THREE MILE ISLAND, UNIT No. 2 – REQUEST FOR ADDITIONAL INFORMATION FOR REQUESTED LICENSING ACTION REGARDING DECOMMISSIONING TECHNICAL SPECIFICATIONS EPID: L-2021-LLA-0038

ACCIDENT ANALYSIS:

By letter dated February 19, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21057A046), TMI-2 Solutions, LLC (TMI-2 Solutions or licensee) submitted a License Amendment Request (LAR) to remove certain requirements from the TMI-2 Technical Specifications (TS) that restrict activities in the TMI-2 Reactor Building during Post-Defueling Monitored Storage (PDMS). The licensee would like to progress to actively decommissioning the remaining structures, systems, and components that were contaminated in the 1979 accident. Previously, the licensee had evaluated the impacts of a fire in a High Integrity Container (HIC) containing spent ion exchange resins. Subsequently, the licensee determined that the HIC fire scenario was not representative of the activities that would be occurring during decommissioning and submitted supplemental information on January 7, 2022 (ML22013A177). The U.S. Nuclear Regulatory Commission (NRC) staff provided preliminary questions on the information on February 7, 2022 (ML22038A936). The licensee provided a response on April 7, 2022 (ML22101A077), including references and additional analyses on May 8, 2022 (ML22138A302). This request for additional information (RAI) is in response to the latest information provided.

Fire is arguably one of the largest risks at a nuclear facility (U.S. Department of Energy (DOE), 1994). Fire risk is a product of the likelihood of a fire occurring and the consequences if a fire were to occur. Though minor in impact, fires have occurred at nuclear reactors undergoing decommissioning (e.g., Crystal River, Ft. Calhoun, Indian Point). By the introduction of fuel and energy sources combined with the diverse activities that are necessary to complete decommissioning, the frequency of occurrence of fires has been higher during decommissioning than during operations or, in the case of TMI-2, PDMS.

When responding to RAIs, the licensee may identify alternative approaches such as management controls, procedures, calculations, or conditions that will ensure the impacts from potential fires during decommissioning will meet established criteria for protection of human health.

RAI 1 Fractional Airborne Release Factor (ARF)

Comment: Insufficient basis was provided for using the revised ARF of 1.5×10^{-4} based on the 1973 reference.

Basis: The license revised the fractional ARF from a previously used value of 1×10^{-3} to a new value of 1.5×10^{-4}. The revised value was indicated to be more appropriate and is based on information found in NUREG/CR-0130 (1978), *Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station*, which in turn references Battelle-Pacific Northwest Laboratories (BNWL)-1730 (1973). The data in BNWL-1730 were developed from measurements of burning different types of uranium (dioxide powder, nitrate solution) containing materials (e.g., cardboard, paper, plastic, rubber) in a small enclosure. The fire produced conditions inside the enclosure were very smoky and some material did not burn well suggesting perhaps the oxygen flow was not sufficient. ARF's were measured from 3×10^{-5} to 5×10^{-4}. Wall deposition was cited as being as high as 2.3×10^{-3}.

Though not extensively studied, the importance of the ARF to accident risk analysis has been recognized. The ARF is likely to depend on material type, condition and form of the material, and projected fire magnitude. New information is available for a variety of different materials and conditions, and the new material reflects a broader consideration of materials and conditions. In NUREG-1140 (1988), *A Regulatory Analysis on Emergency Preparedness for Fuel Cycle and Other Radioactive Material Licenses*, a value is provided of 1 x 10^{-3} for uranium (U), plutonium (Pu), americium (Am), and curium (Cm). In NUREG-1940 (2012), *RASCAL 4: Description of Models and Methods*, values for dry process waste, a packed waste fire (solids), a loose waste fire (solids), and high efficiency particulate air (HEPA) filters are provided of 1 x 10^{-3}, 5 x 10^{-4}, 5 x 10^{-2}, and 1 x 10^{-4}, respectively. In the 1994 DOE Handbook compiling various ARFs (DOE-HDBK-3010-94, ML13078A031), a wide variety of measurements are summarized and discussed. Values cited that may be relevant to TMI-2 range from 5 x 10^{-2} for plastics to 5 x 10^{-4} for packaged waste or a burning container – Figure 5-11 is especially informative. Recently, Hubbard et. al (SAND2019-12565J, 2019), measured ARF's for uranium containing materials and various surrogates. For uranium, the ARF was 9.6 x 10^{-4} with a standard deviation of 7.1 x 10^{-4}. For surrogates, the ARF's were about a factor of 100 lower, though the authors expected the surrogate data may have been impacted by precipitation from solution.

