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Auditable Safety Analysis

for the

Contained Test Facility

Prepared for:
U.S. Department of Energy
Idaho Operations Office
Idaho Falls, Idaho

Idaho National Engineering
and Environmental Laboratory

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ACRONYMS

AE	architectural engineering
ASA	auditable safety analysis
CFR	Code of Federal Regulations
CST	Civil Support Team
CTF	Contained Test Facility
D&D	decontamination and decommissioning
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations office
EDE	effective dose equivalent
EDF	Engineering Design File
ESRP	Eastern Snake River Plain
HAD	Hazard Assessment Document
INEEL	Idaho National Engineering and Environmental Laboratory
LOFT	Loss-of-Fluid Test
NFPA	National Fire Protection Association
NRASA	not requiring additional safety analysis
OSB	Operational Safety Board
OSH	occupational safety and health
OSHA	Occupational Safety and Health Administration
OSR	Operational Safety Requirement
PC	performance category
PCB	polychlorinated biphenyl
PPE	personal protective equipment
PWR	pressurized water reactor

RCRA	Resource Conservation Recovery Act
RQ	reportable quantity
RSAC	Radiological Safety Analysis Computer Program
SAR	Safety Analysis Report
SMC	Special Manufacturing Capability
TAN	Test Area North
TANO	Test Area North Operations
TEDE	total effective dose equivalents
TPQ	threshold planning quantity
TRA	Test Reactor Area
TQ	threshold quantity
TQV	threshold quantity value
WFO	Work for Others (Project)
WMD	weapons of mass destruction

E. EXECUTIVE SUMMARY

E.1 Introduction

The Contained Test Facility (CTF) area of the Idaho National Engineering and Environmental Laboratory (INEEL) was constructed in the late 1950s as a site for testing of nuclear reactors for the Aircraft Nuclear Propulsion Program. This area is located at the north end of the INEEL and is referred to as Test Area North (TAN). This program was phased out in 1961 and replaced with a scaled-down, pressurized water reactor (PWR) to study the behavior of a PWR during a loss-of-coolant accident. This Loss-of-Fluid-Test (LOFT) program was designed to replicate accidents that could occur to a commercial pressurized water reactor. The LOFT reactor vessel and its associated components were mounted on a railroad flatcar and were collectively known as the mobile test assembly. During the LOFT project, which involved a 50-MW reactor, the facility was classified as high hazard. In 1987, the LOFT program ended operations, and the facility's mission was changed to conducting decontamination and decommissioning (D&D) work on the LOFT mobile test assembly. At that time, the facility was reclassified as a low-hazard facility. The mobile test assembly has since been decommissioned, decontaminated, and disassembled. This work was completed in 1990 with the final removal of the mobile test assembly. Since that time, the facility has undergone an inactivation process, and the reactor containment building is currently empty and is not in use.

The CTF is currently in a shutdown, caretaker mode. The D&D and sampling of hazardous materials were scheduled to begin in 2000, but because of the low priority assigned to the facility, the sampling and D&D tasks were not started. Until late in 2002, there was no planned use for these buildings, so process materials were removed. The extension building (TAN-624) is currently used for temporary storage of cargo containers holding approximately 5,090 gal (680 ft^3) of waste with a gross weight of 7,510 lb. The waste consists of personal protective equipment (PPE), gloves, paper, and similar sampling waste contaminated with polychlorinated biphenyl (PCB). Since the waste is solid material in overpack shipping containers, it is not in an easily releasable form. TAN-650, TAN-630, and some underground tanks contain radioactive contamination from previous activities and surveys.

A new function has been identified for CTF, as a training facility for Work for Others (WFO) Project #03706, Weapons of Mass Destruction (WMD) Incident Response Technology and Training. The new use is outlined in IAG-181, "Tenant Use Agreement Between TAN-650 Landlord and National Security Tenant."[1] CTF provides unique training areas and opportunities for all WMD emergency first responders. These teams need to train in conditions similar to those expected during emergency conditions. The CTF provides an environment for training in very low- or no-light conditions while simulating laboratory conditions that may contain radiological, biological, and/or hazardous materials. All training exercises are carried out using simulants that are the least dangerous material available to simulate a much more hazardous material. In general, the simulants are harmless to humans and the environment.

E.2 Hazard Classification

In 1995, an auditable safety analysis (ASA) was developed to support D&D activities, and was written to depict the inactive status of the facility. The classification of CTF was reviewed, and it was determined that CTF still contains enough hazardous materials, specifically PCB, to be a low-hazard, nonnuclear facility.[2] Engineering Design File (EDF)-3752[2] also shows that the quantity of simulants that

will be used in the training exercises is not large enough to affect the low-hazard, nonnuclear facility classification.

E.3 Safety Requirements

The safety analysis performed for CTF demonstrates that operations are conducted in a safe and controlled manner. Administrative controls developed from the accident analysis along with adherence to U.S. Department of Energy (DOE) and INEEL requirements ensure that risk to the public, workers, and environment is acceptable. The following administrative safety requirements are imposed by this document for the CTF:

CTF Fire Safety – The only mechanism identified for release of radioactive and hazardous materials is a large fire. The quantities of flammable and combustible materials in the facilities of CTF were known and deemed acceptable when the facilities were shut down and inactivated, and thus, the present level of combustible materials in CTF buildings does not present an unacceptable level of fire safety. Therefore, **to minimize the possibility of a fire in CTF buildings, the introduction of potential ignition sources such as a forklift or electrical components and flammable or combustible materials in and around the building shall be approved by the facility fire protection engineer or an alternate prior to beginning the activity.**

CTF Life Safety – These facilities are in an inactive status and as such the emergency lighting and exit signs are not functional. There are also no fire extinguishers or other active fire extinguishing or notification features inside the facilities. Therefore, **to improve personnel evacuation in the event of an emergency, the following controls shall be established and approved by the facility fire protection engineer or an alternate prior to beginning the activity:**

1. **Fire extinguishers shall be installed in a conspicuous place inside the building(s) being used for the activity**

2. **A conspicuously marked secondary escape path shall be established**

3. **Emergency egress lighting shall be established.**

Radioactive/Hazardous Material Inventory Control – Since CTF is a low-hazard, nonnuclear facility, the sum of the ratios is not limited to 1 for the hazardous material reportable quantities (RQs) listed in 40 CFR 302.4. **However, to be conservative, the sum of the ratios for the chemicals simulants being used in any one WMD-incident response-team training exercise shall be less than 1 when compared to the chemical RQs in Title 40 Code of Federal Regulations (CFR) Part 302 Section 4.** This ensures that the facilities used for the training exercises remain not requiring additional safety analysis (NRASA), and with the small inventory of radionuclides and hazardous materials used for the training exercises this requirement will be easily met.

