

# Hazard Assessment Document

## Materials Test Reactor Canal and TRA-657 Plug Storage Hole Facility Holes 1 and 2



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TRA Reactor Programs	Hazard Assessment Document	For Additional Info: <a href="http://EDMS">http://EDMS</a>	Effective Date: 09/24/03
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ASA	auditable safety analysis
CFR	<i>Code of Federal Regulations</i>
DOE	Department of Energy
DOE-ID	U.S. Department of Energy, Idaho Operations Office
EDF	Engineering Design File
HAD	Hazard Assessment Document
HFEF-6	Hot Fuel Examination Facility Cask No. 6
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MAR	material at risk
MCP	management control procedure
MTR	Materials Test Reactor
NE-ID	U.S. Department of Energy, Idaho Operations Office
NRASA	not requiring additional safety analysis
PBF	Power Burst Facility
PSH	Plug Storage Hole
RQ	reportable quantity
SAR	Safety Analysis Report
TPQ	threshold planning quantity
TQs	threshold quantities
TQV	threshold quantity value
TRA	Test Reactor Area
TTAF	Test Train Assembly Facility

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## 1. INTRODUCTION

This Hazard Assessment Document (HAD) presents the results of the hazard classification for the Test Reactor Area (TRA) Materials Test Reactor (MTR) Canal and the Plug Storage Hole (PSH) facility Holes 1 and 2 at the Idaho National Engineering and Environmental Laboratory (INEEL). These facilities were previously categorized as Hazard Category 2 nuclear facilities; however, they are now being reexamined as part of the effort to prepare these facilities for the transition from surveillance and maintenance to deactivation.

The two documents requiring hazard categorization of U.S. Department of Energy (DOE) facilities are based on the level of potential hazard the activities pose to the off-Site public, on-Site workers, and the environment, and are listed below:

- 10 Code of Federal Regulations (CFR) 830, Subpart B, "Safety Basis Requirements"<sup>1</sup>
- U.S. Department of Energy, Idaho Operations Office ID O 420.D, Rev. 1, "Requirements and Guidance for Safety Analysis."<sup>2</sup>

These requirements provide a basis for establishing the required safety documentation and level of administrative control. This report documents a hazard categorization for the TRA-603 MTR Canal and TRA-657 PSH facility Holes 1 and 2. The categorization follows guidance in DOE-STD-1027-92,<sup>3</sup> "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports." This categorization is meant to determine whether 10 CFR 830 applies to these facilities. If the facility is determined to be less than Hazard Category 3, then 10 CFR 830 does not apply.

Management Control Procedure (MCP)-2451, "Safety Analysis for NRASA and Nonnuclear Facilities,"<sup>4</sup> states that those facilities that do not meet or exceed the DOE-STD-1027-92 Attachment I Category 3 threshold criteria, but are a non-NRASA facility, may be classified as a "nonnuclear facility." ID O 420.D, Rev. 1, requires that a hazard assessment be performed for all facilities and activities. Hazards associated with the MTR Canal and the PSHs 1 and 2 are evaluated against the criteria taken from ID O 420.D, Rev. 1. On this basis, these items must be assessed against the hazard classification criteria of ID O 420.D, Rev. 1, to determine the proper level of safety documentation approval.

As shown in Table 1, the TRA-603 MTR Vault No. 1 and the Test Train Assembly Facility (TTAF) areas were categorized in Safety Analysis Report – 101 (SAR-101), "Basis for Interim Operation for MTR Canal and Plug Storage Holes 1 and 2."<sup>5</sup> In SAR-101, the MTR Vault No. 1 and TTAF areas were classified as Hazard Category 2 facilities; however, the TTAF is being relocated to the TRA Hot Cell, and no further test assembly activities will be conducted in the MTR facility. All radioactive materials have been removed from MTR Vault No. 1. The vault is currently being used as a records storage area. These two areas were re-categorized as not requiring additional safety analysis (NRASA) in Engineering Design File (EDF) TRA-1554, "TRA Facility Hazard Categorization."<sup>6</sup> As a result, no further evaluation or consideration will be given to these facilities in this document.

