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Environmental
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Project

DOE/NV-499
UC-700

RCRA Part A Permit
Characterization Plan
for the U-2bu Subsidence Crater

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**RCRA PART A PERMIT
CHARACTERIZATION PLAN
FOR THE U-2BU SUBSIDENCE CRATER**

DOE Nevada Operations Office
Las Vegas, Nevada

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**RCRA PART A PERMIT
CHARACTERIZATION PLAN
FOR THE U-2BU SUBSIDENCE CRATER**

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List of Acronyms and Abbreviations

ALARA	As low as reasonably achievable
amsl	Above mean sea level
ASTM	American Society for Testing and Materials
CAU	Corrective Action Unit(s)
CFR	<i>Code of Federal Regulations</i>
CHP	Characterization Plan
cm	Centimeter(s)
cpm	Count(s) per minute
COC	Contaminant(s) of concern
COPC	Contaminant(s) of potential concern
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DOT	U.S. Department of Transportation
DQO	Data Quality Objective(s)
EPA	U.S. Environmental Protection Agency
ERDA	Energy Research and Development Administration
ft	Foot (feet)
ft/day	Foot (feet) per day
ft/s	Foot (feet) per second
IDW	Investigation-derived waste
in.	Inch(es)
IT	IT Corporation
ITS	Integrated Test Series
km	Kilometer(s)
km/h	Kilometer(s) per hour
LLW	Low-level waste

List of Acronyms and Abbreviations (Continued)

m	Meter(s)
m/day	Meter(s) per day
m/s	Meter(s) per second
mg/kg	Milligram(s) per kilogram
mi	Mile(s)
mph	Mile(s) per hour
mrem/hr	Millirem(s) per hour
NAC	<i>Nevada Administrative Code</i>
NDEP	Nevada Division of Environmental Protection
NTS	Nevada Test Site
NTSWAC	<i>Nevada Test Site Waste Acceptance Criteria</i>
PAL	Preliminary action level(s)
PCB	Polychlorinated biphenyl(s)
PPE	Personal protective equipment
ppm	Part(s) per million
PRG	Preliminary Remediation Goal(s)
QA	Quality Assurance
QC	Quality Control
QAPP	Quality Assurance Project Plan
RCRA	<i>Resource Conservation and Recovery Act</i>
REECo	Reynolds Electrical and Engineering Company, Inc.
RMA	Radioactive Materials Area
RSL	Remote Sensing Laboratory
SAA	Satellite Accumulation Area
SVOC	Semivolatile organic compound(s)
TCLP	Toxicity characteristic leaching procedure

List of Acronyms and Abbreviations (Continued)

TID	Tamper-indicating device
TPH	Total petroleum hydrocarbon(s)
VOC	Volatile organic compound(s)
$\mu\text{Ci/mL}$	Microcurie(s) per milliliter
$^{\circ}\text{C}$	Degree(s) Celsius
$^{\circ}\text{F}$	Degree(s) Fahrenheit

1.0 Introduction

This plan presents the characterization strategy for Corrective Action Unit (CAU) 109, U-2bu Subsidence Crater (referred to as U-2bu) in Area 2 at the Nevada Test Site (NTS). The characterization will be conducted for the U.S. Department of Energy, Nevada Operations Office (DOE/NV) Environmental Restoration Division. The following section identifies the purpose, scope, and data quality objectives related to characterization of the U-2bu Subsidence Crater.

1.1 Purpose

The objective of the planned activities is to obtain sufficient characterization data for the crater soils and observed wastes under the conditions of the current *Resource Conservation and Recovery Act* (RCRA) Part A permit (NDEP, 1995a).

1.2 Scope

The scope of the characterization plan includes collecting surface and subsurface soil samples with hand augers and for the purpose of site characterization. The sampling strategy is to characterize the study area soils and look for RCRA constituents. Observable waste soils and surrounding crater soils will be analyzed and evaluated according to RCRA closure criteria (CFR, 1996). Because of the status of the crater a RCRA Part A permit site, acquired radionuclide analyses will only be evaluated in regards to the health and safety of site workers and the disposition of wastes generated during site characterization.

1.3 Data Quality Objectives

The Characterization Plan for this project has been developed through the implementation of the Data Quality Objective (DQO) Process as described in the U.S. Environmental Protection Agency's (EPA) *Guidance for the Data Quality Objectives Process* (EPA, 1994) and as implemented in *Data Quality Objectives for Superfund, Interim Final Guidance* (i.e., EPA, 1993a; 1993b). This plan represents the results of the DQO process between the DOE/NV and the State of Nevada, Division of Environmental Protection (NDEP), the specifics of which are summarized in Appendix A. The approach to site characterization is an iterative process. As part of the Quality Assurance (QA) and Quality Control (QC) program for the project, the seven-stage DQO approach has been employed to ensure that the environmental data gathered for site characterization are adequate to support the

development of a closure strategy for the site. The DQOs for the characterization plan were also developed to adhere to precision, accuracy, representativeness, comparability, and completeness parameters, as discussed in the *Industrial Sites Quality Assurance Project Plan (QAPP)* (DOE/NV, 1996a).

2.0 Facility Description

The U-2bu Subsidence Crater is located in Area 2 at the NTS, a U.S. Department of Energy (DOE) research and development facility in Nye County, Nevada. The NTS is approximately 88.5 kilometers (km) (55 miles [mi]) northwest of Las Vegas, the major population center in the area (Figure 2-1). Area 2 is in Yucca Flat, the central eastern portion of the NTS (Figure 2-2). The U-2bu crater is surrounded by many other test craters of similar size (Figure 2-3). Regional and local topography, soil types, stratigraphy, surface water features, and groundwater, which additionally relate to site characterization, are discussed in Appendix B of this document.

The U-2bu Subsidence Crater was created in 1971 by a Lawrence Livermore National Laboratory underground nuclear test, event name Miniata, and was used as a land-disposal unit for radioactive and hazardous waste from 1973 to 1988 (Nacht, 1992). The crater has an average diameter of 288 meters (m) (944 feet [ft]), an approximate depth of 35 m (115 ft), and an estimated total surface area of 17 acres. The rim of the crater is encircled by a 1-meter (3-foot) high wire fence supplemented by an 2.4-meter (8-foot) high chain-link fence at the northern rim. The northern fence extends approximately 183 m (600 ft) in an east-west direction from the "dumping entrance" which consisted of a concrete trough with a metal lip that extended into the crater. The trough was approximately 3 m (10 ft) long by 1.5 m (5 ft) wide and discharged into an erosion gully on the side of the crater. At the bottom of the erosion gully is an artificial alluvial fan likely to be composed of additional waste material. At the bottom of the crater is a dry ponding area created from internal drainage of precipitation into the crater (Figure 2-4). An aerial photograph was taken of the U-2bu crater in December 1997 (Figure 2-5) (RSL, 1997).

2.1 Waste Inventory

Crater U-2bu was initially used in 1979/1980 for the disposal of drilling muds contaminated with radionuclides (Neagle, 1993). The drilling muds are known to have contained chromium and probably contained lead which was used as stemming material in nuclear testing operations (Haworth, 1989). The drilling muds were routinely collected into a vacuum truck and were then transported to U-2bu for disposal. After disposing of the drilling mud in the crater, the vacuum truck was rinsed out with water from a portable tank across the road. The rinse water was then disposed of in the crater. Materials from the Baneberry Event at Crater U8d and the Area 9 Integrated Test Series

Figure 2-1
Location of the Nevada Test Site

Figure 2-2
Location of the Area 2 U-2bu Subsidence Crater

Figure 2-3
Location of the Area 2 U-2bu Subsidence Crater and Other Craters

U-2bu Digital File Photograph U2fig2_4.tif (IT Corporation, 1997)

Figure 2-4
Photograph of the Area 2 U-2bu Subsidence Crater, Facing Southwest

Source: RSL Photograph No. 9441-29, December 1997.

Figure 2-5
Aerial Photograph of the Area 2 U-2bu Subsidence Crater

(ITS), which may include materials from the Avens-Cream Event, are described as having been disposed of in U-2bu.

Other types of decontamination liquids were also trucked to contaminated mud disposal craters (DOE/NV, 1988). The decontamination liquids originated from operations at drill-back and tunnel reentry sites where contaminated items were generally washed or sprayed with water. Degreasers used in decontamination operations contained 18 percent chlorinated benzenes and 70 percent petroleum solvents (Haworth, 1989).

In November 1988, U-2bu received 3,500 gallons of wastewater from the Area 6 Decontamination Facility sumps which contained solvents and mixed fission products. Soil sampling was conducted approximately one month after the November 1988 disposal event to estimate potential contamination (Haworth, 1989). Two sampling locations were selected 1.5 m (5 ft) and 7.6 m (25 ft) "downstream" of the dumping trough located on the northern rim of the crater. Surface radiation readings were 20,000 counts per minute (cpm) and 12.5 millirems per hour (mrem/hr) at the 1.5-meter (5-foot) sampling location. At the 7.6-meter (25-foot) sampling location, surface radiation readings were 3,600 cpm and 1 mrem/hr (Haworth, 1989). One soil sample had a concentration of 7.5 parts per million (ppm) chlorobenzene and a concentration of 2.5 ppm xylene. Detected metals included lead from 470 to 680 ppm and cadmium from 29 to 37 ppm. The detection of chlorobenzene and xylene is likely to be a direct result of the release of the wastewater from the Area 6 Decontamination Facility.