To ensure that the CTF remains as a low-hazard facility, **at no time shall the quantity of a chemical being brought into a CTF building exceed the threshold quantity (TQ) listed in 29 CFR 1910.119 or the threshold planning quantity (TPQ) listed in 40 CFR 355.** Note: the sum of the ratios does not apply to these limits.

To ensure that the CTF does not become a Category 3 nuclear facility, **the sum of the ratios for the inventory of radionuclides shall not exceed 1 when compared to the Hazard Category 3 threshold quantity values (TQVs) listed in DOE-STD-1027-92.**[3]

Building Access Control – In order to prevent entry into areas containing hazardous material (TAN-624) and the radioactive materials in the TAN-650 containment building, **TAN-624 shall be secured/locked and the personnel access doors into the containment building shall be closed during training exercises to prevent accidental entry into these areas.**

Facility Cleanup – The simulants are the least dangerous chemical/radionuclide/biological material that is required to simulate the more dangerous WMD materials, and in general are harmless to humans and the environment. However, **to prevent the accumulation of waste materials in the CTF buildings being used for the training exercises, the Tenant Use Agreement (IAG-181)[1] requires that all equipment and media be inactivated or decontaminated with bleach at the end of every exercise. It also requires that whatever the tenant brings on-site will be taken off-site, double- and triple-bagged, and disposed of off-site.**

While the biological simulants are not considered to be hazardous, these simulants must be handled and disposed of in a proper manner. Use of these simulants will be subject to the following requirements:

1. **No liquid or solid biological simulant will be released**

2. **Any simulant used in a liquid state in a fermenter vessel either will be inactivated with 10% commercial bleach, autoclaved after prior arrangement at the INEEL, or returned to Dugway for disposal**

3. **The decontamination procedure will be documented at each instance, along with the volume of material inactivated.**

1. FACILITY DESCRIPTION

1.1 Activity Mission

Since 1990, the facility has been idle and inactive, and is currently in a shutdown, caretaker mode. The only activities in the facility have been routine inspection tours, typically to limit the buildup of combustible materials. Sampling operations for decontamination and decommissioning (D&D) activities were scheduled to begin in 2000, but because of the low priority assigned to the facility, the sampling and D&D tasks have not been started.

As the result of increased terrorist activity in the United States of America, there has been an increased need for training facilities for emergency response teams. In particular, the Contained Test Facility (CTF) provides unique training areas and opportunities for the Weapons of Mass Destruction (WMD) Civil Support Teams (CSTs) and other military response units. These teams need to train in conditions similar to those expected during emergency conditions, that is, very low- or no-light conditions that simulate laboratory conditions that may contain radiological, biological, and/or hazardous materials. The CTF provides the capability to use radiological materials in the training scenarios that is not available at Dugway Proving Grounds in Utah, the home base for the West Desert Test Center for chemical and biological antiterrorism training.

1.2 Background

The CTF area of the INEEL was constructed in the later 1950s as a site for testing nuclear reactors for the Aircraft Nuclear Propulsion Program. This area is located at the north end of the Idaho National Engineering and Environmental Laboratory (INEEL) and is referred to as Test Area North (TAN). This program was phased out in 1961 and replaced with a scaled-down test reactor to study the behavior of a pressurized water reactor (PWR) during a loss of coolant accident. The Loss-of-Fluid Test (LOFT) program was designed to replicate accidents that could occur to commercial PWRs. After completion of the LOFT program in 1987, the facility (mainly TAN-650, also known as the containment building) was used to decontaminate, decommission, and disassemble the LOFT mobile test assembly, which was completed in 1990. TAN-650 is a steel-concrete structure that provides an airtight area in which to conduct tests that otherwise could result in releases of radioactive and/or hazardous materials into the environment. Therefore, the facility was renamed the CTF, but no operational mission was ever identified for this use.

1.3 CTF Buildings

This auditable safety analysis (ASA) applies to the facilities listed in Table 1-1.

Table 1-1. TAN area CTF buildings and structures included in this ASA.

Building Number	Facility
624	Containment Building Entryway (CTF)
630	Control and Equipment Building (CTF)
650	Containment and Service Building (CTF)
659	Control Shelter (CTF)
725	Vault Exhaust Stack (CTF)
726	Hot Liquid Waste Storage Tanks/Vault (CTF)
726A	Cleanup Building for TAN-726
736	Septic Tank (CTF)
737	Septic Tank (CTF)
745	Secondary Coolant System Heating System (CTF)
750	Liquid Waste Disposal Pond (CTF Area)
765	Slop Tank (Tank 114)
768	South Electrical Substation
771	Sulfuric Acid Tank (CTF)

In addition, Table 1-2 lists the nonnuclear CTF facilities classified as not requiring additional safety analysis (NRASA) in Hazard Assessment Document (HAD)-107,[4] so further discussion of these facilities will not be provided in this ASA.

Table 1-2. TAN area CTF nonnuclear structures and facilities.

Building Number	Facility
631	Tank Building (CTF)
635	HV-10 South Continuous Air Monitoring Building (CTF)
637	Compressor (CTF)
651	Heat Stress Relief Structure
657	Heat Stress Relief Structure
663	H&V 10 North Continuous Air Monitoring Building (CTF)
671	Office Trailer North (CTF)
672	Office Trailer South (CTF)
703	Exhaust Stack (CTF)
716	Exhaust Duct and Stack (CTF)
719	Shielded Roadway to TAN-630 (CTF)
744	Inlet Gas Supply Platform (CTF Area)
746	Condenser Shelter Structure (CTF)
749	Solar Collector Support (CTF)
767A	Boiler Fuel Tank (FO-T-13A) (CTF)
767B	Boiler Fuel Tank (FO-T-13B) (CTF)
773	Concrete Water Storage Tank (CTF)
774	Concrete Slab (CTF)
1728	Disposal Well (332) (CTF).

The CTF is located at TAN on the INEEL. Information concerning general INEEL site characteristics such as geography, demography, meteorology, hydrology, geology, and seismology may be found in Safety Analysis Report (SAR)-100, Chapter 1,[5] and Section 2.4.7.