The scope of this analysis, through the classification process, is to provide a common hazard classification that will serve both the surveillance and maintenance and DD&D of the facility.

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Table 1. Hazard categorization for TRA facilities.

Bldg. Number	Description	Current Hazard Categorization	Revised Hazard Categorization per this HAD
TRA-603	MTR Canal	Hazard Category 2	less than Hazard Category 3
TRA-657	Plug Storage Holes 1 and 2	Hazard Category 2	NRASA
TRA-657	Plug Storage Holes 3 through 32	None	NRASA
TRA-603	TTAF <sup>a,b</sup>	Category 2	NRASA
TRA-603	MTR Vault No. 1 <sup>a,b</sup>	Category 2	NRASA

a. These facilities were previously classified in SAR-101, Rev. 5 and need to have their individual reclassifications reviewed.

b. These facilities were previously classified in EDF TRA-1554. D.M. Lucoff letter to R. V. Furstenu, "Status, Current Results, and Request for Approval of Test Reactor Area Facility Hazard Classifications/Categorizations," CCN-00-009578, May 31, 2000, was sent to U.S. Department of Energy, Idaho Operations Office (DOE-ID) requesting approval of the TRA Facility hazard classifications/categorizations for the facilities listed in the document.

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## 2. FACILITY DESCRIPTION

The MTR Canal and PSH facility are located in the TRA area, which is located on the southwestern portion of the INEEL within the boundaries of Butte County. Figure 1 shows a plan view of the TRA area with the MTR Canal and TRA-657 identified within TRA. A more detailed description of the geographic characteristics of the INEEL is available in Chapter 1 of SAR-100.<sup>7</sup>

The MTR Canal and PSH 1 and 2 were used to store two similar types of irradiated and unirradiated nuclear fuel. The stored fuels were used in tests conducted during the operational years of the Power Burst Facility (PBF). The difference between the two storage areas is that the PSHs 1 and 2 provided a dry storage environment for contact-handled fuels, such as unirradiated fuel or low-level irradiated fuel, while the MTR Canal was an underwater environment for high-level irradiated radioactive fuels.

The MTR Canal is located in the basement of the MTR building, TRA-603. The canal is oriented lengthwise in an east-west direction. Part of the canal lies under the road to the east of the MTR building. Because the canal is under the roadway, the roadway has been blocked to avoid a potential collapse of the canal roof.

The orientation of PSHs 1 and 2 to the other storage holes (3 – 32) located in TRA-657 is shown in Figure 2. The two storage holes 1 and 2 are behind a locked chain-link fence and bolted closed. The storage holes are oriented horizontally in a dirt berm, in an east-west direction. PSHs 1 and 2 have been defueled and are empty. PSHs 3 through 32 have been empty since October of 1983.<sup>8</sup>

