OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL COVER SHEET

Complete Only Applicable Items

1. QA: N/A

Page: 1 of: 28

2. ☒ Analysis — Check all that apply

Type of Analysis	☒ Engineering ☐ Performance Assessment ☐ Scientific
Intended Use of Analysis	☐ Input to Calculation ☐ Input to another Analysis or Model ☐ Input to Technical Document ☒ Input to other Technical Products

Describe use:

Recommendations from this FHA will be input into CIRS for tracking and resolution.

3. ☐ Model — Check all that apply

Type of Model	☐ Conceptual Model ☐ Abstraction Model ☐ Mathematical Model ☐ System Model ☐ Process Model
Intended Use of Model	☐ Input to Calculation ☐ Input to another Model or Analysis ☐ Input to Technical Document ☐ Input to other Technical Products

Describe use:

4. Title:

Fire Hazard Analysis – Busted Butte

5. Document Identifier (including Rev. No. and Change No., if applicable):

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None

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OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
ANALYSIS/MODEL REVISION RECORD

Complete Only Applicable Items

2. Analysis or Model Title:

Fire Hazard Analysis – Busted Butte

3. Document Identifier (including Rev. No. and Change No., if applicable):

BABFAH000-01717-0200-00003 REV 00

4. Revision/Change No.	5. Description of Revision/Change
00	Initial Issue

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1. PURPOSE

The purpose of this fire hazards analysis (FHA) is to assess the risk from fire within individual fire areas at the Busted Butte Test Facility and to ascertain whether the DOE fire safety objectives are met. The objective, identified in DOE Order 420.1, Section 4.2, is to establish requirements for a comprehensive fire and related hazards protection program for facilities sufficient to minimize the potential for:

- The occurrence of a fire related event.
- A fire that causes an unacceptable on-site or off-site release of hazardous or radiological material that will threaten the health and safety of employees.
- Vital DOE programs suffering unacceptable interruptions as a result of fire and related hazards.
- Property losses from a fire and related events exceeding limits established by DOE.
- Critical process controls and safety class systems being damaged as a result of a fire and related events.

This analysis is prepared in accordance with AP-3.10Q, *Analysis and Models,* and the associated Development Plan (CRWMS M&O 1999a).

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2. QUALITY ASSURANCE

Results of an activity evaluation (CRWMS M&O 1999b) has determined that the preparation of this technical analysis is not subject to the requirements of the *Quality Assurance Requirements and Description* (QARD) (DOE 2000a). However, Addendum 1 (DOE 2000b) of the QARD (DOE 2000a) has applied portions of the QARD to implement the Integrated Safety Management Quality Assurance Program (ISMQAP)(DOE 2000b). The requirements of the ISMQAP are satisfied by preparation of this analysis in accordance with the Quality Affecting Design Control Procedure (AP-3.13Q). The items addressed in this technical analysis are temporary and are therefore not classified in accordance with QAP-2-3, *Classification of Permanent Items*. This analysis does not generate data that will be submitted to the TDMS nor was data required from the TDMS to do this analysis.

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3. COMPUTER SOFTWARE AND MODEL USAGE

This analysis was prepared using Microsoft Word, office automation system which is maintained by the information technology organization. In accordance with AP-SI.1Q Section 2.1 Microsoft Word is exempt from qualification and documentation under that procedure. No software that is subject to the QARD has been used.

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4. INPUTS

4.1 DATA AND PARAMETERS

Input Transmittal No. TFD-NEP-99355.T, *Documentation of Busted Butte Test Facility* (CRWMS M&O 1999c), provided the following:

- Drawings of underground works
- Information on intended and future use of the facility
- List of installed mechanical equipment
- Information on present and future construction activities
- Estimate of equipment replacement cost at $75,000
- Information on remote monitoring capabilities

4.2 CRITERIA

The *Occupational Safety and Health Program* Procedure AP-ESH-004 refers to DOE Order 420.1 *Facility Safety* to establish safety requirements related to fire protection mitigation. The *Exploratory Studies Facility Design Requirements* (ESFDR), (YMP 1997) are extended to the Busted Butte Test Facility as reasonable for the purpose of this analysis.