The sampling and analytical data reported by Haworth do not meet RCRA quality standards and will be used only for qualitative purposes. Waste within U-2bu is anticipated to be mixed waste as U-2bu received construction debris, radioactive drilling mud, and Area 6 Decontamination Facility sump waste. Identified RCRA constituents of potential concern in drilling mud include chromium. Of potential concern are polychlorinated biphenyls (PCBs) and waste solvents from the Area 6 Decontamination Facility (Neagle, 1993). After reviewing available historic information related to process knowledge of previous disposal activities at U-2bu, DOE/NV concludes that U-2bu waste types and volumes are not fully documented. Because documented disposal of Area 6 Decontamination Facility wastes exists, xylene and chlorobenzene, if detected at U-2bu, will be considered as "listed" wastes. Any other detected RCRA constituents will be considered as "characteristic" wastes.

2.2 Previous Characterization Plans and Activities

To date, at least one characterization plan has been produced for the U-2bu Subsidence Crater by the DOE (DOE/NV, 1994). In addition, a closure plan was produced in 1991 (REECo, 1991). Each plan was written to address comments on previous plans and changing characterization methods, strategies, and philosophies. None of the previous plans was fully approved by both the DOE/NV and the NDEP; consequently, there have been no field activities conducted to complete site characterization. This plan incorporates, and in some cases refines, process knowledge presented in the earlier plans. This current Characterization Plan is intended to supersede all previous Characterization Plans and is intended to contain some significant changes to previously planned site characterization efforts. The sampling methodology was designed to provide data leading to characterization of site soils and, consequently, to site closure under the conditions of the current RCRA Part A Permit (NDEP, 1995a).

3.0 Objectives

The following section identifies the primary objectives related to site characterization. Potential RCRA contaminants of concern, preliminary action levels, measurement objectives, and the conceptual model for the site are discussed. As stated in Section 1.1, the sampling strategy is to characterize the study area soils and look for RCRA constituents. The detection of radionuclides as a result of characterization sampling is not an issue related to site characterization but is an issue related to the health and safety of site workers and the disposition of site-generated wastes. Radionuclide sampling will be performed only to address such concerns.

3.1 Potential RCRA Contaminants of Concern

The potential RCRA contaminants of concern (COCs) for the site have been identified through reviews of preliminary investigations and historic documents (Bingham, 1992a; Bingham, 1992b). The potential presence of COCs within crater soils and observable waste is assumed to result from disposal of the following potential contaminant sources:

- Discharge of radioactive drilling mud into the crater
- Discharge of decontamination fluids and Area 6 Decontamination Facility wastewater into the crater

The final list of potential COCs for the site was determined by the DOE/NV and the NDEP during the DQO scoping process (Appendix A). Based on the lack of fluid disposal into the crater in recent years, free liquids are not expected on site. Xylene and chlorobenzene, if detected at U-2bu, will be considered as "listed" wastes. Any other detected RCRA constituents will be considered as "characteristic" wastes. The following constituents have been designated as the potential COCs for the site:

- Volatile organic compounds (VOCs)
- Semivolatile organic compounds (SVOCs)
- Total petroleum hydrocarbons (TPH)
- RCRA metals
- Polychlorinated biphenyls (PCBs)

VOC and SVOC analyses will not be performed for surface soil samples.

3.2 Preliminary Screening Levels

Of primary concern with regard to the detection of contaminants and site characterization is the detection of RCRA-listed compounds at any level. The detection of non-RCRA listed compounds will not be an issue for site closure unless such compounds are detected above established preliminary action levels (PALs) which have been designated through other DQO processes. Although non-detect levels are anticipated for the potential COCs and although remediation may be required if RCRA-listed constituents are detected, the following PALs may be used in the event that greater than 10 percent of the soil samples indicate contamination above non-detect levels.

- RCRA-listed hazardous wastes: concentrations above EPA Region 9, 1996 Industrial Soil Preliminary Remediation Goals (PRGs) for initial site screening and concentrations above risk-based levels (which may be different from the PRGs) for final analysis of characterization sampling results (EPA, 1996)
- RCRA toxicity characteristic hazardous wastes: RCRA toxicity characteristic values from the Code of Federal Regulations (CFR) Title 40 Part 261.24 (CFR, 1996; ESI, 1996)
- PCB constituents: concentrations above EPA Region 9, 1996 Industrial Soil Preliminary Remediation Goals for initial site screening and concentrations above risk-based levels (which may be different from the PRGs) for final analysis of characterization sampling results (EPA, 1996)
- TPH constituents: total concentrations above 100 milligrams per kilogram (mg/kg) per Nevada Administrative Code (NAC) 445A (NAC, 1996)

3.3 Measurement Objectives

All chemical and radiological analyses will be conducted using the standard analytical methods identified in Table 3-1. Total VOC and SVOC analyses will not be performed for surface soil samples. In accordance with EPA issued guidance, total waste analyses may be used to demonstrate that wastes do not exhibit the toxicity characteristic under CFR 261.24 (EPA, 1998). Total VOC and SVOC analyses will be utilized for this purpose. The TCLP VOA and TCLP SVOA analyses will be performed only if total VOC and SVOC analyses indicate the presence of such constituents in high concentrations indicating leachate potential. Because drilling muds are known to have been disposed of in the U-2bu crater, TCLP metals analyses for RCRA metals, including chromium, will be performed at all sampling locations. The detection limits for all the COCs identified in Section 3.1 will be substantially below (i.e., less than 50 percent) the specified preliminary action levels. In the

Table 3-1
Chemical and Radiological Analytical Methods

Analytical Parameter	Analytical Methods
Total volatile organic compounds	EPA Method 8260B ^a
TCLP volatile organic compounds	EPA Method 1311 ^b /8260B ^a
Total semivolatile organic compounds	EPA Method 8270C ^a
TCLP semivolatile organic compounds	EPA Method 1311 ^b /8270C ^a
Total petroleum hydrocarbons (Diesel Range)	EPA Method 8015B ^a
Total petroleum hydrocarbons (Gasoline Range)	EPA Method 8015B ^a
TCLP metals	EPA Method 1311 ^b /6010B/7471A ^a
Polychlorinated biphenyls (PCBs)	EPA Method 8082 ^a
Isotopic Plutonium ^d	NAS-NS-3058 ^c
Gamma scan ^d	HASL-300 ^e
Gross alpha/beta ^d	SM 7110 ^f

^aEPA Test Methods for Evaluating Solid Waste, Parts 1-4 (EPA, 1997)

^b40 CFR 261.24 (CFR, 1996)

^cNational Academy of Science, Nuclear Science Series (NAS, 1963)

^dAnalyzed per laboratory protocol and not as a potential RCRA COC for site closure.

^eEML Procedures Manual, HASL-300, Environmental Measurements Laboratory (DOE, 1990)

^fStandard Methods for the Evaluation of Water and Waste Water (APHA, 1992)

few cases where an action level for a compound is less than the laboratory detection limit (i.e., semivolatiles like polyaromatic hydrocarbons), the detection limit will become the *de facto* action level.

3.4 Conceptual Model

The conceptual model for U-2bu was designed to provide the basis for planning adequate investigative activities under this site characterization plan. The conceptual model was developed during the DQO scoping process and through a review of historical documents and preliminary field investigations (Bingham 1992a, Bingham, 1992b). The model takes into account the observed distribution of U-2bu wastes and limits the migration of potential RCRA COCs (see Section 3.1) within the crater in the following manner.

- Potential RCRA COCs in the crater are primarily concentrated in post-shot drilling muds observed within the gully and artificial alluvial fan.
- Hydrocarbons originating from liquid wastes are nondetectable or are at very low concentrations within the gully, the artificial alluvial fan, and/or the ponding area at the crater bottom.
- Migration/distribution of potential RCRA COCs is limited vertically and horizontally.

To facilitate the evaluation of the conceptual model, the site has been divided into five initial study areas based on varying potentials for contaminant detection (Figure 3-1) The sampling strategy is to characterize the study area soils and look for RCRA constituents. In the following study areas, surface and subsurface soils will be analyzed for the constituents of potential concern identified in Table 3-1:

- Study Area 1 - Soil directly within the trough which may have been impacted by releases of drilling muds and rinsate
- Study Area 2 - Soil directly within the gully where waste is readily observed
- Study Area 3 - Soil directly within the artificial alluvial fan where waste is readily observed
- Study Area 4 - Soil directly within the ponding area at the crater bottom where surface water within the crater internally drains
- Study Area 5 - Soil along the crater rim and/or walls. While RCRA COCs are not anticipated to be present within the area, surface and subsurface soils will be analyzed for the compounds identified in Table 3-1. The sampling will be performed in order to characterize the entire crater

The sampling approach is aimed at characterizing observed wastes in the U-2bu crater and at identifying areas of unidentified concern early on in the characterization process. The sampling methodology was designed to ensure that site characterization activities provide data that lead to a defensible closure strategy according to the current RCRA permit. The analytical results from surface and subsurface soil sampling will be evaluated under the conditions of the current RCRA Part A Permit (NDEP, 1995a).

Source: RSL Photograph No. 9441-29, December 1997.