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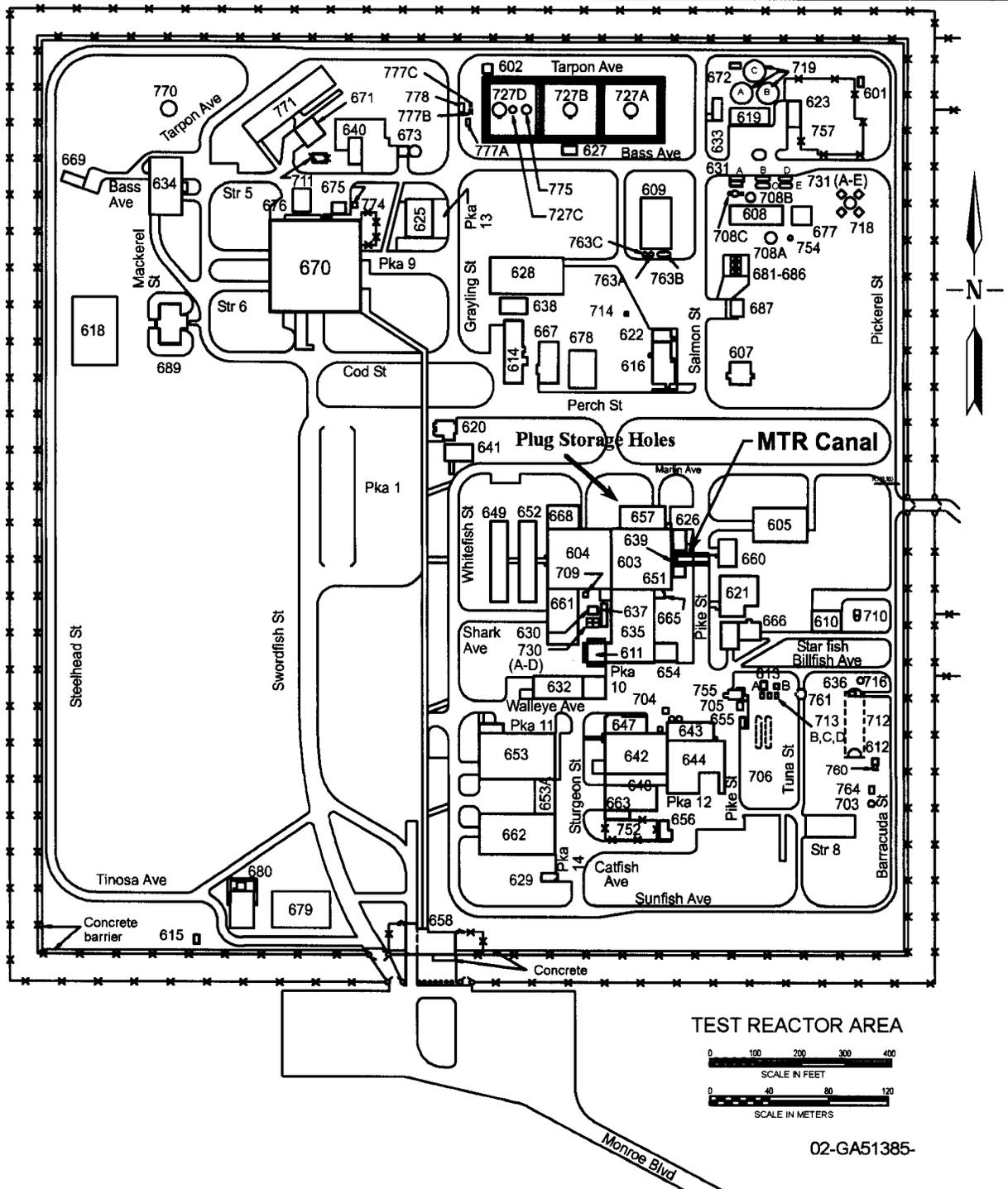


Figure 1. Location of the MTR Canal and PSH facility at TRA.