4.2.1 Environments

"The ESF surface facilities shall be designed to withstand 75 mph (high winds) prevailing winds with maximum gusts up to 97 mph." (YMP 1997, 3.2.1.2.1.1C)

"The ESF surface facilities and equipment shall be designed to withstand maximum daily precipitation levels of 2.18 inches within a 24 hour period." (YMP 1997, 3.2.1.2.1.1.E)

Facilities and equipment shall be designed to operate under the environmental conditions as listed in Section 3.2.1.2.1.1.C and 3.2.1.2.1.1.E of the ESFDR (YMP 1997). These requirements protect the surface facilities from high winds and provide ample secondary containment around fuel storage..

4.2.2 Constraints

"The presence of combustible materials underground during construction and operation shall be controlled and limited." (YMP 1997, 3.2.1.2.3.C)

4.2.3 Fire Protection

"The surface facilities shall be equipped with fire protection systems" (YMP 1997, 3.4.2.1.2.B)

"Subsurface Fire Protection includes the systems, subsystems, and components that provide detection, warning, and suppression to extinguish fires within the underground facilities." (YMP 1997, 3.8.2.9.1)

Fire protection shall be provided as specified by Sections 3.4.2.1.2.B and 3.8.2.9.1.

4.2.4 Alarm Systems

"Sufficient facilities shall be provided which alert on-site personnel of possible dangerous environmental and safety situations." (YMP 1997, 3.8.2.11.1.B)

Section 3.8.2.11.1.B requires that sufficient facilities shall be provided which alert on-site personnel of possible dangerous environmental and safety situations.

4.3 CODES AND STANDARDS

This section lists all the codes and standards used in the development of this technical analysis.

4.3.1 Code of Federal Regulations

4.3.1.1 Safety & Health Regulations for Construction

29 CFR 1926. Labor: *Safety and Health Regulations for Construction.* July 1, 1998.

4.3.2 U.S. Department of Energy Orders

4.3.2.1 Facility Safety

DOE Order 420.1. *Facility Safety.* 1995, Change 2, 10-24-96.

4.3.2.2 Design Implementation

DOE G 440.1-5. *Implementation Guide for the use with DOE Orders 420.1 and 440.1, Fire Safety Program.* September 30, 1995.

4.3.3 National Fire Protection Association (NFPA)

4.3.3.1 Fire Code

NFPA 1. *Fire Prevention Code* – 2000 *Edition.*

4.3.3.2 Portable Fire Extinguishers

NFPA 10. *Standard for Portable Fire Extinguishers – 1998 Edition.*

4.3.3.3 Hot Work

NFPA 51B. *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work – 1999 Edition.*

5. ASSUMPTIONS

5.1 WATER

Adequate water is not available at the Busted Butte Test Facility to be considered a viable fire suppression alternative. Modification to the facility incorporating a fire water system is not believed to be justifiable due to the planned limited life (CRWMS M&O 1999c, item 1 section 2). (Used in Section 6.7.2)

5.2 ALARMS

Installation of an automatic fire alarm system is not justified due to the remoteness of the site and the limited value of equipment present. The response time (approximately one hour) of the Nevada Test Site (NTS) Fire Fighting Services is such that the equipment or structures involved would be a total loss prior to the service reaching the site. (Used in Section 6.6.4)

5.3 OCCUPATIONAL SAFETY AND HEALTH

The test activity at Busted Butte is comprised of drilling, injection of tracer, core drilling and excavation of the test area to determine the results. These activities are considered to be construction work. Therefore, it is deemed that 29 CFR 1926 is the appropriate code for occupational safety and health. (Used throughout)

5.4 REPLACEMENT VALUE

It is assumed that the replacement value any of the portable equipment, structures, or testing equipment (including tools) will not exceed $100,000 in replacement cost. Mobile equipment used in construction will not exceed $200,000. This assumption is based upon the field observations of the relative age, condition and type of structure, equipment and tooling. Test equipment value was provide by input transmittal (Input 4.1).