Areal extent of study area are only identified in this figure:

Study Area 1 - Soil directly within the trough

Study Area 2 - Soil directly within the gully

Study Area 3 - Soil direction within the artificial alluvial fan

Study Area 4 - Soil directly within the ponding area at the crater bottom

Study Area 5 - Soil along the crater rim and/or walls

Figure 3-1
U-2bu Subsidence Crater Study Areas

4.0 Sampling and Analysis Plan

Data will be collected during the field investigation to confirm or refute the conceptual model for the site by characterizing the crater and observed waste for RCRA constituents and by assessing potential migration of RCRA constituents via Toxicity Characteristic Leaching Procedure (TCLP) analysis. Soil samples will also be collected in order to obtain site-specific geotechnical information. Sampling will be conducted to provide adequate data which support site characterization under the conditions of the current RCRA Part A permit. The characterization activities (i.e., sampling, decontamination, etc.) will be conducted in accordance with approved sampling instructions and operating procedures identified in the Industrial Sites QAPP (DOE/NV, 1996a) and other associated documents. Site wastes will be sampled and managed according to the Waste Management Plan (Appendix C).

4.1 Technical Approach

Based on the results of the DQO process between the DOE/NV and the NDEP, the technical approach leading to the completion of characterization activities at the U-2bu Subsidence Crater involves the following steps:

- Surface and subsurface soil samples will be acquired and analyzed to determine concentrations of suspected RCRA COCs within the identified areas of concern.
- Analytical data will be used to determine if the conceptual model for the site is valid. The data will primarily be used to evaluate the regulatory status of observable U-2bu waste soils under the conditions of the current RCRA Part A Permit.

Site characterization will consist of surface and subsurface soil sampling within the identified areas of concern (Figure 3-1). Per the DQO process between the DOE/NV and the NDEP, subsurface soil samples will be acquired with hand augering techniques and will be collected at a minimum depth of 1.2 m (4 ft.) below ground surface. Soil sampling at depths beneath the base of observed U-2bu waste is not likely to be performed since the steep slope of the crater walls presents a health and safety concern to site workers.

4.2 Site Preparation Activities

Prior to acquiring any characterization samples, all work areas will be demarcated, and sampling locations will be identified via stakes and/or flagging. Site preparation activities were conducted in January 1997 to assess the viability of this Characterization Plan and to determine the appropriate number of sampling locations for each study area. Precharacterization activities primarily included the following:

- Constructing a Satellite Accumulation Area (SAA) and a Radioactive Material Area (RMA) for site-generated wastes (Appendix C)
- Conducting a radiological survey of the crater for purposes related to human health and safety
- Installing four positioning/slip protection ropes from the crater trough to the crater bottom
- Performing hand-auger testing to determine the viability of the sampling technique
- Conducting a topographic survey of the entire crater

4.3 Sampling Activities

Sampling activities will not only focus on further characterizing observed waste within the crater, but will also focus on determining whether contaminants are present at levels of concern in other unidentified areas within the crater. Soil samples will be sent to an approved off-site laboratory for analysis of the COCs identified in Table 3-1. Volatile organic compound and semivolatile organic compound analyses will not be performed for surface soil samples. An appropriate number of QA/QC samples will be acquired for the crater as a whole. At least one surface geotechnical sample and at least one duplicate soil sample will be acquired from each study area. Surface and subsurface soil samples will be acquired from the general sampling locations identified in Figure 4-1 and summarized according to the following:

- Study Area 1 - 4 locations from the crater trough
- Study Area 2 - 6 locations from the crater gully
- Study Area 3 - 6 locations from the artificial alluvial fan
- Study Area 4 - 6 locations from the crater bottom
- Study Area 5 - 8 locations from the crater walls and/or rim

Source: RSI Photograph No. 9441-29, December 1997.

- ◆ Study Area 1 - 4 hand auger locations from the crater trough
- ▲ Study Area 2 - 6 hand auger locations from the crater gully
- ▼ Study Area 3 - 6 hand auger locations from the artificial alluvial fan
- Study Area 4 - 6 hand auger locations from the crater bottom
- Study Area 5 - 8 hand auger locations from the crater walls and/or rim

Figure 4-1
Hand-Auger Location Summary

Surface and subsurface samples will be acquired with hand-augering techniques. Due to the rocky conditions of site soils, subsurface soil samples may be acquired after digging with shovels or post hole diggers to a depth of at least 1.2 m (4 ft). If sampling is performed in this manner, a hand auger will ultimately be advanced beyond 1.2 m (4 ft) in order to acquire an uncompromized soil sample for VOC and SVOC analysis.

Sample selection will also be based on the results of on-site screening which may indicate the presence or absence of contamination. All soil samples will be field-surveyed on site and with standard field-screening techniques such as use of a radionuclide/radiation detector, a flame-ionization detector, and/or a photoionization detector. Additional (or fewer) characterization samples may be sent for off-site analysis based on field-screening results and/or field indications of potential changes in contaminant characteristics (i.e., contaminant type, concentration, mobility, soil color, etc.).

4.4 Sample Analysis

Tables 3-1 and 4-1 list the analytical methods that will be used for the characterization of U-2bu site soils. The choice of analytical methods is based upon the results of preliminary investigations, upon

Table 4-1
Geotechnical Methods for Site Characterization

Geotechnical Parameter	Analytical Methods
Initial moisture content	ATSM D 2216 ^a
Dry bulk density	EM-1110-2-1906 ^b
Calculated porosity	EM-1110-2-1906 ^b
Saturated/unsaturated hydraulic conductivity	ASTM D 5084 ^a
Particle size distribution	ASTM D 422 ^a
Atterberg Limits	ASTM D 4318-93 ^a
Water-release (moisture retention) curve	ATSM D 3152 ^a
Specific gravity	ASTM D 854-92 ^a

^a Annual Book of ASTM Standards, Section 4, "Construction," Volume 04.08, Soil and Rock (1), and Volume 04.09, "Soil and Rock" (11), 1996.

^b U.S. Army Corps of Engineers (USACE), Engineer Manual 111-2-19-6, *Laboratory Soils Testing*, Appendix II, 1970.

available process knowledge of previous U-2bu disposal activities, and upon applicable regulations related to site characterization. Based on the results of preliminary sampling and on a review of process knowledge, it is expected that potential contamination associated with the U-2bu crater consists primarily of radionuclides and RCRA-listed chemicals. Of primary interest related to site characterization, however, is the detection of RCRA-listed compounds, not radionuclides.

Geotechnical samples for physical parameter analysis (see Table 4-1) will be collected from one hand-augered borehole at each study area. These surface soil samples will be collected and analyzed in order to evaluate the physical characteristics of the underlying soil with respect to the potential migration of contaminants and to the influence of site geology on closure options.

5.0 Reporting

Upon completion of the field activities and upon receipt of analytical and data validation results (as applicable), a report of findings will be produced. The report will, at a minimum, include the following:

- Drawings of the site, including appropriate site boundaries, sampling locations, estimated boundaries of contamination, and other relevant features
- Brief discussions of the site characterization methods used, including soil sampling methods and materials utilized
- Information about the presence or absence of constituents of concern
- Tables summarizing laboratory analytical results and field screening data, where appropriate
- A discussion about the adequacy of the site characterization
- A discussion about the quality control data obtained for the site characterization
- Recommendations for site remediation or closure

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Appendix A

Data Quality Objectives Worksheets for the U-2bu Subsidence Crater, Area 2, Nevada Test Site, CAU No. 109

DATA QUALITY OBJECTIVES WORKSHEETS FOR THE U-2bu SUBSIDENCE CRATER, AREA 2, NEVADA TEST SITE - CAU NO. 109

Presentation of Known Data Related to the U-2bu Subsidence Crater, Area 2, NTS

These notes are based on historical data and the *Resource Conservation and Recovery Act* (RCRA) Site Characterization Plan for the Area 2 U-2bu Subsidence Crater (DOE/NV, 1994) at the Nevada Test Site (NTS). The notes follow the EPA DQO guidance outline (EPA, 1994). The steps systematically build on the data acquired during background research for the Characterization Plan (CHP). Copies of the background data are in project files.

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I. PROBLEM STATEMENT

A. State the problem.

Radioactive and hazardous wastes were disposed of in the U-2bu Subsidence Crater (U-2bu) between 1973 and 1988.

B. Summarize the contamination problem - combine the relevant background information into a concise description of the problem to be resolved.

1. Problem to be resolved

DOE plans to characterize the solid waste in the crater by determining which, if any, RCRA-listed constituents may be present. Characterization efforts will be performed in order to close the site through modification of the current *Resource Conservation and Recovery Act* (RCRA) permit. DOE will also determine if the solid waste possesses RCRA toxicity characteristics per criteria set forth in 40 CFR 261 (CFR, 1996).

2. List known or suspected sources of contamination.

The U-2bu Subsidence Crater was created by a Lawrence Livermore National Laboratory underground nuclear test, event name Miniata, in 1971 and was used as a land-disposal unit for radioactive and hazardous waste from 1973 to 1988. The crater has an average diameter of 288 meters (m) (944 feet [ft]), an approximate depth of 35 m (115 ft), and an estimated total surface area of 17 acres. The rim of the crater is encircled by a 1-meter (3-foot) high wire fence supplemented by an 2.4-meter (8-foot) high chain-link fence at the northern rim. The northern fence extends approximately 183 m (600 ft) in an east-west direction from the "dumping entrance" which consisted of a concrete trough with a metal lip that extended into the crater. The trough was approximately 3 m (10 ft) long by 1.5 m (5 ft) wide and discharged into an erosion gully on the side of the crater. At the bottom of the erosion gully is an artificial alluvial fan likely to be composed of additional waste material. At the bottom of the crater lies a dry ponding area created from the internal drainage of precipitation into the crater.

