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Underground Test Area Subproject Waste Management Plan

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Revision No: 1

August 1996

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Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

UNDERGROUND TEST AREA SUBPROJECT WASTE MANAGEMENT PLAN

DOE Nevada Operations Office
Las Vegas, Nevada

UNCONTROLLED

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UNDERGROUND TEST AREA SUBPROJECT WASTE MANAGEMENT PLAN

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Approved: Robert M. Bangerter Jr. Date: 8/22/96
Robert M. Bangerter, Jr., Acting Subproject Manager
Underground Test Area Subproject

Approved: David S. Shafer Date: 8/29/96
David S. Shafer, Acting Project Manager
Nevada Environmental Restoration Project

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Attachment 1 - Fluid Management Plan for the Underground Test Area

List of Abbreviations and Acronyms

CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE/NV	DOE Nevada Operations Office
EPA	U.S. Environmental Protection Agency
EPD	Environmental Protection Division
ESSC	Environmental Services Support Contractor
FFACO	Federal Facilities Agreement Consent Order
MSDS	Material Safety Data Sheet(s)
NEPA	National Environmental Policy Act
NRC	Nuclear Regulatory Commission
NTS	Nevada Test Site
NV ERP	Nevada Environmental Restoration Project
PBMC	Performance-Based Management Contractor
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
SAA	Satellite accumulation area(s)
SHD	Safety and Health Division
SOP	Standard Operating Procedure(s)
TRU	Transuranic
UGTA	Underground Test Area

Definitions

Below Regulatory Concern A definable amount of low-level radioactive, hazardous, or mixed waste that can be deregulated with minimal risk to the public.

Decontamination The removal of radioactive and hazardous constituents from facilities, equipment, or soils by washing, heating, chemical or electrochemical action; mechanical cleaning; or other techniques.

Development Pumping groundwater from a drillhole or well to remove sand, gravel, drilling fluids, and drill cuttings from a water-bearing zone.

Disposal Emplacement of waste in a manner that ensures isolation from the biosphere for the foreseeable future with no intent of retrieval and that requires deliberate action to regain access to the waste.

Disposal Facility The land, structures, and equipment used for the disposal of waste.

Disposal Site That portion of a disposal facility that is used to dispose of waste.

Free Liquids Liquids that readily separate from the solid portion of a waste under ambient temperature and pressure.

Hazardous Wastes Those wastes that are designated hazardous by U.S. Environmental Protection Agency (EPA) regulations (Title 40 Code of Federal Regulations [CFR] Part 261). This term includes wastes listed by EPA or having the characteristic of ignitability, reactivity, corrositivity, or toxicity.

High-Level Waste The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation. High-level waste is defined in the Nuclear Waste Policy Act of 1982.

Low-Level Waste Waste that contains radioactivity and is not classified as high-level waste, transuranic waste, spent nuclear fuel, or 11e(2) by-product material as defined by U.S. Department of Energy (DOE) Order 5820.2A.

Monitoring The observations and measurements that provide data to evaluate the performance of a waste management operation.

Definitions (Continued)

Mixed Waste Waste that is (1) radioactive waste (as defined by the Atomic Energy Act of 1952, as amended) that contains material listed as hazardous waste in Subpart D of Title 40 CFR 261 or that exhibits any of the hazardous waste characteristics identified in Subpart C of Title 40 CFR 261, or is defined as a hazardous waste by the state of generation; (2) waste that contains both radioactive and hazardous components as defined by the Atomic Energy Act and the Resource Conservation and Recovery Act (or state of generation hazardous waste regulations). The term "radioactive component" refers only to the actual radionuclides dispersed or suspended in the waste substance.

Quality Assurance All those planned and systematic actions necessary to provide adequate confidence that a facility, structure, system, or component will perform satisfactorily and safely in service. Quality assurance includes quality control, which comprises all those actions necessary to control and verify the features and characteristics of a material, process, product, or service to specified requirements.

Radioactive Waste Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering the costs of recovery.

SW-846 Analytical test methods for liquid and solid hazardous wastes contained in *Test Methods for Evaluating Solid Waste*, Third Edition, November 1986, EPA Office of Solid Waste and Emergency Response.

Toxicity Characteristic Leaching Procedure A sample preparation and analysis method for the determination of the toxicity characteristics of hazardous waste. This sample preparation and analysis method simulates a subsurface fate and transport model as it measures the leaching potential for various hazardous components.

Transuranium Radionuclide Any radionuclide having an atomic number greater than 92.

Transuranic Waste Waste containing more than 100 nanocuries of alpha-emitting transuranic isotopes with half-lives greater than twenty years, per gram of waste except for high-level radioactive wastes; wastes that the DOE has determined, with the concurrence of the EPA Administrator, do not need the degree of isolation required by Title 40 CFR 191; or wastes that the Nuclear Regulatory Commission has approved for disposal on a case-by-case basis in accordance with Title 10 CFR 61.

Definitions *(Continued)*

Treatment Any method, technique, or process designed to change the physical or chemical character of waste to render it less hazardous; safer to transport, store, or dispose of; or reduced in volume.

Treatment Facility The specific area of land, structures, and equipment dedicated to waste treatment and related activities.

Waste Material that is discarded, abandoned, or recycled. Waste may be in solid, liquid, or gaseous form.

Waste Container A receptacle for waste, including any liner or shielding material that is intended to accompany the waste in disposal.

Waste Management The planning, coordination, and direction of those functions related to generation, handling, treatment, storage, transportation, and disposal of waste, as well as associated surveillance, auditing, and maintenance activities.

Waste Package The waste, waste container, and any absorbent that are intended for disposal as a unit. In the case of surface-contaminated, damaged, leaking, or breached waste packages, any overpack shall be considered the waste container and the original container shall be considered part of the waste.

1.0 Introduction

The Nevada Test Site (NTS), located in southern Nevada, was the site of 928 underground nuclear tests conducted between 1951 and 1992. The tests were performed as part of the Atomic Energy Commission and U.S. Department of Energy (DOE) nuclear weapons testing program. The NTS is managed by the DOE Nevada Operations Office (DOE/NV).

Of the 928 tests conducted below ground surface at the NTS, approximately 200 were detonated below the water table. As an unavoidable consequence of these testing activities, radionuclides have been introduced into the subsurface environment, impacting groundwater. In the few instances of groundwater sampling, radionuclides have been detected in the groundwater; however, only a very limited investigation of the underground test sites and associated shot cavities has been conducted to date. The Underground Test Area (UGTA) Subproject was established to fill this void and to characterize the risk posed to human health and the environment as a result of underground nuclear testing activities at the NTS. One of its primary objectives is to gather data to characterize the deep aquifer underlying the NTS.

The DOE Nevada Environmental Restoration Project (NV ERP) encompasses all phases of environmental management of inactive radioactive or release sites under the direction of the DOE/NV, including those at the NTS. Activities associated with the UGTA Subproject are authorized and administered through the Federal Facilities Agreement Consent Order (FFACO). This agreement, between the DOE, the Nevada Division of Environmental Protection, and the Defense Nuclear Agency, outlines an overall management strategy for the UGTA program and its subprojects, among other things. Portions of the FFACO, which address corrective action, have been incorporated into the NTS Resource Conservation and Recovery Act (RCRA) permit. In addition to its obligations under RCRA and the FFACO, the DOE must also comply with applicable DOE Orders and policies relating to UGTA Subproject activities. The scientific objectives of the UGTA Subproject include determination of the extent and magnitude of groundwater contamination from weapons testing, the nature of the threat posed to human health and the environment, and the remedial action(s), if any, that should be taken to reduce or eliminate the threat. Much of this information will be collected through the UGTA Subproject drilling and sampling program. The drilling program focuses on constructing wells in deep aquifers beneath the NTS to obtain geologic and hydrologic data that can be used to support a

risk assessment and remedial design. The sampling program focuses on periodic chemical sampling of groundwater from the wells.