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6. ANALYSIS/MODEL

6.1 INTRODUCTION

The Busted Butte Test Facility has been established to conduct underground tracer injection and monitoring studies at the contact of the Topopah and Calico Hills formations. Tracer injection is planned through December, 1999, followed by well water flushing for about 6 weeks. Sampling will then be performed by core drilling techniques for approximately a month. The facility will then be placed in a stand-by mode until the end of Fiscal Year (FY) 2000, when additional core drilling may be performed. After an additional period of stand-by, the equipment will be removed after FY 2001 (CRWMS M&O 1999c, Item 1, Section 2).

As stated in Section 1 of this analysis, the purpose is to determine if DOE fire safety objectives are being met. The approach taken to review the fire and related hazards program at Busted Butte in regard to these objectives involved a visual inspection of the underground and surface facilities (performed in November 1999), identification of the equipment present and its value to the DOE, and identification of the fire protection systems. An evaluation was performed to determine the relative nature of the fire risks present, whether the installed fire protection is adequate to control these risks, and a determination was made of the potential fire damage that could possibly occur at Busted Butte.

6.2 CONSTRUCTION

The Busted Butte Test Facility consists of a small underground test area supported by minimal surface structures and equipment. The site is located on the southeastern base of Busted Butte, about five miles southeast of the ESF.

6.2.1 Underground Test Area

The underground test area is comprised of a nominal 60-meter access tunnel and a 15-meter test alcove (CRWMS M&O 1999c) constructed using conventional mining techniques. The portal is located at elevation 3525 feet above sea level and consists of the portal pad, headwall, and portal. The tunnel center line projects at N45W (CRWMS M&O 1999c). The headwall is reinforced with super-swellex rock bolts with wire mesh. Steel sets, rock bolts and shotcrete supply portal ground support. The tunnel and alcove ground support is supplied by rock bolts and shotcrete above the spring line.

The underground area is supplied with electric power, compressed air, and water on an as required basis from the pad area immediately south of the portal. The underground is lighted with incandescent lights throughout. A ventilation fan withdraws air from the rear of the tunnel and alcove at a rate of 35,000 CFM (CRWMS M&O 1999c, Item 1, Section 3). Fresh air is drawn in through the portal as makeup. The tunnel begins level at the portal and is approximately 3 meters square (CRWMS M&O 1999c) in cross section. Just inside the portal the tunnel dips down at 13 % gradient (CRWMS M&O 1999c) to just before the test alcove when it becomes level again. About half way to the test alcove the tunnel transitions to approximately 5 meters square in cross section (CRWMS M&O 1999c). The test alcove, which

is on the east side and at a right angle to the tunnel, is also approximately 5 meters square in cross section (CRWMS M&O 1999c).

6.2.2 Surface Structures and Equipment

All support structures and equipment are located on the pad located just to the south of the portal. The main access road approaches from the south, rises up the bottom slope of Busted Butte to the north-west and turns north across the pad and ends at the portal. Structures include an approximately 10 feet wide by 50 feet long office trailer and 20 foot long Connex type tool shed. The description dimensions are based upon observation and are not based upon specifications or drawings. Major equipment on site consists of stationary support units and mobile construction units. The support equipment includes two diesel powered motor generators with a common day tank, a diesel driven air-compressor, and a horizontal water tank with electric-driven supply pump. Mobile construction equipment includes an electric, battery-powered man-lift, a diesel-powered, rubber tired front-end loader, and a diesel-powered hydraulic crane. The air compressor, water tank, front-end loader and crane are used for construction activities only and the mobile items will leave the site when the present construction activities are completed.

