



Department of Energy  
National Nuclear Security Administration  
Washington, DC 20585  
December 21, 2007



The Honorable A. J. Eggenberger  
Chairman  
Defense Nuclear Facilities Safety Board  
625 Indiana Avenue, N.W., Suite 700  
Washington, DC 20004-2901

Dear Mr. Chairman:

In a letter dated August 18, 2006, former Administrator Brooks responded to your request for information regarding the National Nuclear Security Administration's (NNSA) plans for handling the staging, assessment, and disposition of a damaged U.S. Nuclear Weapon and Improvised Nuclear Device (IND). In subsequent meetings between Defense Nuclear Facilities Safety Board (DNFSB) representatives and my office, the DNFSB requested additional information on NNSA's plans for preparing the G-Tunnel for the limited possibility that it will be used for the disposition of an IND.

The NNSA has determined that the G-Tunnel does not meet the definition of a nuclear facility for Department of Energy Emergency Response-identified specific operations and will no longer treat the Tunnel as such. The NNSA will carefully balance the limited probability of an interdicted IND scenario with the benefits of G-Tunnel upgrades and the costs associated with implementation. With the limited possibility that the G-Tunnel will be used in the disassembly of an IND and uncertainties surrounding the circumstances of such use, it is our intent to address appropriate life safety and mission-related facility upgrade issues that are prudent to pursue.

- NNSA will continue to prepare for the potential use of the G-Tunnel for the disassembly and technical nuclear forensics support of an IND. The alacrity of the side-by-side disassembly and forensics operations will be of paramount priority, given the critical nature to national security of such an activity. Several life safety upgrades have been identified for the G-Tunnel that will require significant investment. The life safety issues are identified in the "Facility Safety Plan for U12g Tunnel" (Enclosure 1). We will continue to assess these upgrades to determine the proper scope and prioritization.
- It will also be prudent to pursue improvements that will enhance the ability of the facility to complete any assigned mission and improve the overall safety for operations involving an IND. A program of evaluating potential facility upgrades to determine the relative contribution to the mission completion capability has been initiated. The benefit of each



upgrade with respect to carrying out the facility mission will be evaluated. The "White Paper on Evaluating Proposed U12g Facility Upgrades" (Enclosure 2) describes how facility hazards will be analyzed.

We will continue to analyze the hazards of the G-Tunnel and develop appropriate controls, conduct interagency drills and exercises, and implement specific upgrades to the G-Tunnel to improve both the overall safety posture and the ability of the facility to support a successful mission outcome. We believe these actions are in keeping with the G-Tunnel's mission to serve as a non-nuclear training and transitional facility that *may*, in an extremely unlikely event, under emergency circumstances, be used for the disposition of an IND.

Beginning in Fiscal Year 2008, the NNSA has established a six-year funding profile to address these infrastructure upgrades. The actual length of time to complete these upgrades will, of course, be dictated by the actual costs. The schedule is to complete the cost and risk/benefit assessment on the issues identified in the Documented Safety Analysis Implementation Plan by April 2008. At that time, a comprehensive project plan will be developed that addresses both life safety and facility safety upgrades and prioritizes potential improvements based on the cost and risk reduction they would provide.

Hopefully, the aforementioned synopsis of NNSA's plan to move forward with the G-Tunnel improvements clarifies your understanding. We will continue to work with the DNFSB as we move forward with our plans for the G-Tunnel.

If you have any questions please contact Mr. Thomas Black, Director, Office of National Technical Nuclear Forensics on 301-903-7314.

Sincerely,



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# **FACILITY SAFETY PLAN**

## **for U12g TUNNEL**

**February 2007**

Prepared by

**National Security Technologies, LLC**

**Homeland Security Technologies Division**

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## Revision Log

Revision #	Date	Description of Revision
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## Acronyms and Abbreviations

ANSI	American National Standards Institute
CAA	Clean Air Act/Air Programs
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
CO	carbon monoxide
DOE	U.S. Department of Energy
ESH&Q	Environment, Safety, Health, and Quality
FHA	Fire Hazard Analysis
FM	Facility Manager
fpm	feet per minute
ft	feet
hp	horsepower
hr	hour
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
km	kilometer
mi	mile
MRT	Mine Rescue Team
MSHA	Mine Safety and Health Administration
MW	Mega Watts
NEPA	National Environmental Protection Act
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
NTTR	Nevada Test and Training Range
RadCon	Radiation Control
REOP	Real Estate/Operations Permit
SSC	systems, structures, and components
USAF	U.S. Air Force

# 1. Introduction

## 1.1 Background

The U12g Tunnel on the Nevada Test Site (NTS) is identified by the National Nuclear Security Administration (NNSA) as an industrial facility. The tunnel and supporting infrastructure were originally developed in the 1960s to support below ground nuclear testing. The U12g Tunnel is currently operationally available; however, the facility is not continuously open or regularly occupied. Access is limited to that necessary for maintaining the facility in a standby condition, for infrastructure improvements, for conducting drills and exercises, and receiving tours.

NNSA requested a Facility Safety Plan to address systems, structures, and components (SSC) required to meet life-safety requirements and to sustain the facility. This resulting Facility Safety Plan describes the U12g Tunnel facility and site characteristics, provides background to the hazard analysis for life-safety concerns, provides information regarding recurring facility maintenance requirements, and provides SSC infrastructure improvement recommendations.

## 1.2 Site Overview

The U12g Tunnel is located in Area 12 in the northwest corner of the NTS at the southern edge of Rainier Mesa. The southeast corner of the NTS lies approximately 105 km (65 mi) northwest of Las Vegas, Nevada. The nearest site boundary to the U12g Tunnel is 8 km (5 mi) to the north where the NTS meets the Nevada Test and Training Range (NTTR). Currently, there are no permanently occupied facilities within 8 km (5 mi) of the U12g Tunnel facility perimeter. However, there are several other tunnel complexes and unoccupied facilities within this same radius.

The U12g Tunnel was originally designed, constructed, and utilized for low yield (less than 20 kt) underground nuclear tests and other experiments during the 1960s and 1970s. Since that time, portions of the complex have been used for rock-mechanics related experiments in support of various programs and for some small-scale tests and exercises. The entire U12g Tunnel was decommissioned in December 1989. In 2001, a portion of the tunnel was reactivated for evaluation.

The U12g Tunnel began conversion to its present configuration in 2002, and consists of the following SSC:

- Power and electrical systems
- Ventilation system
- Refuge chamber
- Railroad transportation system
- Surface support structures, equipment, and storage

The U12g Tunnel also contains multiple drifts and alcoves not utilized at this time. They are generally in disrepair and have not been analyzed for the purpose of habitation. These unused



areas of the tunnel are separated from the current facility by distance, various types of barricades, and access restrictions. Legacy radioactive material remaining in these other areas has been evaluated and is considered sufficiently separated from the current operating areas that no significant exposure or movement is anticipated.

There is only one route of ingress/egress for the tunnel. A refuge chamber is provided at approximately 1,255 m (4,120 ft) from the portal entrance. The refuge chamber provides a shelter for personnel trapped underground during an emergency that would normally require evacuation.

### **1.3 Hazard Estimation**

Hazards associated with U12g Tunnel activities are those presented by underground work conditions and the specific maintenance activity taking place. Those hazards are addressed in pre-job and safety briefings prior to starting work. In addition, the facility is posted as a Radiation Area due to residual contamination from prior nuclear testing activities in unused drifts.

### **1.4 Normal Work Activities**

Organizational responsibilities are defined in the National Security Technologies, LLC (NSTec) Process Description PD-0001.001, “Integrated Safety Management System Description,” and the Policy PY-3200.002, “Integrated Safety Management System Policy,” including other documents referenced therein. NSTec line management is responsible for the protection of workers, the public, and the environment. Personal worker safety responsibility and accountability is an NSTec corollary to the Integrated Safety Management (ISM) principle and underpins the effectiveness of the system. Line management includes NSTec workers who are assigned management or supervisory responsibilities.

Line management safety responsibilities include, but are not limited to, the following:

- Define the work scope.
- Ensure that workers have the knowledge, skills, and abilities to identify the hazards associated with their work activities.
- Ensure that workers have the knowledge, skills, and abilities to execute assigned tasks safely.
- Ensure that workers perform assigned tasks safely.
- Monitor and strengthen safety performance.
- Acquire feedback, including worker input, for system improvements.