The licensee indicated that in the case of TMI-2, the loose contamination is primarily on non-combustible metal and concrete surfaces. The licensee stated that the contamination will not be involved in the fire but could be swept up into it. Fire of non-combustible materials is not of concern aside from the potential for a large fire to volatize cesium (Cs) associated with pore water of the contaminated concrete. The concrete walls of the reactor building basement are one of the largest sources of radioactivity remaining outside of debris contained within the reactor.

From examination of historical photos, some materials located within the reactor building are combustible. In addition, fuel and other combustible materials will be introduced to facilitate decommissioning. A critical assessment of materials present, and appropriate ARF's for those materials, may help support selection of ARF's or help determine if additional controls are necessary for certain materials.

Path Forward: Describe the form and material types that may be subject to a fire with emphasis on combustible materials. Provide additional basis for the ARF selected addressing the more recent observations noted in the basis section. As necessary, revise the ARF to be consistent with the ranges and uncertainties.

RAI 2 Fire Scenarios

Comment: Fire scenarios evaluated do not encompass the range of operating configurations that may occur during decommissioning.

Basis: The licensee evaluated different fire scenarios. The scenarios were designed to account for fires in different locations and with different structures, systems, and components in place to mitigate the impacts of a hypothetical fire. The locations of the fires were assumed to be the operating platform, A & B D-rings, fuel transfer channel, and the reactor building basement (BAS). The licensee analysis considered three scenarios: a fire while the reactor building purge is running (Case 1), a fire while the reactor building is held at a slightly negative pressure (Case 2), and a fire while the reactor building is under passive ventilation (Case 3). The licensee stated that Case 1 would be the limiting case.

Potential offsite fire impacts are a function of how much material is released and over what duration as well as how long a person is exposed to that release. The release point is also important as the atmospheric dispersion and dilution can vary with release point. The licensee estimated that ground level releases would lead to larger doses (by about a factor of 2) compared to a release at height under similar atmospheric conditions.

In case 2, the licensee assumed that the radioactive material released by the fire would be contained and released slowly over a 14-hour duration. In case 3, it was assumed that release would occur while the reactor building was under passive ventilation. A small fire could result in material passing through the filters (being filtered) while a large fire would trigger a pressure differential resulting in the breather isolation valve closing and sealing off the reactor. The magnitude of the fire was not otherwise discussed.

A large fire should result in the release of more radioactive material because more contaminated material would be consumed. HEPA filters will not perform indefinitely in response to a fire. Filters may clog with soot and debris and fail. The analysis should consider the actions of fire personnel responding to a fire. It is unlikely that the fire impacts will be insensitive to fire magnitude. A primary objective of personnel responding to a fire is to extinguish the fire and to do that fire personnel must be able to see what is happening. A large fire is more likely to have ingress and egress as well as actions taken to increase visibility. The three cases analyzed do not seem to encompass the set of reasonable permutations (e.g., the building purge may be inoperable or deactivated and ingress/egress may lead to ground release) associated with active decommissioning as opposed to PDMS, and Case 1 is not clearly bounding.

Path Forward: Please provide a discussion and analysis of alternative cases that may occur as systems are dismantled and deactivated or discuss management controls that will be used to ensure the limiting case examined (Case 1) is bounding.

RAI 3 Offsite Dose Calculations

Comment: The offsite dose calculations lack transparency and traceability.