During the period 1973 to 1988, U-2bu was used as a land-disposal unit (Bingham, 1992a; Bingham, 1992b). Materials described to have been disposed include: drilling muds, decontamination rinsate, solvents in wastewater, and construction debris. After crater U9y was filled to capacity in 1979 or 1980, U-2bu was used for the disposal of post-shot and decontamination fluids normally placed in crater U9y. Drilling muds were trucked onto the trough and were dumped into the crater. After disposal of the drilling muds, the truck was rinsed with water, and the rinsate was disposed of in the crater. Materials from the Baneberry Event at U8d and Area 9 ITS tests, which may include materials from the Avens-Cream Event, were described to have been disposed in U-2bu. Additionally, on November 29, 1988, U-2bu received 3,500 gallons of wastewater from the Area 6 Decontamination Facility sumps which have been described to have contained solvents.

Approximately one month after the wastewater from the Area 6 Decontamination Facility sumps was disposed of, a soil investigation was conducted. The analytical results indicated that chlorobenzene, xylene, lead, and cadmium were present above regulatory levels. The analytical package from which the data are derived is incomplete, however (i.e., no chain-of-custody forms and missing analytical data).

II. DEVELOP/REFINE THE CONCEPTUAL MODEL

RCRA contaminants of potential concern (COPC), if present, are expected to be similar to wastes deposited in U9y. Solid wastes originated from radioactively contaminated drilling mud; liquid wastes originated from the drilling mud transport vehicles and from the Area 6 Decontamination Facility. Therefore, U-2bu wastes are currently considered mixed wastes.

The post-shot drilling muds disposed of in the U-2bu subsidence crater are likely to be muds from one or two different sources. The origin of the post-shot drilling muds could be: 1) excess, naturally radioactive drilling mud disposed of prior to drilling into highly radioactive material; or 2) excess, highly radioactive drilling mud inadvertently brought to the ground surface. Radioactive soil may also have been deposited from cleanup of the Baneberry Event. Therefore, radiologic concerns must also be considered in regards to the health and safety of workers characterizing the site and the disposition of waste generated during site characterization.

A. Primary Model

The primary model is considered the most probable scenario for current conditions at the U-2bu Subsidence Crater. Proposed characterization methods are based upon the following assumptions:

1. RCRA COPCs are primarily concentrated in post-shot drilling muds located within the gully and the artificial alluvial fan.
2. Hydrocarbons originating from liquid wastes are nondetectable or are at very low concentrations within the gully, the artificial alluvial fan, and/or the ponding area at the crater bottom.
3. Migration of RCRA COPCs is limited vertically and horizontally.

B. Alternate Model

Assumed conditions under the alternate model are considered less likely than assumed conditions under the primary model. Under the following conditions, the alternate model accounts for COPC migration beyond the immediate vicinity of the drilling muds:

1. Hydrocarbons originating from liquid wastes are present in detectable concentrations beneath and/or away from the gully, the artificial alluvial fan, and/or the ponding area at the crater bottom.
2. If vertical migration of COPCs is greater than approximately 1,715 feet, groundwater is potentially contaminated. This scenario is not considered likely.

III. IDENTIFY THE DECISION

Select the appropriate decision for the current phase of the site assessment process.

Due to the remoteness of the site and primarily to site accessibility issues, the following activities are currently suggested as the means by which U-2bu wastes are to be characterized within the trough, gully, artificial alluvial fan, and ponding area of the crater.

A. Characterize Nature of U-2bu Waste

The following activities are suggested for determining the nature of U-2bu wastes.

1. Phase I - Initial Screening/Survey

- a. Thoroughly survey the site by performing a preliminary radiation screening of surface soil for health and safety purposes.
- b. For soil sampling purposes, determine the maximum sampling depth reasonably achievable with hand augers.
- c. Survey crater to determine accurate area site map of zones of concern.

2. Phase II - Hand-Auger Sampling for Site Characterization

- a. Per standard operating procedures, acquire surface and hand-augered soil samples at maximum depths achievable for RCRA-listed COPCs identified in IV.C.4.
- b. Evaluate analytical data for detected RCRA-listed COPCs identified in IV.C.4.
- c. If RCRA-listed COPCs are detected above levels of concern, rescope Characterization Plans. If RCRA-listed COPCs are not detected above levels of concern, modify the current RCRA permit and close the site.

IV. IDENTIFY THE INPUTS TO THE DECISION

A. Identify the information inputs needed and resolve the decision.

Contaminant Identification: Analyze soils for RCRA-listed COPCs identified in IV.C.4. in the following areas:

1. Within the diversion trough above the alluvial fan
2. Within the eroded gully along the crater wall
3. Within the artificial alluvial fan
4. Within the ponding area at the crater bottom
5. Along crater walls and around crater rim

Action Level Exceedences: Analytical results will be evaluated to support permit modification for site closure.

Contaminant Migration: If RCRA-listed COPCs are detected above levels of concern, rescope Characterization Plans.

Closure Requirements: Characterization Plan should address all foreseen data acquisition requirements necessary for site closure.

Also to be considered

- Site Access/Health and Safety Issues
- Waste Management Issues

B. List types of contaminants and affected media.

Affected media are the observed wastes within the crater to be analyzed for the following types of contaminants:

1. Volatile organic compounds (VOCs) - subsurface soil
2. RCRA metals - surface and subsurface soil
3. Semivolatile organic compounds (SVOCs) - subsurface soil
4. Total Petroleum Hydrocarbons (TPH) as oils and greases - surface and subsurface soil
5. PCBs - surface and subsurface soil

C. Identify potential sampling approaches and appropriate analytical methods.

1. Utilize hand-augering techniques when performing biased sampling during the field investigation to confirm or refute the conceptual model for the site and to determine if COPCs are present at levels of concern.

2. Characterize entire crater, but in general, investigate the contents of the trough, gully, artificial alluvial fan, and ponding area at the crater bottom. Regions containing detected RCRA-listed compounds above levels of concern would necessitate horizontal step-out and/or deeper sampling, as necessary, to investigate the potential for migration of subsurface contaminants (CFR, 1996).
3. If drilling becomes necessary, additionally collect site-specific geotechnical samples applicable to evaluating remediation and/or closure options.
4. Analytical parameters selection is based on process knowledge of waste disposal at U-2bu where the following RCRA COPCs are considered:
 - a. Total VOCs - EPA Method 8260
 - b. Total SVOCs - EPA Method 8270
 - c. Total RCRA Metals - EPA Method 6010/7470
 - d. Total petroleum hydrocarbons - EPA Method 8015 for gasoline, diesel, and oil fractions
 - e. PCBs - EPA Method 8080

The following geotechnical analyses are also included:

- a. Initial moisture content
- b. Dry bulk density
- c. Calculated porosity
- d. Saturated/unsaturated hydraulic conductivity
- e. Particle size distribution and hydrometer
- f. Moisture retention characteristics
- g. Atterberg limits

V. DEFINE THE BOUNDARIES OF THE STUDY

A. Define the geographic areas of the field investigation.

1. **Define the domain or geographic area within which all decisions must apply (in some cases this may be defined by the Corrective Action Unit)**

The study area specifically concerns entire U-2bu Subsidence Crater and, of special concern, the observed waste found in the trough area, the gully area, the artificial alluvial fan area, and the artificial ponding area at the crater bottom. In short, the primary study area encompasses zones where waste material is physically observed. Administrative controls with respect to site entry and egress are already in place via fencing around the entrance to the site.

2. Specify the characteristics that define the population of interest

The population of interest is the observed waste present in the trough, gully, artificial alluvial fan, and ponding area within the crater.

B. Define the temporal boundaries of the decision

1. Determine the time frame to which the study data apply

- a. Laboratory holding times must be considered for the acquired soil samples.
- b. The deadline for the Closure Plan is March 5, 1999.
- c. Migration (if occurring) is assumed to be imperceptibly slow with no waste input since 1988 and minimal surface water infiltration.
- d. The time frame begins after the Characterization Plan is approved and allows for finalizing the data in preparation for the request for permit modification.

2. Determine when to collect data

Field activities (data collection) are scheduled to take place in April 1998. Data will not be collected during electrical storms, heavy winds, or during holidays.

3. Define relevant time constraints

The Final Characterization Report will be delivered to NDEP on October 27, 1998

C. Identify any practical constraints on data collection

1. Testing operations (NTS security constraints)
2. Equipment access, operation, and mobility within the crater
3. ALARA considerations
4. Remoteness of the site
5. Approval of the Characterization Plan
6. Meteorological
7. Heavy equipment availability
8. Health and safety of workers

VI. DEVELOP A DECISION RULE - DEFINE A LOGICAL BASIS FOR CHOOSING AMONG ALTERNATIVE ACTIONS

A. Specify the action level or preliminary action level for the decision

Acquired analytical results will be evaluated with regard to modification of the current RCRA permit for site closure (NDEP, 1995a).

VII. OPTIMIZE THE DESIGN - OUTLINE A SAMPLING DESIGN, SPECIFYING THE OPERATIONAL DETAILS OF THE SAMPLING PLAN WHICH FALLS WITHIN THE PROJECTS CONSTRAINTS

A. Develop general sampling and analysis design alternatives

Refer to Step III for the sampling strategy.

B. Select the most resource-effective design that satisfies all of the DQOs

The most resource-effective design that satisfies all of the DQOs is a phased approach for characterization leading to permit modification for site closure. Under the phased approach, site safety is addressed prior to the advancement of hand-augered soil samples representative of the localized areas of concern. Soil samples will be collected for laboratory analysis as outlined in Step IV.C.4.