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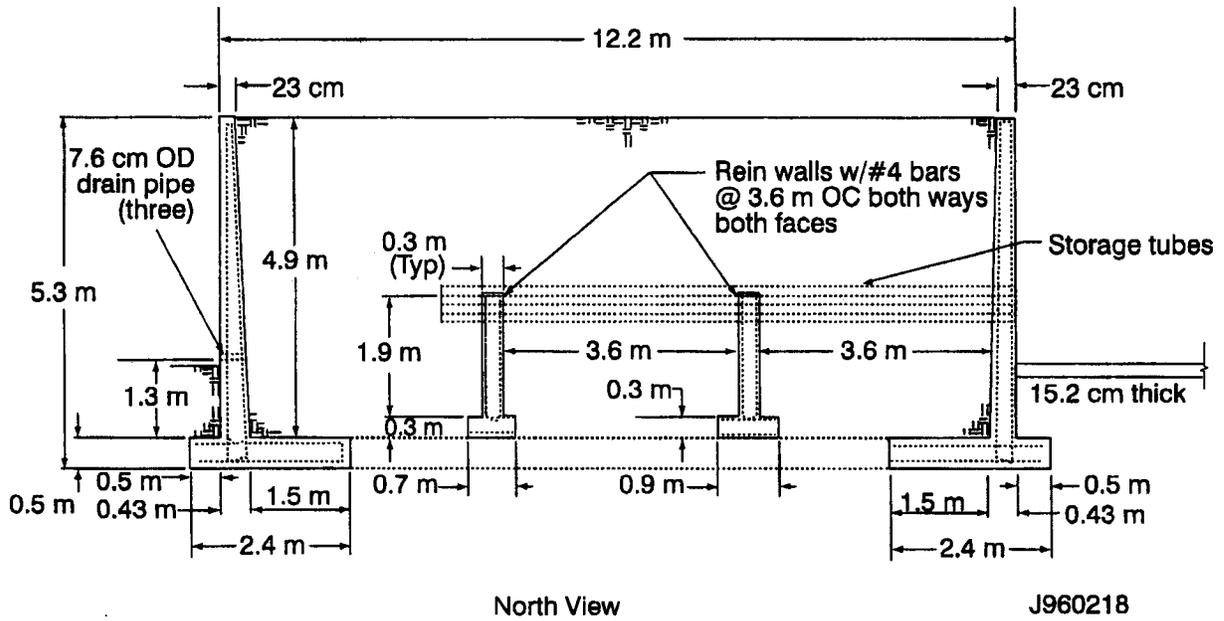
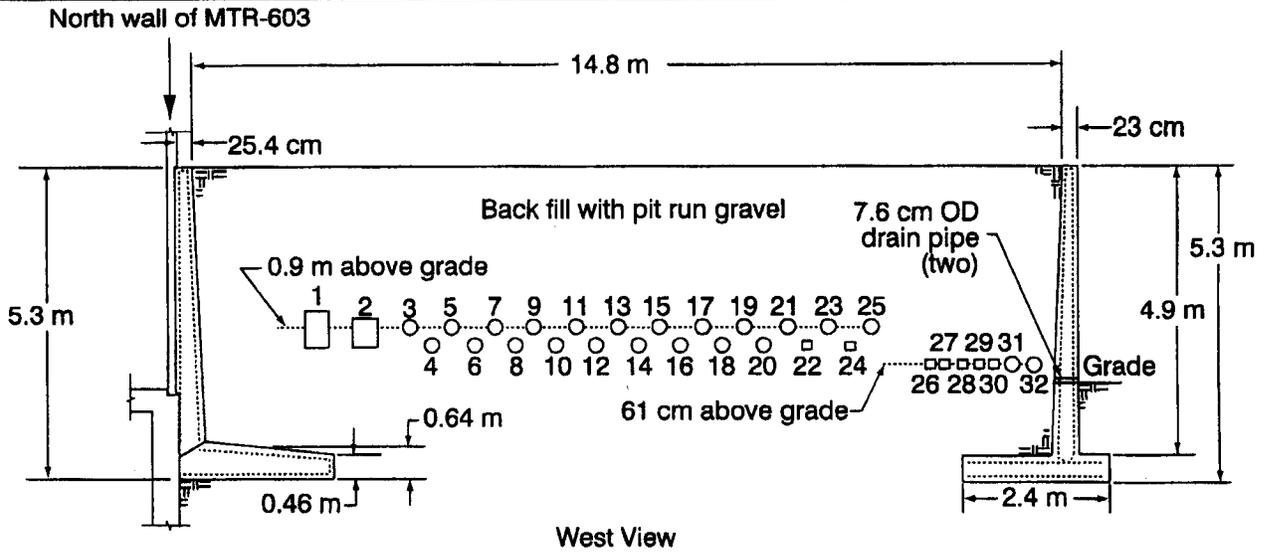


Figure 2. Plug Storage Hole facility layout.