The UGTA Subproject is administered by the NV ERP. Several organizations are involved in UGTA Subproject operations. Geologic and hydrologic interpretations, waste characterization oversight, regulatory compliance, and records management services are provided by the Environmental Services Support Contractor (ESSC). Drilling, health physics monitoring, and waste management services are provided by the Performance-Based Management Contractor (PBMC). The PBMC also provides inspection services for drilling operations, oversight of geophysics, drilling support, and engineering services. Other organizations, such as the U.S. Geological Survey, Desert Research Institute, and national laboratories provide scientific expertise to UGTA Subproject activities.

This document provides a general framework for all UGTA Subproject participants to follow for the characterization, storage, treatment, and disposal of wastes generated by UGTA Subproject activities. The objective of this waste management plan is to provide guidelines to minimize waste generation and to properly manage wastes that are produced. Wastes will be managed in accordance with existing regulations and DOE waste minimization and pollution prevention objectives, waste management programs, radiological control programs, training programs, and Standard Operating Procedures (SOPs).

Four classifications of waste may be generated by UGTA Subproject activities: nonhazardous, hazardous, low-level, and mixed waste. Based on historical information and the parameters that define these wastes, the generation of transuranic (TRU) waste and high-level waste is not anticipated.

This Waste Management Plan describes activities to monitor materials for regulated constituents before they are brought on site; segregate waste by category and form; and capture, contain, and characterize fluids generated from well construction and sampling operations. These activities will ensure that pollution prevention and waste minimization objectives are met.

Section 2.0 describes the responsibilities of UGTA Subproject participants. Section 3.0 describes UGTA Subproject activities and the wastes expected to be produced from those activities. Section 3.0 also discusses characterization requirements and parameters and presents a

strategy to properly manage and minimize wastes. Section 4.0 describes project documentation, quality assurance, program assessment requirements, operating procedures and emergency response planning, and employee training, followed by a list of references in Section 5.0.

2.0 Underground Test Area Subproject Participants and Responsibilities

This section identifies the primary participants and describes each organization's functional responsibilities as related to UGTA Subproject waste management activities. The DOE/NV has responsibility for administration of the UGTA Subproject. Primary project participants include the DOE/NV, ESSC, and the PBMC. A complete description of responsibilities of all UGTA Subproject participants may be found in the UGTA Operable Unit Project Management Plan and Quality Assurance Project Plan (QAPP).

2.1 DOE Nevada Operations Office Participants and Responsibilities

The primary DOE/NV participants involved in UGTA Subproject waste management activities are the Waste Management Division and Environmental Restoration Division.

2.1.1 DOE/NV Waste Management Division

The functions and responsibilities assigned to the Waste Management Division are listed below.

- Supports the NV ERP by operating accumulation and disposal facilities for program waste streams and manages centralized waste services for NTS-generated hazardous and sanitary wastes.
- Manages the low-level radioactive and mixed waste disposal operations at the NTS in compliance with applicable regulations and DOE requirements and policies. Develops and maintains waste acceptance criteria and operating requirements for NTS waste operations. Manages programs to assess the performance of waste management facilities and manages efforts to mitigate the environmental impact of operations.
- Manages programs for waste certification, acceptance, and verification at DOE/NV disposal facilities. Manages programs required of disposal facility operators in DOE Order 5820.2A.
- Supports DOE/NV waste generating and waste minimization activities through the development of waste acceptance criteria, guidance documents, and implementation plans for DOE Order 5820.2A.
- Verifies that all waste management operations are conducted in accordance with applicable federal, state, and local laws and DOE-prescribed environmental, safety, and health policies, Orders, standards, and guidelines.

2.1.2 DOE/NV Environmental Restoration Division

The DOE/NV Environmental Restoration Division functions and responsibilities related to UGTA Subproject waste management activities are listed below.

- Ensures that all UGTA Subproject operations, including management of subproject wastes, are conducted in accordance with applicable federal and state laws and regulations, and DOE-prescribed safety, environmental, and health policies. Orders, standards, and guidelines.
- Develops and implements procedures to ensure compliance with policies and standards as they relate to assigned activities.

2.1.3 DOE/NV Environmental Protection Division

The DOE/NV Environmental Protection Division (EPD) is responsible for providing advice and recommendations on technical and regulatory issues relating to environmental protection and compliance, and interprets and provides guidance on externally-imposed laws and regulations. The EPD develops and implements policies unique to the DOE/NV and procedures as they relate to protection of the environment, compliance with environmental laws, regulations, and DOE Order requirements. The EPD houses the National Environmental Policy Act (NEPA) Compliance Officer for DOE/NV and coordinates the preparation of NEPA documents. The EPD also serves as the formal coordinating interface with federal, state, and local regulatory agencies for obtaining and processing environmental permits, coordination of inspections, and establishing agreements for achieving compliance. The EPD conducts environmental audits, surveillances, and appraisals of UGTA Subproject activities.

2.1.4 DOE/NV Safety and Health Division

The DOE/NV Safety and Health Division (SHD) provides health protection advice and recommendations on matters relating to radiological and nuclear safety, industrial hygiene, and occupational medicine. The SHD develops policy and procedural requirements for activities unique to DOE/NV regarding the protection of the DOE/NV work force from radiological and industrial hygiene hazards. The SHD provides technical advice to the UGTA Subproject to help ensure worker protection.

2.2 Performance-Based Management Contractor Responsibilities

The PBMC is responsible for providing construction, drilling, waste treatment and disposal, radiological control, and general support services to the UGTA Subproject. The PBMC is also

responsible for modifying existing procedures or developing new procedures specific to UGTA Subproject activities as required.

The PBMC also provides Title I and II design services; Title III inspection services; oversight of geophysics; coordination of drilling and testing activities; and other services as agreed upon between the PBMC and NV ERP. At the request of the NV ERP, the PBMC may also develop conceptual designs, assist in the preparation of design criteria, and perform special studies. The PBMC ensures that project designs and drawings comply with the federal and state of Nevada environment, safety, and health requirements and conform to DOE and other applicable design criteria.

2.3 Environmental Services Support Contractor Responsibilities

The ESSC is responsible for conducting the geologic and hydrologic aspects of UGTA Subproject field activities. The ESSC is also responsible for developing the QAPP and for providing NV ERP-selected laboratory services. The ESSC's responsibilities include determining the number of samples required to characterize waste, reviewing laboratory analytical results to determine which category waste falls into, and providing NV ERP with adequate documentation to demonstrate that waste streams meet appropriate requirements, such as those found in NVO-325. The ESSC serves as the waste originator for Environmental Restoration Division-generated waste from assessment activities managed under NVO-325. The ESSC is responsible for reviewing and approving products for use at UGTA Subproject sites.