C. Document the operational details and theoretical assumptions of the selected design in the sampling and analysis plan

Detailed documentation of sampling and analysis operations will be contained in the Characterization Plan and associated field instructions or standard operating procedures. NDEP will walk the site and assist DOE with the determination of an adequate number of soil borings to represent characterization of the various areas of concern.

Appendix B
Environmental Setting

B.1.0 Environmental Setting

The environmental setting of the U-2bu Subsidence Crater location plays an important role in characterizing the migration pathways for RCRA contaminants of potential concern.

B.1.1 Climate

The continental arid climate of the NTS is typical of the southwestern high desert region and is characterized by large diurnal temperature ranges, limited precipitation, and low relative humidity (DOE, 1986; Gonzalez, 1988). The hottest months are generally July and August, with an average monthly temperature of about 24.8 degrees Celsius (°C) (76.6 degrees Fahrenheit [°F]) and an average diurnal temperature range of nearly 22 °C (72 °F). Temperatures at or near freezing have been recorded in all months except July and August. December is usually the coldest month of the year, with a monthly average temperature of approximately 1.8 °C (35.3 °F). At Yucca Flat, recorded temperature extremes range from 46 to -26 °C (115 to -15 °F).

The NTS lies in one of the most arid parts of Nevada, the most arid state in the nation. Pacific air masses generally drop most of their moisture on the western slopes of the Sierra Nevada Mountains, and little moisture is left to precipitate on the eastern slopes. Precipitation that does reach the area is concentrated in the winter months, but summer thunderstorms can also be significant sources of moisture (DOE, 1986).

Precipitation at the NTS ranges from 8 centimeters (cm) (3 inches [in.]) in the flats to 28 cm (11 in.) in upland areas. Rainfall at Yucca Flat averages about 18 cm (7 in.) per year (DOE, 1988). The evaporation of standing water at Yucca Flat is at least 150 cm (60 in.) per year and perhaps as high as 200 cm (80 in.) per year (DOE, 1988).

Wind direction, as measured at a 30-meter (m) (98-foot [ft]) tower at the Yucca Flat weather observation station, is generally from the north, except during the months of May through August when south-southwesterly winds predominate. Wind speeds measured at the Yucca Flat station average 10 kilometers per hour (km/h) (8 miles per hour [mph]), or 3.6 meters per second (m/s) (11.8 feet per second [ft/s]), with maximum average wind speeds of about 23 km/h or 6.3 m/s (14 mph or 20.7 ft/s) associated with spring and summer southerly winds (DOE, 1986).

B.1.2 Biological Resources

A total of 706 taxa of vascular plants representing 67 families have been collected within or near the boundaries of the NTS. The greater part of the NTS is vegetated by various associations of desert shrubs representative of the Great Basin and Mojave Desert and the transition zone between the two. Vegetation at the higher elevations of the NTS may be described as desert- shrub/woodland. Typically, desert-shrub associations appear as scattered individual plants or clumps of plants with large areas of bare soil or rock between. Coverage of the soil surface by shrubs is generally in the range of 15 to 30 percent. Although desert shrubs or desert shrub/woodland associations predominate, herbaceous plants are also numerous on the NTS. About one third of the herbaceous plants belong to one of three families (i.e., Compositae, or sunflower family; Gramineae, or grass family; and Polygonaceae, or buckwheat family) (ERDA, 1977).

Animals at the NTS include small mammals (e.g., rats and mice), larger mammals (e.g., coyotes), birds, arthropods (e.g., insects, spiders, and scorpions), and reptiles (e.g., snakes and lizards). The only plant or animal species identified on the NTS that is currently listed or proposed for listing under the *Endangered Species Act of 1973* is the desert tortoise (*Copherus agassizii*), which was listed as a threatened species in 1990.

The U-2bu Subsidence Crater is north of the desert tortoise range at the NTS (Figure B.1-1); however, prior to initiation of site characterization activities, an areal survey will be performed to ensure that proposed activities will not disturb potential desert tortoise habitats.

B.1.3 Topography

The NTS lies in the Great Basin section of the Basin and Range physiographic province that encompasses Nevada, Arizona, and western Utah. The Basin and Range province was formed by east-west tectonic extension that stretched the original crust over 100 percent. Large north-south-striking normal faults accommodated the extension, resulting in long, thin, parallel, north-south-oriented mountain ranges separated by down-dropped basins. The ranges are steep-sided and are relatively constant in elevation and width. The basins are broad and flat.

On the NTS, the higher elevations are on Pahute Mesa, approximately 2,200 m (7,230 ft) above mean sea level (amsl), and Rainier Mesa, approximately 2,340 m (7,690 ft) amsl. The lowest elevations are

Figure B.1-1
Approximate Distribution of the Desert Tortoise at the Nevada Test Site

in Frenchman Flat and Jackass Flat, both at approximately 900 m (3,000 ft) amsl. The NTS can be generally described as ranging from 900 to 1,370 m (3,000 to 4,500 ft) amsl in the valleys to the south and east and rising to 1,700 to 2,100 m (5,600 to 6,900 ft) amsl in the high country toward the northern and western boundaries (ERDA, 1977). Yucca Flat lies more than 1,200 m (4,000 ft) amsl. The U-2bu Subsidence Crater is about 1,280 m (4,190 ft) amsl.

There are three principal valleys within the NTS: (1) Yucca Flat, a north-south elongated, closed basin with Yucca Lake, a dry lake (playa), at the southern end; (2) Frenchman Flat, an oval-shaped closed basin, with Frenchman Lake (a playa) at the center; and (3) Jackass Flat, a valley that drains off the NTS at its southwest corner. Pahute Mesa, Rainier Mesa, Timber Mountain, and Shoshone Mountain are prominent highland areas that dominate the NTS landscape (ERDA, 1977).

Figure B.1-2 shows major topographical features of the NTS.

Yucca Flat is approximately 100 km (80 mi) northwest of Las Vegas. It is 31 km (19 mi) long and 16 km (10 mi) wide, with elevations ranging from 900 to 1,400 m (3,000 to 4,600 ft) (DRI, 1988). The U-2bu Subsidence Crater is situated in the northern part of Yucca Flat. The site topography consists of semi-flat surfaces with small drainages.

B.1.4 Geology

An understanding of the geology of the NTS has developed over several decades of surface, subsurface, and geophysical investigations in support of the weapons-testing program. The following sections provide general information about NTS soils, stratigraphy, and tectonic activity, with emphasis on the Yucca Flat area. Currently, there are no site-specific data for alluvial characteristics; however, this information will be obtained as part of the site characterization process.

B.1.4.1 Soils

Soils are important because of their physical and chemical properties in retarding the migration of contaminants of potential concern. The mesa and upland areas in the northwestern section of the NTS contain soils developed from local bedrock that weathered in place. The smaller mountains and ridges in the southern and eastern parts of the NTS are completely eroded to bedrock or contain thin residual soils. Their slopes are covered by coarse alluvial deposits that fan onto the plains of the basins. The basins contain very thick, finer-textured alluvial soils up to 600 to 900 m (2,000 to

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LEGEND

- Primary highway
- Nevada Test Site

Figure B.1-2
Topographic Features of the Nevada Test Site and Vicinity

3,000 ft) thick in the central portions of the valleys. These soils are mainly derived from tuffs and limestones and include quartzite, shale, dolomite, and granite washed down from the surrounding mountains. The NTS soils are generally alkaline (pH 8 to 9) and tend to be well-drained except through any hardpan, where infiltration is very slow. They have a low moisture content of 3 to 9 percent (DOE, 1988). Deep soil-water movement (below the depth of active evaporation and transpiration) is possible in areas where the surface is highly permeable (e.g., mesa tops, fractured bedrock surface, and wash bottoms).

The U-2bu Subsidence Crater is located in Quaternary and Tertiary valley fill composed of alluvial fan, fluvial, fanglomerate lake-bed, and mud flow deposits overlying ash-fall and ash-flow tuffs of Tertiary age, massively altered to zeolite or clay (Winograd and Thordarson, 1975).

B.1.4.2 Stratigraphy

A generalized stratigraphic column for the NTS is shown in Figure B.1-3. The subsurface geology at the NTS can be described in terms of three major rock units (ERDA, 1977): (1) complexly folded and faulted Paleozoic and Precambrian sedimentary rocks overlain in many places by (2) Cenozoic volcanic tuffs and lavas, which in the valleys are covered by (3) late Cenozoic alluvium (i.e., Quaternary and Tertiary) that was derived from erosion of the nearby hills of Cenozoic and Paleozoic rocks. The volcanic rocks in the valleys are downdropped and tilted along steeply dipping normal faults of late Tertiary age; although uncommon, the overlying alluvium may be faulted. The Paleozoic rocks have undergone major deformation, produced mainly by thrust faulting in the Mesozoic. The Cenozoic rocks are relatively undeformed, and dips are generally gentle.

Figure B.1-4 shows a generalized geologic map of the NTS.

The Paleozoic sedimentary rocks are thousands of feet thick and are comprised mainly of marine carbonate rocks (dolomite and limestone) with a middle section of clastic rocks (shale and quartzite) (ERDA, 1977). Precambrian and Lower Cambrian clastic rocks form the lower clastic aquitard. The lower Paleozoic carbonate rocks, deposited between the Middle Cambrian and the Devonian Periods, form the lower carbonate aquifer. The middle Paleozoic clastic rocks (Eleana Formation), deposited during the Mississippian, form the upper clastic aquitard. Upper Paleozoic carbonate rocks (Tippipah Limestone, deposited during the Permian/Pennsylvanian) form the upper-carbonate aquifer.

