENT. **Emergency Action Level (EAL):** Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which indicate a potential degradation of the level of safety of the facility or indicate a security threat to facility protection has been initiated. No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of equipment required for spent fuel cooling occurs. **TMI Basis:** This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Director to fall under the emergency classification level description for an UNUSUAL EVENT.	☐ No Change ☒ Difference ☐ Deviation • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Removed number from EAL. • Removed "SAFETY SYSTEM" as the item is not applicable in the permanently shut down defueled condition. Revised to clarify that the EAL applies to systems, components or equipment that are needed for spent fuel cooling. • Removed numbering from EAL since it's a single EAL. • Replaced "plant" with "facility." • Replace NOUE with "UNUSUAL EVENT."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
PD-HA3 **ECL:** Alert **Initiating Condition:** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an Alert. **Operating Mode Applicability:** Not Applicable **Example Emergency Action Levels:** (1) Other conditions exist which in the judgment of the Emergency Director indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant or a security event that involves probable life threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels. **Basis:** This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Director to fall under the emergency classification level description for an Alert.	**PD-HA3** **Category:** H – Hazards and Other Conditions Affecting Facility Safety **PD-HA3** Other conditions exist which in the judgment of the Emergency Director warrant declaration of an ALERT. **Emergency Action Level (EAL):** Other conditions exist which, in the judgment of the Emergency Director, indicate that events are in progress or have occurred which involve an actual or potential substantial degradation of the level of safety of the facility or a security event that involves probable life-threatening risk to site personnel or damage to site equipment because of HOSTILE ACTION. Any releases are expected to be limited to small fractions of the EPA Protective Action Guideline exposure levels. **TMI Basis:** This IC addresses unanticipated conditions not addressed explicitly elsewhere but that warrant declaration of an emergency because conditions exist which are believed by the Emergency Director to fall under the emergency classification level description for an ALERT.	☐ No Change ☒ Difference ☐ Deviation • Removed Emergency Classification Level ("ECL") information. • Added Recognition Category ("Category"). • Changed Initiating Condition to IC/EAL identifier. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Removed number from EAL since it's a single EAL. • Replaced "plant" with "facility."

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
E-HU1 **ECL:** Notification of Unusual Event **Initiating Condition:** Damage to a loaded cask CONFINEMENT BOUNDARY. **Operating Mode Applicability:** All **Example Emergency Action Levels:** (1) Damage to a loaded cask CONFINEMENT BOUNDARY as indicated by an on-contact radiation reading greater than (2 times the site-specific cask specific technical specification allowable radiation level) on the surface of the spent fuel cask.	**E-HU1** **Category:** E – ISFSI Malfunction **E-HU1** Damage to a loaded cask CONFINEMENT BOUNDARY. **Emergency Action Level (EAL):** Damage to a loaded cask CONFINEMENT BOUNDARY as indicated by a radiation reading **> 2 times the ISFSI Technical Specification allowable levels**.	☐ No Change ☒ Difference ☐ Deviation • Removed Emergency Classification Level ("ECL") information. • Added "Recognition Category" ("Category"). • Changed "Initiating Condition" to IC/EAL identifier. • Removed "Operating Mode Applicability" information as it does not apply in a permanently defueled condition. • Removed "Example" from Emergency Action Levels since they are no longer examples. • Removed numbering from EAL since it's a single EAL. • Using generic reference which will be addressed in the ISFSI Technical Specifications.

NEI 99-01 Rev 6 Appendix C – Permanently Defueled Station ICs/EALs	**Proposed EAL Matrix for TMI**	**Comparison**
Basis: This IC addresses an event that results in damage to the CONFINEMENT BOUNDARY of a storage cask containing spent fuel. It applies to irradiated fuel that is licensed for dry storage beginning at the point that the loaded storage cask is sealed. The issues of concern are the creation of a potential or actual release path to the environment, degradation of one or more fuel assemblies due to environmental factors, and configuration changes which could cause challenges in removing the cask or fuel from storage. The existence of "damage" is determined by radiological survey. The technical specification multiple of "2 times", which is also used in Recognition Category A IC AU1, is used here to distinguish between non-emergency and emergency conditions. The emphasis for this classification is the degradation in the level of safety of the spent fuel cask and not the magnitude of the associated dose or dose rate. It is recognized that in the case of extreme damage to a loaded cask, the fact that the "on-contact" dose rate limit is exceeded may be determined based on measurement of a dose rate at some distance from the cask. Security-related events for ISFSIs are covered under ICs HU1 and HA1.	**TMI Basis:** This IC addresses an event that results in damage to the CONFINEMENT BOUNDARY of a storage cask containing spent fuel. It applies to irradiated fuel that is licensed for dry storage beginning at the point that the loaded storage cask is sealed. The word cask, as used in this EAL, refers to the storage container in use at the site for dry storage of irradiated fuel. The issues of concern are the creation of a potential or actual release path to the environment, degradation of any fuel assemblies due to environmental factors, and configuration changes which could cause challenges in removing the cask or fuel from storage. The existence of "damage" is determined by radiological survey. The cask technical specification multiple of "2 times," which is also used in Recognition Category R IC PD-RU1, is used here to distinguish between non-emergency and emergency conditions. The emphasis for this classification is the degradation in the level of safety of the spent fuel cask and not the magnitude of the associated dose or dose rate. It is recognized that in the case of extreme damage to a loaded cask, the fact that the "on-contact" dose rate limit is exceeded may be determined based on measurement of a dose rate at some distance from the cask. Security-related events for ISFSIs are covered under ICs PD-HU1 and PD-HA1.	☐ No Change ☒ Difference ☐ Deviation • The sentence referring to the "word cask" is being provided for clarification. • "AU1" is replaced with "RU1" reflect the appropriate references in the proposed EALs. • Added "PD" to references to RU1, HU1 and HA1 to reflect the appropriate references in the proposed EALs.

ATTACHMENT 2

CORRESPONDENCE FROM PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION, BUREAU OF RADIATION PROTECTION

(1 page)

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

October 30, 2020

Mr. Robert Brady
Three Mile Island
441 South, P.O. Box 480
Middletown, Pennsylvania 17057

Re: Exelon TM-20-029 TMI PDEP Supplement R1 document

Dear Mr. Brady:

The Bureau of Radiation Protection's Nuclear Safety Division has reviewed the referenced draft submittal and currently have no comments as presented. It is our understanding that the NRC will be conducting a review of this document in a timely manner. The Commonwealth will be monitoring the progress of this submittal.

Sincerely,

Wade DeHaas
Department of Environmental Protection| Bureau of Radiation Protection
Nuclear Safety Division |RPPM| Radiation Health Physicist
Rachael Carson State Office Building
PO Box 8469|Harrisburg, PA 17105
Phone: 717-787-2699 | Fax: 717-783-8965
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