The office has sheet-rock interior walls, fiber-board siding and the stud were unable to be determined without extra work, all mounted on a steel frame connected to multiple axles with pneumatic rubber tires. The inside is divided into three rooms, two used for office/work space and one used for a storage room. Climate control is provided by a wall-mounted heat pump attached to the front of the unit.

The tool room is a connex/transportainer. The connex is a steel container with corrugated panels used in the sides, roof and back providing rigidity to the structure. A later modification of double wooden doors has been installed at about the mid- point of one side. The floor has been supplemented with the installation of plywood sheeting. Sheeting has also been added to the interior walls to allow for the installation of shelves and hooks for storing equipment.

6.3 OPERATIONS

The purpose of the site is for studying the migration of injected liquids containing a tracer through the geologic zone that will contain the proposed repository (Topopah Springs) and the zone directly beneath (Calico Hills). Bulk samples of the Calico Hills formation are also being obtained.

The site is manned on a four days per week, ten hours per day basis. The work requires that a two-person crew spend approximately one-half of their time in the underground area monitoring and maintaining the tests and equipment (CRWMS M&O 1999c, Item 1, Section 5). Bulk rock sampling and construction activities are manned by a contractor on an as required basis.

6.4 HIGH VALUE PROPERTY

DOE provides protection for its facilities such that a fire will not result in an unacceptable program delay or property loss. They consider any facility in excess of 5,000 square feet ground

floor area and any facility with a maximum potential fire loss (MFPL) of $1,000,000.00 as warranting protection by an automatic fire suppression system (DOE G 440.1-5 1995, Section IV, Para. 9.7).

Based on this guidance, there is no high value property at the Busted Butte Test Facility. It is estimated that any of the mobile equipment, structures, or testing equipment will not exceed $100,000.00 in replacement cost (Assumption 5.4).

6.5 FIRE HAZARDS

NFPA 1, *Fire Protection Code*, defines a fire hazard as "any situation, process, material, or condition that, on the basis of applicable data, may cause a fire or explosion or provide a ready fuel supply to augment the spread of intensity of the fire or explosion and that poses a threat to life or property."

For a fire or explosion to occur, four elements are required: fuel, oxygen, ignition, and chemical chain reaction. If any one of these elements are removed from a fire, it will be extinguished. All of the elements necessary for a fire are found at Busted Butte Test Facility. Fuel sources include, combustible liquids, wiring insulation, rubber tires, trash, tubing, paper, and wood. Combustible liquids include diesel fuel, hydraulic fluid, grease, and lubricating oil. Ignition sources may include faulty electrical equipment, welding and cutting operations, engine heat, and friction. Oxygen is supplied from the air.

It is reported that the major contributing causes to most fires were found to be poor maintenance of electrical equipment, poor housekeeping and the ready availability of fuel (CRWMS M&O 1998, Section 7.5). Experience with diesel-powered equipment has shown that this equipment poses a substantial fire risk. The surface temperature of an engine exhaust system will normally be above the auto-ignition temperature of combustible materials, particularly the diesel fuel and hydraulic fluid found on the equipment. If these materials contact the hot exhaust system they are likely to ignite. Fires and explosions may also be caused by hot particulate that is sometimes emitted from diesel exhausts. Other types of fires may smolder for some times before a flame develops, however, many diesel-powered equipment fires develop open flames rapidly and are more difficult to extinguish than a smoldering fire.

6.5.1 Diesel Powered Mobile Equipment

6.5.1.1 Combustible Material Hazards

Diesel powered mobile equipment is used intermittently at Busted Butte in support of sampling and construction activities. When these activities are completed the mobile equipment is typically removed from the site.

Diesel powered mobile equipment has rubber tires and carries diesel fuel, lead-acid batteries, lubricating oil, hydraulic fluids, and bearing grease.

