

Nevada
Environmental
Restoration
Project

DOE/NV-475
UC-700



Corrective Action Investigation Plan
for CAU No. 453:
Area 9 Landfill,
Tonopah Test Range

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FOR CAU NO. 453:
AREA 9 LANDFILL,
TONOPAH TEST RANGE**

DOE Nevada Operations Office
Las Vegas, Nevada

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**CORRECTIVE ACTION INVESTIGATION PLAN
FOR CAU NO. 453: AREA 9 LANDFILL,
TONOPAH TEST RANGE**

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List of Acronyms and Abbreviations

APHA	American Public Health Association
ASTM	American Society for Testing and Materials
bgs	Below ground surface
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site(s)
CAU	Corrective Action Unit(s)
CFR	<i>Code of Federal Regulations</i>
DOE	U.S. Department of Energy
DOE/NV	DOE Nevada Operations Office
DOT	U.S. Department of Transportation
DQO	Data Quality Objective(s)
DU	Depleted uranium
EG&G	EG&G Energy Measurements
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency
EQL	Estimated Quantitation Limit
ERD	Environmental Restoration Division
ERDA	U.S. Energy Research and Development Administration
ERP	Environmental Restoration Project
FFACO	<i>Federal Facility Agreement and Consent Order</i>
ft	Foot (feet)
HASP	Health and Safety Plan
IDW	Investigation-derived waste
in.	Inch(es)
IT	IT Corporation
LLW	Low-level radioactive waste
m	Meter(s)
$\mu\text{g/L}$	Microgram(s) per liter
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter

List of Acronyms and Abbreviations (Continued)

NAC	<i>Nevada Administrative Code</i>
NAS	National Academy of Science
NDEP	Nevada Division of Environmental Protection
NTSWAC	<i>Nevada Test Site Waste Acceptance Criteria</i>
ORERP	Offsite Radiation Exposure Review Project
PCB	Polychlorinated biphenyl(s)
PPE	Personal protective equipment
ppm	Part(s) per million
PRG	Preliminary Remediation Goal(s)
QAPP	Quality Assurance Project Plan
QA/QC	Quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RPD	Relative percent difference
SNL	Sandia National Laboratories
SVOC	Semivolatile organic compound(s)
TBD	To be determined
TC	Toxicity characteristic
TPH	Total Petroleum Hydrocarbon(s)
TTR	Tonopah Test Range
USACE	U.S. Army Corps of Engineers
U ²³⁸	Uranium ²³⁸
UXO	Unexploded ordnance
VOC	Volatile organic compound(s)
%R	Percent recovery

1.0 Introduction

This Correction Action Investigation Plan (CAIP) has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the U.S. Department of Energy (DOE), Nevada Operations Office (DOE/NV); the Nevada Division of Environmental Protection (NDEP); and the U.S. Department of Defense. The CAIP is a document that provides or references all of the specific information for planning investigation activities associated with Corrective Action Units (CAUs) or Corrective Action Sites (CASs) (FFACO, 1996).