The CTF is located in the north-central portion of the INEEL on the western edge of TAN, which is approximately 19 km (12 mi) west of the town, Mud Lake. The CTF site is fenced and shares its location with the Special Manufacturing Capability (SMC) project (see Figure 1-1). SMC buildings include TAN-629, TAN-773, TAN-675, TAN-676, TAN-677, TAN-678, TAN-679, TAN-681, TAN-682, TAN-688, TAN-689, and TAN-690 and are not discussed in this document.

The SMC is adjacent to the CTF to the west, and the TAN Technical Support Facilities are 2.4 km (1.5 mi) to the east of the CTF. The Water Reactor Research Test Facility, now inactive, is 4.2 km (2.6 mi) to the southeast of the CTF. The closest point of Idaho State Highway 33 to the CTF is located approximately 2.7 km (1.7 mi) to the southeast.

Systems installed for the LOFT project are inactive and are in various stages of dismantlement. Tanks and piping have been pumped or drained of liquids, although some residuals may remain in the bottom of some tanks (e.g., fuel oil in TAN-767A & TAN-767B). The tanks and piping containing hazardous and radioactive materials have all been drained of liquid. Computer systems for the LOFT data acquisition have been removed. The facility is not operated continuously, so fire control and life safety operations are performed only as needed. The CTF was in an inactive status and was scheduled for D&D activities before the new training mission was identified.

1.3.1 Building Descriptions

The following is a brief description of each of the buildings listed in Table 1-1. Figure 1-1 shows a plan view of the CTF area, including the SMC.

TAN-624 is the entry building for the reactor containment building (TAN-650). It is constructed of steel with steel siding and roof. The concrete floor has a four-track rail for entry of the LOFT mobile test assembly on a railroad flatcar into TAN-650. It is attached to the south side of TAN-650.

TAN-630 is the control and equipment building. It is a two-level structure covered with an earth berm. The ground level houses the control room, data rooms, office space, and operations support rooms. The basement contains facility utility systems that are not in use. A tunnel connects TAN-630 with TAN-629, which is the SMC assembly building, but for SMC security purposes, the door between TAN-629 and TAN-630 is welded shut.

TAN-650 is the containment building and is constructed of steel and reinforced concrete. The containment building is a 70-ft-diameter, vertical, steel cylinder with a hemispherical top and torospherical bottom. The top is 97 ft from the main floor. The containment basement contains support equipment. Both the basement and main floor are accessible by airlocks. Access from TAN-624 into TAN-650 is via a moveable 33 × 22-ft steel door. The equipment portion of TAN-650 is four-stories high with basement, and houses various inoperable reactor support systems.

TAN-659 is the control building and houses communication and control system equipment.

TAN-725 is the vault exhaust stack and is presently shut down pending D&D.

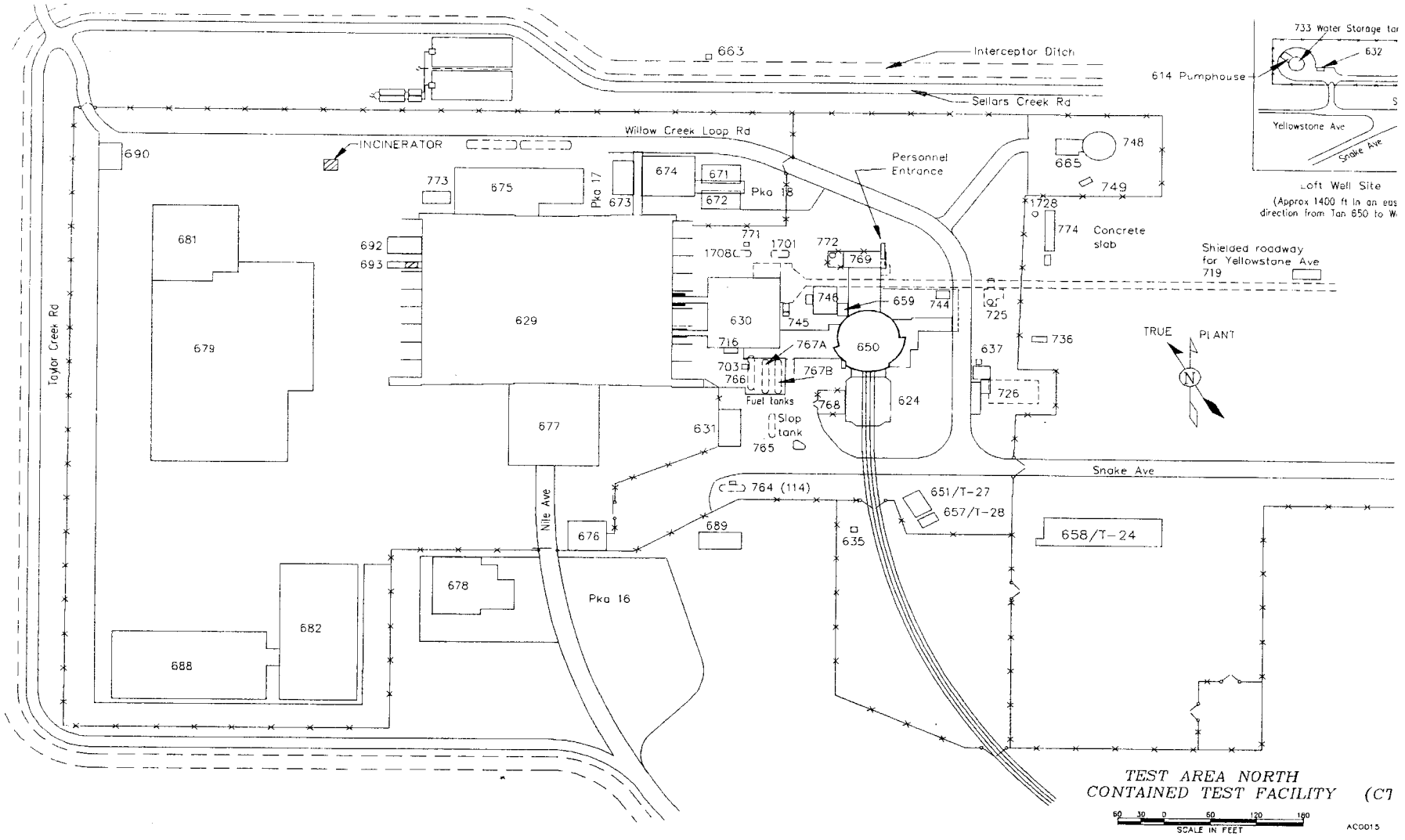

Figure 1-1. CTF area plan.