Geologic Time Divisions			General Lithology	Hydrogeologic Units
ERA	PERIOD			
Cenozoic	Quaternary-Tertiary		Valley-Fill Alluvium, Basalt	Lava Flow & Valley Fill Aquifers
	Tertiary		Paintbrush Tuff	Welded-Tuff Aquifers
		Tuff, Ash Flows, Ash Falls, Basalts	Tuff & Lava Flow Aquitards
Paleozoic	Permian/Pennsylvanian		Primarily Marine Carbonates	Upper Carbonate Aquifer
	?		Primarily Marine Clastics	Upper Clastic Aquitard
	Mississippian		Primarily Marine Carbonates	Lower Carbonate Aquifer
	?			
	Devonian			
	Silurian		Primarily Marine Sandstones	Lower Clastic Aquitard
	Ordovician			
Precambrian	Cambrian		Igneous-Metamorphic Complex	

? Refers to an uncertain boundary
No vertical scale inferred
Source: DOE/NV, 1994

Figure B.1-3
Generalized Stratigraphic Column for the Nevada Test Site

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Source: DOE/NV, 1994

LEGEND

-
Qa Alluvial Deposits: Locally includes beach and sand dune deposits.
-
Qp Playa Deposits: Playa, marsh and alluvial-flat deposits, locally eroded.
-
Cv Cenozoic Volcanic Rocks: Consists primarily of silicic ash-flow tuffs, air-fall tuffs and tuffaceous sedimentary rocks. Also contains localized basalt flows, rhyolitic flows and intrusives, and andesitic flows and breccias.
-
Mzi Mesozoic-Granitic Plutonic Rocks: Predominantly quartz monzonite and coarsely porphyritic granodiorite.
-
Pz Paleozoic Sedimentary Rocks: Consists predominantly of carbonate facies, with local shales, siltstones, sandstones, and conglomerates.

Figure B.1-4
Generalized Geologic Map of the
Nevada Test Site

The Cenozoic volcanic rocks are predominantly rhyolitic tuffs and lavas extruded from various volcanic centers (ERDA, 1977). They vary widely in distribution, thickness, and lithology. The surface on which the oldest Cenozoic volcanics were deposited had substantial topographic relief (up to 600 m [2,000 ft]) that was later filled by volcanic extrusions. The degree of welding in the tuffs also varies widely throughout the area. The Cenozoic tuffs form the tuff aquifers and aquitards. Associated Cenozoic sedimentary rocks are conglomerates, tuffaceous sandstones, lacustrine limestones, and claystones.

Late Cenozoic alluvial materials are 600 to 900 m (2,000 to 3,000 ft) thick in the central portions of the valleys and form the valley-fill aquifer. The site-specific geotechnical characteristics of the alluvium are currently unknown; these data will be obtained from site characterization activities. The alluvium in Yucca Flat is offset along the prominent north-south trending Yucca Fault, a geologically recent offset marked by a conspicuous topographic scarp in the northern and central portion of Yucca Flat (ERDA, 1977). An east-west cross section showing Yucca Flat structure and stratigraphy near the U-2bu Subsidence Crater is shown in Figure B.1-5.

B.1.4.3 Tectonic Activity

Extensional block faulting (normal faulting) in the late Tertiary (Miocene) to early Quaternary characterizes the entire Basin and Range physiographic province. The present topography of the province reflects the underlying faulted structure. The displacement on these faults varies but is generally less than 150 m (500 ft). However, the displacement on some of the faults is much greater.

Tectonic activity continues today. Recent sediments in Yucca Flat are vertically offset by faulting along the Yucca Fault. The alluvium at the surface is geologically young, and, therefore, the changes in topography indicate that movement has occurred along the Yucca Fault sometime during the last few thousand to tens of thousands of years (DOE, 1988). The near-surface expression of the Yucca Fault System is located between 350 and 460 m (1,150 and 1,500 ft) east of the Area 2 U-2bu Subsidence Crater.

The faults in the Yucca Fault System dip to the east, away from the Area 2 U-2bu Subsidence Crater. This fault may serve as a pathway for migration of contaminants of potential concern from the U-2bu Subsidence Crater to the subsurface.

LEGEND

- Quaternary and Tertiary valley fill
- Ashfall and ashflow tuff massively altered to zeolite or clay: includes some tuffaceous and clayey lake and fluvial deposits: predominantly rocks of the Indian Trail Formation: also includes rocks of Pavits Spring and Salyer Formation in southern Yucca Flat
- Eleana Formation
- Paleozoic carbonate rocks; includes minor shale and quartzite
- Fault showing relative movement
- Potentiometric surface in Pre-Tertiary rocks

Datum is mean sea level
Source: DOE/NV, 1994

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Figure B.1-5
East-West Cross Section of Yucca Flat

Since the initiation of block faulting, the resultant basins (e.g., Yucca Flat) have received deposits from highland areas. These valley-fill deposits range from hundreds to thousands of meters thick and consist of unconsolidated alluvial gravel, sand, and silt, with some lacustrine limestones.

B.1.5 Hydrology

The Colorado River and Lake Mead, which comprise the two main sources of surface water in southern Nevada, are hydrologically isolated from the NTS area and do not receive runoff from the NTS. Regional groundwater flow is toward Death Valley. Aquifers that transmit groundwater in relatively high volume include the lower and upper carbonate units, Tertiary welded and bedded tuffs, and Quaternary-Tertiary valley-fill deposits.

B.1.5.1 Surface Water

The only perennial surface-water bodies on the NTS are several small springs and associated pools that occur on the flanks of ranges or the edges of topographic basins. The sources of spring recharge are perched, saturated zones in the highland ranges (Winograd and Thordarson, 1975). Surface-water features near the NTS are shown in Figure B.1-6. Localized surface drainage basins and their corresponding flow patterns at the NTS are shown in Figure B.1-7.

Yucca Flat is a playa on the NTS that receives and collects surface runoff during heavy precipitation. The runoff collects at Yucca Lake, an ephemeral surface-water body at the southern end of Yucca Flat. The U-2bu Subsidence Crater is approximately 23 km (14 mi) north of the northern margin of Yucca Lake. Runoff does not tend to accumulate in the vicinity of the U-2bu Subsidence Crater. It is unlikely contaminants of potential concern will migrate in surface water, infiltrate, and be discharged at springs because the U-2bu Subsidence Crater lies at a elevation lower than the NTS springs and is downgradient from any perched zones in the surrounding uplifted ranges (i.e., spring recharge sources).

B.1.5.2 Groundwater

Regional groundwater basins present beneath the NTS are shown in Figure B.1-8. The Ash Meadows groundwater basin lies under the eastern two thirds of the NTS (which encompasses Yucca Flat, including the U-2bu Subsidence Crater) and adjacent areas to the north and east of the NTS.

Figure B.1-6
Surface Water Features Near the Nevada Test Site

Figure B.1-7
Localized Surface Drainage Basins

Source: ERDA, 1977

LEGEND

- Paved road
- - - Groundwater basin boundary
- ➔ Direction of regional groundwater movement

Figure B.1-8
Regional Groundwater Basins

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Numerous studies at the NTS have resulted in a general understanding of regional groundwater characteristics. Hydrogeologic units have been mapped and are shown in Figure B.1-9. Aquifers, those hydrogeologic units that transmit groundwater in relatively high volumes, include the lower Paleozoic (Cambrian-Devonian) carbonates, upper Paleozoic (Pennsylvanian-Permian) carbonates, Tertiary welded and bedded tuffs (including the Paintbrush and overlying tuffs), and Quaternary-Tertiary valley-fill deposits. Aquitards, the hydrogeologic units that do not readily transmit groundwater, occur in Precambrian-Cambrian clastic units, middle Paleozoic clastic units, and Tertiary (pre-Paintbrush) tuffs and associated rocks.

Beneath the central part of Yucca Flat, the volcanic and Paleozoic rocks are saturated; the lower part of the valley fill is also saturated. Bedrock faulting has produced deep grabens in the southern part of the basin, where over 600 m (2,000 ft) of valley fill may be saturated. The depth to the water table ranges from approximately 460 m (1,500 ft) near the southern end of the valley to approximately 580 m (1,900 ft) at the northern end of the valley (DRI, 1988). Within Yucca Flat, both the carbonate aquifers and the valley-fill aquifers are used for water supply.

There is a vertical potentiometric gradient between aquifers in the valley fill, the volcanics, and the Paleozoic rocks. The shallower units have higher potentiometric heads than the deeper units. Regionally, groundwater migrates through the valley fill and volcanic units to the carbonate units. Groundwater flows southward from Yucca Flat to Frenchman Flat through the carbonate rocks with eventual discharge to springs in the Ash Meadows area of the Amargosa Desert. The discharge area is about 68 kilometers (km) (42 miles [mi]) southwest of the U-2bu Subsidence Crater. Estimated flow velocity in the lower carbonate aquifer ranges from 0.06 to 0.6 meters per day (m/day) (0.2 to 2 feet per day [ft/day]) (DRI, 1988).