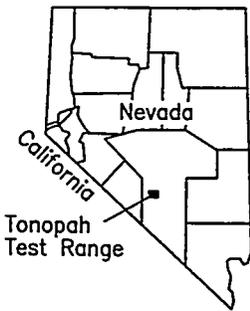
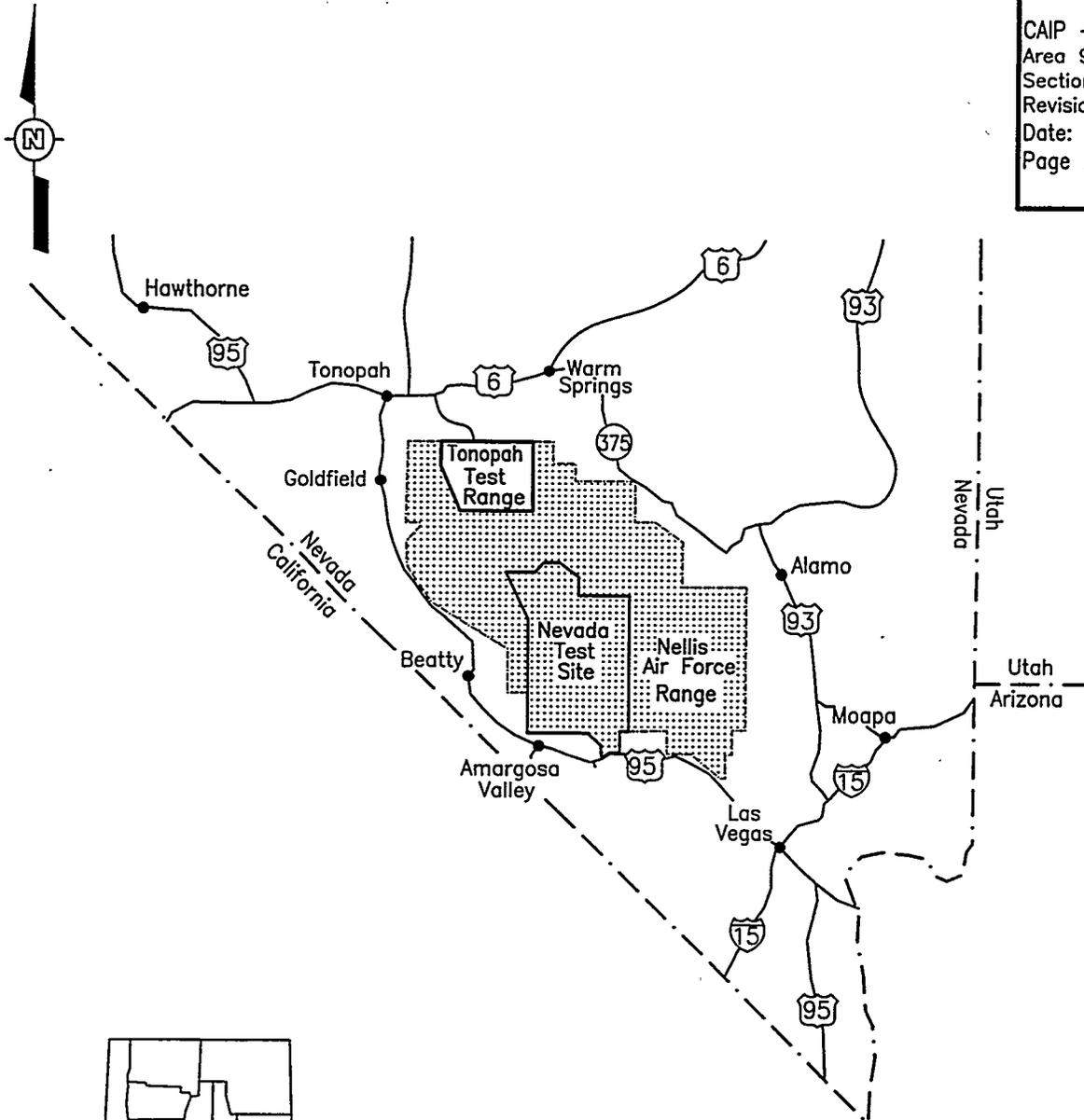
This CAIP contains the environmental sample collection objectives and criteria for conducting site investigation activities at the Area 9 Landfill, CAU 453/CAS 09-55-001-0952, which is located at the Tonopah Test Range (TTR). The TTR, included in the Nellis Air Force Range, is approximately 255 kilometers (140 miles) northwest of Las Vegas, Nevada (see Figures 1-1 and 1-2). The Area 9 Landfill is located northwest of Area 9 on the TTR (DOE, 1996a) (see Figure 1-2 and Plate 1 for the location of the Area 9 Landfill).

1.1 Purpose

The landfill cells associated with CAU 453 were excavated to receive waste generated from the daily operations conducted at Area 9 and from range cleanup which occurred after test activities (DOE, 1996a). The landfill cells were operated during different time intervals spanning from the early 1960s (Karas, 1993a) to approximately 1993 (see Attachment C of Appendix A for an operational time frame). Due to the unregulated disposal activities commonly associated with early landfill operations, an investigation will be conducted to:

- Identify the presence and nature of possible contaminant migration from the landfill cells.
- Determine the vertical and lateral extent of possible contaminant migration.
- Ascertain the potential impact to human health and the environment.
- Provide sufficient information and data to develop appropriate corrective action strategies for the landfill.

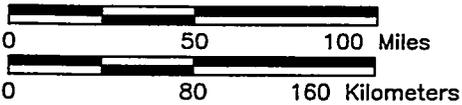
This CAIP was developed using the U.S. Environmental Protection Agency (EPA) Data Quality Objectives (DQOs) (EPA, 1994) process in order to clearly define the purpose(s) for which



LEGEND

-  Nevada Test Site boundary
-  Tonopah Test Range boundary
-  Nellis Air Force Range boundary
-  State Line
-  Road or Highway
-  City