Basis: Offsite doses resulting from a potential fire were described in TMI2-RA-COR-2022-0007, LAR TMI- 2 "GPU Nuclear Calculation 4440-7380-90-017, Revision 4, PDMS Safety Analysis Report (SAR) Section 8.2.5 Fire Analysis Source Terms") of ML22138A302 (May 13, 2022, Attachment 2). The licensee described modifications to previous calculations (revision 3) to account for additional decay and ingrowth, the presence of additional loose contamination, and use of updated dose conversion factors (revision 4). These changes were sufficiently described and appropriate.

Staff were able to verify the dose conversion factors that were used and most other parameters, as well as the calculated decay and ingrowth. However, the approach taken for the amount of source material (inventory) that is released as a result of the fire was not clear. In revision 3 of the analysis, the amount released was calculated as a product of two factors: the amount of material available and the fraction of available material that was released to the air. The amount of fuel elements available (e.g., Pu, Am) was assumed to be 100 percent or a fraction of 1.0. The amount of Cs and Sr available was assumed to be 1 percent or a fraction of 0.01 for a fire in the reactor basement. These were then multiplied by factors of 8×10^{-4} for actinides and apparently 1.5 x 10^{-3} for Cs and Sr. Staff could only replicate the basement fire dose of 0.889 mrem by using these factors. The impact is the dose for new ARF of 1.5 x 10^{-4} does not decrease by a factor of 6.67 but instead would be 0.80 mrem for the basement fire (note RAI #1 on the basis for the ARF).

Path Forward: Please verify the combined factors of material available and airborne fraction released in revision 3 of the fire analysis source terms and update the revision 4 analyses as appropriate.

RAI 4 Basis for Inventory

Comment: Additional information is necessary to adequately support the inventory of radionuclides assumed in the fire analyses scenarios.

Basis: Fire analyses were previously performed as part of the PDMS safety analyses. The previous analyses assumed most of the transuranic radionuclides remained with or was present in different areas of the plant proportional to how much fuel was estimated to be present. This assumption was appropriate when characterization data was limited. Characterization data has been developed which suggests the inventory assumed for the BAS fire may have been underestimated. Because of high radiation fields in some areas of the plant, characterization data was difficult to obtain and in many cases was limited to total radiation (e.g., R/hr). The reactor building basement was flooded to a depth of approximately 2.6 m (8 ft) during the accident and subsequent recovery activities. Table 1 is the inventory of select radionuclides estimated to be present at the time of the accident (1979) and in 1990. Only about 1 percent (1.3 kg out of 100 kg) of fuel is estimated to remain in the reactor building basement (about 1 percent of the total transuranics shown).

Table 1 Inventory of Select Radionuclides Pre- and Post-Defueling

Radionuclide	Inventory at Accident (1979) Ci	Inventory in 1990 Ci
^{90}Sr	760,000	2,400
^{137}Cs	820,000	43,000
^{241}Pu	160,000	950
^{239}Pu	9,000	90
^{241}Am	19	22

In the current submittal for the analysis of potential fires during decommissioning, the license revised the inventory (using the same starting point/inventory) to account for additional radioactive decay and ingrowth as well as the presence of additional surface contamination that was identified after the previous analyses. Whereas radioactive decay decreased the amount of ^{137}Cs and ^{90}Sr as well as many transuranics, the amount of some radionuclides increased. For example, ^{241}Pu has a 14.4-year half-life and decays into ^{241}Am. The amount of ^{241}Am present was estimated to have increased significantly thereby offsetting the decay of other radionuclides.

In GEND-INF-011-Vol3 (1983), samples of the liquid and sediment/debris in the reactor building basement were obtained and characterized. The measured plutonium in the solids averaged 3.4 mg/g. In other documents, various estimates of solids in the basement were provided and about half of the solids was reported as being removed. The remaining solids are on the order of 3000 kg (6600 lbs). Approximately 90 percent of the plutonium would be expected to be ^{241}Pu based on the inventory assigned by the licensee in the accident analysis. The specific activity of ^{241}Pu is approximately 103.35 Ci/g. The measurement data corresponds to approximately 1,000 Ci of ^{241}Pu, which is significantly larger than the approximate 10 Ci (1% of the 950 Ci shown in Table 1) included in the analyses.