2.4 Other Participants

Other UGTA Subproject participants are not usually directly responsible for the disposition of wastes generated through their scientific studies. However, all UGTA Subproject participants must be proactive in efficient and cost effective management of investigation-derived wastes and conduct their UGTA Subproject activities in a manner that minimizes waste generation. All UGTA Subproject participants are required to submit Material Safety Data Sheets (MSDSs) to the ESSC Technical Lead or Site Supervisor prior to bringing the product on site.

3.0 *Underground Test Area Subproject Activities and Waste Streams*

This document discusses UGTA Subproject activities common to all well sites. Following are descriptions of UGTA Subproject activities, the wastes expected to be generated, and the strategy for the characterization and management of each waste stream.

3.1 *Description of Activities*

UGTA Subproject activities begin with the selection of the well site. Sites are selected based on identified data needs. Archaeological and environmental surveys will be conducted during well site selection to ensure that well construction will not affect historic sites or endangered species. In addition, radiological surveys of the drill pad area will be conducted prior to construction.

Site-specific drilling/recompletion design criteria documents will be developed for each well. The drilling/recompletion design criteria documents will detail the drilling method, drillhole size, and aquifer characterization objectives for each well. These drilling/recompletion design criteria documents will also include detailed information for selection of well construction materials and site-specific guidance for characterization and management of expected wastes.

A comprehensive Fluid Management Plan (see Attachment 1) has been prepared to provide guidance for fluid management activities applicable to all UGTA Subproject sites.

Nonhazardous/nonradioactive saturated zone drilling effluent is routed to a lined sump and then to an infiltration area or overland flow. Low-level effluent will be managed in lined sumps at the well site. Mixed waste effluent will be sent to the Area 5 TRU storage pad pending treatment (if required) and disposal. Additional fluid management activities required for a specific well will be addressed in the site-specific drilling/recompletion design program documents.

3.2 *Description and Management of Wastes*

This section describes the wastes expected to be produced by UGTA Subproject activities and the minimization, characterization, and management strategies to be used to ensure proper disposition of wastes. The management of drilling fluids, groundwater, and decontamination fluids is discussed separately in Sections 3.2.6 through 3.2.8. Specific analytical parameters are described in the QAPP and the Fluid Management Plan. Additional parameters may be included in the site-specific drilling/recompletion design program documents.

The following wastes are addressed in this section: nonhazardous waste, hydrocarbon waste, hazardous waste, low-level waste, mixed waste, drilling fluids and groundwater, and decontamination fluids. High-level wastes will not, by definition, be generated, and TRU wastes are not expected to be produced and are not addressed in this document. Drilling fluids, groundwater, and decontamination fluids may be characterized as nonhazardous, hazardous, low-level, or mixed, depending upon the particular well site and the conditions encountered during well construction and operation.

All materials used at the well site, such as drilling fluid, drilling fluid additives, pipe dope, and lubricants, will be examined for hazardous components prior to the start of drilling. This examination will be conducted through review of product specifications and MSDSs. As mentioned in Section 2.0 of this document, MSDSs for all products must be reviewed by the ESSC prior to the product's use on site. If the MSDSs or product specifications are not adequate to fully characterize each material, a sample of the material will be collected and analyzed for RCRA-regulated components. If the material contains hazardous components that may create a RCRA-regulated waste stream, a suitable nonhazardous material will be substituted, if possible. If a nonhazardous substitute is not available, the DOE/NV UGTA Subproject Manager's written approval must be obtained prior to the product's use.

3.2.1 Nonhazardous Wastes

Nonhazardous wastes generated by UGTA Subproject activities include office supplies, human refuse, air filters from engines, drill-pipe plastic protective covers, sampling and monitoring supplies, drill cuttings, and construction debris. Most nonhazardous solid wastes will be disposed of in an approved NTS sanitary landfill. Nonhazardous drill cuttings and muds may be disposed of at the drill site under elimination of a point source and the state of Nevada Industrial Landfill Waiver requirements. Liquid nonhazardous wastes that require disposal include human refuse and nonhazardous solvents. These wastes will be treated and disposed of in accordance with NTS-SOP-5408, Environmental Protection and Regulatory Compliance.

The sampling and monitoring process will generate wastes in the form of sampling supplies. Most of these wastes will be nonhazardous. Sampling supplies (e.g., gloves, buckets, and disposable sampling equipment) may be disposed in the sanitary trash if samples of the fluid and/or cuttings associated with the sampling event(s) have been shown to be within regulatory parameters for hazardous and/or radioactive constituents. The mixing of hazardous and radioactive wastes with nonhazardous wastes will be minimized or eliminated through

administrative controls, such as good housekeeping, waste segregation practices, and control of materials allowed on site. Administrative control guidelines may be found in the DOE/NV Waste Minimization and Pollution Prevention Awareness Plan (DOE, 1994).

3.2.2 Hydrocarbon Wastes

UGTA Subproject activities generate various types of hydrocarbon wastes, including used motor oil, used transmission fluid, used antifreeze, oily rags, oily debris, and hydrocarbon-burdened soil. Hydrocarbon waste consists of petroleum-based materials that may come in liquid form, as sludge, or in solid form as contaminated debris or soil. These wastes are generally a result of routine equipment maintenance but may also result from hydrocarbon spills or leaks. Spills and leaks are prevented from reaching the surrounding environment through the use of plastic liners and catch pans placed underneath equipment. In the event that soil becomes contaminated with a hydrocarbon material, the adequacy of process knowledge will determine the need for soil sampling and analysis. If spills or leaks of hydrocarbons occur, they should be reported to the ESSC Technical Lead and/or Site Supervisor. Spills or leaks of greater than 25 gallons of product or which impact three cubic yards or more of soil must be reported immediately to the Site Supervisor. The Site Supervisor notifies the ESSC Technical Lead and the DOE/NV UGTA Subproject Manager, who notifies the appropriate regulatory authorities.

Hydrocarbon wastes are considered nonhazardous waste, unless sampling and analysis reveals contamination of the hydrocarbon material with hazardous or radioactive constituents. The NTS manages hydrocarbon wastes separately from other nonhazardous waste. Many hydrocarbon waste forms, such as oil/water and antifreeze/water mixtures, are amenable to recycling. Hydrocarbon waste that is not recycled is sent to the NTS Area 6 hydrocarbon landfill.

3.2.3 Hazardous Wastes

Drilling operations have the potential to generate hazardous waste by the nature of their activities. A variety of lubricants, fluids, and drilling-specific products are used during drilling and completion activities. Special drilling compounds or products, which may contain hazardous constituents, are sometimes necessary to effectively operate. As previously mentioned, all materials are reviewed and characterized prior to being brought or used on site. This review is performed, in part, to identify opportunities for nonhazardous material substitution in order to minimize the generation of hazardous or mixed waste. When substitution is not feasible, strict

controls are placed on the use of the hazardous product, to ensure that hazardous waste generation is minimized.

Hazardous wastes are managed in accordance with the requirements found in NTS-SOP-5409, Hazardous Materials and Waste Management, and DOE/NV policies (such as for disposal of aerosol cans). The organization with responsibility for the process that generates hazardous waste must notify the PBMC to arrange for the establishment of satellite accumulation areas (SAAs) at the well site. NTS-SOP-5409 provides detailed guidance for establishment and management of SAAs for hazardous waste. The PBMC provides appropriate empty waste containers, labels, and signs for SAAs, if needed. When SAA containers are 7/8 full or operations have ceased at the well site, the generating organization is responsible for contacting the PBMC for waste collection. The PBMC transports the waste to the Hazardous Waste Accumulation Site in Area 5 and arranges for shipment of the waste to an off site treatment, storage, and disposal facility.