The organizational safety chain of responsibility is established and maintained in accordance with PY-3200.002, “Integrated Safety Management System Policy,” and CD-A010.002, “Real Estate/Operations Permit (REOP) Process.” NSTec is the primary REOP holder for the U12g Tunnel and is responsible for ensuring that the conditions of authorization established in the REOP are maintained. The NSTec execution planning process provides for a clearly defined safety chain of responsibility for NSTec-managed facilities and NSTec work. The U12g Facility

Manager (FM) is responsible for implementing the NSTec Integrated Safety Management System (ISMS) at U12g. The FM develops a Facility Execution Plan, and under the primary REOP conducts safety coordination for operations conducted and coordinates work conducted in the assigned facility.

The FM is responsible for ensuring that:

- Activities of one organization do not present unknown hazards to another organization's employees.
- Implementation of work authorization documents is sufficiently integrated between NSTec organizations to avoid adverse consequences.
- Organizations are prepared to take appropriate emergency response actions to protect the health and safety of their workers and the environment.

Under the primary REOP, the U12g Tunnel FM permits work to be conducted within the assigned locations through a documented process. Operations Superintendents execute work through this process under the cognizance of their respective line management. Operations Superintendents ensure that their activities are conducted safely and that the respective facility and activity safety and operational envelopes are maintained during the execution of work. Subcontractors working in an NSTec-managed facility are required to work within the controls defined in Environment, Safety, Health, and Quality (ESH&Q), Procurement, and Property Management directives. NSTec appoints a subcontract technical representative to interface with the subcontractor for safety matters.

Title 10 Code of Federal Regulations (CFR) 851, "Worker Safety and Health Program," requires all covered U.S. Department of Energy (DOE) contractors, including NSTec, to submit a worker safety and health program that identifies the methods to implement requirements. A Program Description PD-P200.001, "10 CFR 851 Worker Safety and Health Program Description," has been prepared by ESH&Q to define how 10 CFR 851 criteria have been implemented by existing NSTec programs. This Facility Safety Plan is written in accordance with the requirements of that program description.

U12g Tunnel SSC maintenance and improvement activities are scheduled on a periodic basis, dependent on the utilization and construction schedule for the tunnel. Within U12g Tunnel, the only SSC in the underground main drift, bypass drift, and alcove are maintained. SSC maintained in those areas include the refuge chamber, rail transportation system, ventilation system, lighting system, compressed air system, electrical distribution system, and the associated structures outside in the vicinity of the portal.

## 1.5 Related Documents

The U12g Tunnel also has the following documentation that helps to define the scope and establish controls:

- Primary REOP, Area 12 G Tunnel, BN-0147
- Secondary REOP, NNSA-0002
- Hazard Analysis, HA-PEP-SS-1168-01
- National Environmental Protection Act (NEPA) Environmental Evaluation Checklist, NV-2001-042
- Emergency Response Procedure, ERP-1011
- Emergency Planning Hazards Survey, EPHS-1011
- Emergency Planning Hazards Assessment, EPHA-1011
- Area 12 G-Tunnel Event/Exercise Security Plan

## 2. Site Characteristics

### 2.1 Site Description

The NTS is a portion of federally owned land withdrawn from public domain under Public Land Order 805, issued in 1952, and Public Land Order 2568 issued in 1961. It is located in Nye County, Nevada, approximately 105 km (65 mi) northwest of Las Vegas, Nevada, and 435 km (270 mi) southeast of Reno, Nevada. In 1999, DOE acquired additional land for the NTS in the northwest corner of the site. In its current configuration, the NTS encompasses 3,561 km<sup>2</sup> (1,375 mi<sup>2</sup>) and lies between latitudes N 36° 54' to N 37° 41' and longitudes W 115° 69' to W 116° 80'. Its dimensions vary from 46 to 56 km (28 to 35 mi) in width (eastern to western border) and from 64 to 88 km (40 to 55 mi) in length (northern to southern border).

The NTS is bounded on the north, east, and west by the NTTR. The northwest portion of the NTTR is occupied by the Tonopah Test Range. The use of the land and air space is controlled by the U.S. Air Force (USAF) under a DOE Memorandum of Understanding between DOE and the USAF that excludes public use or access. These ranges, particularly to the north and east, provide a buffer zone between the NTS and public lands. The buffer zone varies from 24 to 105 km (15 to 65 mi) between the NTS and land that is open to the public. Lands administered by the Bureau of Land Management and the National Park Service make up most of the area to the south and west. The U12g Tunnel Complex is located in Area 12 at the south edge of Rainier Mesa, latitude N 37° 11' and longitude W 116° 12'.

The approximate distances to the U12g Tunnel Complex from the following locations are as follows:

- Approximately 168 km (105 mi) northwest of Las Vegas
- Approximately 80 km (50 mi) northwest of Indian Springs
- Approximately 72 km (45 mi) north of Mercury
- Approximately 30 km (19 mi) northeast of Area 6 Control Point
- Approximately 8 km (5 mi) south of the NTS/NTTR site boundary

U.S. Highway 95 roughly forms the south boundary of the NTS and serves as the major access road to the site. Mercury, the NTS main base camp, is located in the southeast corner of the NTS, approximately 4.9 km (3 mi) north of U.S. Highway 95. Mercury consists of residential and administrative buildings.

The main access in and out of the NTS is via Mercury Highway, which is controlled, restricted, and guarded on a 24-hr basis. The main route to the U12g Tunnel Complex consists of following Mercury Highway north to Area 6, then northwest along Tippipah Highway until it joins with Rainier Mesa Road before Area 12 base camp. Rainier Mesa Road turns into Stockade Wash Road and continues up to and beyond the U12g Tunnel Complex access road. The Mercury Highway/Tippipah Highway junction is just north of Area 6 Control Point.

## 2.2 Facility Description

The U12g Tunnel is primarily an underground complex; however, there are a few outside structures directly associated with the tunnel complex. Those structures are required to maintain the U12g Tunnel in an operational standby mode. The underground tunnel is posted as a radioactive material area, due to legacy contamination from prior nuclear testing activities in now sealed and unused drifts of the complex. The underground complex consists of approximately 15,000 feet of tunnel.

The U12g Tunnel consists of the underground tunnel complex, the portal yard area to support the underground complex, the underground access control trailer, the storage areas in support of the underground complex, the utility water tanks, the Sutorbilt ventilation station and surface area around the station, and several miscellaneous trailers used for support of the underground complex. Figure 2-1 shows the tunnel portal entrance area.

The U12g Tunnel boundaries are not marked by fence lines, but can be stated generally as: bounded on the west side by the area above the tunnel portal and the water tanks, on the north side by the conference trailer, on the east side by the area immediately around the portal and on the south side by the farthest extent of the Sutorbilt ventilation station.



**Figure 2-1.** U12g Tunnel portal entrance.

The facility is not serviced by utility water or sewer systems. Sanitation services are provided by portable toilets. Communications to the facility consist of telephone and the NTS radio systems. A fire suppression system is not available within the facility; however, portable fire extinguishers are located in all structures and placed every 200 feet in the underground tunnel complex. A 16,000-gallon non-potable storage tank located adjacent to the portal provides water to the tunnel via a 4-inch distribution line. Electricity supplied to U12g Tunnel is via a 4.16-kilovolt distribution system from the Rainier Mesa substation, which is then further reduced to a 480/208/120 volt working voltage. Heating, ventilation, and air conditioning systems are installed locally at individual structures as required.

### **2.3 Residual Radioactive Material**

The U12g Tunnel was used in the 1960s and 1970s for testing nuclear weapons. Residual contamination from the testing is present in the tunnel complex in drifts that are sealed and not accessible for normal work processes. The tunnel itself is posted as a radioactive material area and is monitored for contamination by the Radiation Control (RadCon) Department. Continuing surveys by RadCon in the accessible areas of the tunnel indicate that contamination is not migrating into the alcove.

### 3. Hazard Analysis

#### 3.1 Hazards

The hazards associated with U12g Tunnel can be categorized by physical, radiological, and chemical hazards. Physical hazards are the primary threat to worker safety, with limited threats coming from exposure to small amounts of chemicals and legacy radioactive contamination. The facility does not have a significant inventory of hazardous chemicals, except for diesel fuel. There is legacy radioactive contamination sealed in the unused tunnel drifts, but the facility has no active inventory of ready use radioactive materials.

Physical hazards associated with U12g Tunnel are:

- Transportation hazards
- Underground environmental hazards
- Fire and explosion hazards
- Operations working on elevated surfaces, and material handling
- Weather and climate changes
- Seismic events
- Lightning
- Noise

ESH&Q and other subject-matter experts determine which hazards are identified with these facilities. These hazards are identified during beneficial occupancy inspections or during the initial or routine facility inspections.