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## 2.1 MTR Canal Description

The MTR Canal is constructed of concrete and tile with a stainless-steel liner, and is rectangular with dimensions of 33.5 × 2.4 m, and 5.5 m deep (110 ft × 8 ft × 18 ft deep). The canal contains fuel canister storage racks located on the bottom of the canal near the east end. Near the west end is a cask loading and unloading area (a shielded bulkhead separates the far west end underneath the decommissioned MTR reactor and contains no water). Near the center, under a hatch leading to the surface outside of the MTR building, is an ion exchange column. The test train storage cabinets have been removed from the facility.

There are three ceiling hatches of various sizes leading to the MTR Canal. The first is near the west end for access to the canal with the MTR 30/5-ton crane and cask handling operations. The second is near the center of the canal and leads to the surface outside the MTR building. The third is a man-way hatch at the extreme east end of the canal area. The man-way also leads outside the TRA-603 building and surfaces approximately 4.6 m (15 ft) west of the TRA-660 building.

A 27-metric-ton (30-ton) crane with a 4.5-metric-ton (5-ton) auxiliary is available to support MTR Canal operations. Smaller hoist and material handling equipment reside in the canal area.

A crush pad was designed and fabricated to mitigate damage to the MTR Canal upon dropping the Hot Fuel Examination Facility Cask No. 6 (HFEF-6) into the canal from 8.8 m (29 ft) through air and then through 5.5 m (18 ft) of water 0.48 m (19 in.) above the TRA-603 main floor. The crush pad is located on the MTR Canal bottom, immediately below the area in which the cask was handled. Structural analysis<sup>9</sup> shows that a canal leak of less than 100 gpm would develop if the HFEF-6 cask were dropped and the MTR Canal would not catastrophically fail, following a drop event. An analysis was performed that concluded a drop of the HFEF-6 cask that removed the concrete floor of the canal would drain the pool to a level of 4.23 m (14 ft) in 6 days.<sup>10</sup> A Chem-Nuclear CNS 1-13C II cask will be used for removal of the radioactive material from the MTR Canal. EDF-2012, Rev. 1, "MTR Fuel Removal Project—Canal Draining Calculations,"<sup>10</sup> shows the structural consequence to the canal resulting from the CNS 1-13C II cask drop scenario is bounded by the earlier HFEF-6 cask analysis.

All of the reactor fuels have been removed from the MTR Canal. The MTR Canal now only contains neutron-activated materials, an ion exchange module, irradiated metals, and trace amounts of fissile material in the sediment.<sup>11</sup>

## 2.2 Plug Storage Hole Facility Description

The PSH facility is located in the western portion of TRA-657 and provided additional storage for low-level irradiated test fuel from the PBF reactor. The PSHs consist of horizontal steel tubes surrounded by fill dirt. The back end of each hole is welded shut, and the front end (east) is closed by a bolted plate with neoprene gaskets. Plug Storage Hole 1 is 54.6 × 39.4 cm (21.5 × 15.5 in.), and 8.79 m (28.8 ft) long. PSH 2 is 39.4 cm (15.5 in.) on a side by 8.79 m (28.8 ft) long.

This analysis evaluates PSHs 1 through 32; however, there are other hazardous materials stored in the adjacent facility areas. These other hazards are addressed in EDF TRA-1554, "TRA Facility Hazard Categorization,"<sup>6</sup> and Auditable Safety Analysis (ASA)-112, "Test Reactor Area Research and Development Laboratories."<sup>12</sup>

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### 3. MATERIAL INVENTORY

DOE-STD-1027-92 provides a methodology for determining a hazard categorization of facilities or activities involving radioactive material. The hazard categorization is based on the inventory of releasable radioactive material in the MTR Canal and the PSH facility Holes 1 and 2.