6.5.1.2 Mitigation

The primary protection system for the diesel mobile equipment are onboard pre-engineered multipurpose dry chemical extinguishing systems. 29 CFR 1926.800 (m)(8) requires that fire-resistant hydraulic fluids be used in underground equipment unless the equipment is protected by a fire suppression system or by multipurpose fire extinguisher(s) rated at least 4A:40B:C.

6.5.2 Electrical Powered Mobile Equipment

6.5.2.1 Combustible Material Hazards

The electrical (battery) powered man-lift is used intermittently at Busted Butte in support of testing program maintenance. The unit provides a portable platform for the testing crew to perform maintenance on the various injection and monitoring holes drilled into the tunnel and alcove walls.

The man-lift has rubber tires and carries DC electric motors, hydraulic fluid, lead-acid batteries, and grease on-board.

6.5.2.2 Mitigation

The man-lift should have a portable fire extinguisher on-board for mitigation of incipient stage fires.

6.5.3 Tunnel and Test Alcove

There is no limiting boundary between the tunnel and test alcove, therefore, they are considered a single fire area.

6.5.3.1 Combustible Material Hazards

All electrical equipment has the potential to cause a fire. The electrical equipment in the tunnel and alcove consists of electrical distribution, lighting, eight syringe pumps, a data logger, seven load cells , and two electric motor driven mixers. All the equipment is 110 VAC and small in size. Most of the pumps are enclosed in steel cabinets.

The majority of wood found in the tunnel and alcove is incorporated into a wall constructed of plywood, used as a light barrier for fluorescent studies. The wall is approximately 5-meters high and 3.5-meters wide. Fluorescent light fixtures are attached to the inside of the wall.

A large piece of black canvas is attached to the tunnel wall adjacent to the plywood wall. At several locations there are remnants of brattice cloth hanging from the tunnel walls. A brattice cloth partition has been constructed at the entrance to the alcove.

6.5.3.2 Mitigation

Incipient fire fighting response is manual, utilizing portable multi-purpose type fire extinguishers located along the tunnel and in the alcove in accordance with NFPA 10.

Much of the electrical equipment is contained inside metal cabinets that will restrict contact of an electrical fire starting in these components with other fuel sources.

29 CFR 1926.800 (m)(12) requires that underground structures shall be constructed of materials having a fire-resistance rating of at least one hour. The plywood partition has been removed from the underground subsequent to the visual inspection and identification of the hazard.

The black canvas sheet has also been removed from the tunnel. As the need for brattice cloth partitions ends, the cloth should be removed completely from the tunnel.

6.5.4 Surface Structures

6.5.4.1 Combustible Material Hazards

The potential fire hazards are those typical of field facilities of this type. The office trailer contains office furniture, personal computers, small electrical equipment, mine lamp battery charging station, paper products, a microwave oven, and storage for test supplies. The tool shed contains small tool storage, microwave oven, mine lamp battery charging station, and miscellaneous supplies. The office trailer has a large accumulation of exposed paper in the office portion of the unit and several empty corrugated boxes in the storage area.

6.5.4.2 Mitigation

Dry chemical fire extinguishers are available in the office trailer, however the locations are not immediately visible due to the amount of material in the unit. NFPA 10 requires that fire extinguishers be conspicuously located where they are readily accessible and immediately available. The unit should be organized with all paperwork placed in file cabinets and items no longer needed disposed of.

6.5.5 Portable Diesel Powered Equipment

6.5.5.1 Combustible Material Hazards

Portable diesel powered equipment has diesel fuel, lubricating oil and lead-acid batteries associated with them. The motor generating set has the additional hazard of the electrical generator and associated switch gear.

An external fuel tank is associated with the motor-generator set. The fire extinguisher for the generator and fuel tank was located inside the fuel tank containment between the tank and the generator.