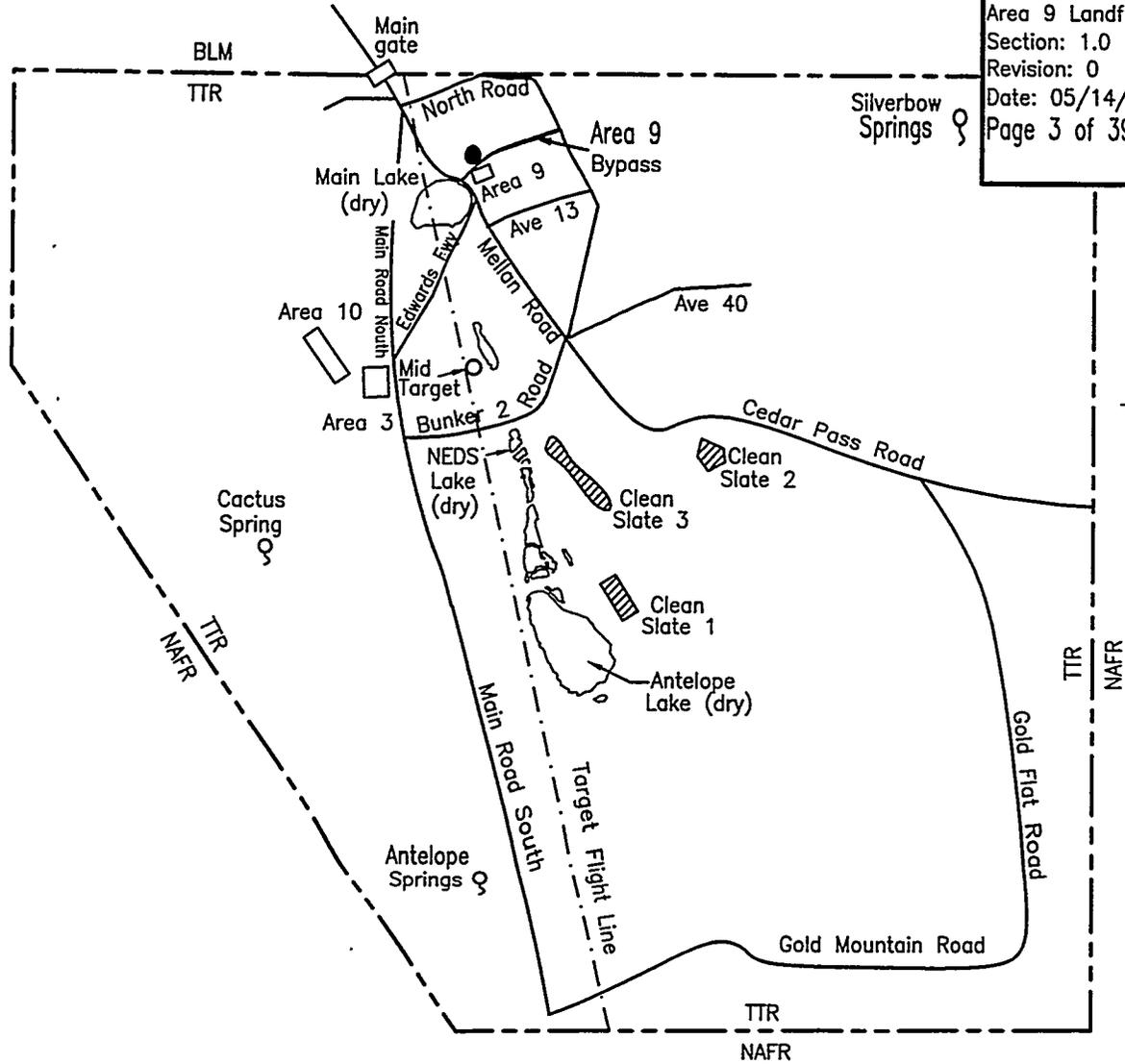
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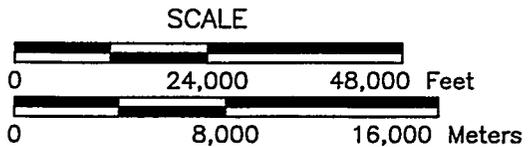
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**Figure 1-1
 Tonopah Test Range Location Map**



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-  Tonopah Test Range boundary
-  Primary roadway
-  Area 9 Landfill
-  Operation Roller Coaster sites
-  Area/gate
-  Spring
- BLM Bureau of Land Management
- NAFR Nellis Air Force Range
- TTR Tonopah Test Range



Source: Adapted from DOE/NV, 1996a

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Figure 1-2
Range Layout and Location of the Area 9 Landfill, Tonopah Test Range

environmental data will be used and to design a data collection program that will satisfy these goals. A summary of the results of the DQO process is presented in a worksheet format as Appendix A of this plan. The NDEP reviewed the draft version of the CAIP and made comments (see Appendix B). These comments were responded to accordingly and were incorporated as required.