TAN-726 is the hot liquid waste storage tank/vault, which houses a waste tank. The tanks have been decontaminated and decommissioned as part of a Resource Conservation and Recovery Act (RCRA)-regulated closure action and the inlet piping has been blanked off.

TAN-726A is the cleanup building for TAN-726 and previously contained an ion exchange waste-water purification system. Waste-water piping from TAN-650 is blanked off to TAN-726.

TAN-736 is a buried 4,000-gal septic tank and is presently shut down pending D&D.

TAN-737 is a buried 5,000-gal septic tank and is presently shut down pending D&D.

TAN-745 was part of the secondary coolant system for the LOFT reactor and is presently shut down pending D&D.

TAN-750 was the liquid waste disposal pond. The pond is located well behind TAN-629 (i.e., the SMC assembly building) to the north, and is outside of the security fence surrounding SMC and CTF, and so does not show on Figure 1-1. Use of the pond was stopped in 1995 and does not affect operations at CTF. It is presently shut down pending D&D.

TAN-765 is the LOFT slop tank, which was located underground approximately 90 ft south of TAN-630 and 120 ft southwest of TAN-650. This tank was installed to receive waste jet fuels from nuclear aircraft engines, which were never tested. In 1965, it was emptied of all flammable liquids and filled with sand.[6]

TAN-768 is the south electrical substation, which is a fenced area adjacent to TAN-624 on the west side.

TAN-771 is the sulfuric acid tank, and all sulfuric acid has been drained from the tank.

1.3.2 Services and Utilities

Heating and Ventilation – In the past, steam supplied from the SMC project building (TAN-675) was used for heating CTF areas containing fire suppression systems. Water is no longer supplied to any CTF buildings, so there is no present need for heating.

Electrical System – The CTF is provided with 13.8 kVA power from the Technical Support Facilities area of TAN to the south electric substation (TAN-768). This power is transformed down to 480 Vac, 220 Vac, and 110 Vac for electric service at the CTF.

Emergency Systems – The fire sprinkler system has been disconnected and the fire extinguishers in the CTF buildings have been removed. The manual fire-alarm boxes, heat and smoke detectors, emergency lighting, and exit lights may still be installed, but are no longer tested and are not deemed functional. Fire water to hydrants around the facility is available for fire suppression and is supplied from the TAN-614 pumphouse.

1.4 Facility Management

The facility is managed as part of Test Area North Operations (TANO), which includes current activities on the spent fuel storage pads (TAN-790 and TAN-791) and operations in TAN-607, which include the large hot shop at the north end of the building and waste handling operations.

2. QUALITATIVE HAZARD ANALYSIS

A hazard is defined as a material, energy source, or operation that has a potential for causing injury or illness in humans, or damage to a facility or the environment without regard for the likelihood or credibility of accident scenarios.

2.1 Facility Hazard Classification

The CTF is presently classified as a low-hazard, nonnuclear facility. The Weapons of Mass Destruction Incident Response Technology and Training activity was evaluated in Engineering Design File (EDF)-3752[2] and shown to fall within the facility's low-hazard, nonnuclear classification.

2.2 Site Characteristics Affecting Safety Analysis

The site characteristics that affect CTF operations are primarily climatological. The Snake River Plain where the CTF is located is characterized as a cool desert. Precipitation averages about 9 in. per year. Adverse climatological conditions will not affect CTF operations as personnel can be evacuated during extreme inclement weather or in the event of flooding conditions that develop slowly.

2.3 Waste Confinement and Management

Waste generated at the CTF is managed in accordance with INEEL "Manual 17–Waste Management,"[7] guidance from personnel in the Waste Generator Services Department, and Chapter 9 of SAR-100.[8] The waste generated at the CTF is categorized as solid municipal waste, liquid cold waste, and liquid effluent from the sewer system.

Routine nonhazardous and nonradioactive solid waste is defined as being any solid material that is considered to be useless, unwanted, or discarded. It is a nonsalvageable solid material that meets the criteria in the INEEL Radiological Controls Manual for fixed and removable surface contamination and removable surface radioactive contamination, and cannot be classified as RCRA-regulated hazardous waste under 40 CFR 261 nor as a hazard listed under the Toxic Substance Control Act regulations.[9]

Cold waste (green) dumpsters are provided throughout the INEEL for use by tenants. Waste generators are responsible for ensuring that only waste permitted by the INEEL Landfill Operations Waste Acceptance Criteria[10] is deposited in the cold waste dumpsters and that cold wastes having the potential for being radioactively contaminated are checked prior to disposal. The cold waste is monitored to verify that no radioactive or hazardous materials are present.

Liquid cold waste from facility drains is routed to the SMC liquid cold waste drainage system. Liquid effluent from the sewer system at CTF is routed to the installed septic system. These systems are not operational.

The liquid radioactive waste tanks in Building TAN-726 are not in service, and the inlet piping has been blanked off. The tanks have been decontaminated and decommissioned as part of a RCRA-regulated closure action.

2.4 Industrial Hazards

Table 2-1 presents a list of standard industrial hazards regulated by DOE-prescribed occupational safety and health (OSH) standards and identifies those hazards that are applicable to CTF.

2.4.1 Chemical Exposure

Other than the drums of polychlorinated biphenyl (PCB) contaminated waste stored in TAN-624, the only other chemical that will be brought into CTF will be cleaning products and the chemical simulants, which are in very small quantities. While some commercially available products contain hazardous chemicals (such as cleaning solutions), the quantity of hazardous material is small and the hazard from these products is routinely accepted by the public. Therefore, use of these products does not require further analysis and personal, public, and environmental safety is adequately covered by Occupational Safety and Health Administration (OSHA) standards, which are implemented by the INEEL Safety and Health Manuals 14A and 14B. Since the CTF will remain a low-hazard facility until the waste drums in TAN-624 are removed, there is no limit to the quantity of chemical simulants listed in Table 302.4 of Title 40 Code of Federal Regulations (CFR) Part 302 Section 4 that can be taken into the CTF. While it is possible to bring in large quantities of chemicals under the low-hazard classification, the consequences of an accidental release is unanalyzed and may be too severe to meet the INEEL evaluation guidelines for a low-hazard facility. To be conservative, **the sum of the ratios for the chemicals simulants being used in any one WMD-incident response-team training exercise shall be less than 1 when compared to the chemical reportable quantities (RQs) in 40 CFR 302.4.** Since the existing PCBs are isolated in TAN-624, there is enough distance and lockable barriers to consider the training exercise area and TAN-624 to be separate areas for classification purposes. Adherence to the above safety requirement (**bold lettering**) will ensure that the training exercises are conducted in accordance with an NRASA facility classification.