3.2.4 Low-Level Radioactive Wastes

Low-level wastes may be produced during decontamination of equipment or when a contaminated aquifer is encountered. Liquid low-level wastes, such as decontamination fluids, drilling fluids, and groundwater, may be produced, along with solid wastes, such as personal protective equipment and contaminated soil and drill cuttings. The management of liquid wastes is addressed in Sections 3.2.6 through 3.2.8.

Waste suspected to be low-level will be characterized by the ESSC or other NV ERP designee through field monitoring and laboratory analyses in accordance with DOE/NV waste acceptance criteria.

The PBMC operates two low-level waste disposal sites at the NTS, one in Area 5 and one in Area 3. The Area 5 site accepts packaged solid waste; the Area 3 site accepts bulk packaged solid waste. The waste must be adequately characterized to certify that it is not mixed waste and waste acceptance criteria have been met. The ESSC prepares and submits documentation required by DOE/NV waste acceptance criteria. The documentation is submitted through the NV ERP for approval. The ESSC certifies the waste prior to disposal.

3.2.5 Mixed Wastes

Mixed wastes are not expected to be generated unless groundwater or cuttings which contain contaminants above fluid quality objectives are encountered or incidents such as spills occur. Encountering radioactive groundwater or cuttings may result in the generation of other mixed waste, such as construction debris, personal protective equipment, disposable sampling equipment, and equipment that is not feasible to decontaminate. Spills, leaks, and releases from equipment may reach soils, drilling fluids, effluent, and equipment. If radioactive contamination is also present, mixed waste may result.

Suspected mixed waste will be characterized in accordance with DOE/NV waste acceptance criteria, which includes requirements for characterization of radioactive and hazardous components in accordance with applicable laws, regulations, and DOE Orders. Characterization is accomplished through sample collection and laboratory analyses or through process knowledge and field screening. Waste acceptance criteria and the approval process for disposal are contained in the DOE/NV waste acceptance criteria and are analogous to those for low-level waste.

Generation of mixed wastes will be reduced through waste minimization activities, but if the sump contents are found to contain constituents above regulatory levels that would constitute mixed waste, operations will be suspended until a disposal and compliance strategy is developed by the NV ERP for the specific mixed waste generated. Mixed waste will be transported to the Area 5 TRU pad for storage or to the appropriate disposal site for disposal.

3.2.6 Drilling Fluids and Groundwater

For the purposes of this document, groundwater is defined as the water produced by the aquifer being studied, and make-up water is groundwater from another source used as a drilling fluid. Drilling fluids are the solutions used to lift drill cuttings out of the borehole, maintain stability of the borehole, and clean and cool the drill bit. Drilling fluids, such as air, air-water, air-foam, natural and synthetic polymers, and bentonite may be used during drilling operations. These drilling fluids (and groundwater, in the saturated zone) are routed from the drill hole to a lined sump pending characterization. All drilling fluids will be characterized through process knowledge and/or sampling and analysis prior to use downhole and again upon discharge from the drill hole or well. Characterization of fluids will be conducted in accordance with the Fluid Management Plan (Attachment 1).

Drilling, well development, aquifer testing, and sampling may produce a substantial volume of groundwater and lesser amounts of drilling fluids from each well. Because of the large volume generated, it is essential that drilling fluids and groundwater be appropriately characterized, contained, and/or disposed.

Rock properties and the presence or absence of groundwater dictate which drilling fluids will be required. These variables make it difficult to predict the drilling fluids that will be required throughout drilling of a specific well. In all cases, the drilling fluids will be examined to ensure that they do not contain metals or organic compounds that would degrade water quality, result in the generation of a RCRA-regulated waste, or affect future groundwater sampling. The site-specific drilling/recompletion design program documents will specify which drilling fluids will be used initially at a particular well site.

3.2.7 Drilling Fluid and Groundwater Containment

Several documents support the management of drilling fluids and groundwater produced by UGTA Subproject activities. The Fluid Management Plan (Attachment 1) which covers the management of UGTA Subproject drilling fluids and groundwater is negotiated with the state of Nevada. This plan outlines the fluid management criteria and the requirements for sampling and analysis required to make decisions on the disposition of drilling fluids and groundwater. Well-specific documents are also prepared for each UGTA Subproject well. The documents provide the site layout, specifying the number and kind of structures to be constructed to support fluid management. The documents also address any deviations or special requirements not included in the Fluid Management Plan or this Waste Management Plan.

Fluids are initially contained in lined sumps pending characterization. Lined sumps are fenced to prevent wildlife from entering. Flagging around fences discourages waterfowl from entering the sumps. Laboratory analysis of sump contents assists in confirming process knowledge and determining if fluid quality objectives are met as outlined in the Fluid Management Plan. If characterization results indicate that fluid quality objectives are met, the fluid may be routed to an infiltration area or directly to the ground surface, depending on operational variables. If fluids are characterized as hazardous waste, they will be managed in accordance with NTS-SOP-5409. If fluids are greater than ten times the Safe Drinking Water Act maximum contaminant level for radioactive constituents, and if it cannot be demonstrated that radioactivity is naturally occurring, the fluids may be considered low-level or mixed waste. Low-level and mixed waste fluids will

be managed in accordance with DOE/NV waste acceptance criteria. Nonhazardous fluids will be evaporated or solidified; nonhazardous solids will be managed as sanitary wastes.

3.2.8 Decontamination Fluids

Decontamination fluids may be divided into two categories, those resulting from the decontamination of small equipment and those from the decontamination of large equipment. Small equipment decontamination generally results in the generation of less than 20 liters of fluid per 8-hour shift; large equipment decontamination may result in the generation of several thousand liters of fluid.

Small equipment decontamination generally involves washing sampling equipment free of contaminants that may be found in the drilling fluids lined sump. Decontamination solutions may include water, a solution of 10 percent nitric acid, 5 percent hydrochloric acid, and water, or isopropyl alcohol. Other decontamination solvents may not be used without written permission from the DOE/NV UGTA Subproject Manager. Fluids generated from the decontamination of small sampling equipment may be returned to the lined sump if approved solutions are used. If solutions are used that subject the decontamination fluids to RCRA regulatory requirements, the resulting fluids must be properly contained and managed as hazardous or mixed waste (see Sections 3.2.2 and 3.2.4).

Fluids used for the decontamination of large equipment at the drilling site may include water obtained from NTS construction or potable water wells, nonhazardous solvents, and nonhazardous detergents.

When hazardous or radioactive constituents are encountered during drilling, it may be necessary to decontaminate the drilling and ancillary equipment prior to allowing the equipment to leave the site. Ancillary equipment, such as wireline equipment and submersible pumps, may require decontamination after each use.

Fluids resulting from decontamination of large equipment will be contained prior to characterization. If well site decontamination is planned, a lined sump may be constructed for containment of decontamination fluids. The sump size will be provided in the drilling and recompletion design program documents and the State notified that a decontamination sump will be constructed at the well site. Equipment will be decontaminated in a manner to assure that fluids are contained within the lined sump to the greatest extent possible.