Two groundwater test wells are located within 1.9 km (1.2 mi) of the U-2bu Subsidence Crater. Well 85-68 is about 2 km (1 mi) east of the crater and taps the lower carbonate aquifer. At this test well, the elevation of the static water level in the lower carbonate aquifer is 728 m (2,387 ft) amsl (Winograd and Thordarson, 1975). Well 85-67 lies 1.4 km (0.9 mi) south of the crater. No information about this well is available. No water supply wells are in the vicinity of the crater.

The depth to the water table at the U-2bu Subsidence Crater (as measured from the rim of the crater) is about 523 m (1,715 ft). Beneath the U-2bu Subsidence Crater, the water table lies in the tuff

aquitard. The thickness of the unsaturated zone suggests that it is highly unlikely that contaminants of potential concern will migrate from the crater to groundwater via downward movement through the unsaturated zone. However, the possibility exists for accelerated vertical migration of contaminants of potential concern through local fractures. Pathways for migration of contaminants of potential concern from the U-2bu Subsidence Crater to groundwater sources will be assessed during site characterization.

Appendix C
Waste Management Plan

C.1.0 Waste Management

Management of Investigation-Derived Waste (IDW) will be based on regulatory requirements, field observations, and analytical results of U-2bu site characterization samples. Decontamination activities will be performed according to approved procedures for removing site-specific COCs from equipment and according to approved field sampling instructions provided by the contractor.

Solid materials are waste only by virtue of contact with contaminated media. Therefore, separate sampling and analysis of IDW samples from site characterization samples will not be required. The data generated as a result of site characterization will be used to assign the appropriate waste type (i.e., sanitary, hazardous, low-level radioactive, or mixed) to the IDW.

Sanitary, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with DOE Orders, U.S. Department of Transportation regulations, RCRA regulations, Nevada Revised Statutes, and agreements and permits between DOE and NDEP. Site characterization and decontamination procedures and strategy are intended to minimize the waste generated during the investigation.

In the following sections, operational requirements are provided for managing sanitary, hazardous, low-level radioactive, and mixed wastes. However, when the waste is initially generated, the waste will be managed according to mixed waste requirements until laboratory analyses are received and a final waste determination can be made.

C.1.1 Waste Minimization

Characterization activities, including the proposed field technique of hand-auger borings, have been planned to minimize the amount of IDW generated. Because of the significant health and safety constraints involved in moving material up and down the crater walls of U-2bu, only soil required for sampling will be collected and containerized. Remaining soil will be placed back into the hand-augered borehole. Decontamination activities are planned to minimize the use of rinsate and limit the need to move material up and down the crater walls; decontamination materials will consist of detergent, deionized water, and wipes. The hand auger will be decontaminated at each borehole, and the rinsate will not be captured. Waste, such as disposable sampling equipment and Personal

Protective Equipment (PPE), will be containerized and segregated to the greatest extent possible (such as by borehole).

C.1.2 Potential Waste Streams

Historical records and process knowledge (Bingham, 1992a; Bingham, 1992b) indicate that potentially hazardous materials were disposed of in the U-2bu Subsidence Crater. Wastes generated during the investigation activities will include the following:

- Sanitary wastes (such as paper and food articles) from outside the controlled area
- Contaminated disposable sampling equipment (such as plastic, paper, sample containers, aluminum foil, or stainless steel spoons, scoops, or bowls) from inside the controlled area
- Personal Protective Equipment from inside the controlled area

For administrative purposes, the waste generated from inside the controlled area will be managed as one waste stream. Segregation will occur within this waste stream by placing the waste generated at each borehole in a plastic bag numbered by borehole.

C.1.3 Investigation-Derived Waste Management

To allow for the segregation of radioactive and nonradioactive materials, radiological swipe surveys will be conducted on reusable sampling equipment and waste streams exiting from within the controlled area. Swipeable contamination limits, as defined in Table 2-2 of the DOE/NV Radiological Control Manual (DOE/NV, 1996b), shall be used to determine if such materials may be declared nonradioactive. Once a radiological or nonradiological disposition has been made for a particular waste stream, a sanitary or hazardous waste disposition will be made. The final disposition of such wastes will be determined by evaluating the analytical results of acquired soil samples. Management requirements for sanitary, Low-Level Waste, Hazardous, and/or mixed U-2bu wastes are discussed further in the following sections.

C.1.3.1 Sanitary Wastes

Sanitary waste generated outside the controlled area will be contained in plastic bags and will be transported to an NTS-managed solid waste management unit. Potential sanitary waste generated

from within the controlled area will be swiped to determine if the swipable contamination is under the limits defined in Table 2-2 of the DOE/NV Radiological Control Manual (DOE/NV, 1996b).

Analytical results from the swipe surveys will be used for determining if swipeable materials will be declared nonradioactive, and analytical results from soil sampling will be used for determining if the materials will be declared sanitary.

C.1.3.2 Low-Level Waste

Low-level waste, if generated, will be managed in accordance with the contractor-specific waste certification program plan and the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (DOE/NV, 1997). The low-level waste will be placed in plastic bags marked with the date and an associated borehole number. The bags will be tagged with a contractor-specific waste tracking tag and will be placed in designated storage drums labeled "Hazardous Waste Awaiting Analysis." The drums will be locked or fitted with tamper-indicating devices (TIDs). Traceability shall be maintained by assigning unique waste tracking numbers to each container and by maintaining records that trace the IDW back to the original sampling locations. The drums will be staged at a designated Radioactive Materials Area pending certification and disposal under NTSWAC requirements (DOE/NV, 1997).

C.1.3.3 Hazardous Waste

All waste streams exiting the controlled area will be considered hazardous until the analytical results from soil sampling are evaluated. The suspected hazardous waste will be managed in accordance with RCRA and State of Nevada hazardous waste management regulations, interpreted as follows. Suspected hazardous waste will be placed in 55-gallon drums that meet U.S. Department of Transportation (DOT) specifications (49 CFR 172) (CFR, 1997) which will be locked or fitted with TIDs. The IDW shall be containerized in a manner to comply with Subpart I of 40 CFR 265 (CFR, 1996), and the drums shall be compatible with the waste in accordance with the requirements of 40 CFR 265.172 (CFR, 1996). No incompatible wastes are expected to be generated; however, if incompatible waste is encountered in the field, such waste will be managed in accordance with 40 CFR 265.177 (CFR, 1996) (i.e., shall not be placed in the same container) and shall be separated such that in the event of a spill, leak, or release, incompatible wastes shall not contact one another.

Drums shall be handled and inspected in accordance with the requirements of 40 CFR 265.173 and 174, respectively (CFR, 1996).

Hazardous waste shall be characterized in accordance with the requirements of 40 CFR 261 (CFR, 1996). Hazardous waste characterization will be based on laboratory results. Drums containing IDW pending characterization will be marked with the words "Hazardous Waste Awaiting Analysis" until its regulatory status can be determined through interpretation and evaluation of laboratory results. The IDW shall be traceable to its source and/or samples considered analogous to the IDW (such as PPE associated with a sample). Traceability shall be maintained by assigning unique waste tracking numbers to each container and by maintaining records that trace the IDW back to the original samples. After receipt of analytical results, hazardous wastes, if identified, will be labeled and marked in accordance with the requirements of 40 CFR 262.32 (CFR, 1996) and State of Nevada requirements (NAC, 1996a) to include writing the EPA hazardous waste number on the hazardous waste label.

Alpha and gamma spectroscopy are included in the required site characterization analyses to determine if the waste will meet the objectives for certification as nonradioactive waste (BN, 1995). Hazardous waste shall be analyzed by these methods in order for the waste to be eligible for off-site shipment to a permitted treatment, storage, and disposal site.

Hazardous waste management methods will include the establishment of Satellite Accumulation Areas or a 90-day Hazardous Waste Accumulation Area which will be employed to temporarily accumulate IDW pending characterization. These methods will be appropriate for the amount of waste being accumulated and will be in compliance with applicable State of Nevada and federal requirements.

Hazardous waste will be accumulated at or near the site of generation for up to 90 days in accordance with 40 CFR 262.34 (CFR, 1996). Prior to or on the 90th day of accumulation as specified in 40 CFR 262.34 (a) (CFR, 1996), hazardous waste will be shipped by a licensed/permitted hazardous waste transporter to a permitted treatment storage and disposal facility. When required, a copy of the uniform hazardous waste manifest shall be provided to the State of Nevada.

C.1.3.4 Mixed Wastes

Mixed waste, if generated, shall be managed in accordance with RCRA (40 CFR 262) (CFR, 1996) and State of Nevada NAC 444 (NAC, 1996a) regulations. These regulations, as well as NTSWAC requirements (DOE/NV, 1997) for radioactive waste, are interpreted as follows. Where there is a conflict in regulations or requirements, the most stringent regulation or requirement shall apply. For example, the 90-day accumulation time limit and weekly inspections per RCRA regulations will be applied to mixed waste even though it is not required for radioactive waste. Conversely, while RCRA does not require documented traceability, the waste acceptance program for low-level waste does; therefore, traceability shall be documented as described in Section 1.3.2.

In general, mixed waste shall be managed in the same manner as hazardous waste, with added mandatory radioactive waste management program requirements. Suspected mixed waste will be managed in accordance with applicable regulations and requirements and will be marked with the words "Hazardous Waste Awaiting Analysis" pending characterization and confirmation of its regulatory status. However, once the waste determination is made, or the 90-day clock draws to a close, mixed waste shall be transported to the NTS transuranic waste storage pad for storage pending treatment or disposal. Mixed waste with hazardous waste constituents below land disposal restrictions may be disposed of at the Area 5 Radioactive Waste Management Site.