To avoid exceeding the low-hazard classification, **at no time shall the quantity of a chemical being brought into CTF exceed the threshold quantities (TQs) listed in 29 CFR 1910.119 or the threshold planning quantities (TPQs) listed in 40 CFR 355.**

2.4.2 High Pressure

There is a portable air compressor located in the basement of TAN-650 that is used on an infrequent basis. The air compressor has proper machine guarding installed. This is a standard industrial hazard.

2.4.3 Compressed Gases

Compressed gases are not used in normal CTF activities, and if used are considered a standard industrial hazard that will be handled, stored, and used in accordance with the INEEL Industrial Safety Program.[11]

Table 2-1. Occupational hazards checklist.

Hazard	Applicable	DOE-Prescribed Program and OSH Standards
High voltage (≥600 V)	No	N/A
Low voltage (≤600 V)	Yes	29 CFR 1910, Subpart S; NFPA 70
Volatile flammable or reactive gases or liquids	Yes	29 CFR 1910, Subpart H, .144, .1200 and 29 CFR 1926.152
Explosive materials	No	N/A
Cryogenic systems	No	N/A
High temperature (≥125°F at contact or 203°F)	No	N/A
High-pressure systems (≥25 psig for gas or vapor or ≥200 psig for liquid)	Yes	ASME Boiler and Pressure Vessel Code, Standard B31
Low pressure	No	N/A
Inert or low-oxygen atmospheres	No	N/A
Toxic materials	No	N/A
Nonionizing radiation	No	N/A
High-intensity magnetic fields	No	N/A
High noise levels	No	N/A
Mechanical and moving equipment dangers	Yes	29 CFR 1910.147; .211 through .222; 29 CFR 1910, Subparts O, P, Q; 29 CFR 1926, Subpart W
Working at heights	No	N/A
Excavation	No	N/A
Material handling dangers	Yes	29 CFR 1910.120, .176 through .182; 29 CFR 1926.953; DOE-STD-1090 Hoisting and Rigging
Material transport	No	N/A
Pesticide use	Yes	29 CFR 1910.1200
Temperature extremes (high and low temperatures during activities)	No	N/A
Construction	No	N/A
Ionizing radiation	Yes	Radiation Protection Program, 10 CFR 835
Reactive materials: alkali, metal, and corrosives	No	N/A
Structural or natural phenomena	Yes	DOE Order 420.1, DOE-ID AE standards, DOE Guide 420. 1-2, 29 CFR 1910.119, Subpart E
Fire	Yes	Fire Protection Program, DOE Order 420.1
Biological agents	Yes	None of the DOE-prescribed standards clearly address biological agents
Chemical exposure	Yes	INEEL evaluation guidelines in DOE-ID Order 420.D[12]
Container overpressurization	No	N/A
Low-pressure systems	No	N/A
Compressed gases	Yes	29 CFR 1910.101, Subpart M
Flammable gases, liquids, or dusts	No	N/A
Pyrophoric materials	No	N/A
Nonionizing radiation	No	N/A

AE	architectural engineering
CFR	Code of Federal Regulations
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
N/A	not applicable
NFPA	National Fire Protection Association
OSH	occupational safety and health
TRA	Test Reactor Area

2.4.4 Electrical Hazards

Buildings TAN-650 and TAN-630 are equipped with 110, 220, and 480 Vac electrical power. This electrical service has been installed in accordance with the requirements of 29 CFR 1910, Subpart S, and the National Electrical Code's National Fire Protection Association (NFPA) Publication 70. The electric service is a standard industrial hazard.

2.4.5 Fire

Primary Buildings TAN-650 and TAN-630 are mainly constructed of concrete and steel, contain limited ignition sources, and do not contain large quantities of fuel to support combustion. The CTF is isolated from other INEEL locations; thus, it will not be affected by fire at other facilities. The area around the buildings is kept clear of weeds and will not propagate a range fire.

Some flammable material containing PCB is stored in TAN-624, which is mainly constructed of steel. **To minimize the possibility of a fire in CTF buildings, the introduction of potential ignition sources such as a forklift or electrical components and flammable or combustible materials in and around the building shall be approved by the facility fire protection engineer or an alternate prior to beginning the activity.**

The fire sprinkler system has been disconnected and the fire extinguishers in the CTF buildings have been removed. The manual fire alarm boxes, heat and smoke detectors, emergency lighting, and exit lights may still be installed but are no longer tested and not deemed functional. **To minimize the risk from fire during the training exercises and improve personnel evacuation in the event of an emergency, the following controls shall be established and approved by the facility fire protection engineer or an alternate prior to beginning the activity:**

1. **Fire extinguishers shall be installed in a conspicuous place inside the building(s) being used for the activity**

2. **A conspicuously marked secondary escape path shall be established**

3. **Emergency egress lighting shall be established.**

Fire water to hydrants around the facility is supplied from the TAN-614 pumphouse. The TAN Fire Department is located approximately 1.5 mi away by road.

2.4.6 Volatile Flammable or Reactive Gases or Liquids

Flammable gases and dusts are not normally used at CTF, although welding tasks may take place infrequently. Flammable liquids such as consumer cleaning products may also be used on an infrequent basis. These are standard industrial hazards.

2.4.7 Natural Phenomena

Flooding – CTF is not located on a flood plain, so flooding at CTF would result from runoff augmented by heavy rainfall. External flooding from precipitation accumulation and runoff is not feasible

as the CTF buildings are situated on a slight grade, and the average yearly precipitation is approximately 9 in. of water in the form of snow, rain, and fog.

High Winds – CTF is situated at the INEEL. The peak wind gust recorded at the INEEL is 78 mph based on records from 1950 to 1983.[13] High winds are not a hazard to personnel because peak wind velocities develop over a relatively long time (usually hours), and any activity that might be affected adversely by the winds can be shut down prior to the occurrence of peak wind velocities.