6.5.5.2 Mitigation

Incipient fire fighting response is manual, utilizing portable multi-purpose type fire extinguishers located near the equipment. The motor-generators and their external fuel tank are located inside containment structures that will limit the migration of fuel should the tanks rupture. Based upon a design requirement of 2.18 inches of daily precipitation (Criteria 4.2.1), the containment structures are conservatively judged to have sufficient capacity to contain the largest tank

volume plus water that would accumulate in a 24-hour storm event. Fuel storage is located greater than 100 feet from the portal in accordance with 29 CFR 1926.800 (m)(7). The extinguisher should be located outside the containment, on a hanger which is firmly mounted to a post, and in a location where it is easily accessible by personnel without exposing themselves to a fire.

6.5.6 Analysis of Potential Fire Scenarios

Based on the fire hazards listed above, several potential fire scenarios can be postulated. In all scenarios the projected fire loss is less than $1 million due to the limited extent of the facility. Automatic fire suppression is not required for this facility.

6.5.6.1 Tunnel And Test Alcove

When construction activities are being conducted, a fire could occur at a piece of equipment at any point in the underground area. This scenario is the more serious as the equipment could be in the smaller diameter of the tunnel and may cause failure in the rock surface. Replacement cost of the equipment could range from $100,000 to $200,000 (Assumption 5.4), with the cost to repair the damage to the tunnel unknown.

6.5.6.2 Surface structures

The largest fuel load exists in the office trailer with the wooden structure and office supplies. A coffee maker left on during a period of non-occupancy could start a fire that would spread rapidly throughout the structure. Due to the proximity of the tool shed it may also be involved. The projected loss would be less than $200,000 (Assumption 5.4) plus the loss of any technical data that had not been downloaded to an off-site computer. The dollar value of the lost data is unknown.

6.5.6.3 Portable Equipment

The diesel-powered generator is the only unit that intentionally runs during periods on non-occupancy. A fire could be caused on this unit due to a fuel leak or an electrical system failure. The fuel tank is a double tank with leak detection so the probability of a leak occurrence that could result in the spread of fire is low. If the tank is somehow ruptured and ignited, an earthen berm has been constructed around the generator to contain the flow of diesel and limit the spread of the fire. The generator is located greater than 100 feet from the portal (29 CFR 1926.800(m)7). Projected loss would be less than $100,000 (Assumption 5.4).

6.6 LIFE-SAFETY CONSIDERATIONS

In the underground area, any fire will release fire byproducts into the tunnel and test alcove. Tunnel ventilation is critical during a subsurface fire, as toxic smoke is the primary life safety hazard.

6.6.1 Ventilation

The ventilation system withdraws air at a total of 35,000 CFM from the rear of the tunnel and the back of the test alcove. For a fire in the alcove or at the plywood wall, the byproducts would be swept to the outside through the air ducts and the air would get better for personnel as they exit the tunnel. For a fire near the portal the ventilation system would draw the byproducts into the tunnel and create hazardous conditions to the rear of the tunnel and alcove. The ventilation system is reversible per 29 CFR 1926.800 (k)(4) to mitigate this potential scenario. The ventilation system is operating any time personnel are underground.

6.6.2 Egress

Only a single means of egress is available from the underground area. The maximum distance to the portal is approximately 65 meters (Section 6.2.1), which should permit egress in less than two minutes. Busted Butte meets the safe means of egress requirements of 29 CFR 1926.800(b).

There are two primary escape routes from the portal pad to a large parking area below the facility. The parking area is the designated assembly point in an emergency.

6.6.3 Personal Respiratory Protection

All subsurface personnel are required to be trained in the use of, and to carry, personal self-rescuers. The standard unit carried is suitable for escape from fire where there is sufficient oxygen. These units convert carbon monoxide, generated in a fire, to carbon dioxide via exothermic reaction. These units are rated for about 30 minutes of moderate activity and their use is limited to escape activities.