1.2 Scope

The scope of this investigation includes the following:

- Drilling characterization boreholes by the angle drilling method using a hollow-stem auger rig
- Conducting field screening of sample intervals
- Collecting environmental samples for laboratory and geotechnical analysis
- Logging soil cuttings to assess soil characteristics
- Assessing the limits of existing migration and the potential for future migration
- Documenting investigation results

1.3 CAIP Contents

Section 1.0 of this CAIP provides an introduction to this project, including the purpose and scope for this corrective action investigation. The FFACO requires that CAIPs address the following elements:

- Management
- Technical aspects
- Quality Assurance
- Health and safety
- Public involvement
- Field sampling
- Waste management

The managerial aspects of this project are discussed in the DOE/NV Environmental Restoration Project (ERP) *Project Management Plan*, Rev. 0 (DOE, 1994a). The technical aspects of this CAIP are contained in the *Corrective Action Unit Work Plan, Tonopah Test Range, Nevada* (hereafter referred to as the TTR Work Plan [DOE, 1996a]) and in Sections 2.0 and 3.0 of this

document. General field and laboratory Quality Assurance and Quality Control (QA/QC) issues are presented in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE, 1996b; DOE, 1994b), and the specific aspects of field QA/QC are discussed in approved procedures. The health and safety aspects of this project are documented in the DOE/NV ERP Health and Safety Plan (HASP) (DOE, 1994c) and will also be supplemented with a site-specific HASP written prior to commencement of field work. No CAU-specific public involvement activities are planned at this time; however, an overview of public involvement is documented in the draft *Public Involvement Plan* in Appendix V of the FFACO (1996). Field sampling activities are discussed in Section 4.0 of this CAIP. Waste management issues are discussed in the TTR Work Plan (DOE, 1996a) and in Section 5.0 of this CAIP. The project schedule and records availability information are discussed in Section 6.0, and a complete list of project references is provided in Section 7.0 of this CAIP.