In addition, authorized personnel identify transient hazards in work packages for modifications, repairs or maintenance to an operation, an activity or to the facility itself. The FM documents a comprehensive, consolidated list of identified hazards, their location and provides a document for potential hazard mitigation. The identified hazards for U12g Tunnel, as listed in Tables 3-1 through 3-7, are updated and maintained to reflect the introduction of new hazards following the initial beneficial occupancy inspection, if applicable.

**Table 3-1.** Identification, Location and Mitigation of Hazards within the U12g Tunnel—U12g Site

<b>The U12g Site</b>		
Hazard Identification	Diesel fuel/diesel fuel storage tank	
Room Number/Space	Diesel engines/Generators	
Mitigation Requirement/ Reference	40 CFR 50-100	Protection of Environment—Clean Air Act/Air Programs (CAA)
	CD-0442.004	Air Pollution Control and Permitting
	CM-0444.001-050	Housekeeping and Fire Protection
	CM-0444.001-051	Flammable/Combustible Liquids and Aerosol Products

<b>The U12g Site</b>		
Hazard Identification	Rotating machinery	
Room Number/Space	Diesel engines/Generators	
Mitigation Requirement/ Reference	CM-0444.001-001	General Safety Rules
	CM-0444.001-003	Indoctrination and Training
	CM-0444.001-004	Job Hazard Analysis and Pretask Hazard Review
	CM-0444.001-050	Housekeeping and Fire Protection
<b>The U12g Site</b>		
Hazard Identification	Electrical hazards, cables and equipment	
Room Number/Space	Diesel engines/Generators	
Mitigation Requirement/ Reference	CM-0444.001-030	Electrical Safety
	CM-0444.001-063	Lockout/Tagout
<b>U12g Tunnel Pad Yard</b>		
Hazard Identification	Trip/Drop/Upset hazards	
Room Number/Space	Rail tracks; uneven ground throughout yard	
Mitigation Requirement/ Reference	CM-0444.001-001	General Safety Rules
	CM-0444.001-003	Indoctrination and Training
	CM-0444.001-004	Job Hazard Analysis and Pretask Hazard Review
	CM-0444.001-050	Housekeeping and Fire Protection
<b>U12g Tunnel Pad Yard</b>		
Hazard Identification	Storage of hazardous materials	
Room Number/Space	Throughout yard	
Mitigation Requirement/ Reference	CM-0444.001-014	Selecting, Using, and Storing Chemicals
	CM-0444.001-015	Hazard Communication
	CM-0444.001-050	Housekeeping and Fire Protection
	CM-0444.001-051	Flammable/Combustible Liquids and Aerosol Products
	CM-0444.001-060	Personal Protective Equipment

**Table 3-2.** Identification, Location and Mitigation of Hazards within the U12g Facility—U12g Tunnel Underground Drifts

<b>Tunnel U12g</b>		
Hazard Identification	Underground work/operations/fires/explosions	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	30 CFR	Mine Safety and Health Administration
	CM-0444.001-100	Underground Operations Safety and Health
	OP-2110.415	Technical Evaluation of Underground Diesel Powered Mobile Equipment
	OP-2120.021	Underground Rescue and Emergency Response
<b>Tunnel U12g</b>		
Hazard Identification	Electrical safety	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	CM-0444.001-030	Electrical Safety
	CM-0444.001-063	Lockout/Tagout
<b>Tunnel U12g</b>		
Hazard Identification	Use of man lifts/scaffolding	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	CD-0444.070	Hoisting Apparatus, Cranes, and Conveyors
	CM-0444.001-073	Aerial Work Platforms/Lifts
	CM-0444.001-071	Chains and Slings
	CM-0444.001-061	Fall Prevention and Protection

<b>Tunnel U12g</b>		
Hazard Identification	Hazardous wastes	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	CM-0444.001-014	Selecting, Using, and Storing Chemicals
	CM-0444.001-015	Hazard Communication
	CM-0444.001-050	Housekeeping and Fire Protection
	CM-0444.001-051	Flammable/Combustible Liquids and Aerosol Products
	CM-0444.001-060	Personal Protective Equipment
<b>Tunnel U12g</b>		
Hazard Identification	Pressure systems	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	CD-2110.002	Standard Pressure Systems
	CD-2110.003	Non-Standard Pressure Systems
	CM-0444.001-014	Selecting, Using, and Storing Chemicals
	CM-0444.001-015	Hazard Communication
	CM-0444.001-051	Flammable/Combustible Liquids and Aerosol Products
	CM-0444.001-090	Compressed Gas Cylinders
<b>Tunnel U12g</b>		
Hazard Identification	Welding and cutting operations	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	CM-0444.001-015	Hazard Communication
	CM-0444.001-050	Housekeeping and Fire Protection
	CM-0444.001-054	Hot Work (Cutting, Welding, Brazing, and Grinding)
	CM-0444.001-060	Personal Protective Equipment
	CM-0444.001-067	Abrasive Wheels
	CM-0444.001-082	Occupational Exposure Prevention and Control of Carcinogens and Reproductive Hazards
<b>Tunnel U12g</b>		
Hazard Identification	Storage and use of hazardous materials	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	CM-0444.001-014	Selecting, Using, and Storing Chemicals
	CM-0444.001-015	Hazard Communication
	CM-0444.001-050	Housekeeping and Fire Protection
	CM-0444.001-051	Flammable/Combustible Liquids and Aerosol Products
	CM-0444.001-060	Personal Protective Equipment
<b>Tunnel U12g</b>		
Hazard Identification	Noise	
Room Number/Space	Underground	
Mitigation Requirement/ Reference	CD-0444.085	Noise Control and Hearing Conservation Program
	CM-0444.001-060	Personal Protective Equipment



<b>Tunnel U12g</b>		
Hazard Identification	Waste management	
Room Number/Space	Inside and outside tunnel, portable toilets	
Mitigation Requirement/ Reference	40 CFR 260-280	Protection of Environment—Resource Conservation Recovery Act (RCRA)
	40 CFR 761	Polychlorinated Biphenyls (PCBs)
	CD-0442.006	Hazardous Waste Management
	CD-0442.010	Waste Management

**Table 3-3.** Access Control Trailer

<b>Access Control Trailer</b>		
Hazard Identification	Storage of mine safety equipment (hazardous materials)	
Room Number/Space	Access Control Trailer	
Mitigation Requirement/ Reference	CM-0444.001-014	Selecting, Using, and Storing Chemicals
	CM-0444.001-015	Hazard Communication
	CM-0444.001-050	Housekeeping and Fire Protection
	CM-0444.001-051	Flammable/Combustible Liquids and Aerosol Products
	CM-0444.001-060	Personal Protective Equipment
<b>Access Control Trailer</b>		
Hazard Identification	Electrical safety	
Room Number/Space	Access Control Trailer	
Mitigation Requirement/ Reference	CM-0444.001-030	Electrical Safety
	CM-0444.001-063	Lockout/Tagout

**Table 3-4.** Machine Shop/Tool Trailer

<b>Machine Shop/Tool Trailer</b>		
Hazard Identification	Electrical safety	
Room Number/Space	Inside building	
Mitigation Requirement/ Reference	CM-0444.001-030	Electrical Safety
	CM-0444.001-063	Lockout/Tagout
<b>Machine Shop/Tool Trailer</b>		
Hazard Identification	Storage and use of hazardous materials	
Room Number/Space	Inside shop area	
Mitigation Requirement/ Reference	CM-0444.001-014	Selecting, Using, and Storing Chemicals
	CM-0444.001-015	Hazard Communication
	CM-0444.001-050	Housekeeping and Fire Protection
	CM-0444.001-051	Flammable/Combustible Liquids and Aerosol Products
	CM-0444.001-060	Personal Protective Equipment
<b>Machine Shop/Tool Trailer</b>		
Hazard Identification	Waste management	
Room Number/Space	Inside and outside building	
Mitigation Requirement/ Reference	40 CFR 260-280	Protection of Environment—Resource Conservation Recovery Act (RCRA)
	40 CFR 761	Polychlorinated Biphenyls (PCBs)
	CD-0442.006	Hazardous Waste Management
	CD-0442.010	Waste Management

<b>Machine Shop/Tool Trailer</b>		
Hazard Identification	Trip/Drop/Upset hazards	
Room Number/Space	Inside and outside building	
Mitigation Requirement/ Reference	CM-0444.001-001	General Safety Rules
	CM-0444.001-003	Indoctrination and Training
	CM-0444.001-004	Job Hazard Analysis and Pretask Hazard Review
	CM-0444.001-050	Housekeeping and Fire Protection