6.6.4 Alarm/Notification Systems

Criteria 4.2.4, Alarm Systems, requires sufficient means (facilities) be provided to alert personnel of dangerous situations. Communication at the site is limited to telephones in the office trailer and the test alcove. Emergency communication is through the use of these phones or by direct voice communication between the site personnel. It is important that there is an attendant on the surface any time personnel are working underground. Due to the limited extent of the underground area and the close proximity of the surface facilities, it is believed that the site communication system provides an adequate alarm system. (Assumption 5.2).

6.6.5 Exit and Emergency Lighting

Neither exit lighting nor emergency lighting, with battery backup, are presently provided at the test facility. All subsurface personnel are required to carry miner's lights or approved flashlights to provide emergency lighting. The office facility layout has sufficient windows in all rooms to prevent a total blackout in the event of loss of lighting. Miner's lights are readily available at the charging racks to provide emergency lighting as necessary for the surface structures.

6.7 FIRE PROTECTION FEATURES

6.7.1 Fire Prevention

Fire prevention practices fall into three categories: limiting fuel sources: limiting ignition sources: and limiting fuel and ignition source contact.

Fire prevention practices apply equally to construction and operational activities.

6.7.1.1 Limiting Fuel Sources

Use of low (or reduced) hazard materials is required. Fire-resistant hydraulic fluids, hydraulic hoses, electric cable insulation, and ventilation control barriers shall be used in the sub-surface area of the test facility to the extent possible.

Refueling and maintenance of mobile equipment shall be conducted on the surface. Safety precaution procedures should be strictly observed during any underground emergency refueling.

Transient combustibles such as paper, cardboard boxes, wood, plastics, etc., shall be limited. Strict enforcement of "good housekeeping" rules are necessary to effectively limit the presence of transient combustibles (criteria 4.2.2).

6.7.1.2 Limiting Ignition Sources

Medium and low voltage power distribution is through insulated cables. Connections and switch-gear are primarily contained inside metal cabinets. In the case of an electrical fire inside these cabinets, the risk of propagation to the outside is considered extremely low.

Smoking is strictly controlled to minimize matches and lighters as sources of ignition (CRWMS M&O 2000, Para.10.1.3).

6.7.1.3 Limiting Fuel and Ignition Source Contact

Precautions must be observed during welding and cutting operations, following NFPA 51B and 29 CFR 1926.800 (i)(5) requirements, and the *Hot Works Permits* procedure (LP-ESH-003-M&O). Nearby combustibles must be covered with fire-resistant materials or moved. Fire extinguishers must be readily available and a trained fire-watch posted as long as necessary to guard against smoldering fires.

Smoking should be restricted to areas free of fire hazards, in accordance with OSHA regulations and "No Smoking" signs posted.

6.7.2 Fire Protection

Multipurpose dry chemical fire extinguishers are the only fire suppression systems available at the Busted Butte Test Facility (Assumption 5.1). They exist as automatic units located on the diesel-powered mobile equipment and as hand-held portable units located throughout the facility.

6.8 POTENTIAL FOR A HAZARDOUS INCIDENT

The fluids currently being used in the Phase II tracer injection testing program (UZ Transport Testing) are dilute aqueous salt solutions with concentrations less than 500mg/l with the exception of Lithium Bromide which is less than 1500 mg/l (Brake 1998). The amounts of solution quantities on hand are minimal since syringe pumps have very low capacities. These solutions are noncombustible. The potential for a toxic, biological and /or radiation incident due to fire is not considered a threat.

6.9 NATURAL HAZARDS

Wind forces present the greatest potential hazard to the surface installations at the site. The structures are anchored mitigating the possibility of the office trailer and/or tool shed to be overturned by high winds.(criteria 4.2.1). Busted Butte is in Uniform Building Code Zone 3 (YMP 1997, A-1). The portability of the structures and equipment (non-fixed foundations and manufacturing codes for trailers) and the anchoring of the structures will withstand affects from a seismic event. Electrical shorting resulting from such events could cause a fire. A fire break does exist between the facility and the native vegetation surrounding it but high winds could extend a fire from the facility to the surrounding area or in the case of wild fire, to the surface portion of the facility.