The source term (inventory) used in the BAS fire scenario (Attachment 2, TMI2-RA-COR-2022-0007, LAR TMI- 2 "GPU Nuclear Calculation 4440-7380-90-017, Revision 4, PDMS SAR Section 8.2.5 Fire Analysis Source Terms", ML22138A302) used the inventory from previous analyses as the starting point.

The enrichment of the fuel at the time of the accident is not precisely known (Cragnolino, 1997). A value of 2.57 percent in U-235 was used (the core average). A higher enrichment may be conservative with respect to criticality analysis, but a lower enrichment is conservative with respect to other accident analyses because of the increase in ^{241}Pu which decays into ^{241}Am. The inventory used in the fire accident analysis is apparently based on the 2.57 percent value.

Path Forward: Please address the apparent discrepancy between the characterization data (concentrations) provided in GEND-INF-011-Vol3 and the assumed basement inventory applied in the fire analyses. Please address the assumed fuel enrichment and how it yields a conservative starting inventory for fire accident analyses.

RAI 5 Buildup of Radiolytic Gas

Comment: The licensee did not provide sufficient information of radiolytic gases (primarily Hydrogen (H_2)) that could pose an explosion hazard.

Basis: Interaction of radiation with water or other materials can result in the production of radiolytic gases, primarily hydrogen. In sufficient concentrations and with oxygen present, hydrogen is flammable. Through operation of the Submerged Demineralizer System and packaging of the generated waste for disposal, it was observed that TMI-2 debris could generate H_2 in short-term storage that could reach Lower Flammability Limits (LFL). Licensing of the dry cask storage system in Idaho for TMI-2 debris applied multiple controls and systems in order to prevent buildup of H_2 gas to the LFL (ML18296A527). Canisters were vacuumed dried prior to storage and the systems included a HEPA filter to vent hydrogen. Monitoring of hydrogen levels is performed (ML19259A017) and observed hydrogen levels have been around 0.04 percent where the LFL with oxygen present is 5 percent - the venting has been very effective but hydrogen generation is continual.

Though a large fraction of the radioactivity has been removed from the TMI-2 systems, high radiation fields remain. The deactivated reactor systems have dead end and closed portions (e.g., high points in unused piping) where H_2 gas could collect. Significant moisture is present in many systems and components. Decades have passed since the accident where H_2 could be generated.

Path Forward: Please demonstrate the impacts of a hydrogen explosion initiated by decommissioning activities is bound by the fire scenarios evaluated, or please describe management controls and procedures such as circulation of air and monitoring for flammable gases that will be used prior to cutting or introduction of flame to systems being decommissioned.

RAI 6 Dust Explosion and Exothermic Reaction Hazard

Comment: The licensee did not address the potential for dust explosions or discuss management controls that would be used to ensure a dust explosion will not occur.

Basis: In typical decommissioning of a reactor, contamination is primarily present in a fixed or embedded form that is not easily dispersed. During the accident at TMI-2, aggressive conditions occurred. Fuel, cladding, and other materials were melted and distributed, primarily within the reactor pressure vessel, but with some material (estimates range from 0.5 to 1 percent) distributed outside the pressure vessel. Contaminated coolant leaked and flowed to different areas of the plant including the reactor basement. During the accident approximately 40 percent of the fuel melted which would have produced approximately 13 tons of Zirconium (Zr). If approximately 1 percent of the melted material exited the pressure vessel, that means approximately 130 kg (290 lbs) was deposited throughout the systems and about 1 kg (2 lbs) would be < 5 um powder based on measured particle size distributions.