3.2.8.1 Characterization and Management of Decontamination Fluids

Samples of decontamination fluids will be collected and analyzed to determine the fluid's waste category prior to discharge or disposal. The fluids will be discharged to an infiltration area or lined sump if analytical results show that the fluids fall within fluid quality objectives. If the fluids meet the definition of hazardous, low-level, or mixed wastes, they will be managed in accordance with applicable regulations and DOE Orders and procedures. If the fluids do not meet the definition of low-level waste and are below RCRA regulatory requirements, they will be managed as sanitary wastes. Fluids meeting the definition of sanitary wastes will be managed in one of two ways:

- Fluids will be placed in the lined sump constructed for unsaturated-zone drilling-fluid containment. The unsaturated-zone drilling fluid sump will be closed as elimination of a point source and as a Class III industrial landfill.
- Fluids will be evaporated and the remaining sludge, sump liner, and ancillary disposable equipment will be transported to an appropriate landfill.

3.3 Analytical Laboratories

Selection of analytical laboratories depends on several factors: data quality objectives, regulatory requirements, turnaround time, laboratory capability and capacity, and Nuclear Regulatory Commission (NRC) licensing. Only NRC-licensed facilities should receive samples directly from the NTS because of liability issues and the potential for generating radioactive samples. Exceptions can be made if the samples have been properly screened by a licensed facility and the documentation verified by an authorized radiochemist. Specific laboratory capabilities and capacity must be adequately demonstrated to meet the minimum analytical requirements of the UGTA Subproject QAPP and DOE/NV waste acceptance criteria. The ESSC is responsible for ensuring that only qualified laboratories are used in support of UGTA Subproject objectives. The types of samples collected, data quality objectives, turnaround time, and the intended purpose for the data will determine which qualified laboratories will receive samples.

Samples containing hazardous and radioactive constituents may be returned from the laboratory for proper disposition. Sample wastes will be managed in accordance with their waste type (nonhazardous, hazardous, low-level radioactive, or mixed), as described in Section 3.2 of this document.

4.0 References

Atomic Energy Act of 1954, Title 42 U.S.C. 2021(k).

CFR, see Code of Federal Regulations.

Code of Federal Regulations. 1984. *Title 40, "Protection of Environment,"* Part 260, U.S. Government Printing Office, Washington, DC.

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ATTACHMENT 1

**FLUID MANAGEMENT PLAN
FOR THE UNDERGROUND TEST AREA
SUBPROJECT**

DOE Nevada Operations Office
Las Vegas, Nevada

Revision: 1

August 1996

**FLUID MANAGEMENT PLAN
FOR THE UNDERGROUND TEST AREA
SUBPROJECT**

Approved: Robert M. Bangerter Jr. Date: 8/22/96
Robert M. Bangerter, Jr., Acting Subproject Manager
Underground Test Area Subproject

Approved: David S. Shafer Date: 8/29/96
David S. Shafer, Acting Project Manager
Nevada Environmental Restoration Project

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List of Acronyms and Abbreviations

BoFF	Bureau of Federal Facilities
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
FMP	Fluid Management Plan
HDPE	High density polyethylene
NDEP	Nevada Division of Environmental Protection
NDWS	Nevada Drinking Water Standards
NTS	Nevada Test Site
pCi/L	PicoCurie(s) per liter
ppm	Part(s) per million
RCRA	Resource Conservation and Recovery Act
TD	Total depth
UGTA	Underground Test Area

1.0 Introduction

The U.S. Department of Energy, Nevada Operations Office (DOE/NV) has initiated an Underground Test Area (UGTA) Subproject to characterize the risk posed to human health and the environment as a result of underground nuclear testing activities at the Nevada Test Site (NTS). A primary UGTA Subproject objective is to gather adequate data to characterize the deep aquifer beneath the NTS. One of the tools used for collecting these data is to drill and/or recomplete a number of deep wells. Wells to be drilled or recompleted include far-field wells (i.e., far from past underground nuclear weapons tests) and near-field wells (i.e., close to past underground nuclear weapons tests). This Fluid Management Plan (FMP) provides guidance for the management of fluids generated from near- and far-field new and recompleted wells. Final well-site solids and liner disposition and site reclamation are discussed in the *UGTA Waste Management Plan* (DOE, 1996).

The ultimate disposition of fluids depends upon sample analysis results in relation to fluid management criteria. This FMP utilizes a fluid management decision strategy based on process knowledge, laboratory analyses, and field screening methodologies. Applicable process knowledge includes well construction material chemistry, soil and rock chemistry, the characterization of the strata penetrated during drilling, and the potential for detecting hazardous and radioactive constituents. Laboratory analyses of effluent (drilling fluid) involves independent sample analyses to confirm process knowledge. Field screening provides for the timely detection of contamination indicators (tritium for radionuclides and lead for metals) on site during drilling operations.

Section 2.0 of this document describes well site operations; Section 3.0 of this document discusses fluid management criteria; Section 4.0 discusses the fluid monitoring program; Section 5.0 presents the fluid management strategy; Section 6.0 provides for fluid management during routine well monitoring; and Section 7.0 provides reporting criteria.

2.0 Generic Site Operations Description

Figure 2-1 represents a generic layout for well-site operations. Site-specific characteristics and restrictions may require modifications to the generic site layout. Required layout modifications affecting fluid management operations shall be provided in well-specific criteria documents.

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Figure 2-1
Generic Site Operations Schematic

Draft versions of these documents shall be submitted to the State of Nevada Division of Environmental Protection (NDEP), Bureau of Federal Facilities (BoFF) for review prior to initiation of well construction activities.

2.1 Well Types

In general, there may be four types of wells constructed: new far-field wells, new near-field wells, recompleted far-field wells, and recompleted near-field wells. Recompleted wells may involve only one or up to all of the steps involved in constructing a new well. These wells may be completed as water level and/or monitoring wells. The primary difference in the generic site layout among the types of wells will be the number of lined sumps present at a given site. The number of lined sumps constructed will depend on expected fluid volume and whether contamination is expected to be encountered.

2.2 Liner Specifications

The type of liner chosen will depend on a number of factors, such as anticipated active life of the lined sump, type of fluid the sump will receive (contaminated or uncontaminated), anticipated wear and tear, cost, and availability. Sumps that are designated to receive potentially contaminated fluids directly from the blooie line shall be double-lined. Sumps that are designated to receive uncontaminated fluids (such as at far-field wells, or unsaturated zone fluids at near-field wells) may be single-lined. Sumps that will receive fluids which exhibit no hazardous characteristics only via pumping may also be single lined.

Double-Lined Sumps

Typically, for near field drilling operations, one double-lined sump with a leak detection system is constructed. Drilling fluid circulation returns are diverted to the sump just prior to reaching the water table, if contamination is expected, or prior to the return fluid reaching a predetermined tritium concentration. The purpose of the double-lined sump is to provide adequate containment, control, and method of monitoring any mixed waste which may be produced during the drilling operations. Main features of the typical double-lined sump construction are described below:

- Dirt work and preparation for liner installation - The typical standard size sump is 10 feet deep with a 50 foot by 80 foot rectangular bottom and a 2 to 1 slope on the sides. This makes the outside perimeter of the sump approximately 90 feet by 120 feet. The preferred construction method is simply to excavate the native soil and contour the slopes. However, depending on the hardness of the ground and the presence of rocks or boulders, cut-and-fill techniques are used when necessary. The bottom of the sump is sloped slightly to one side or one corner into a leak detection trench or pit. The trench or pit is typically about 3 feet deeper than the base of the sump. Prior to line installation any

rocks are removed from the bottom or slopes of the sump and 2 to 3 inches of sand or fine grained soil is spread over the complete sump area to provide protection from punctures or tears.