Inclement Weather – The climate of the INEEL is that of a semi-arid desert with precipitation averaging 9 in. per year. During the summer season, storms may be encountered that exhibit lightning and thunder. All CTF buildings provide adequate protection for operating personnel.

Seismic Events – The Eastern Snake River Plain (ESRP) is seismically quiescent, relative to the surrounding seismically active regions. Studies have confirmed the presence of active faults in the mountains near the INEEL.[14] The largest earthquake within the region occurred on August 17, 1959, at Hebgen Lake, Montana, and was located 160 km (100 mi) northeast of the INEEL Site. The event was felt at the INEEL, but caused no damage.[15] Another large earthquake occurred on October 28, 1983, with the epicenter located in the Thousands Springs valley near the western flank of Borah Peak, approximately 90-110 km (55-70 mi) from INEEL facilities.[16] Although earthquake ground motions were felt at the INEEL, no significant damage occurred to any facility at the INEEL.[17] A major earthquake that could affect CTF is unlikely given the distance to major faults and the seismic quiescence of the ESRP; therefore, there is not a personnel hazard at CTF from earthquakes.

Snow Loading – The hazard to CTF from snow loading is negligible.

Temperature Extremes – Temperature extremes at the CTF are weather related and do not represent an unusual hazard to personnel.

Volcanism –Volcanic events are preceded by detectable seismic warnings. The type and frequency of seismic events indicates whether an eruption is imminent or months away. The seismograph network provides adequate warning of renewed volcanism. Any activities could be cancelled should volcanism erupt near the CTF.

2.4.8 Ionizing Radiation Sources

The estimated radioactive material in CTF[2] is not enough to categorize it as a Hazard Category 3 nuclear facility. Areas of fixed radioactive contamination are marked with warning signs. Areas of removable contamination are roped off and marked with warning signs and are not normally accessible. The hazard from ionizing radiation sources is slight, and exposure is controlled by the INEEL Radiation Protection Program.

2.4.9 Material Handling Dangers

Material handling does not occur on a regular basis, and is a standard industrial hazard.

2.4.10 Mechanical and Moving Equipment Dangers

There are some electric motors powering ventilation fans. All rotating equipment is guarded in accordance with the requirements of 29 CFR 1910, Subpart O (machinery guarding). This is a standard industrial hazard.

2.4.11 Biological Agents

While there are no dangerous biological agents that will be used in the CTF for the training exercises, the exercises will require the use of the biological simulants listed in Table 2-2. All of the biological simulants in Table 2-2 were reviewed by the Biotechnologies Department and **do not pose a threat to human health or represent a danger to the environment,[18] when used as follows:**

1. **No liquid or solid biological simulant will be released**

2. **Any simulant used in a liquid state in a fermenter vessel either will be inactivated with 10% commercial bleach, autoclaved after prior arrangement at the INEEL, or returned to Dugway for disposal**

3. **The decontamination procedure will be documented at each instance, along with the volume of material inactivated.**

Therefore, the biological simulants are safe to use for the training exercises. Note, while these biological simulants are not hazardous, they could pose a risk to immunocompromised personnel.

Table 2-2. Biological simulants to be used in scenario training exercises.

Name of Biological Simulant	Synonyms	Chemical Abstract Service Registry Number (CAS#)
Deoxyribonucleic acid, Bacteriophage (Lambda Phage) from E-Coli	None listed	91080-14-7
Alpha-Amylase from Bacillul Globigii (Bacillus licheniformis)	None listed	9000-85-5
Bacitracin from Bacillus Globigii (Bacillus licheniformis)	None listed	1405-87-4
Bacillus Subtilis	None listed	None
Anti-fd Bacteriophage	Rabbit Anti-fd Bacteriophage, IGG Fraction	None
Biotrol 4K	Bactimos, DiPel, Thuricide, Vectobac, Acrobe, B 401, Bactis, Foray, Gnatrol, Javelin, Berliner, bacillus thuringienses, bacillus thuringiensis Berliner	68038-71-1
Albumin, Egg, Powder	Obalbumin	9006-50-2.

2.5 Normal Operations

The analysis of normal operating conditions focuses on the effects and consequences that occur as the result of normal CTF activities. As such, the controls described in the preceding sections ensure that CTF operations are conducted in a safe manner and that the consequences of these activities are acceptable. There is no normal or abnormal activity at the CTF that presents a hazard or risk for which there is not an adequate plan or provision. The safety procedures for the scenario training activities will be provided by Dugway Proving Grounds, and are not part of this document. Within the constraints developed in this document the training exercises may be conducted in any of the buildings listed in Table 1-1 and Table 1-2, except TAN-624 and TAN-650, which are not considered NRASA.

The simulants are the least dangerous chemical/radionuclide/biological material that is required to simulate the more dangerous WMD materials, and in general are harmless to humans and the environment. However, **to prevent the accumulation of waste materials in the CTF buildings that are being used for the training exercises, the Tenant Use Agreement (IAG-181)[1] requires that all equipment and media be inactivated or decontaminated with bleach at the end of every exercise. It also requires that whatever the tenant brings on-site will be taken off-site, double- and triple-bagged, and disposed of off-site.**

Documentation[18] concerning the safety of the biological simulants used in the CTR shows that **the biological simulants do not pose a threat to human health or represent a danger to the environment when used as follows:**

1. **No liquid or solid biological simulant will be released**

2. **Any simulant used in a liquid state in a fermenter vessel either will be inactivated with 10% commercial bleach, autoclaved after prior arrangement at the INEEL, or returned to Dugway for disposal**

3. **The decontamination procedure will be documented at each instance, along with the volume of material inactivated.**

2.6 Accident Analysis

2.6.1 Introduction

Accident safety analysis is a process used to estimate the likelihood and consequences of abnormal operating events and credible accidents. An abnormal operating event is defined as any unplanned event that occurs due to malfunctioning systems, abnormal operating conditions, or operator error. These events do not have significant adverse consequences. A credible accident is any unplanned event or unmitigated anticipated event that can have significant adverse consequences. Such consequences can include the release of radioactive/hazardous materials, injuries to personnel or the public, and significant facility or environmental damage.

The following sections will identify abnormal operating events and credible accidents. The features established to prevent and mitigate the hazards leading to abnormal occurrences and accidents will be identified and a qualitative assessment of the risks made.