Metallic Zr with sufficient surface area is pyrophoric and numerous accidents have occurred (Atomic Energy Commission (AEC), 1956). Many other powders, especially powdered metals such as aluminum, magnesium, sodium, lithium, potassium, and titanium, can be highly reactive. The minimum explosible concentration (MEC) is dependent on the form of the material and the particle size. For iron dust, which is generally viewed as being somewhat inert, the MEC is on the order of 100 to 200 g/m^3 for 4 mm particles (Cashdollar, 2000). Dust explosions can occur when the “fire triangle” is achieved: a fuel, an oxidizer (usually air), and a heat or ignition source is present. It is expected that most of the material deposited outside of the pressure vessel would have been oxidized during the event. However, characterization data is limited in some areas due to high radiation fields.

Pyrophoricity studies were completed prior to defueling and pyrophoricity of debris was not observed (Clark et al., 1984). However, those studies evaluated debris from inside the pressure vessel and focused on larger particle sizes of the core debris (lower specific surface area). Because the debris deposited outside the reactor vessel has smaller particle sizes, the surface area to volume ratio will be higher.

Path Forward: Please describe controls that will be used to minimize the risk of dust explosions or other exothermic reactions during decommissioning. Please summarize characterization data and other studies that demonstrate that reactive dusts are not present in sufficient quantities to present an explosion or fire hazard.

RAI 7 Cork Seams

Comment: A potential fire in the contaminated cork seams and associated materials was not addressed.

Basis: The TMI-2 cork seam is a construction joint between the various major facility structures. During the 1979 accident, the cork seam was immersed in contaminated water. The cork and associated polyurethane sheet material are potential fuel sources, that when exposed during decommissioning, could become a source of contaminated fuel consumed in a fire. The release pathways may be more limiting than the evaluated fire scenarios.

Path Forward: Please describe controls that will be used to prevent a fire in the cork seams and associated materials during decommissioning or complete analyses to demonstrate that the evaluated fire scenarios, subject to the technical comments provided in the RAI, are more limiting.

TECHNICAL SPECIFICATIONS

RAI 8 Annual Effluent Monitoring Report

In TMI-2 Solutions' application, as supplemented, TMI-2 Solutions proposed deletion of this Technical Specification below and relocation to the Decommissioning Quality Assurance Plan:

> ANNUAL RADIOACTIVE EFFLUENT
> RELEASE REPORT
>
> "6.8.1.2 The Annual Radiological Effluent Release Report covering the operation of the ~~unit~~ facility during the previous calendar year shall be submitted before May 1 each year. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the facility. The material provided shall be (1) consistent with the objectives outlined in the ODCM and (2) in conformance with 10 CFR 50.36a and Section IV. 8.1 of Appendix I to 10 CFR Part 50."

Comment: The licensee did not address the requirement that the annual effluent monitoring reporting is required by regulation to be in the technical specifications.

Basis: As TMI-2 Solutions holds a part 50 license, then Title 10 of the *Code of Federal Regulations* (10 CFR) 50.36a(a)(2), "Technical specifications on effluents from nuclear power reactors," continues to require TMI-2's TS to contain this TS. This is because 50.36a states:

> (a) [E]ach licensee of a nuclear power reactor … will include technical specifications that … require that:
>
> (1) …
>
> (2) Each holder of an operating license … shall submit a report to the Commission annually that specifies the quantity of each of the principal radionuclides released to unrestricted areas in liquid and in gaseous effluents during the previous 12 months, including any other information as may be required by the Commission to estimate maximum potential annual radiation doses to the public resulting from effluent releases. The report must be submitted as specified in § 50.4, and the time between submission of the reports must be no longer than 12 months. If quantities of radioactive materials released during the reporting period are significantly above design objectives, the report must cover this specifically. On the basis of these reports and any additional information the Commission may obtain from the licensee or others, the Commission may require the licensee to take action as the Commission deems appropriate.