- Liner installation - In the standard double-lined sump system the primary liner is the liner in contact with the liquids and the secondary liner is a back-up to the primary liner. The first geomembrane placed on top of the sand is typically high density polyethylene (HDPE) or a tri-layer combination of high density and low density polyethylene. The minimum thickness of this geomembrane is typically 40 mils. Both prefabricated liners and on-site fabricated liners have been used. Typically, independent liner inspections are performed to verify the material specifications and the quality of the welds used to join sections of liner. The secondary liner is laid in the bottom of the leak detection trench or pit, and washed pea gravel is used to fill the pit after the bottom of the leak detection pipe has been installed. The leak detection pipe is of adequate diameter to provide access to the leak detection trench or pit for measuring fluid accumulation between the two liners and for pumping the contents of the trench or pit. Prior to placement of the primary liner a layer of geo-webbing, geo-netting, or geo-fabric is placed on top of the secondary liner and pea gravel to provide for separation and allow free flow of liquids between the primary and secondary liners. The access pipe, typically plastic or fiberglass, is slotted at the bottom to allow free entry of any fluid which accumulates in the leak detection trench or pit. The leak detection pipe is run through the primary liner at a point near the top of the slope and the liner is sealed around the circumference of the pipe. To anchor the outer edges of the liners, a trench, approximately 1½ feet wide by 2½ feet deep, is dug around the perimeter of the sump. The edge of the liners are laid in the bottom of the trench and the trench backfilled with native material.
- Wildlife escape ladder - A section of "snow fence" is lain on the sump slope on top of the primary liner on one side of the sump and anchored at the top in the liner footing trench and by sand bags at the bottom. Since maintaining a footing on the lined sump slope is very difficult, this provides a means for wildlife to egress from the sump.
- Fencing - After the liners are in place and the liner footing trench backfilled, the fence is installed completely around the perimeter of the sump. This fence serves as barrier to keep wildlife out of the sump and also serves a control fence around an exclusion zone once contaminated fluids have been introduced into the sump. The fence is typically plastic "snow fence" attached to 6-foot steel posts driven into the ground.
- Flagging - After the fence has been installed flagging material is strung across the sump both lengthwise and diagonally and anchored to the fence posts. The flagging serves as a deterrent to water fowl or other birds from entering the sump.

More detailed information for a typical double-lined sump with leak detection can be obtained from Bechtel Nevada Drawing No. JS-020-ER20-6-DR13. This was the drawing used for the construction of the double lined sump on the ER-20-6 location.

Single-Lined Sumps

Single-lined sumps are constructed much the same as the described above for the double-lined sumps.

- Dirt work and preparation for liner installation - The dirt work and the preparation for installation of the liner is the same as the double-lined sump with the exception of the construction of the leak detection trench or pit within the sump. Single-lined sump sizes are typically the same as the double-lined sump.
- Liner installation - Liner installation for the single-lined sump is typically the same as the double-lined sump using the same types of liner material and using a trench around the perimeter of the sump to anchor the edge of the liner.
- Wildlife escape ladders, fencing, and flagging - Construction of these three features of the single-lined sump is the same as the double-lined sump.

More detailed information for a typical single-lined sump can be obtained from Bechtel Nevada Drawing No. JS-090-129-DR5.

Sump Liner Material Options

The type and thickness of liner materials used will depend on a number of factors including:

- Weather - Consideration will be given to the weather condition the liner will be exposed to during its planned life. The location of the sump to be lined will be considered since there is a wide range of weather conditions due to the differences in elevations of the flats and the mesas.
- Type of service - The type of service and associated risk the sump will be subjected to. There are more risks of mechanical damage to the liner of a sump used for drilling returns while air drilling than one used to receive fluid from a pump test.
- Probability of contamination - Knowledge of the types of fluids/materials to be placed in the sumps and probability of the fluid/materials being radiologically or otherwise contaminated. This includes the probability of generating mixed waste.

Depending on the application, typical liner thickness will range from 30 - 60 mil and material types may include:

- (1) HDPE - High density polyethylene
- (2) LMDPE - Linear medium density polyethylene
- (3) LLDPE - Linear low density polyethylene

(4) VLDPE - Very low density polyethylene

(5) PVC - Polyvinylchloride

(6) Laminates - includes laminates of materials listed above or single materials reinforced with nylon or other such fibers. Re-inforced laminates may only be used on a case-by-case basis and only with written approval of the NDEP regulator.

Geomembrane suppliers and product names include but are not limited to:

- Thor Enterprises, Ltd. Polyshield 400 (40 mil tri-layer)
- National Seal Co. VLDPE & HDPE products (40 - 60 mil)
- Ploy-Flex VLDPE & HDPE products (40 - 60 mil)
- Serrot Corporation VLDPE & HDPE products (40 - 60 mil)

2.3 Well Construction

Well construction activities can be divided into two main operative phases: Phase I, which includes vadose-zone and saturated-zone drilling; and Phase II, which includes initial well development, aquifer testing, well completion, final development/testing, and initial sampling. Activities at new and recompleted wells are essentially the same. Recompletion wells may entail all or part of Phase I and II activities. A description of each phase is provided in the following sections. In general, Phase I activities are those activities which advance the drill hole; Phase II activities are those activities which convert the borehole into a well. Routine monitoring, which occurs on a scheduled periodic basis, is discussed in Section 6.0 of this document.

2.3.1 Phase I

Phase I activities include all operations associated with advancement of the borehole.

Unsaturated-zone, or vadose-zone drilling, takes place above the permanent groundwater table. The initial drilling for emplacement of the conductor casing is done with an auger or bucket rig. Fluids produced during vadose-zone drilling are mainly rock cuttings and drilling fluids.

Saturated-zone drilling begins once the water table is reached and continues through the saturated-zone to the desired total depth (TD). Groundwater, cuttings, and drilling fluids are produced during saturated-zone drilling.

Drilling fluids typically used are water (imported from a clean source), bentonite and/or synthetic polymer solutions (a commercially-available dry powder or concentrated liquid mixed with water) and soap/detergent introduced by compressed air. Certain operating conditions may

require the use of other drilling fluid formulations to maintain borehole integrity. The NDEP will be consulted prior to use of other formulations.

2.3.2 Phase II

Phase II begins when TD is reached and borehole advancement is complete. Once borehole advancement has ceased, the borehole may then be developed to remove residual cuttings and any drilling fluids which may have invaded the formation during drill advancement. Note that due to borehole conditions, not all wells undergo initial well development.

Depending on borehole stability, aquifer testing may be conducted after the well is initially developed and prior to completion. Phase II also includes well completion, final well development, and final aquifer testing of single or multiple productive zones. Well completion designs and activities will vary depending on well-specific objectives; and may include the setting of intermediate casing, the running of a completion string to a specified depth, and/or the isolation of productive fracture zones with gravel, cement, packers, and sliding sleeves. Following well completion, final development is required to clean out the well and remove interstitial materials from the gravel pack and formation. After final development, final testing of productive zones will be conducted to complete the well installation. Multiple zones may be tested.

3.0 Fluid Monitoring Program _____

Fluid shall be characterized through on-site field monitoring of well discharge line and sump contents and off-site independent laboratory analysis of sump contents.

3.1 On-Site Monitoring

Fluids generated during drilling will be analyzed for lead and tritium while the drill hole is being advanced. During periods when the hole is not being advanced, such as during circulation or while attempting to establish circulation, monitoring is not required.