#### 3.1 Radioactive Material

Surveys and analysis of the radiological hazards in the facility have been previously conducted as part of the preparation for deactivation. The estimated volume of water in the MTR Canal was  $4.49 \times 10^5$  L ( $1.18 \times 10^5$  gal) and the estimated mass of sediment was 44.8 kg (98.8 lbs). The canal water contained an approximate total of 1.90 Ci of dissolved radionuclides and the sediment contained an approximate total of 0.78 Ci of various nuclides, based on site characterization sampling, as documented in EDF-2565, "MTR Canal and Plug Storage Holes 1 and 2 Radioactive and Hazardous Material Inventories."<sup>13</sup>

The MTR Canal also contains an ion exchange module that has an estimated inventory of 14.8 Ci of mixed radionuclides. The inventory source term was derived in EDF-2565.<sup>13</sup> The PSH facility Holes 1 and 2 are empty and contain no material at risk (MAR).

#### 3.2 Fissile Material

There are no fissile materials or inventory in the form of fuel rods, elements, bundles, or capsules at the MTR Canal and PSH 1 and 2. Trace amounts of fissile material are present in the canal sediment. As of September, 2002, all of the fuel that was stored at the MTR Canal and PSHs 1 and 2 has been transferred to the Idaho Nuclear Technology and Engineering Center (INTEC) CPP-603 Irradiated Fuel Storage Facility.<sup>11</sup> The MTR Canal was surveyed using an underwater survey meter. The objects surveyed included various fuel rod holders, test train assemblies and components, filter canisters, and screw lid storage canisters that were located on the floor of the canal or in the test train parts box. Based on the results of surveys and a Safeguards and Security inventory<sup>14,15</sup> it has been determined there is no fissile or transuranic elements in the form of fuel or fuel elements. There were no objects that appeared to be fuel. Physical sampling of the activated test train assemblies on the canal floor was conducted and the analytical results showed no fissile materials.<sup>16</sup>

The canal water pH has been historically tracked from 1988 to present, with results ranging between 5.38 and 7.15.<sup>17</sup> A physical inspection of the fuel racks and test train housings verified there are no fuel elements present at the MTR Canal. The sampling of the MTR Canal sediment taken December, 2002, produced analytical results that showed only trace amounts of fissile or transuranic material in the sediment.<sup>18</sup> The total calculated amount of fissile material in the sediment was approximately 4.23 g.<sup>13</sup> The amount of calculated fissile material is overestimated and conservative for bounding purposes. There is no possibility of a criticality event.

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### 3.3 Hazardous Material

To aid in determining the level of safety documentation that must be developed for nonradioactive material, the estimated quantities of MAR are evaluated against the reportable quantity (RQ) values listed in 40 CFR 302, "Designation of Hazardous Substances," Table 302.4.<sup>19</sup> Nonnuclear inventories of hazardous materials are also compared to the threshold quantities (TQs) specified in 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals,"<sup>20</sup> or the threshold planning quantities (TPQs) specified in 40 CFR 355, "Emergency Planning and Notification,"<sup>21</sup> if not listed in 29 CFR 1910.119. There were no volatile or semivolatile organic compounds found in the MTR Canal water or sediment samples.<sup>13</sup>

Inorganic compounds were detected in the canal sediment; however, the contaminate concentrations did not exceed any of the 40 CFR 302, Table 302.4 RQ values and the sum of the ratios was less than one.<sup>13</sup> The results of the canal water sampling activities produced no positive results for inorganic compounds. There are no hazardous materials stored or used in PSH 1 and 2.

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## 4. HAZARD ASSESSMENT

ID O 420.D, Rev. 1, requires classification of DOE activities and facilities based on the level of potential hazard that the activity or facility poses to the public and to on-site personnel. In order to determine the hazard classification, the hazards are compared to the TQs established in DOE-STD-1027-92.<sup>3</sup> If these hazards are below the Hazard Category 3 level, the activity is classified as a non-nuclear facility and must go through further evaluation. This additional analysis shall provide the basis for whether the safety analysis should be approved by the U.S. Department of Energy, Idaho Operations Office (NE-ID) or the contractor.

The PSH 1 and 2 have no hazardous or radioactive materials. In this case there are no radioactive or hazardous material inventories that exceed the RQs specified in 40 CFR 302.4.