Path Forward: Therefore, granting TMI-2 Solutions LAR (for removal of TS Section 6.8.1.2) would cause the TS to cease meeting 50.36a(a)(2); the license may only be amended in the requested fashion only if the licensee is first exempted from 50.36(a)(2).

Alternatively, TMI-2 Solutions may supplement its application to request including TS Section 6.8.1.2 in its TS for the staff's consideration in its review of the February 21, 2021 amendment application, as amended. TMI-2 Solutions should include a markup of the proposed TS change, if it decides to pursue this option.

SAFE FUEL MASS LIMITS

RAI 9 Criticality

Comment: It is not clear in the application how the requirements of 10 CFR 50.68(a), "Criticality accident requirements," are satisfied.

Basis: Paragraph a to 10 CFR 50.68 states that the applicant shall comply with the requirements of 10 CFR 70.24, "Criticality accident requirements," or meet certain alternative requirements, as described in 10 CFR 50.68(b), in lieu of maintaining a criticality accident alarm system (CAAS) as described in 10 CFR 70.24.

10 CFR 70.24(a) requires, in part, that each licensee authorized to possess special nuclear material (SNM) in a quantity exceeding 700 grams of contained uranium-235 (U-235), 520 grams of U-233, 450 grams of plutonium, 1.5 kilograms of contained U-235 if no uranium enriched to more than 4 wt. percent U-235 is present, or 450 grams of any combination thereof, maintain in each area in which such licensed SNM is handled, used, or stored, a CAAS.

Attachment 1 to TMI-RA-COR-2022-0001, "Supplemental Information to License Amendment Request, Three Mile Island, Unit 2, NRC Possession Only License No. DPR-73, Response to Questions on [Safe Fuel Mass Limit] Analysis," states that the use of a traditional CAAS is not planned due to the low likelihood of inadvertent criticality. However, it is not clear how the requirements of 10 CFR 50.68(a) are satisfied.

Path Forward: Provide information that demonstrates compliance with 10 CFR 50.68 or request an exemption from the requirements of 10 CFR 50.68 in accordance with 10 CFR 50.12, "Specific exemptions."

MATERIAL CONTROL AND ACCOUNTING (MC&A)

RAI 10 Accounting for Debris Material

Comment: It is not clear in the LAR how TMI-2 Solutions plans to control and account for Debris Material throughout decommissioning.

Basis: Debris Material must be controlled and accounted for at all times during decommissioning because the Debris Material contains large quantities of SNM, including uranium-235 and plutonium. Once TMI-2 has entered DECON, the applicant has stated that SNM will be retrieved, aggregated, and placed into dry cask storage using various shapes and sizes of containers to place into a basket and canister. To minimize aggregating the remaining SNM, the core debris will be generally packaged and loaded as it is retrieved. These canisters will then be transferred to the expanded Independent Spent Fuel Storage Installation (ISFSI) inside the Three Mile Island Station, Unit No. 1 ("TMI-1"), ISFSI fence to store the canisters after TMI-1 completes their spent fuel transfer campaign to the ISFSI. In addition, estimates of the quantities and form of SNM at TMI-2 provided by the applicant indicate that the site may need more detailed plans for material control and accounting during decommissioning, compared to sites where SNM is generally restricted to undamaged spent fuel assemblies. 10 CFR Part 74, "Material Control and Accounting of Special Nuclear Material," establishes requirements for the control and accounting of SNM at fixed sites and for documenting the transfer of SNM. General reporting requirements as well as specific requirements for certain licensees possessing SNM of low strategic significance, special nuclear material of moderate strategic significance, and formula quantities of strategic special nuclear material are included.

Path Forward: Describe how TMI-2 Solutions will control and account for Debris Material being removed from the Reactor Building to the Three Mile Island ISFSI throughout the decommissioning process in order to meet the applicable requirements of 10 CFR Part 74. Describe TMI-2 plans to refine current rough estimates of radionuclide content in Debris Material in existing reports and provide more accurate information on quantities of SNM as materials are packaged and removed.