Mixed waste not meeting land disposal restrictions will remain in Area 5 and will require development of a treatment plan under the requirements of the Mutual Consent Order between DOE and the State of Nevada (NDEP, 1995b).

Appendix D

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT

DOCUMENT REVIEW SHEET

(Page 1 of 5)

1. Document Title/Number: RCRA Part A Permit Characterization Plan for the U-2bu Subsidence Crater DOE/NV--499			2. Document Date: February 23, 1998	
3. Revision Number: Revision 0			4. Originator/Organization: IT Corporation	
5. Responsible DOE/NV ERP Subproject Mgr.: Janet Appenzeller-Wing			6. Date Comments Due: April 9, 1998	
7. Review Criteria:				
8. Reviewer/Organization/Phone No.: David Poley/IT Corporation/702.295.2033			9. Reviewer's Signature:	
10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
Section 1.1 Purpose	M	The objective is to characterize the U2-bu Subsidence Crater to satisfy a requirement of Permit NEV HW009 (Permit), not acquire enough information to modify the permit. Modification of the Permit will not be considered, as the permit contains sufficient latitude in Section V. A. 1 and V. A. 2. The NDEP previously addressed this in a letter, Libendorfer to Wycoff 2/20/98. The DOE/NVO will remove all references to modification of the Permit from the Characterization Plan.	Comment noted. All references to modification of the Permit have been removed and replaced with a statement concerning site closure under the conditions of the current Permit.	
Section 1.2 Scope	S	Complete delineation of a "contaminant plume" is not considered strictly necessary, however the Department of Energy, Nevada Operations (DOE/NVO) must accumulate sufficient information upon which to base a closure plan for review by the state.	Comment noted. Related text has been modified to read, "The sampling strategy is to characterize the study area soils and look for RCRA constituents."	
Section 1.3 Data Quality Objectives (DQOs)	S	As the DQO process is by definition an "iterative process," the proposed hand auguring may be insufficient to characterize the Site fully. If the DOE/NVO is unable to collect sufficient data with this method, U2-bu may require further characterization.	Comment noted. Additional characterization may be required upon evaluation of analytical results of acquired soil samples.	

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10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
Section 2.1 Waste Inventory	M	The U2-bu Subsidence Crater disposal site was active for the period 1973 to 1988. Disposal activities involving waste associated with the Baneberry Event, Area 9 Integrated Test Series (ITS) Avens-Cream Event and the area 6 Decontamination Pond has occurred into U2-bu. There is no information provided with respect to waste inventories, other than the Decon Pond in this section. The Department of Energy, Nevada Operations (DOE/NVO) must provide in-depth process history for waste types and/or quantities of waste disposed, then this section would conflict with Section 3.0 Objectives, Table 3-1. Should historical information not exist (i.e., disposal has not been fully documented) or is incomplete, a waste determination under 40 CFR 261.24 Toxicity Characteristic, must also be made with respect to Volatile and Semi-Volatile Organic.	Comment noted. With the exception of Area 6 Decontamination Ponds waste which was disposed of at U-2bu, there is inadequate process knowledge of waste disposal practices within the U-2bu Subsidence Crater. The end of Section 2.1 acknowledges that U-2bu wastes types and volumes are not fully documented. For the purpose of making a waste determination in accordance with 40 CFR 261.24 at U-2bu, wastes that were considered "listed" at the Area 6 Decontamination Pond will be considered "listed" at U-2bu. All other identified wastes at U-2bu will be considered "characteristic," unless additional process knowledge is identified that would require such wastes to be considered "listed." The EPA has issued guidance that allows a generator to use Method 1311, the Toxicity Characteristic Leaching Procedure (TCLP), or to substitute total waste analysis in order to demonstrate that a waste does not exhibit the toxicity characteristic. If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that the analytes are present at such a low concentration that appropriate regulatory levels could not be exceeded, the TCLP procedure does not need to be run. Analyses to be performed now include TCLP VOC and TCLP SVOC soil samples at one subsurface location within each study area identified in Figure 3.1. Total VOA and SVOC soil analyses will be performed at all subsurface locations. TCLP metals and not total RCRA metals will be performed at all sampling locations. The RCRA Hotline FAX Back Service has three documents that support this conclusion. The documents can be ordered on the FAX Back system at (202) 651-2060. Request documents 13647, 11721, and/or 13116.	

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10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
Section 3.1 Potential RCRA Contaminants of Concern (COCs)	M	This section should be consistent with assumed (and/or known) waste inventory in Section 2.1. Disposal from the Baneberry Event and the Area 9 ITS (which may have included waste from the Avens-Cream Event) has been presumed to have occurred. Therefore, the listing of potential COCs for the Site may be incomplete. A Toxicity Characteristic determination (based on EPA SW846 Method 1311) would also have to be made for Volatile Organic, Semi-Volatile Organic and RCRA Metals.	Comment noted. U-2bu waste disposal process knowledge is considered incomplete, and Table 3.1 has been modified accordingly. Please refer to the response above for Section 2.1 and to the modifications of Table 3.1	
Section 3.2 Preliminary Action Levels	M	First bulleted item - This section will be called Preliminary Screening Levels consistent with previous conversations between NDEP and DOE/NVO staff and the body of this section. Evaluation of sampling results will also be based upon detected amounts, not risk based levels nor the EPA PRGs.	Text has been modified accordingly. Section 3.2 is now called Preliminary Screening Levels.	
Section 3.2 Preliminary Action Levels	M	Second bulleted item - In order to make a waste determination under 40 CFR 261.24, it would be necessary to use EPA Method 1311. There is no mention of Method 1311 anywhere in the Characterization Plan other than briefly in Section 4.0, Sampling and Analysis Plan, with no specifics on how it would be used. This needs to be clarified.	Comment noted. Table 3.1 has been modified accordingly. Please refer to the response above for Section 2.1 and to the modifications of Table 3.1	
Section 3.4 Conceptual Model Table 3.1 Chemical and Radiological Methods	M	Item 4: RCRA Metals EPA Method 010/7470. It is unclear what application this method has in relation to the rest of the Characterization Plan. Method 010 has not been referred to before and the NDEP requests some clarification to this method EPA Method 7470 is used to detect Mercury in liquid wastes, while Method 7471 is used for a solid or semi solid matrix. No information has been submitted show mercury specifically is of any concern. The NDEP request <u>very</u> specific clarification of this table.	Comment noted. Table 3.1 has been modified accordingly. Please refer to the response above for Section 2.1 and to the modifications of Table 3.1	

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10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
Section 4.0 Sampling and Analysis Plan	M	In the opening statement, there is mention of the TCLP analysis (EPA Method 1311). However, this method is not mentioned in any of the tables and is only referred to in the text. Since this particular method will become necessary should incomplete historical information be available, it would be prudent to include it in the Characterization process.	Comment noted. Table 3.1 has been modified accordingly. Please refer to the response above for Section 2.1 and to the modifications of Table 3.1. The opening statement of Section 4.0 has been modified to read, "Data will be collected during the field investigation to confirm or refute the conceptual model for the site by characterizing the crater and observed waste for RCRA constituents and by assessing potential migration of RCRA constituents via Toxicity Characteristic Leaching Procedure (TCLP) analysis."	
Section 4.1 Technical Approach	S	Due to the uniqueness of the site and logistical problems with standard drilling techniques, the NDEP concurs hand auguring is a reasonable initial approach. However, the DOE/NVO should be aware this technique may not yield sufficient information based on the limit of the hand auguring tool of four (4) feet (ft.). With respect to Section 4.2 Site Preparation Activities, most of the hand auguring achieved a depth of approximately 2 to 3 ft. The only study area in excess of 2.5 ft in depth was at the crater bottom. If this depth cannot be exceeded, the DOE/NVO may be unable to characterize the Site with these techniques. If this first step in the DQO process does not yield enough information, the NDEP may require the DOE/NVO present an alternative to characterizing the Site. bottom. If this depth cannot be exceeded,	Comment noted. As stated in Section 4.3, shovels and/or post hole diggers will be utilized to a depth of at least 1.2 meters (m) (4 feet [ft]). If sampling is performed in this manner, a hand auger will ultimately be advanced beyond 1.2 m (4 ft) in order to acquire an uncompromized soil sample for analysis.	
Appendix C Section C.1.3.3 Hazardous Waste	M	The correct 265 Citation is Subpart I for the Management of Containers not Subpart C.	Comment noted. Text has been changed to reflect the correct Subpart I Citation.	

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10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
Appendix C General	M	The DOE/NVO should also provide to the NDEP within the characterization plan a site plan showing the location of the waste management area.	Comment noted. The DOE/NVO will manage the IDW within the boundaries of the CAU. The map identifying the location of the Hazardous Waste Management Area (HWAA) is prepared after the Characterization Plan receives approval from the NDEP. The Map is included in the Site Specific Emergency Response and Contingency Action Plan (SS ERCAP.) The SS ERCAP is posted at the HWAA and distributed to the Nye County Sheriff's Office, the NTS Fire Department, and Mercury Medical. The SS ERCAP is designed to be integrated with the a Master Emergency Response and Contingency Action Plan (ERCAP.) If field conditions present problems with the location of the HWAA, it will be moved within the boundaries of the CAU; the map will be updated and all copy holders will be notified.	

* Comment Types: M = Mandatory, S = Suggested.

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