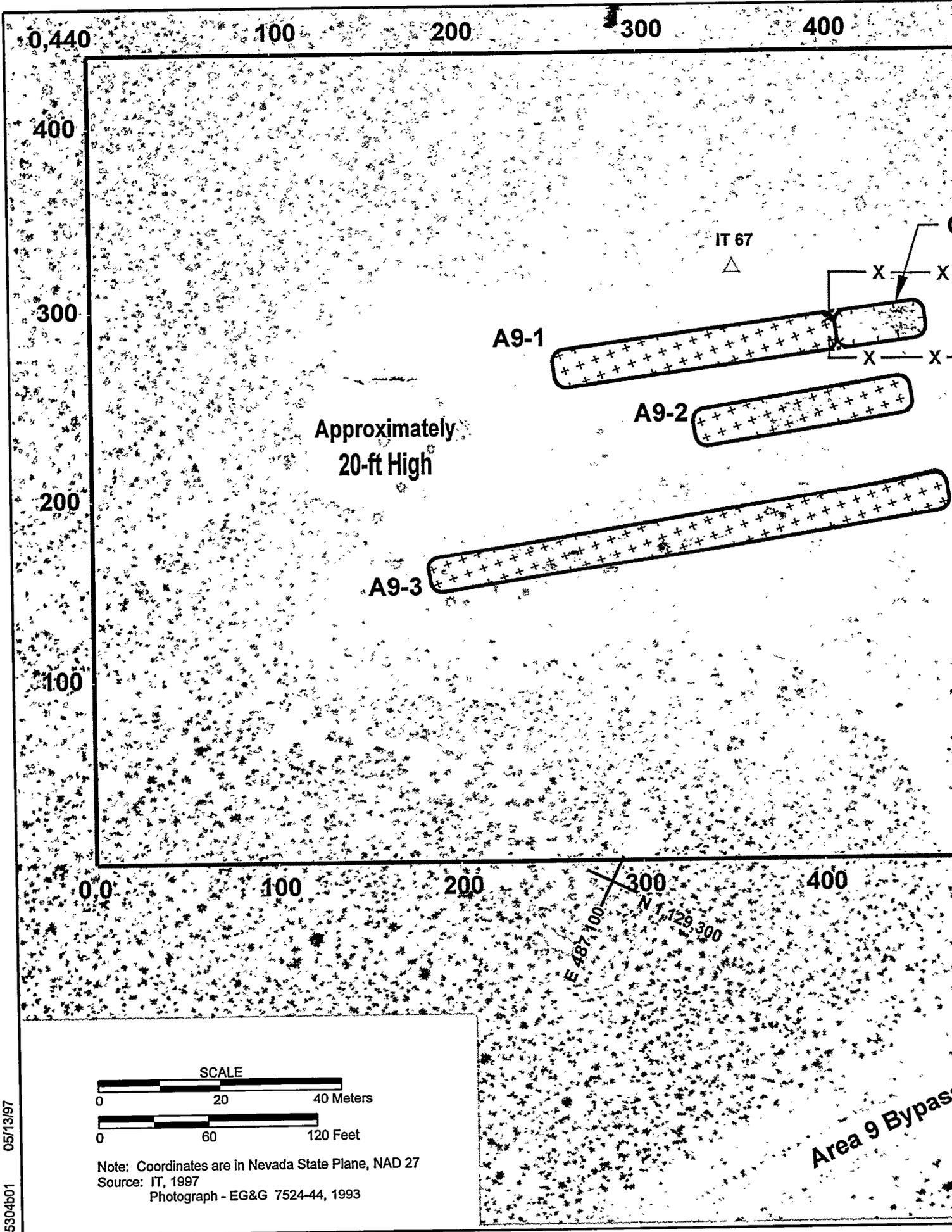
2.0 Facility Description

Corrective Action Unit 453 is comprised of three individual, buried landfill cells that were open during different time frames. The DQO worksheet (Appendix A) outlined the process knowledge and information that is currently available to assess the landfill. This information includes geophysical surveys, historical aerial photographs, TTR reports, and interviews with current and former TTR workers. General background information pertaining to the history of TTR and Area 9, a geologic assessment, and an overview of the area hydrogeology (including depths to groundwater) are provided in the TTR Work Plan (DOE, 1996a).

2.1 Site Assessment and Operational History

The site assessment and operational history for each cell were determined from interpretations of historical aerial photographs (Attachment A of Appendix A) and surface geophysical studies (IT, 1997). The Area 9 Landfill covers approximately 2.3 acres and is located along the Area 9 Bypass Road northwest of Area 9 (Figure 1-2 and Plate 1). Based on geophysical data obtained in 1993 by IT Corporation (IT) (IT, 1997), the site was originally believed to consist of four buried cells; however, after reviewing historical aerial photographs, it is apparent that the site consists of only three buried cells (A9-1, A9-2, and A9-3) (see Figure 2-1 for a site map). What appeared as a small buried cell (the fourth cell) at the west end of Cell A9-3 on the geophysical data is actually a portion of Cell A9-3, as shown in a 1980 aerial photograph (see Attachment A of Appendix A for aerial photograph listing).

Through interviews with former employees and by using dates of the historical aerial photographs, it is estimated that the Area 9 Landfill began operation sometime in the early 1960s (Karas, 1993a) and was closed prior to 1993 (see Attachment C of Appendix A for an operational time line and listing of aerial photographs). Cell A9-3 was the first operational cell. It is believed to have been in use sometime in the early 1960s and closed sometime between 1986 and 1988. Interviews with former employees indicate that debris placed in this cell was burned much like a typical, historic landfill operation (Karas, 1993a). It is uncertain when Cell A9-2 was operational because it is not observed to be open in any of the historic aerial photographs; however, it is believed to have been operational after the close of A9-3 and prior to the opening of Cell A9-1 (sometime between 1986 and 1988). Cell A9-1 is the newest of the three cells and is believed to have been operational sometime after 1986 and before 1993.