**Table 3-5.** Conference Trailer

<b>Machine Shop/Tool Trailer</b>		
Hazard Identification	Electrical safety	
Room Number/Space	Inside building	
Mitigation Requirement/ Reference	CM-0444.001-030	Electrical Safety
	CM-0444.001-063	Lockout/Tagout

**Table 3-6.** Classified LANL Trailer

<b>Machine Shop/Tool Trailer</b>		
Hazard Identification	Electrical safety	
Room Number/Space	Inside building/outside HVAC Unit	
Mitigation Requirement/ Reference	CM-0444.001-030	Electrical Safety
	CM-0444.001-063	Lockout/Tagout

**Table 3-7.** Classified LLNL Trailer

<b>Machine Shop/Tool Trailer</b>		
Hazard Identification	Electrical safety	
Room Number/Space	Inside building	
Mitigation Requirement/ Reference	CM-0444.001-030	Electrical Safety
	CM-0444.001-063	Lockout/Tagout

## 3.2 Hazard Control

Hazards of the various operations conducted at U12g Tunnel are controlled by an established work control program. All contact work within the facility is performed through a Work Package Program in accordance with Process Description PD-4000.001, “Work Control/Authorization.” A Job Hazard Analysis is performed for each job task being performed. Specific operations require written programs of conduct. Awareness and training provide additional hazard controls.

## 3.3 Hazard Mitigation

ESH&Q reports, Industrial Hygiene surveys, radiological surveys, and other documentation identify hazards and specify mitigation requirements.

### 3.4 Housekeeping

Good housekeeping practices are the responsibility of every person assigned to the project. Awareness of such hazards is a major factor in the prevention of housekeeping-related accidents and decreasing fire hazard concerns. Construction equipment and materials are stored or placed in designated areas in an orderly manner, and work areas are checked at the beginning and end of each shift.

### 3.5 Transportation and Heavy Equipment Hazards

The U12g Tunnel yard area has a moderate level of vehicle traffic, mostly small trucks carrying passengers, tools or items for delivery. Passenger and support vehicles are found within the area of the tunnel portal. Drivers approaching the portal area should be alert for railroad activities and train movements as they approach. Due to the layout of rails and railroad activity in the portal area there are areas designated as parking restriction zones.

The railroad locomotive is operated by personnel with documented qualifications to drive locomotives. Regularly scheduled maintenance is performed on the locomotive and the lowboy transport car. The locomotive and lowboy car are visually inspected prior to daily use to ensure safety of operation.

Heavy equipment will be operated only by those with required qualifications. Outside the tunnel in the portal area, personnel are to stay in the line of sight of the heavy equipment operator whenever possible. Only essential personnel are allowed in the work area where heavy equipment is in operation. No one is allowed inside the swing radius of the backhoe or other equipment without specific consent of the operator.

### 3.6 Fire and Explosion Hazards

The Fire Hazard Analysis (FHA) for U12g Complex, ENGR-FP-111, “Fire Hazard Analysis for Nevada Test Site—The U12g Complex,” identifies the following as potential fuel sources for fires:

- Locomotive diesel fuel and transmission fluid (hydraulic oil)
- Wooden lagging
- Electrical control and power cables
- Transient combustibles
- Diesel oil

Potential ignition sources are:

- Locomotive
- Electrical distribution system
- Energized electrical equipment
- Lightning

These ignition and fuel sources were evaluated as potential initiators of accident scenarios that involve fire. The FHA identified the locomotive as the single most likely source of ignition and fuel together in one package. A spill of the locomotive diesel fuel (50 gallon) and its subsequent ignition is expected to produce a 50 MW peak heat-release-rate fire.

Initial response to a fire at U12g Tunnel is provided by facility personnel utilizing manual fire-suppression equipment (fire extinguishers). However, the primary mechanism for fighting on-site fires at the U12g Tunnel Complex is notification of the Operations Coordination Center operator. This activates NTS Fire & Rescue resources, and if necessary the Mine Rescue Team (MRT). The MRT is based out of Area 6, while fire response crews and fire fighting equipment are located at Area 23 and Area 6. The Area 23 Fire Station is located approximately 72 km (45 mi) southeast of U12g Tunnel, while the Area 6 Fire Station is located approximately 30 km (19 mi) southeast of the U12g Tunnel. Both fire stations are staffed on a 24-hr/7-day schedule.

Several safety rules are in place to reduce the risk of fires. Fueling vehicles is prohibited within the underground tunnel. All mechanical repairs to the locomotive are performed outside the underground tunnel. Hot work is permitted in the tunnel or the outside yard only when using the work permit process that contains an analysis of the job risks and specifies precautions to reduce risk. The vegetation control program is ongoing, which reduces the risk of fire by limiting fuel available for brush fires in the yard area and along the access road.

## **3.7 Natural Phenomena Hazards**

### ***3.7.1 Adverse Weather Hazards***

Lightning represents a concern for both normal activities in the portal outside yard area and inside the underground tunnel. Electrical discharges may be transferred along the rail lines to the tunnel interior. During work activities, supervisors will observe site conditions and monitor messages from the NTS lightning warning system to determine if work activities are to be altered or suspended. When severe weather and/or lightning occur within 5 mi of U12g Tunnel, supervisors will shut down work at the U12g Tunnel portal area.

### ***3.7.2 Seismic Hazards***

#### ***3.7.3 Tunnel Seismic Analysis***

The tunnel design, construction, and maintenance (collectively the tunnel structure) are important factors that reduce the likelihood for rock falls or failure of the ground support system. The ground support system prevents large-scale rock falls that could cause personnel injury or damage to equipment and machinery. The tunnel structure provides support for overhead equipment such as the ventilation system ductwork. The U12g Tunnel is constructed in competent rock, and the overall design can withstand substantial seismic loads without failure. The tunnel's seismic capabilities were evaluated against seismic threats pertinent to the NTS. The seismic analysis indicated that seismically induced stresses and strains in the tunnel

structure, for any credible seismic event at NTS, are well below the levels that would challenge the integrity of the tunnel.

### **3.7.4 Alcove Seismic Analysis**

The alcove design, construction, and maintenance (collectively the alcove structure) are important design features that, similar to the tunnel structure, reduce the likelihood of rock falls in the alcove. The alcove structure and ground support system provide sound structural support for overhead equipment items. The ground support system prevents debris from falling from the back (roof) of the alcove. A seismic analysis of the alcove indicates that the structural integrity of the alcove will not be challenged by any seismic events postulated for the NTS. In the event of a cave-in at the U12g Tunnel, the MRT responds according to OP-2120.021, “Underground Rescue and Emergency Response.”

## **4. U12g Tunnel Maintenance**

### **4.1 Ground Support**

The ground support rock bolt fixtures have been tested against Mine Safety and Health Administration (MSHA) criteria, which contains the requirements for installation and testing of all rock fixtures and accessories used for ground support. In all cases where rock fixtures are selected as the method used to support ground, they must meet the requirements of 30 CFR § 56, “Safety and Health Standards-Surface Metal and Nonmetal Mines”/57.3203, “Safety and Health Standards-Underground Metal and Nonmetal Mines, Ground Control.”

### **4.2 Ventilation System**

U12g Tunnel is ventilated when occupied to support maintenance or other activities; normally the units remain in a shutdown mode until needed. Dual 300-horsepower (hp) Sutorbilt ventilation fans, located outside the tunnel portal, operate as a negative pressure exhaust system that brings fresh air underground and exhausts air to the surface, see Figure 4-1. Parts have been replaced from other unused systems similar to this one at the U12g Tunnel. Currently this system, built in 1961, does not have readily available commercial off-the-shelf components.

Fresh air is normally supplied through the tunnel system via the main drift tunnel portal. Shown in Figure 4-2, two 26-inch diameter steel spiral-weld ducts, in the main drift, connected to two 30-inch diameter spiral-weld ducts, outside the portal, draw air from the alcove through the tunnel exhaust duct to the outside. Air is exhausted from the drift and alcove by these two return ducts located along the drift tunnel back. Transition between ducts occurs at approximately 1,840 ft from the portal entrance.

The duct network originates with a 30-inch diameter duct from the outside of the tunnel portal and extends approximately 1,840 ft reducing to a 26-inch duct and continues to the end of the main tunnel drift. The entire duct network is approximately 4,500 ft. Ventilation direction and flow rate is manually controlled locally at the units and is reversible.