Table A.1 of Attachment 1 to DOE-STD-1027-92 provides the Hazard Category 2 and 3 threshold quantity values (TQVs) for each radionuclide. Comparisons of the MTR Canal water and ion exchange module radioactive material inventories were made against the Hazard Category 3 TQVs. The sum of the ratios were calculated in EDF-2565.<sup>13</sup> The calculated value was 0.25. The facility will be classified as less than Hazard Category 3. The hazard analysis will compare the facility to the thresholds identified in Table 1 of ID O 420.D Rev. 1.

### 4.1 PSH Facility Holes 1 and 2 Hazards

A hazard can be determined to be NRASA if: (1) it is determined to be routinely encountered and accepted in the course of everyday living by the vast majority of the general public, and (2) it is determined that no further safety analysis is required. That determination is based on the type of hazard identified in Table 2 and if that type of hazard is of a magnitude that does not exceed the associated criteria or thresholds identified in the table. In accordance with MCP-2451, further assessment is required if any of the NRASA thresholds are exceeded. As shown in Table 2, none of the NRASA thresholds have been exceeded; therefore, the PSH 1 and 2 hazards are considered standard industrial hazards. Review of the facility hazard list for TRA-657 disclosed no additional hazards relative to plug storage Holes 1 and 2.

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Table 2. NRASA hazards comparison for the PSHs.

Hazard Type	Criteria or Threshold Limits	Criteria or Threshold Exceeded?	Explanation
Radioactive Material	The MAR quantity of radioactive material, determined in accordance with DOE-STD-1027-92 methodology, is below the 40 CFR 302, Table 302.4, Appendix B, RQ limits.	No	There are no MAR quantities of radioactive material in the PSHs.
Chemical Hazards	The MAR quantity of chemical hazards is below the RQ limits in Table 302.4 of 40 CFR 302.	No	No chemicals listed in Table 302.4 of 40 CFR 302 are present in the PSHs.
Standard Industrial Hazards	Applicable OSHA regulations.	No	The PSHs will be closed and secured to prevent any inadvertent access. After this event, there will be no anticipated activities associated with the PSHs.
Nuclear Criticality Hazard	The inventory of fissionable material is less than 15 g of U-233, U-235, Pu-239, and Pu-241 in any area.	No	There are no fissile materials in the PSHs.
Field and Low-level fixed x-ray Equipment	The field and low-level x-ray equipment meets ANSI <sup>a</sup> x-ray standards.	No	There are no low-level x-rays or x-ray equipment present at the PSHs.
Toxic Materials	Potential air concentrations of toxic materials are less than the ERPG limit or its equivalent for substances exceeding 5 times the RQ values of 40 CFR 302.	No	There are no toxic materials listed in Table 302.4 of 40 CFR 302 present in the PSHs.
Flammable Material	The inventory of flammable materials is not more than allowed by the NFPA code for building occupancy classification.	No	There is no inventory of flammable material in the PSHs that the NFPA for building occupancy classification regulates.
Explosive Materials	The inventory of explosive materials is not more than allowed by the applicable Uniform Fire Code.	No	No explosive materials are present at the PSHs.
Electrical	Electrical sources are not more than 600 V, or if more than 600 V, not more than 25 mA, and not more than 50 J stored energy.	No	Exposure to electrical hazards is controlled under INEEL STD-101, "Integrated Work Control Process," <sup>22</sup> or JSA according to INEEL MCP-3562, "Hazard Identification, Analysis and Control of Operational Activities." <sup>23</sup>
Kinetic Energy	There are no unusual or unique high-kinetic energy systems.	No	There are no high-kinetic energy systems present or in use at the PSHs.
Pressure	The pressure stored energy is no more than 0.1-lb TNT equivalent if the pressure is more than 3,000 psig.	No	There are no high-pressure systems associated with in the PSHs.

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Table 2. (continued).