0,440 100 200 300 400

400

300

200

100

0,0

100

200

300

400

IT 67

A9-1

A9-2

A9-3

Approximately
20-ft High

E 487.00
N 1,129.300

Area 9 Bypass

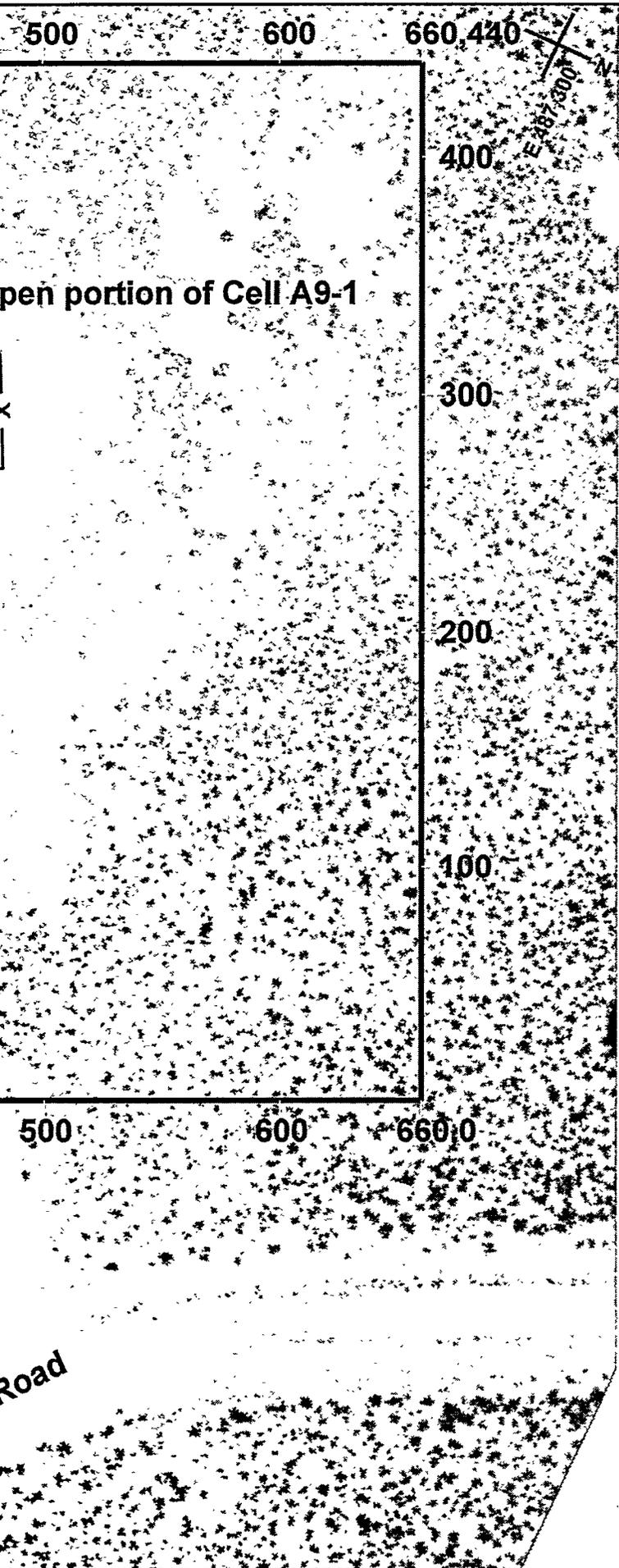
SCALE

0 20 40 Meters

0 60 120 Feet

Note: Coordinates are in Nevada State Plane, NAD 27
Source: IT, 1997
Photograph - EG&G 7524-44, 1993

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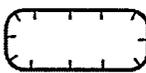
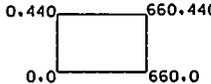
-  Interpreted landfill cell location
-  Fence
-  Surface Depression
-  Soil Mound
-  Geophysical Survey Grid
-  Surveyed IT photodocumentation monument location

Figure 2-1
Site Map, Area 9 Landfill, Tonopah Test Range

Approximately 15.2 meters (m) (50 feet [ft]) of the east end of Cell A9-1 were left uncovered and fenced off to prevent additional use. This was verified during Voluntary Corrective Action cleanup activities performed at this location in 1995 (IT, 1995).

The buried cells are elongated along an approximate southwest-northeast axis and are situated subparallel to one another. The cells vary in size (IT, 1997) (see Figure 2-1). Cell A9-1 is approximately 47.2 m long by 6.1 m wide (155 ft by 20 ft). The open portion of Cell A9-1 is approximately 15.2 m long by 6.1 m wide (50 ft by 20 ft). Cell A9-2 is the smallest of the three buried cells and is approximately 36.6 m long by 6.1 m wide (120 ft by 20 ft). Cell A9-3 is approximately 86.9 m long by 6.1 m wide (285 ft by 20 ft). Geophysical survey results indicate that the depth to the top of the buried debris in Cells A9-1, A9-2, and A9-3 varies from greater than 1.2 m (4 ft), from between 0.5 m to 0.8 m (1.5 ft to 2.5 ft), and from between 0.3 m to 1.2 m (1 ft to 4 ft), respectively. Survey results and associated figures can be found in the *Initial Surface Geophysical Survey Report for the Tonopah Test Range Environmental Restoration Sites* (IT, 1997); a representative example of the geophysical results can be found in Appendix C. Currently, there is no geophysical information to indicate the vertical extent of the cells. Due to the potential for unexploded ordnance (UXO) within the cells, geophysics will be conducted in the field prior to drilling the boreholes to determine the vertical extent of the cells (see Section 4.1.1). The locations of the boreholes will be calculated based on the determined cell depths to ensure that drilling operations will not disturb the cells (see Section 4.1.2).

2.2 Waste Inventory

Information from interviews with TTR workers (Section I.C. of Appendix A) and analysis of historical photographs (see Attachment C of Appendix A for a listing of aerial photographs and an operational time frame) and TTR operations (DOE, 1996a) indicates that the covered cells received municipal type trash (including construction debris and office trash from Area 9, debris from range cleanup activities, and possible ordnance) and were used as burn pits (DOE, 1996a). The cells also were reported to have received residue from burning explosives that had deteriorated or become obsolete or defective (DOE, 1996a). In March 1995, a Voluntary Corrective Action ordnance cleanup was conducted at the open portion of Cell A9-1. Items removed from the open portion included various ordnance items and parts (i.e., inert artillery rounds, spent rocket motors, tail fins, pieces of casings), miscellaneous metal scrap, an empty 55-gallon drum, insulated cables, and other construction debris (DOE, 1996a). No evidence of burned debris or ashes was discovered in the open portion of Cell A9-1.

Resource Conservation and Recovery Act (RCRA)-regulated hazardous constituents and containerized liquids are not expected to be a primary component of the landfills because liquid drains were available in most of the buildings to segregate solid and liquid wastes (i.e., solvents) (DOE, 1996a); improved waste management procedures were instituted in the late 1980s and 1990s; and there are no reports of hazardous wastes being disposed in the landfills. If, however, RCRA-regulated wastes are present in the landfill cells, they would probably be associated with the activities and operations that were conducted in the Area 9 shops (outlined in the DQOs [Appendix A]), and they would be limited in volume (due to the reasons stated above). The potential also exists for small quantities of depleted uranium to be present in the landfills based on one personal interview (Section I.C. of Appendix A). This contradicts a former worker that mentioned in a separate interview that radioactive material from tests of mock nuclear ordnance was routinely collected and buried near the point of impact on the target area (Karas, 1993b).