Tritium shall be monitored hourly while the drill hole is being advanced. Tritium shall be monitored using a liquid scintillation counter, following approved operating procedures and manufacturer's recommended instructions for use. Lead shall be monitored at least once every eight hours while the drill hole is being advanced. Lead may be monitored with a digital voltmeter, colorimetric method, or other approved method following approved operating procedures and the manufacturer's recommended instructions for use. These tritium and lead

samples shall be collected from the blooie line. Figure 3-1 outlines the decision process for lead on-site monitoring during borehole advancement.

In the event that a scheduled lead sample (taken every eight hours) reveals concentrations equal to or above 3 parts per million (ppm), a confirmatory sample from the blooie line will be taken immediately. If this sample result indicates lead levels lower than 3 ppm, another blooie line sample will be taken and if shown to confirm a level less than 3 ppm, the eight hour blooie line sample schedule will be reinstated. If either confirmatory sample indicates lead levels equal to or greater than 3 ppm, both of the following two actions shall be taken:

- (1) *Blooie line lead monitoring shall increase to hourly.* The hourly sampling shall continue until at least three consecutive hourly samples indicate that lead levels from the blooie line are less than 3 ppm. At this point, a monitoring schedule of once every eight hours may resume.
- (2) *A composite sump sample shall be taken immediately.* This composite sample shall be collected from the sump to which the blooie line discharged at the time of the original sample (the first blooie line sample showing lead levels equal to or greater than 3 ppm) and all other sumps to which the suspect fluid may have been transferred.

If the lead concentration from this sump sample is less than 3 ppm, scheduled eight-hour blooie line monitoring shall be resumed. If the on-site monitoring of the sump contents indicates levels at or above 3 ppm, an additional sump sample will be collected and analyzed on site. If this confirmatory sump sample indicates elevated levels, an additional sump sample will be taken and sent off site for laboratory analysis. If the sample indicates levels below 3 ppm, another confirmatory sump sample will be collected and analyzed on site. If this confirmatory sample indicates lead levels above or equal to 3 ppm, another sump sample shall be taken and analyzed in accordance with Figure 3-1. If this confirmatory sample indicates a lead level below 3 ppm, sump monitoring shall continue once every two hours until three blooie line samples consistently indicate that blooie line discharge contains lead at levels less than 3 ppm. Once the blooie line discharge is confirmed to be consistently below 3 ppm, sump monitoring may cease and regularly scheduled blooie line monitoring resumed. If sump lead levels approach 5 ppm, drilling shall stop until it can be determined that continuing would not generate a hazardous waste. If laboratory results indicate lead concentrations at hazardous or mixed waste levels, drilling operations will remain halted for an indefinite period of time, during which the NDEP will be notified.

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Figure 3-1
On-Site Lead Monitoring Decision Process

3.2 Laboratory Analytical Samples

In all drilling scenarios, a sump sample shall be collected and analyzed by an off-site laboratory prior to routing fluids to an infiltration area or the ground surface. If fluids are being added to the sumps, as during borehole advancement (Phase I) or during well completion activities (Phase II), a sump sample does not need to be collected. However, once operations that affect sump volume have ceased, a sump sample must be taken for laboratory analysis. In the event that a time lapse of three months or more is anticipated between activities at a given well site, a sample shall be collected from each of the lined sumps at the site.

Fluids will be analyzed for the parameters listed in Table 3-1.

4.0 Fluid Management Criteria

Based on process knowledge, the following parameters were selected for establishing drilling fluid quality relative to Nevada Drinking Water Standards (NDWS): arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, tritium, gross alpha, and gross beta. The fluid quality objectives are based on dissolved constituents and indicate the thresholds at which fluid management decisions are made. These objectives are as follows:

- < 5 x NDWS = Fluids may be conveyed to the ground surface/infiltration area
- 5 to 10 x NDWS = Fluids may be conveyed to a constructed infiltration area
- 10 to 50 x NDWS = Contain fluids
- 50 to 99 x NDWS = Confirm the concentration of hazardous constituents
- ≥ 100 x NDWS = Manage in accordance with state of Nevada hazardous waste criteria (for Resource Conservation and Recovery Act-regulated parameters only)

Table 4-1 outlines the decision criteria limits used to manage fluids covered under this plan.

Although the decision criteria are based on the concentration of dissolved constituents, samples will be analyzed for total concentrations, with the exception of radiological parameters. As long as the total concentration remains below the decision thresholds, the dissolved fractions are assumed to be below thresholds. In the event analyses indicate total levels at or near decision thresholds, fluids will be resampled, filtered, preserved and analyzed for dissolved fractions to confirm management decisions based on fluid quality.

Table 3-1
Analytical Laboratory Requirements for Fluid Management Samples

Parameter	Analytical Method	Container Type ^a	Preservative	Maximum Holding Time	Reporting Detection Limit (RDL)	Fluid Quality Objectives
Total Metals: Arsenic Cadmium Chromium Lead Selenium Silver Mercury	SW-846 6010 SW-846 6010 SW-846 6010 SW-846 6010 SW-846 6010 SW-846 6010 SW-846 7470	(1) 500-mL ^b polyethylene or amber glass	HNO ₃ to pH <2, Cool to 4°C	180 Days 28 days	0.1 mg/L ^c 0.01 mg/L 0.1 mg/L 0.2 mg/L 0.001 mg/L 0.05 mg/L 0.1 mg/L	0.5 mg/L 0.05 mg/L 1.0 mg/L 0.5 mg/L 0.02 mg/L 0.5 mg/L 1.0 mg/L
Gross Alpha Gross Beta	EERF 00-02 ^d or EPA 900.0 or SW-846-9310	(1) 1-liter polyethylene	Lab Filtration or Field Filtration, HNO ₃ to pH<2,	180 Days	<15 pCi/L ^e <15 pCi/L	150 pCi/L 500 pCi/L
Tritium	EPA 906.0 or equivalent	(1) 500-mL polyethylene or amber glass	Lab filtration or Field Filtration, Cool to 4°C	180 Days	3,000 pCi/L	20,000 pCi/L

^aVolume specifications are based on sample compositing requirements.

^bMilliliter

^cMilligram per liter

^dEastern Environmental Radiation Facility gross alpha method for samples containing high total dissolved solids (>500 parts per million).

^ePicoCurie per liter

Table 4-1
Fluid Management Decision Criteria Limits

FMP Parameters	NDWS Standard (micrograms per liter)	5X MCL Limit ^a (micrograms per liter)	10X MCL Limit ^b (micrograms per liter)
Arsenic	50	250	500
Cadmium	5	25	50
Chromium	100	500	1,000
Lead	50	250	500
Selenium	50	250	500
Silver	100	500	1,000
Mercury	2	10	20
Gross Alpha	15 pCi/L	75 pCi/L	150 pCi/L
Gross Beta	50 pCi/L	250 pCi/L	500 pCi/L
Tritium	20,000 pCi/L	100,000 pCi/L	200,000 pCi/L

^aLimit for overland flow
^bLimit for infiltration area

5.0 Fluid Management Strategy

Fluids generated while the borehole is being advanced will be routed to a lined sump for containment prior to final disposition. Depending upon operational requirements and fluid quality, fluids may be:

- Routed to the ground surface
- Routed to a constructed infiltration area
- Routed to another lined sump
- Retained in lined sumps pending evaporation
- Transported to a lined sump or infiltration area at another location
- Transported to a treatment, storage, or disposal facility
- Routed into portable (i.e., Baker) tanks

In no event will fluids be routed or transported to an infiltration area or the ground surface if fluid quality parameters as provided in Section 4.0 of this document are not met. Figure 5-1 illustrates the general decision-flow process for the management of fluids under this FMP; assuming overland flow is not used for fluid disposition.