**Figure 4-1.** Dual 300-hp Sutorbilt Ventilation Fans.



**Figure 4-2.** 30-inch duct network originating from the tunnel portal entrance.

Normal airflow into the tunnel measures approximately 240 fpm through the tunnel cross section. Ventilation system oil levels are checked upon entry and during daily operation. The ventilation electrical system and motor control center is not currently on a preventive maintenance program, but maintenance is performed periodically.

### 4.3 Material Handling Equipment

**Rail Transport System**—Consists of a locomotive, a specialized flatbed railcar (lowboy), regular flatbed rail cars, personnel railcars, and the tracks that the equipment traverses.

The diesel locomotives are equipped and have design features that minimize the potential for inadvertent movement of the locomotive in the wrong direction or sudden movements of the locomotive at a high rate of acceleration.

The rail car (see Figures 4-3) is a single flatbed railcar (Figure 4-4) designed with a lowered center bed (lowboy, Figure 4-5). The design affords a lower center of gravity for added stability and reduction of the overall payload height for additional clearance. The rated load capacity of the rail car is 20,000 lb (10-T).



**Figure 4-3.** Locomotive and personnel car shown near alcove.



**Figure 4-4.** Flatbed rail car used to support movement of materials.



**Figure 4-5.** Lowboy to support movement of equipment and material.

- The tracks run from the U12g Tunnel Complex yard, through the U12g Tunnel main and bypass drifts, to just within the alcove. Electrical grounding from the tunnel messenger to the rail system provides a grounding grid within the U12g Tunnel Complex. The equipment is maintained and controlled under the MAXIMO Preventive Maintenance Program. Locomotive maintenance is performed on the equipment upon 250 hours of use or annually, whichever occurs first.

#### 4.4 Fire Protection and Prevention

The U12g Tunnel Complex has reliable means of notifying emergency services during operations. Facility operations have implemented an Emergency Rescue Plan ERP-1011, “U12g Tunnel Emergency Response, Nevada Test Site,” that establishes senior tunnel staff to be in control of emergency or fire response. Fire protection and prevention are integral to potential operations at the U12g Tunnel Complex. Throughout the tunnel main drift, bypass drift, and alcove there are fire prevention strategies to control fire spread

**Wood Lagging**—The existing tunnel entrance as shown in Figure 4-6, is scheduled to have the timber coated with a fire-retardant chemical. The wood is reported to have been chemically treated with fire retardant when it was installed; however, the fire retardant in the wood lagging has degraded.

The new application of fire-retardant coating shall comply with the requirements stated by MSHA, 30 CFR § 57.4560, “Fire-Retardant Timber in Mine Entrances,” which states that three alternative methods of compliance are applicable to deter the propagation of fire when support timber is in place.

Approximately 200 ft of tunnel entrance timber will be coated with a fire-retardant coating, which provides a flame spread rating of 25 or less.





**Figure 4-6.** First 200 feet of timber scheduled for fire retardant coating.

**Fire Extinguishers**—The existing tunnel main drift and bypass drift have fire extinguishers located every 200 ft. The refuge chamber has two fire extinguishers and the alcove has four fire extinguishers. The facility has fire extinguishers located throughout the support structures. Extinguisher placement is in compliance with 29 CFR § 1926.800, “Safety and Health Regulations for Construction, Underground Construction, Caissons, Cofferdams and Compressed Air.” Annual inspection and service is performed according to National Fire Protection Association (NFPA) 10, “Standard for Portable Fire Extinguishers.” Portable fire extinguisher annual inspection, testing, and maintenance are performed by the NTS Fire & Rescue team. Monthly inspections are performed by tunnel personnel.

**Electrical**—Significant unused electrical wiring conductors, such as power, instrument, and control cabling hang from the walls and drift sides. These cables represent a fire hazard and their removal is recommended in the U12g FHA. These abandoned cables, as shown in Figure 4-7, are a significant fire load that can produce heavy toxic smoke, making this a serious life safety hazard.

Should a fire occur, the elements implemented by PD-2120.004, “Fire Prevention Program Plan,” are intended to minimize the consequences of a fire and promote a rapid recovery and return to service. Abandoned electrical circuits are currently being removed and isolated according to 30 CFR § 57.4011, “Safety and Health Standards-Underground Metal and Nonmetal Mines, Fire Prevention and Control,” so that they do not become inadvertently energized.



**Figure 4-7.** Abandoned electrical wiring scheduled for removal.

Access to the U12g Tunnel is limited to maintenance that is necessary to keep the facility in a standby condition, to make infrastructure improvements, to conduct drills and exercises, and to receive tours. The facility is not continuously open or regularly occupied.

The U12g Tunnel was a test tunnel developed for underground nuclear testing several decades ago. Most of the equipment supporting the U12g Tunnel is antiquated. Frequently, serviceable parts are unavailable, and spare parts are no longer manufactured. However, there are some SSC that are routinely maintained and have preventive maintenance procedures. The SSC equipment work procedures follow the DOE Conduct-of-Maintenance guidelines. SSC currently included in the maintenance program are listed in Table 4-1, while SSC proposed to be added to a maintenance program are identified in Table 4-2.

**Table 4-1.** Current U12g Tunnel Maintenance

Equipment List	Maintenance Frequency
<p><i>Tunnel—Mechanical:</i></p> <ol style="list-style-type: none"> <li>1. Ventilation System</li> <li>2. Locomotive</li> <li>3. Personnel Car</li> <li>4. Lowboy Car</li> </ol>	<p><i>Tunnel—Mechanical:</i></p> <ol style="list-style-type: none"> <li>1. Upon Entry, Daily During Operation</li> <li>2. Upon Entry, Monthly</li> <li>3. Upon Entry, Monthly, Daily during Operation</li> <li>4. Upon Entry, Monthly, Daily during Operation</li> </ol>

<p><i>Tunnel—Ventilation Equipment:</i></p> <ul style="list-style-type: none"> <li>5. 300 HP Sutorbilt Ventilation Fans</li> <li>6. Ventilation Spiral Wrap Duct</li> <li>7. Ventilation Isolation Valves</li> </ul>	<p><i>Tunnel—Ventilation Equipment:</i></p> <ul style="list-style-type: none"> <li>5. Upon Entry – Daily During Operation</li> <li>6. Upon Entry –Visual Only, Repair if problem occurs</li> <li>7. No Maintenance; Condition unknown</li> </ul>
<p><i>Tunnel—Alcove:</i></p> <ul style="list-style-type: none"> <li>8. Lights (high intensity) – Ribs &amp; Back</li> <li>9. Flexible Ventilation Duct</li> <li>10. Fire Extinguishers</li> </ul>	<p><i>Tunnel—Alcove:</i></p> <ul style="list-style-type: none"> <li>8. Upon Entry (Visual, Repair if necessary)</li> <li>9. Upon Entry (Visual)</li> <li>10. Monthly, Annual Hydro-test</li> </ul>
<p><i>Tunnel—Refuge Chamber</i></p> <ul style="list-style-type: none"> <li>11. Lights (high intensity)—Back</li> <li>12. Draeger tube set (Air Sniffing kit for Hazardous Material)</li> <li>13. Fire Extinguishers</li> <li>14. Flexible Ventilation Duct</li> </ul>	<p><i>Tunnel—Refuge Chamber</i></p> <ul style="list-style-type: none"> <li>11. Upon Entry</li> <li>12. Part of the Monthly PM checks</li> <li>13. Monthly, Annual Hydro-test</li> <li>14. Upon Entry</li> </ul>
<p><i>Tunnel—Support Mining Equipment</i></p> <ul style="list-style-type: none"> <li>15. Alpine Miners</li> <li>16. Water Tank and associated motor</li> <li>17. Fire Water Tank (16K-gallon)</li> <li>18. Water Distribution Piping</li> <li>19. Air Compressor</li> <li>20. Air compressor Piping</li> <li>21. Fire Extinguishers</li> </ul>	<p><i>Tunnel—Support Mining Equipment</i></p> <ul style="list-style-type: none"> <li>15. Upon Entry, Every shift in operation</li> <li>16. Upon Entry, Every shift in operation</li> <li>17. Upon Entry, Every shift in operation</li> <li>18. Upon Entry, Every shift in operation</li> <li>19. Upon Entry, Every shift in operation, 250 hours or semi-annual; oil samples</li> <li>20. Upon Entry –No Maintenance;</li> <li>21. Monthly, Annual Hydro-test</li> </ul>
<p><i>Tunnel—Electrical Distribution Equipment</i></p> <ul style="list-style-type: none"> <li>22. Switch Gear—Main entrance</li> <li>23. Switch Gear—by Sutorbilt fans</li> <li>24. Step Down Transformer</li> <li>25. Yard Lighting Fixtures</li> </ul>	<p><i>Tunnel—Electrical Distribution Equipment</i></p> <ul style="list-style-type: none"> <li>22. Upon Entry—No Maintenance; Run-To-Failure</li> <li>23. Upon Entry—No Maintenance; Run-To-Failure</li> <li>24. Upon Entry—No Maintenance; Run-To-Failure</li> <li>25. Upon Entry—Replace upon failure</li> </ul>