RAI 11 Reports of Loss or Theft of SNM

Comment: In the LAR TMI-2 Solutions does not address reporting of loss, theft, or attempted theft of SNM.

Basis: 10 CFR 74.11(a), "Reports of loss or theft or attempted theft or unauthorized production of special nuclear material," requires each licensee who possesses one gram or more of contained uranium-235, uranium-233 or plutonium to notify the NRC Operations Center within 1 hour of discovery of any loss or theft or other unlawful diversion of SNM which the licensee is licensed to possess, or any incident in which an attempt has been made to commit a theft or unlawful diversion of SNM.

Path Forward: Provide a description of the MC&A activities that are performed or the measures in place to show how the reporting requirement of 10 CFR 74.11(a) is met.

RAI 12 Material Status Reports

Comment: In the LAR TMI-2 Solutions does not address completion or submission of Material Balance Reports or Physical Inventory Listing Reports.

Basis: 10 CFR 74.13(a), "Material status reports," requires each licensee possessing SNM in a quantity totaling 1 gram or more of contained uranium-235, uranium-233, or plutonium to complete and submit, in computer-readable format Material Balance Reports concerning SNM that the licensee has received, produced, possessed, transferred, consumed, disposed, or lost. The Physical Inventory Listing Report must be submitted with each Material Balance Report.

Path Forward: Provide a description of the MC&A activities that are performed or the measures in place to show how the reporting requirements of 10 CFR 74.13(a) are met.

RAI 13 Nuclear Material Transaction Reports

Comment: In the LAR TMI-2 Solutions does not address completion of Nuclear Material Transaction Reports.

Basis: 10 CFR 74.15(a), "Nuclear material transaction reports," requires each licensee who transfers or receives SNM in a quantity of 1 gram or more of contained uranium-235, uranium-233, or plutonium to complete, in computer-readable format, a Nuclear Material Transaction Report. In addition, each licensee who adjusts the inventory in any manner, other than for transfers and receipts, shall submit a Nuclear Material Transaction Report, in computer-readable format, to coincide with the submission of the Material Balance Report. Each licensee who transfers SNM shall submit a Nuclear Material Transaction Report no later than the close of business the next working day. Each licensee who receives SNM shall submit a Nuclear Material Transaction Report within 10 days after the material is received.

Path Forward: Provide a description of the MC&A activities that are performed or the measures in place to show how the reporting requirements of 10 CFR 74.15(a) are met.

RAI 14 MC&A Records

Comment: In the LAR TMI-2 Solutions does not address MC&A recordkeeping.

Basis: 10 CFR 74.19(a), "Recordkeeping," requires licensees to keep records showing the receipt, inventory (including location and unique identity), acquisition, transfer, and disposal of all SNM in its possession regardless of its origin or method of acquisition. Each record relating to material control or material accounting must be maintained and retained for the period specified by the appropriate regulation or license condition. Each record of receipt, acquisition, or physical inventory of SNM must be retained as long as the licensee retains possession of the material and for 3 years following transfer or disposal of the material. Each record of transfer of SNM to other persons must be retained by the licensee who transferred the material until the Commission terminates the license authorizing the licensee's possession of the material.

Path Forward: Provide a description of the MC&A activities that are performed or the measures in place to show how the MC&A records requirements of 10 CFR 74.19(a) are met.

RAI 15 Written MC&A Procedures

Comment: In the LAR TMI-2 Solutions does not address the use of written MC&A procedures to enable the licensee to account for the SNM in its possession.

Basis: 10 CFR 74.19(b) requires each licensee authorized to possess SNM in a quantity exceeding one effective kilogram to establish, maintain, and follow written MC&A procedures that are sufficient to enable the licensee to account for the SNM in its possession under license.

Path Forward: Provide a description of the MC&A activities that are performed or the measures in place to show how the procedure requirements of 10 CFR 74.19(b) are met, if applicable.

RAI 16 Annual Physical Inventory of SNM

Comment: In the LAR TMI-2 Solutions does not address conduct of an annual physical inventory of SNM.