Hazard Type	Criteria or Threshold Limits	Criteria or Threshold Exceeded?	Explanation
High Temperature	The temperature is incapable of environmental interaction to cause strong overpressure, toxic products, or to initiate a release of hazardous materials. (A safety analysis is required if the high temperature could cause any of the following conditions: (a) strong overpressure [contact with coolant or other fluid], (b) toxic products from exposure of materials in the area, or (c) a fire that would spread radioactive or toxic materials).	No	The PSHs do not meet the conditions that would classify it as a high-temperature hazard area.
Biohazards	There are no special industrial hygiene controls required.	No	No biohazards are associated with the PSHs. The storage holes will be closed and secured, thereby limiting all access.
<p>a. ANSI - American National Standards Institute, "American National Standard for General Radiation Safety, Installations Using Non-Medical X-ray and Sealed Gamma-Ray Sources, Energies up to 10 MeV," 1993.</p> <p>ANSI            American National Standards Institute</p> <p>ERPG           Emergency Response Planning Guide</p> <p>INEEL          Idaho National Engineering and Environmental Laboratory</p> <p>MAR            material at risk</p> <p>NDE            nondestructive examination</p> <p>NFPA           National Fire Protection Association</p> <p>OSHA           Occupational Safety and Health Administration</p> <p>PSH            Plug Storage Hole</p> <p>RQ              reportable quantity</p> <p>TNT             trinitrotoluene</p> <p>VCO            Voluntary Consent Order</p>			

## 4.2 MTR Canal Hazards

The analysis of the five facility hazard thresholds is completed in this section.

### 4.2.1 Chemical – "H" Facility – Above 40 CFR 355 or 29 CFR 1910.119

The canal is not an "H" facility as defined in the International Building Code.<sup>24</sup> The MTR Canal facility does not have hazardous chemicals that exceed the 29 CFR 1910.119 TQs or 40 CFR 355 TPQs. Hazardous materials, as listed in 29 CFR 1910.119 or 40 CFR 355, were not detected in the MTR Canal water or sediment.

### 4.2.2 Biological – BSL-3 and 4

The MTR Canal is not a biological safety facility.

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The dose threshold for radiation generating devices/sources is greater than 100 rem in 1 hr (external, whole body, dose) or greater than 500 rads in 1 hr (external extremity dose). The highest risk activities which could challenge this threshold will be loading the transport cask "bucket" and handling the loaded transport cask prior to lid installation. One radioactive item to be removed from the canal reads 400 R/hr at 1 in.<sup>25</sup> This field drops to 2.8 R/hr at 1 ft of air and to 0.31 R/hr at 3 ft of air. Canal construction and availability of hoisting and rigging equipment prevent raising this source into the area occupied by the workers. If this were to happen, the institutional safety programs would prevent an employee exposure from challenging these criteria. The second activity of concern is the handling of the loaded cask. A consequence of cask handling could be that the source becomes unshielded and resting on the TRA-603 main floor. As noted above, the radiation field drops to 0.31 R/hr at 3 ft. Again, the institutional programs employed would prevent an employee exposure for challenging these criteria.

**4.2.4 Explosives – Class I (remote handled)**

Explosives are not stored or handled at the MTR Canal. This criterion is not challenged.

**4.2.5 Live Firearms Training – Live Fire Range**

The MTR Canal is not a live fire range. This criterion is not challenged.

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## 5. CONCLUSIONS

Based on the information presented in Subsection 4.1 and in accordance with MCP-2451, the hazard classification of the PSH 1 and 2 are to be NRASA. None of the hazards associated with PSH facility operations exceeded any of the NRASA thresholds specified in Table 2. These holes will be managed under the purview of ASA-112, "Auditable Safety Analysis for the Test Reactor Area Research and Development Laboratories."

The MTR Vault No. 1 and the TTAF area are classified as NRASA. These areas will not be considered part of the MTR Canal.

Based on the hazard analysis<sup>13</sup>, the MTR Canal does not meet the Hazard Category 3 thresholds of STD-1027-92, the MTR Canal is classified as non-nuclear. The safety analysis document will be contractor approved, since none of the lower threshold criteria listed in ID O 420.D, Rev. 1, Table 1, as shown in Subsection 4.2, are challenged by the activities to be performed at the MTR Canal.

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