**Table 4-2.** Proposed U12g Maintenance

Equipment List	Proposed Maintenance Frequency
<i>Tunnel—Entrance, Main Shaft, Refuge Chamber &amp; Alcove:</i>	
1. Access Control Shack	1. Upon Entry—Repair if necessary
2. Meeting Trailers	2. Upon Entry—Repair if necessary
3. Heating, Ventilation, and Air Conditioning	3. Winter/Summer
4. Tunnel Wood Lagging	4. per Mfg. Recommendations
5. Alcove Ground Support (Rock Bolt)	5. TBD, (ref. Bechtel Corp. report)
6. Ventilation System (Electrical)	6. Annual Inspection
7. Gray Phone (Emergency call)	7. Monthly
8. Breathing Air System	8. TBD, based on design

Equipment List	Proposed Maintenance Frequency
<i>Tunnel Running Gear:</i>	
9. Locomotive	9. Mfg. Recommendation
10. Low Boy (Rail Car)	10. Engr. Recommendation
11. Personnel Car	11. Engr. Recommendation

## 5. Infrastructure Upgrades

The following infrastructure upgrades are identified to improve life safety conditions in the U12g Tunnel. Each upgrade item listed in Table 5-1 is discussed in detail in the following paragraphs.

**Table 5-1.** U12g Infrastructure Upgrades

Proposed Upgrade	Source of Requirement
Ventilation System Fans, Ducting Tie-In, and Electrical Supply	Existing system operability exceeded
Breathing Air Upgrade to Refuge Chamber	30 CFR 57
Emergency Lighting	NFPA 101, 2006, Sect. 7.9
Fire Protection	U12g FHA

### 5.1 Ventilation Upgrade

Ventilation is comprised of a negative pressure exhaust system that brings fresh air underground and exhausts air to the surface. Fresh air is normally supplied through the tunnel system via the main drift tunnel portal. Air is exhausted from the drifts and alcoves by two return ducts located along the drift tunnel back. Dual 300-Hp Sutorbilt ventilation fans located outside the tunnel portal ventilate the entire U12g Tunnel. The direction and ventilation is manually controlled locally at the outside units and is reversible. Design capacity and flow rate of the system is unavailable, but actual flow was measured at various intervals for use as baseline measurements. Normal airflow into the tunnel measures approximately 240 fpm through the tunnel cross-section.

The U12g Tunnel ventilation system has exceeded its operational lifespan and has been kept operational using parts taken from similar decommissioned installations at the NTS. Both of the Sutorbilt fans were installed in the 1960s and are in need of replacement. Figure 5-1 shows the Sutorbilt fans located on the hill above the tunnel portal. Figure 5-2 represents a cross section of the drift interior showing the ventilation duct work suspended from the ceiling.



Figure 5-1. Sutorbilt ventilation fans.

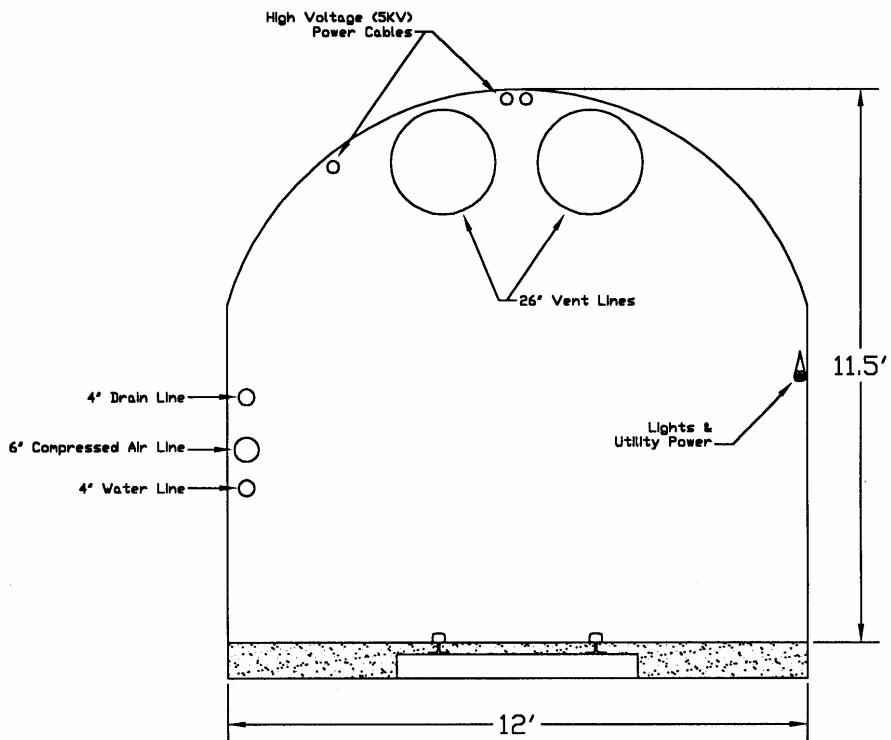


Figure 5-2. Typical cross-section diagram of the main tunnel bypass drift.

The ventilation system is proposed for upgrades with four new vane axial fans and respective ductwork to dove-tail into the existing ductwork. The proposed ventilation controls will automatically operate a shutdown circuit to prevent the spread of toxic gases caused by fire, radiation detection, explosion, etc. originating in underground areas.

The ventilation main fans shall be capable of routing air directly through the exhaust system by employing ventilation system air flow reversal. Figure 5-3 depicts a proposed block diagram of airflow with the new vane axial fans located outside the portal entry to the tunnel. It is proposed to have two identical vane axial fan units supplied and equipped with a second, independent power source from the utility switch gear.

With the proposal of the new vane axial fan units, the electrical equipment, which is required to run the new equipment, must be upgraded. Each fan must be supported and equipped with a second, independent power source from the utility switch gear. Figure 5-4 is a representation of proposed power source feed. The main drift contains an oil filled cut-off unit that is proposed to be upgraded.

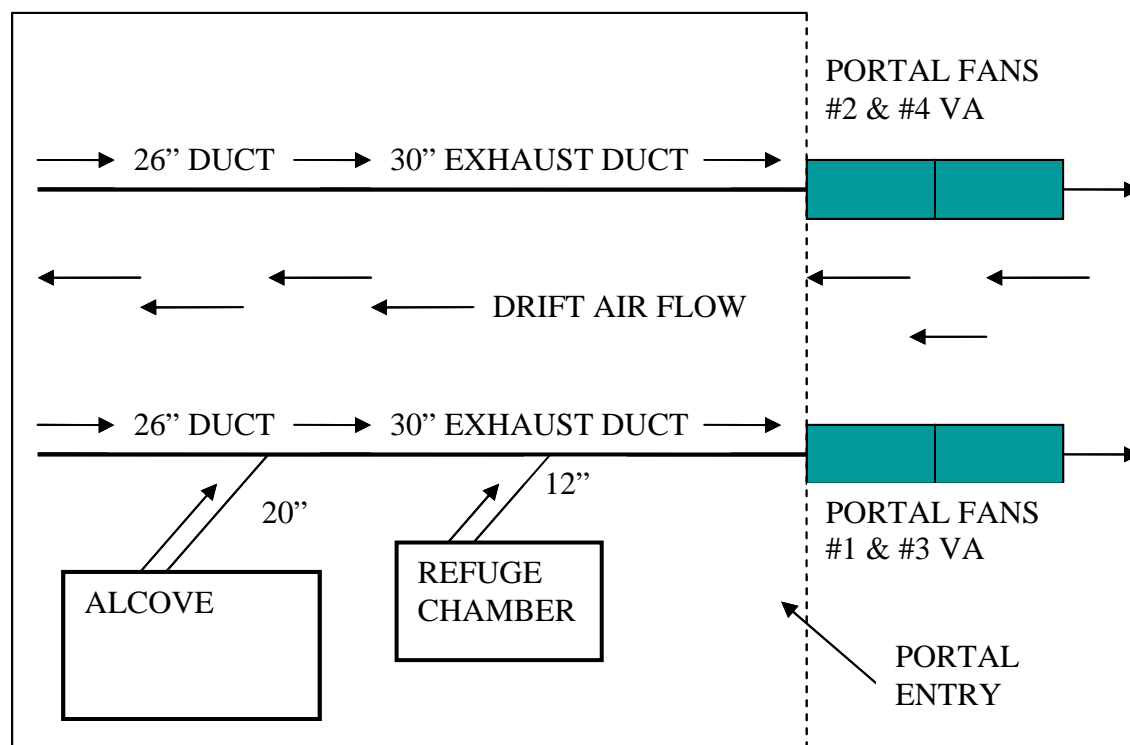


Figure 5-3. Ventilation air flow with fans located at portal entry.