2.3 Release Information

Historic information indicates that the primary waste components buried in the landfill cells are probably solid, rather than liquid, materials. These solid materials include construction debris, office trash, other components of municipal-type trash, and potential UXO.

There is no evidence to suggest that large volumes of liquids were disposed of in the landfill cells. However, if any liquids have been disposed of in the landfills and/or have been released, they are probably in small amounts. The premise for this is based on the likelihood that large volumes of liquids would have been disposed of down the sewer system rather than transported to the landfills. Liquids typically associated with the various shops (see Attachment E of Appendix A for list of Area 9 shops) that support Area 9 daily operations include waste oil, grease, paints, solvents, diesel fuel, and cleaning supplies (Attachment D of Appendix A).

If contamination has been released in the landfill cells, the contaminant migration would probably be limited to within the first 7.6 m (25 ft) below ground surface (bgs) in the unsaturated soil below the bottom of the cells. This premise is based on the following three points:

(1) There is a high likelihood that the alluvial soils have low unsaturated hydraulic conductivities; (2) There is no driving force (i.e., low precipitation); and (3) Source material quantities are small, if present.

2.4 Investigative Background

A geophysical survey was conducted at the Area 9 Landfill to identify and delineate the landfill cells in July of 1993 (IT, 1997). The survey provided data from which the landfill cell geometries were interpreted. One example of definitive geophysical data is included as Appendix B. In March 1995, a Voluntary Corrective Action ordnance cleanup was conducted at the open portion of Cell A9-1. The majority of the debris within the open portion of Cell A9-1 consisted of construction and wood debris, miscellaneous metal scrap, and various ordnance items. The ordnance items included inert artillery rounds, spent rocket motors, and miscellaneous ordnance parts (i.e., tail fins, pieces of casings). All debris within the open end of Cell A9-1 was removed (DOE, 1996a).

3.0 Objectives

The sampling objectives were determined using the DQO process outlined in the EPA's *Guidance for the Data Quality Objectives Process* (EPA, 1994). The DQOs are qualitative and quantitative statements that specify the quality of the data required to support potential courses of action for the landfill cells. The DQOs were developed to clearly define the purpose(s) for which environmental data will be used and to design a data collection program that will satisfy these goals. The DQOs for this CAIP are presented in Appendix A. The following section discusses the formulation of a site conceptual model, one step in the DQO process.