Accidents analyzed for CTF operations include ionizing radiation exposure and fire. The analysis demonstrates that possible accidents at the CTF will be minor.

2.6.1.1 Fire. Buildings at the CTF are mainly constructed of concrete, brick, and metal; contain limited ignition sources; and contain very little fuel to support combustion. Housekeeping requirements limit the amount of combustibles allowed in the facility. The area around the CTF is kept clear of weeds to prevent propagation of a range fire to the CTF buildings.

A large fire usually results in major damage to a facility structure, and removal of fire-protection water from these facilities further increases the potential for large fires. TAN-650 and TAN-630 are mainly constructed of concrete, steel, and brick and they have a low combustible material loading. Therefore, the most likely fire will be small, fueled mainly by those items brought into the building, and will not easily propagate from one CTF building to the next.

2.6.1.2 Ionizing Radiation. When the LOFT reactor system was decontaminated and decommissioned in 1988, several areas of the facility had radioactive contamination and/or activated equipment. These sources of radiation are a negligible hazard to personnel in the facility.

2.6.1.3 Radioactive Material Release. The worst-case radioactive material release scenario for the CTF is a release of the total radioactive source term listed in Table 2-3 and the resulting hazard from ionizing radiation sources to personnel. This accident is postulated with no mitigation assumed. Conservative bounding calculations demonstrate that this accident will not result in workers, co-located workers, or members of the public receiving exposures in excess of DOE radiation limits.

Methodology – The general process of estimating potential exposure to releases of radioactive materials requires the following:

- The source term for radioactive constituents (total curie content for specific radionuclides)
- Fraction of the total source term that is released
- For inhalation exposures, the fraction of the release term that is respirable (that is, those particulates in the 1 to 10 μm mass median aerodynamic diameter), for evaluating exposure via the inhalation pathway.

Co-located workers and off-site individuals can be exposed to radiation from inhalation of particulates, external exposure from immersion in a plume, or direct external exposure to contaminants. Off-site individuals (residents) can also be exposed through ingestion of contaminated crops and animals. Ingestion is not considered to be an exposure pathway for the worker because no food items are grown and consumed in the work area.

Radiological doses were calculated using the Radiological Safety Analysis Computer Program (RSAC)-5 computer code.[19] For the worker, a box model was used for the κ/Q values.[a] All other

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a. Since RSAC-5 cannot compute κ/Q values for distances less than 100 m, for worker exposures, a box model was used to calculate a source-term distribution factor. This included a 5-min time factor for the source term from the release to distribute itself in the radioactive vapor cloud space of 10 × 10 × 5 m. This term (300 s/500 m^3) was then directly input into RSAC-5 to mathematically determine the worker inhalation exposure. This methodology is only appropriate for worker inhalation exposures and not ground-surface or air-immersion exposures. It is expected that ground-surface and air-immersion exposures for the worker would be proportional to those calculated by RSAC-5 for distances of 100 m and greater.

exposures were based on the RSAC-5 code calculating the values. Meteorological data are based on neutral stability (Class D) conditions and a wind speed of 2.5 m/sec for exposure distances.[20] The option to include dry deposition in the dose calculations was selected.

The radiological doses calculated were evaluated for the immediate area, at distances of 100 m from the immediate area, 2.7 km at State Highway 33, and 9.0 km at the INEEL nearest site boundary for members of the public. Co-located and on-site worker exposures occur via inhalation of resuspended particles, ground-surface dose (for one week), and air immersion. Additionally, exposures at a distance of 9.0 km include the ingestion of exposed vegetation.

Release Calculations – This postulated accident scenario involves the release of the radioactive inventory due to an earthquake or other catastrophic event. It is assumed that:

- The release fraction for cesium is 0.01 and for cobalt, strontium, and yttrium, it is 0.001[3]
- The release period is 1 hr
- The worker is exposed for 5 min and is 10 m away from the release.

The following listing of radionuclides was used for the accident scenario. This listing was developed from Table 2-3. The estimated source term is calculated from the amount of the release, and the release fraction is shown in Table 2-4:

Table 2-3. CTF estimated source term.

	Curies Available	Release Fraction
Cesium-137	9.0E-1	9.0E-3
Cobalt-60	1.9E-2	1.9E-5
Strontium-90	9.0E-1	9.0E-4
Yttrium-90	9.0E-1	9.0E-4

Table 2-4 summarizes the total effective dose equivalents (TEDEs) from all exposure routes, as calculated by RSAC-5.

Table 2-4. Radiological EDEs (rem) from a CTF radioactive inventory release accident.

Pathway	Release Area	100 m	2.7 km	9.0 km
Inhalation	1.01E-1	2.39E-4	1.45E-6	2.19E-7
Ingestion	N/A	N/A	N/A	5.51E-6
Ground Surface	N/A	5.55E-4	3.37E-6	5.09E-7
Air immersion	N/A	1.21E-6	7.74E-9	1.17E-9
TOTAL	1.01E-1	7.95E-4	4.83E-6	6.24E-6

EDE effective dose equivalent

A release of the estimated CTF radioactive materials inventory could result in a worker receiving approximately 100 mrem. A member of the public could receive approximately 4.8E-03 mrem at State Highway 33 and 6.2E-03 mrem at the nearest site boundary. This is a conservative calculation, since the estimate of the radionuclide inventory is conservative and the radionuclides are scattered throughout

TAN-650. Therefore, a small fire can only affect a small portion of the releasable radionuclide inventory. The most likely release mechanism is a large fire, which is considered extremely unlikely, because of the small amount of combustible material in the facility. Even if some of the chemicals used in the training exercises are flammable or an ignition source, there is essentially no fuel to ignite. The only building with a large radionuclide inventory is TAN-650, mainly in the containment building, and release of all the radionuclides in one event is extremely unlikely. In addition, TAN-650 is a steel and concrete structure, which is essentially fireproof. While entry into the containment building during a training exercise will not result in a significant radiation dose to the training team members, **the personnel access doors into the containment building shall be closed during training exercises to provide the greatest margin of safety to the team members.**