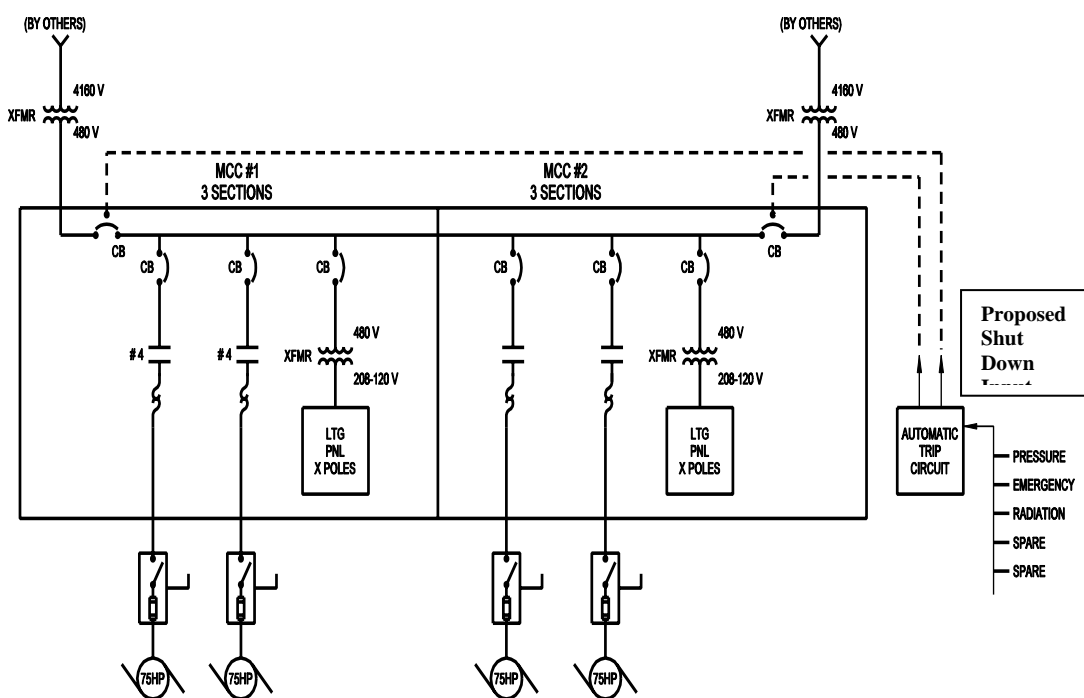


Figure 5-4. Electrical gear proposal to support ventilation fans.

## 5.2 Breathing Air Upgrade

Mine safety requirements specified in 30 CFR § 57.11050/11052, “Safety and Health Standards-Underground Metal and Nonmetal Mines, Travelways and Escapeways,” state the need for two independent egress portals. U12g Tunnel has only one egress through the main drift. It also requires that a refuge chamber be available and equipped with a compressed air supply.

The chamber is located approximately 60 m (200 ft) from the alcove and is stocked with first aid supplies, water, sealing supplies, sanitary equipment, and carbon monoxide (CO) detection devices. Entry into the refuge chamber (Figure 5-5) requires a person to pass through an enclosure that is made of fire resistive construction (double layers of gypsum board wall) and a 1.5-hr fire-rated UL [Underwriters Laboratory] listed steel door. Facility Instruction U12g-600, “U12g Tunnel Refuge Chamber Procedure,” specifies the quantity and condition of refuge supplies. The quantity and condition of the refuge chamber supplies is maintained in accordance with MSHA requirements. An air system supports the refuge chamber.



**Figure 5-5.** Refuge chamber entrance.

The current air supply is skid-mounted diesel engine oil-bath compressor, used to provide compressed air as shown in Figure 5-6. The system has the necessary distribution headers and valves to provide compressed air. Within the refuge chamber the filtering system is not tested for air quality. CO sensing or detection equipment used to measure air quality for the refuge chamber is not installed for the breathing air supply system. However, filters are provided for interim purposes and portable CO testers are located in the refuge chamber.



**Figure 5-6.** Compressed air for U12g Tunnel operations.

The existing air supply system is inadequate for life safety and inadequate for breathing air. It is recommended to upgrade the existing equipment to provide a Class D breathing air per 30 CFR 57, “Mine Safety and Health Administration,” which references American National Standards Institute (ANSI)/Compressed Gas Association (CGA).



### 5.3 Fire Protection Upgrade

Legacy cabling from nuclear tests are found throughout the tunnel main and bypass drifts. During the April 2004 U12g FHA, this cabling was determined to present a significant fire hazard both as source of combustible material and as a source of toxic fumes in the event of a fire. Based on the FHA it is recommended that the cabling be removed to eliminate both hazards.

The current water supply line is a 4-inch water line with distribution headers every 200 ft. The tunnel would use hoses outside and underground connected to the supply headers to fight an underground fire. This water supply line leaks and needs to be replaced prior to complete failure. It is recommended to replace the water supply line and add Underwriters Laboratory/Factory Mutual listed valves, with Fire Department connections and hose stations every 200 ft throughout the main drift and bypass drift.

The on-site water supply is 16,000 gallons as shown in Figure 5-7. The minimum water supply calculated in accordance to NFPA 1142, “Standard on Water Supplies for Suburban and Rural Fire Fighting,” indicates that the water supply should be upgraded to 49,236 gallons or approximately 50,000 gallons.



Figure 5-7. U12g Tunnel 16,000-gallon water tank.

## 6. References

10 CFR 851	Worker Safety and Health Program
29 CFR 1926.800	Safety and Health Regulations for Construction, Underground Construction, Caissons, Cofferdams and Compressed Air
30 CFR 57.11050	Safety and Health Standards-Underground Metal and Nonmetal Mines, Travelways and Escapeways
30 CFR 57.11052	Safety and Health Standards-Underground Metal and Nonmetal Mines, Travelways and Escapeways
30 CFR 57.3203	Safety and Health Standards-Underground Metal and Nonmetal Mines, Ground Control
30 CFR 57.4011	Safety and Health Standards-Underground Metal and Nonmetal Mines, Fire Prevention and Control
30 CFR 57.4560	Fire-Retardant Timber in Mine Entrances
30 CFR 56	Safety and Health Standards-Surface Metal and Nonmetal Mines
30 CFR 57	Mine Safety and Health Administration
NFPA 10	Standard for Portable Fire Extinguishers
NFPA 1142	Standard on Water Supplies for Suburban and Rural Fire Fighting
NV-2001-042	National Environmental Protection Act (NEPA) Environmental Evaluation Checklist
NNSA-0002	Secondary REOP
BN-0147	Primary REOP for Area 12 G Tunnel
CD-3500.002	Controlling Performance Documents
CD-A010.002	Real Estate/Operations Permit (REOP) Process
ENGR-FP-111	Fire Hazard Analysis for Nevada Test Site—The U12g Complex
EPHA-1011	Emergency Planning Hazards Assessment
EPHS-1011	Emergency Planning Hazards Survey
ERP-1011	U12g Tunnel Emergency Response, Nevada Test Site
PD-0001.001	Integrated Safety Management System Description
PD-2120.004	Fire Prevention Program Plan
PD-4000.001	Work Control/Authorization

PD-P200.001            10CFR851 Worker Safety and Health Program Description  
PY-3200.002            Integrated Safety Management System Policy

HA-PEP-SS-1168-01 Hazard Analysis for U12g Tunnel

OP-2120.021            Underground Rescue and Emergency Response

U12g-600                U12g Tunnel Refuge Chamber Procedure

Area 12 G-Tunnel Event/Exercise Security Plan

## **White Paper on Evaluating Proposed U12g Facility Upgrades - Mission Performance Risk Reduction Plan**

The U12g mission requires facility availability for important national security related missions to be maintained. Deficiencies in the physical plant and supporting mission upgrades have been previously identified. In order to ensure that availability of U12g when required, it is necessary to manage ongoing activities, avoid degradation of existing systems, and upgrade known deficiencies. Resources are not available to support all desired activities and upgrades. Consequently, a process that will help ensure facility availability and improvement is needed to assist management in understanding current and future risks to mission accomplishment and in evaluation of where limited resources will be most effectively applied to facility upgrade and maintenance. This white paper is intended to define a proposed process to develop a Mission Performance Risk Reduction Plan that will provide National Security Technologies, LLC.(NSTec) and National Nuclear Security Administration (NNSA) management the tools necessary to make more effective decisions regarding ensuring mission capability at U12g.