6.10 DAMAGE POTENTIAL

In compliance with DOE orders the requirements for automatic sprinkler system and redundant fire protection have been evaluated and found not to be required for the Busted Butte Test Facility. A fire at the facility would not create an unacceptable program loss, a fire loss potential of greater than $1 million, or a maximum potential fire loss (MPFL) exceeding $50 million.

6.11 SAFETY CLASS EQUIPMENT

The Busted Butte Test Facility is a temporary facility for the testing of geologic formations. Radioactive materials are not present during construction and test operations. The Busted Butte Test Facility is not in the boundaries of the proposed repository. No safety class equipment has been identified for the Busted Butte Test Facility.

6.12 CRITIAL PROCESS EQUIPMENT

This criterion does not apply to the Busted Butte Test Facility.

6.13 EMERGENCY PLANNING

The operating contractor is currently responsible for developing and maintaining the emergency action plan in accordance with the *Emergency Management Plan* (DOE 2000c) and *Emergency Management* procedure (LP-ESH-010-M&O).

6.14 FIRE DEPARTMENT/BRIGADE RESPONSE

There is no fire department or fire brigade associated with the Busted Butte Test Facility. In accordance with *Occupational Safety and Health Program* (AP-ESH-004, Section 5.14.4.1) it is policy that no fire fighting will be conducted beyond an incipient stage. The occupants may do incipient level fire fighting.

6.15 RECOVERY POTENTIAL

The ability to recover from a credible fire at the Busted Butte Test Facility is considered acceptable. Major program delays are not anticipated as equipment replacement is easily accomplished.

Unacceptable levels of environmental damage will occur only if high winds were to spread the fire to surrounding range land.

6.16 SECURITY AND SAFEGUARDS

The Busted Butte Test Facility is an unclassified facility, so there are no security requirements for storing and/or protecting sensitive data. There are no security considerations related to fire protection. The only security consideration is related to life safety. Access to the underground facility is controlled by administrative procedure that requires personnel that enter the underground area to have completed training in hazard awareness, use of miner lamps, and use of self-rescuers. Personnel sign-in and out at the portal in accordance with *Underground Access Control Process*, AP-OM-005 and 29 CFR 1926.800(c).

7. CONCLUSIONS

Busted Butte Test Facility has no major fire protection deficiencies. The level of protection provided at this facility is considered to present an acceptable level of risk, without the need for additional fire protection measures. The objectives, stated in Section 1, to minimize the potential various occurrences are satisfied as follows:

- Containment protection is provided to prevent the release of hazardous material and there is no radiological material present.
- Based on the schedule for completion of activities at the facility, unacceptable delays will not result from a fire or related hazard.
- Property loss from a fire and related events will not exceed the limits established by the DOE.
- There are no critical process controls or safety class systems at the Busted Butte Test Facility.

To minimize the occurrence of a fire related event, the following minor deficiencies are recommended to be corrected:

- Enforce housekeeping rules throughout the test facility to limit transient fuel sources(Section 6.7.1.1).
- Install a post to support the fire extinguisher at the diesel powered motor generator. The post should be located on the east or north side of the external fuel tank, outside the containment structure (Section 6.5.5)
- An automatic shut-off coffee maker should be used since the office is not constantly occupied. (Section 6.5.6.2)
- A portable fire extinguisher shall be installed in the man-lift basket. (Section 6.5.2.2)

This analysis has been prepared based on occupancy, arrangement, and fire hazards at the facility as documented during November 1999. This includes an evaluation of equipment, structures, and hazards present. If occupancy changes, the arrangement is modified, equipment is changed, or other significant modifications are made at the facility, this evaluation may be invalid.

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