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Figure 5-1
Decision Diagram for Fluid Management

Fluids that do not meet criteria specified in Section 4.0 (i.e., greater than ten times the NDWS) will be retained in lined sumps; transported to another lined sump; transported to a treatment, storage, or disposal facility; or routed into portable tanks. Fluids documented to be below the Resource Conservation and Recovery Act (RCRA) limits, but above 10 times the NDWS, would be allowed to evaporate in lined sumps for future management as industrial solid waste in accordance with the *UGTA Waste Management Plan* (DOE, 1996). Fluids documented to be above RCRA limits would result in the suspension of operations and would be managed as hazardous (or mixed) waste in accordance with state of Nevada hazardous waste regulations and U.S. Department of Energy (DOE) Orders. Fluids above DOE limits for radiological constituents would be managed in the lined sump or transported to an appropriate treatment, storage, or disposal facility. If the level of radioactive constituents is great enough that air quality or employee health and safety limits could be exceeded, operations would be suspended and the waste managed in accordance with applicable DOE Orders and state and federal regulations.

5.1 Far-Field Fluid Management Strategy

At far-field wells, it is not expected that contamination will be encountered. No far-field wells constructed to date have exceeded fluid quality parameters for routing fluids to a constructed infiltration area; in fact, most have met fluid quality parameters for routing fluids to the ground surface.

Fluids generated during Phase I activities will be contained in a single-lined sump pending laboratory analysis of fluids from the lined sump. When a sump is filled to capacity and/or at the completion of Phase I activities, sump fluids may be routed to the ground surface or to a constructed infiltration area if laboratory analysis confirms that fluid meets FMP fluid quality parameters. Prior to initiation of Phase II operations, process knowledge and laboratory analytical results will be reviewed to determine the potential for generation of fluids which do not meet fluid quality parameters. If there is sufficient confidence in this information to ensure that FMP parameters will not be exceeded, fluids generated during Phase II activities may be routed directly from the well to an infiltration area or to the ground surface. If fluids are routed to the ground surface, care shall be taken to prevent erosion to the greatest extent possible. Sump fluids shall be routed using a floating intake pump to minimize the amount of solids routed to the ground surface or infiltration area.

5.2 Near-Field Fluid Management Strategy

Near-field well sumps require a higher degree of containment to prevent contamination from reaching the ground surface. A single-lined sump shall be constructed at each near-field well for

collection of unsaturated zone fluids and fluids shown, through on-site monitoring, to be below fluid management criteria (i.e., "uncontaminated"). A double-lined sump with a leak detection system shall be constructed to contain fluids from saturated zone drilling that are shown, through on-site monitoring, to exceed fluid management criteria (i.e., "contaminated"). In all cases during near-field drilling, the blooie line shall be fitted with an energy dissipation system or equivalent, to prevent damage to the lined sumps. The sumps themselves shall have rubber pads installed at the point where cuttings fall from the blooie line into the sump to lessen the impact of the cuttings on the liner. (See Section 2.0 for more information on liner specifications and requirements.)

Fluids meeting fluid quality objectives as stated in Section 4.0 of this FMP may be routed to the ground surface or infiltration area. Fluids contained in the double-lined sump that do not meet fluid quality objectives may be routed to other lined sumps. At near-field wells during Phase I operations, the single-lined sump designed for collection of uncontaminated fluids shall be used only for uncontaminated fluids until the last well is drilled. When the last well is drilled (such as for a well cluster), contaminated fluids may be routed to the single-lined sump. However, placement of contaminated fluids into this sump calls the entire sump contents into question and may prevent release of fluids to the infiltration area or ground surface. Therefore, the single-lined sump designated for holding uncontaminated fluids may be used for holding contaminated fluids only after uncontaminated fluids are routed to an infiltration area or the ground surface and only after it is not anticipated that future operations will produce uncontaminated fluids.

6.0 Fluid Management for Routine Monitoring _____

Monitoring activities are defined as those routine, scheduled, periodic activities associated with collection of groundwater monitoring samples. In general, groundwater monitoring samples are collected annually. Fluid generated from the activities associated with groundwater sampling (such as from purging the well) shall be contained in a lined sump, unless process knowledge is sufficient to allow for direct routing to an infiltration basin or the ground surface. After the groundwater sampling event has ceased (i.e., no more fluid will be generated by that sampling event), a composite sump sample shall be collected and analyzed for the parameters listed in Table 3-1. Six months following the sampling event, another composite sump sample shall be collected and analyzed for the parameters listed in Table 3-1. Analytical results shall be reported to the NDEP in accordance with Section 7.0 of this FMP.

7.0 Reporting Criteria

The reporting criteria proposed for meeting the requirements of a general water pollution control permit for environmental restoration activities consists of the following:

1. The NDEP shall be provided a draft copy of all well-specific design documents for review prior to initiation of well construction or re-entry into an existing borehole or well. The design document will either include a commitment to follow this FMP or will document deviations from the FMP.
2. All fluids in excess of ten times the NDWS limits, as defined by this plan, that are conveyed to the infiltration area or beyond the confines of the constructed fluid management devices, in excess of 1 cubic meter (1 cubic meter of liquid = 264.2 gallons), shall be reported orally to the NDEP by telephone (486-2866) prior to the end of the next business day following verification of the incident. Oral notification shall be followed by a written report which includes elements described in spill reporting regulations within ten calendar days.
3. The synopsis of well-site activities occurring within a 24-hour period (i.e., the morning report) shall be faxed to the NDEP each day during well drilling and completion activities.
4. The well completion report will be sent to the NDEP within nine months of well completion.
5. The hydrogeologic letter of accomplishment will be sent to the NDEP within nine months of initial well sampling.
6. A report will be sent to the NDEP within nine months of collection of sump samples collected during routine well monitoring activities (see Section 6.0). The report will contain:
 - Date of sampling
 - Synopsis of laboratory analytical data

All correspondence to the BoFF Regulator shall be addressed to the following:

Nevada Division of Environmental Protection
Bureau of Federal Facilities
555 E. Washington, Suite 4300
Las Vegas, NV 89101
Program Manager Telephone: (702) 486-2866
Office Telefax: (702) 486-2863

All field and laboratory data generated in support of UGTA Subproject well construction activities will be archived and made available for inspection by the BoFF Regulator. Copies of interim fluid status reports will be forwarded to and maintained at the well site for on-site field

inspection. The following data will be generated and retained on file. This data may be made available to the NDEP for inspection upon request:

- Legible copies of daily drilling progress reports and records of daily well-site activities
- Volumetric measurements of fluids generated during each stage of well construction
- Records of make-up water delivery and usage during each stage of well construction
- On-site effluent monitoring data
- Laboratory analytical data with supplemental quality assurance/quality control and chain of custody records
- Records of process materials (cement, grout, casing, screens, packing, drilling fluids) and drilling additive usage, and equipment decontamination
- Records of geological, geotechnical, and hydrological evaluations
- Photographs illustrating site operations, methods, procedures, and progress

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