The U12g facility had been operated by the contractor as a hazard category 2 nuclear facility, according to the approved safety basis documentation. This documentation included a Documented Safety Analysis (DSA). An implementation plan was written to address facility deficiencies identified in the NNSA Safety Evaluation Report (SER) that approved the DSA and other safety basis documents. In 2007, the Nevada Site Office sent a letter to NSTec instructing that the G-Tunnel facility was to be operated as a less than Hazard Category 3 nuclear facility and rescinding the approved status of the SER and the safety basis documents. NSTec now operates G-Tunnel as a radiological nuclear facility, on the basis that legacy contamination from prior underground testing programs remains in the tunnel and is a potential hazard to workers performing maintenance activities.

Facility safety deficiencies and recommended improvements and upgrades were previously identified in an NNSA approved SER. That evaluation, while focusing on nuclear safety issues, is also a starting point for mission capability as the same or similar safety upsets also adversely affect the ability of the facility to execute its assigned mission. Based on the safety evaluation an implementation plan for future facility upgrade projects has been published previously. The implementation plan lists several needed projects for the facility, along with a tentative schedule for completion based on available funding. However, the Implementation Plan was based strictly on compliance to operating the U12g Tunnel as a Hazard Category 2 Nuclear Facility whereas the focus of this new initiative is to help ensure mission availability of the U12g tunnel and supporting mission equipment. This change in focus may alter the priority for facility upgrades from the existing DSA Implementation Plan, since some safety compliance based issues have limited practical impact on mission readiness or worker safety. Items found to have a practical impact would be elevated in priority over issues related to compliance and not having practical impact.

This document proposes a risk based analysis which will look at the needs for facility availability and facility safety, with the goal of quantifying each item contained in the implementation plan with regards to the benefit attained for mission availability. Using the results of the risk analysis, selection decisions can be based on the factors which provide greatest benefit.

Items currently in the safety implementation plan are shown below in Table 1 appearing in no particular rank order. Mission support evaluation criteria will be developed and applied to each item in the list, with the goal of quantifying the benefit to mission readiness so that management decisions with regard to budget, scheduling and quality grading can be made with a documented basis.

**Table 1: Facility Upgrade Issues from DSA Implementation Plan**

<b>Item #</b>	<b>Description</b>	<b>Estimated Cost</b>	<b>Comments</b>
1	Electrical Grounding System in Alcove (No continuous electrically conductive pathway)		Electrical Grounding System and no continuous electrically conductive pathway are implemented through a <b>Faraday cage</b>
2	Automatic Ventilation Shutdown		Part of overall ventilation system upgrade
3	Fire Detection and Alarm System		Conceptual design completed previously based on FM200 system for preparation of cost estimate
4	Fire Suppression System in Mission Alcove		Conceptual design included in item #3
5	Water System Upgrades/Valve Replacement		Includes above ground supply tanks and fire water supply valves compatible with NTS Fire Department
6	Mission Alcove Seismic Evaluation		Completed to determine if alcove hard shell structure required
7	Fire retardant treatment of wood lagging and alcove ceiling support crib		Some treatment completed as part of preventive maintenance
8	Replace refuge chamber door and frame with UL listed components		Included as part of current FY maintenance budget
9	Remove unused legacy cabling		Included as part of current FY maintenance budget; continuing for three year period
10	Remove combustible vegetation annually		Included in maintenance budget; performed semi-annually
11	Carbon Monoxide sensing and removal system		Currently the tunnel is monitored by IH personnel prior to and during entry
12	Upgraded device handling configurations		Includes low boy modification with enhanced tie down system
13	Upgrade portable fire extinguishers		Initially installed to existing mine safety standards in April 2005
14	Develop second tunnel exit		Initial cost estimate was prohibitive
15	Install Criticality Alarm System		Initial cost estimate was prohibitive

<b>Item #</b>	<b>Description</b>	<b>Estimated Cost</b>	<b>Comments</b>
16	Upgraded shipping container configuration		Mission team provides shipping container based on national emergency requirements
17	Alcove Roll-up Door		Additional scope to Faraday cage modification (#1 above) for mission performance criteria
18	Shock absorbing Alcove flooring		Additional scope to Faraday cage modification (#1 above) for mission performance criteria

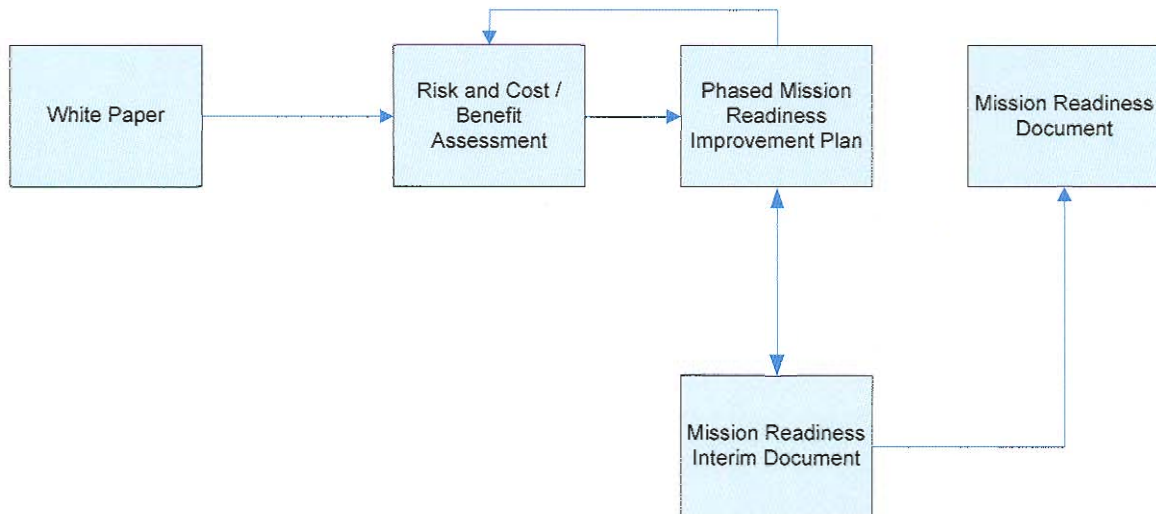
Source: Enclosure 3, U12g DSA Implementation Plan, Revision 1

Items included in this listing as potential candidates for further upgrade/installation will be evaluated for their contribution to mission readiness as will other items that may be identified through an evaluation of mission readiness requirements. The evaluation will be quantified based partially on risk assessment methodology approved in DM-NENG-002, "Hazard Analysis Methodology" modified to account for the mission readiness criteria addressed below. The criteria used for the proposed evaluation will be documented, and the evaluation process will quantify the extent of improvement or value gained from each potential upgrade to determine how the graded quality criteria should be applied. The work impact of each proposed upgrade with respect to specific process upset conditions and some selected Natural Phenomena Hazards events will be evaluated. Proposed facility upgrades with a major impact on the facility mission will be candidates for increased quality assurance requirements in a graded QA system. Both the consequences and the frequency of each impact will be assessed and documented. Assessments will be largely qualitative or semi- quantitative to limit the cost of the assessment.

The mission readiness criteria can include:

- Contribution to consistent online capability
- Need for redundant back up capability
- Potential for mission ending interactions during process
- Contribution to uninterrupted habitation
- Protection of critical processes and personnel
- Preservation of critical mission data

If this approach is accepted, the development of a risk based mission readiness condition will be consistent with the following diagram.



The diagram shows the development of a Risk and Cost Benefit Assessment that provides the basis for which improvements and upgrades may be most beneficial. From this a Phased Mission Readiness Improvement Plan is developed that implements the results of the Risk and Cost Benefit Assessment. As improvements and upgrades are made, a Mission Readiness Interim Document is prepared that defines the level of readiness currently achieved. Finally, all upgrades and improvements are made and a Mission Readiness Document is developed. As time goes on, additional upgrades or improvements may be required and the process will repeat to the extent necessary to identify candidate improvements and support management decisions to implement them or not. The final Mission Readiness Document becomes the operating framework that users may access for the state and capability of mission related information.