2.6.1.4 Hazardous Material Release. TAN-624 is the only building that contains a quantity of hazardous material (more than 1 lb of PCB) that exceeds its RQ listed 40 CFR 302.4. Approximately 44% of the waste is contained in wooden containers (Barcodes TAN010110 and TAN010111) and 1% in fiber or plastic containers (Barcode TAN010038), which are not fireproof; the remaining 55% is contained in 55-gal steel drums. Therefore, 55% of the inventory is unlikely to be released should a fire occur in TAN-624. In addition, there are few ignition sources in the building and no large sources of combustible material outside of the waste storage containers. While wooden and fiber containers are combustible, it takes a sustained fire to burn through the walls of wooden containers before any hazardous material can be released. The same cannot be said of plastic containers that can melt through from a relatively small fire. A small fire might cause a few metal drums to burst from overpressurization. The larger the fire, the more drums will burst, and the more likely the contents of the drums will burn and release toxic fumes. The estimate of the amount of PCB present in TAN-624 is conservative, and the likelihood of a fire large enough to affect any of the containers is small. However, **to minimize the possibility of a fire in CTF buildings, the introduction of potential ignition sources such as a forklift or electrical components and flammable or combustible materials in and around the building shall be approved by the facility fire protection engineer or an alternate prior to beginning the activity.**

2.7 Conduct of Operations

2.7.1 Organization

The following sections summarize the TANO site management organizational responsibilities relative to safety and quality assurance that apply to CTF.

2.7.2 Responsibilities

TANO Operations Director

The TANO Site Area Director is responsible for overall operations and activities of CTF. In this capacity, the director assigns the responsibility for safety training, quality assurance, and facility maintenance to cognizant individuals.

CTF Facility Manager

The facility manager has the ultimate responsibility for all operations at CTF, which include:

1. Ensuring that safety reviews of assigned facilities and operations conducted within are performed and documented

2. Developing plans to prevent discharges to the environment

3. Coordinating building maintenance activities

4. Ensuring a safe work environment

5. Providing a comprehensive training program that fulfills all applicable requirements, ensures employee safety and proficiency, and promotes employee development

6. Development of CTF procedures and any required training, qualification, and/or certification of personnel to perform the procedures

7. Ensuring that the procedures are performed in accordance with the requirements of INEEL quality assurance and safety programs, and that the CTF maintains compliance with environmental, safety, industrial hygiene, and housekeeping standards

8. Ensuring that all personnel are properly trained for their tasks.

The facility manager can delegate any of these responsibilities to other individuals.

Operational Safety Board

The Operational Safety Board (OSB) is responsible for the independent review of hazard classification and safety analysis for the CTF.

3. HAZARD CONTROLS

3.1 Introduction

This chapter provides a discussion of the controls intended to ensure safe operation of the CTF. These requirements have been derived from the hazard and accident analysis presented in Chapters 2 and 3 of this document.

3.2 Operational Safety Requirements

Operational Safety Requirements (OSRs) are not applicable to low-hazard facilities. Since the CTF is classified as a low-hazard, nonnuclear facility, OSRs are not required.

3.3 Administrative Controls

Administrative controls are employed to ensure that the operation of the facility is conducted in accordance with applicable safety analyses, DOE Orders, and pertinent safety documents. Within the following constraints, the training exercises may be conducted in any of the buildings listed in Table 1-1 and Table 1-2 except TAN-624 and TAN-650, which are not considered NRASA.

3.3.1 CTF Personnel Safety

CTF Fire – The only mechanism identified for release of radioactive and hazardous materials is a large fire. The quantities of flammable and combustible materials in the facilities of CTF were known and deemed acceptable when the facilities where shut down and inactivated, and thus, the present level of combustible materials in the CTF buildings does not present an unacceptable level of fire safety. Therefore, **to minimize the possibility of a fire in CTF buildings, the introduction of potential ignition sources such as a forklift or electrical components and flammable or combustible materials in and around the building shall be approved by the facility fire protection engineer or an alternate prior to beginning the activity.**

CTF Life Safety – These facilities are in an inactive status and as such, the emergency lighting and exit signs are not functional. There are also no fire extinguishers or other active fire extinguishing or notification features inside the facilities. Therefore, **to improve personnel evacuation in the event of an emergency, the following controls shall be established and approved by the facility fire protection engineer or an alternate prior to beginning the activity:**

1. **Fire extinguishers shall be installed in a conspicuous place inside the building(s) being used for the activity**
2. **A conspicuously marked secondary escape path shall be established**
3. **Emergency egress lighting shall be established.**

3.3.2 Radioactive/Hazardous Material Inventory Control

Since the CTF is a low-hazard, nonnuclear facility, the sum of the ratios is not limited to 1 for the hazardous material RQs listed in 40 CFR 302. **However, to be conservative, the sum of the ratios for the chemicals simulants being used in any one WMD-incident response-team training exercise shall be less than 1 when compared to the chemical RQs in 40 CFR 302.4.** This ensures that the training exercises remain an NRASA activity.

To ensure that the facility classification remains low-hazard, the following requirement must be satisfied at all times. **At no time shall the quantity of a chemical being brought into a CTF building exceed the TQ listed in 29 CFR 1910.119 or the TPQ listed in 40 CFR 355.**

It is also necessary to limit the amount of radionuclides brought into the facility so that the facility does not become a Category 3 facility. Therefore, **the sum of the ratios for the inventory of radionuclides shall not exceed 1 when compared to the Hazard Category 3 threshold quantity values (TQVs) listed in DOE-STD-1027-92.**

3.3.3 Building Access Control

In order to prevent entry into areas containing hazardous material (TAN-624) and the radioactive materials in the TAN-650 containment building, **TAN-624 shall be secured/locked and the personnel access doors into the containment building shall be closed during training exercises to prevent accidental entry into these areas.**

3.3.4 Facility Cleanup

The simulants are the least dangerous chemical/radionuclide/biological material that is required to simulate the more dangerous WMD materials, and in general are harmless to humans and the environment. However, **to prevent the accumulation of waste materials in the CTF buildings being used for the training exercises, the Tenant Use Agreement (IAG-181)[1] requires that all equipment and media be inactivated or decontaminated with bleach at the end of every exercise. It also requires that whatever the tenant brings on-site will be taken off-site, double- and triple-bagged, and disposed of off-site.**

While the biological simulants are not considered to be hazardous, they must be handled and disposed of in a proper manner. Use of these simulants will be subject to the following requirements:

1. **No liquid or solid biological simulant will be released**

2. **Any simulant used in a liquid state in a fermenter vessel either will be inactivated with 10% commercial bleach, autoclaved after prior arrangement at the INEEL, or returned to Dugway for disposal**

3. **The decontamination procedure will be documented at each instance, along with the volume of material inactivated.**

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