Basis: 10 CFR 74.19(c) requires certain licensees who are authorized to possess SNM in a quantity greater than 350 grams of contained uranium-235, uranium-233, or plutonium, to conduct a physical inventory of all SNM in its possession under license at intervals not to exceed 12 months. The results of these physical inventories shall be retained in records by the licensee until the Commission terminates the license authorizing the possession of the material.

Path Forward: Provide a description of the MC&A activities that are performed or the measures in place to show how the inventory requirements of 10 CFR 74.19(c) are met.

REFERENCES

AEC, "Zirconium Fire and Explosion Hazard Evaluation," Accident and Fire Prevention Information, Issue No. 45, Atomic Energy Commission, 1956.

Cashdollar, K. L., "Overview of Dust Explosibility Characteristics," Pittsburgh Research Laboratory, Pittsburgh PA, 2000.

Clark et al, "TMI-2 Leadscrew Debris Pyrophoricity Study," GEND-INF-044, Pacific Northwest Laboratory, Richland WA, 1984.

Cragnolino, G. "Characteristics of the Three Mile Island Unit 2 Fuel Debris – Final Report," CNWRA 98-002, Center for Nuclear Waste Regulatory Analyses, San Antonio, TX, 1997.

Cox et. al, "Reactor Building Basement Radionuclide and Source Distribution Studies", GEND-INF-011-Vol3, GEND, US DOE, 1983.

DOE, "Airborne Release Fractions/Rates and Respirable Fractions for non-Reactor Nuclear Facilities, DOE-HDBK-3010-94, US Department of Energy, Washington DC, 1994. ML13078A031.

Hubbard et. al, "Airborne Release Fractions from Surrogate Nuclear Waste Fires Containing Lanthanide Nitrates and Depleted Uranium Nitrate in 30% Tributyl Phosphate in Kerosene," SAND2019-12565J, Sandia National Laboratories, Albuquerque, NM 2019.

Mishima, J. and L. C. Schwendiman, "Fractional Airborne Release of Uranium (Representing Plutonium) During the Burning of Contaminated Wastes," BNWL-1730, Battelle Pacific Northwest Laboratories, Richland WA, 1973.

AREVA Federal Services and Spectra Tech, Inc., prepared for DOE-Idaho Office, REDACTED TMI-2 Independent Spent Fuel Storage Installation Application for 10 CFR 72 Specific License Renewal, Special Nuclear Materials License Number SNM-2508, Revision I, dated August 26, 2018 (ML18296A527).

TMI-2 ISFSI Renewed Technical Specifications [Letter to J. Zimmerman re: Issuance of Renewed Materials License No. SNM-2508 for the Three Mile Island Unit 2 Independent Spent Fuel Storage Installation], dated August 16, 2019 (ML19259A017).

Three Mile Island Nuclear Station, Unit 2 (TMI-2) Response to Request for Additional Information, Attachment 2, TMI2-RA-COR-2022-0007, License Amendment Request Three Mile Island Nuclear Station, Unit 2 "GPU Nuclear Calculation 4440-7380-90-017, Revision 4, PDMS SAR Section 8.2.5 Fire Analysis Source Terms", dated (ML22138A302, Pkg).

Three Mile Island Nuclear Station, Unit 2 (TMI-2) - License Amendment Request - Three Mile Island, Unit 2, Decommissioning Technical Specifications, Response to Questions, dated May 16, 2022 (ML21057A046 Pkg - Non-public).

Three Mile Island Nuclear Station, Unit 2 (TMI-2) License Amendment Request - Three Mile Island, Unit 2, Decommissioning Technical Specifications, Supplemental Information, dated January 7, 2022 (ML22013A177).

Request for Additional Information - TMI2 Accident Analyses Questions, dated February 7, 2022 (ML22038A936).

Three Mile Island, Unit 2, Supplemental Information to License Amendment Request, Decommissioning Technical Specifications, dated April 19, 2022 (ML22101A077).

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