3.1 Conceptual Site Model

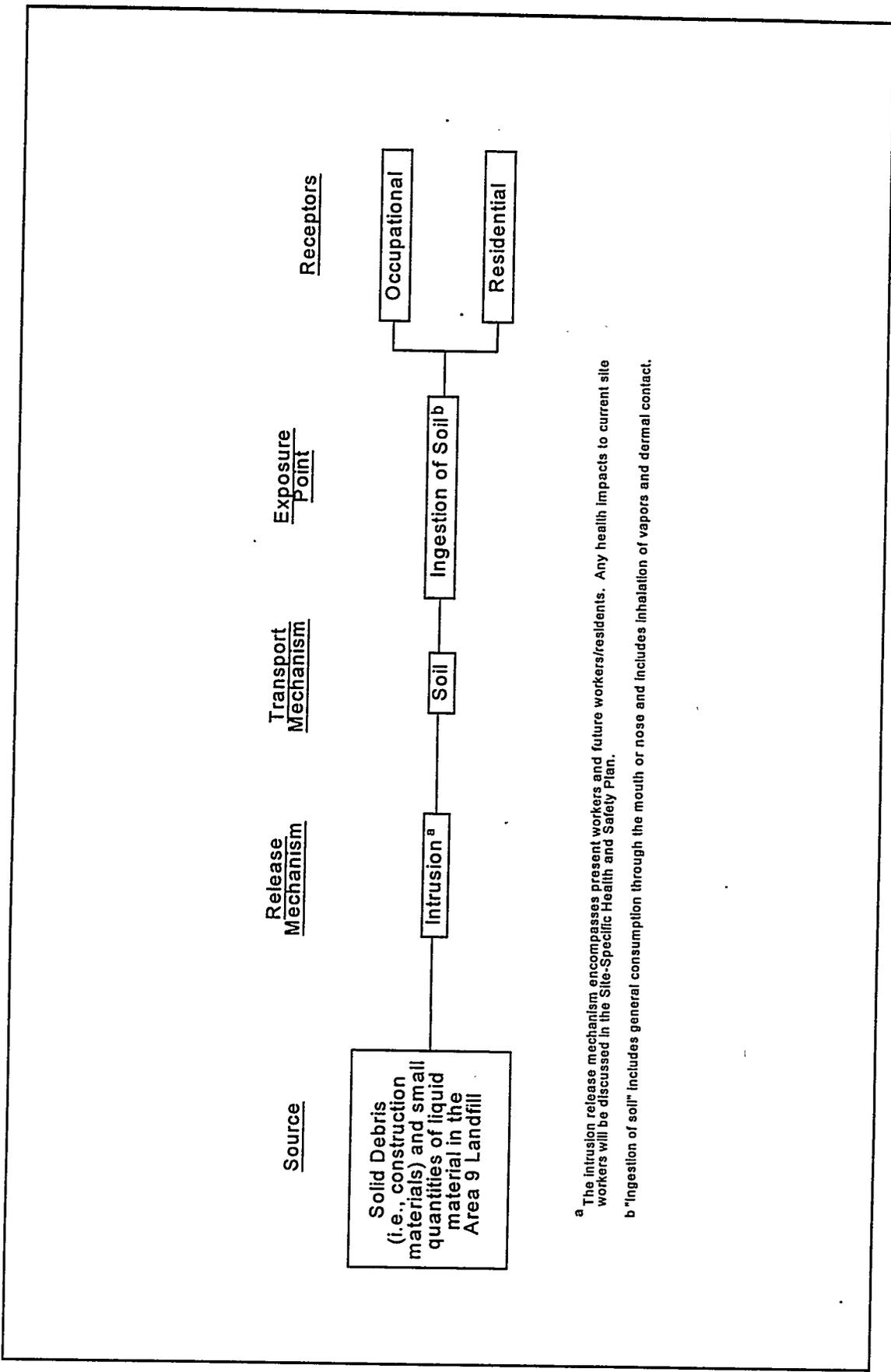
A conceptual model has been developed to postulate exposure pathways from potential contaminant sources at the landfills. The model is based on assumptions and premises that were discussed during the DQO process and outlined in the DQO worksheet (Appendix A). If the conceptual model is proven incorrect from the results of environmental sampling, then NDEP will be notified, and the site will be rescoped. The following summarizes the primary assumptions that were included in the DQOs (Appendix A) and considered in formulating the site conceptual model:

- The landfill cells contain UXO similar to what was removed from the open east end of the northern-most cell (A9-1) (DOE, 1996a).
- Nonordnance wastes disposed in the landfills are nonhazardous solid wastes similar to that found in municipal landfills. Based on interviews with former employees (Section I.C. of Appendix A) and historical aerial photographs (see Attachment C of Appendix A for a listing of aerial photographs), construction debris and office trash constitute a majority of the waste volume.
- Improved waste management practices in the late 1980s and early 1990s reduce the potential for hazardous materials in the later cells (A9-1 and A9-2).
- The presence of sewer/septic system lines and underground discharge points in the Area 9 Compound reduces the possibility that liquids were disposed of in the landfill cells.
- There is no evidence verifying disposal of hazardous or RCRA materials in the landfill cells.

- If hazardous materials were disposed of in the landfill cells, the constituents of concern would be based on the activities of the shops and facilities operating within the Area 9 Compound (Karas, 1993a) and their potential to contribute hazardous materials to the landfills.
- Future use of the area is likely to be similar to current use.
- Groundwater is not thought to have been impacted because liquids were probably not disposed of in large quantities, if at all. Depth to groundwater is estimated at 40 m (131 ft) (DOE, 1996a); the environmental conditions at the site (i.e., arid climate, low permeabilities, etc.) are not conducive to downward migration.
- If contaminant migration is present, it will be limited to the soil beneath the landfill at a total depth of 7.6 m (25 ft) bgs. Anisotropy is not considered a major element for controlling migration.
- Excavation of contaminated material by site workers is the likely potential exposure pathway.
- The directional drilling method with hollow-stem augers is adequate to provide characterization sampling.

These assumptions were considered, and from them a conceptual model was created (Figure 3-1). It was conceptualized that contents within the landfill cells are mostly construction debris, office trash, and UXO and that the primary contaminant source in the landfills would be from a small amount, if any, of solid and liquid materials generated from the shop activities in the Area 9 Compound deposited in the landfills. The most likely area affected is located immediately beneath the cells from the base of the landfills to 7.6 m (25 ft) bgs (Figure 3-2). In order to adequately assess the possibility of lateral migration of possible contamination, soil characteristic information (including moisture content) will be collected during the investigation to determine if conditions exist that are conducive for lateral movement. If both contamination and anisotropic conditions are found to exist, NDEP will be notified, and the project will be rescoped to account for lateral migration.

The conceptual model indicates that the site has only a shallow soil source and one exposure route - ingestion of soil, which also includes inhalation of vapors and dermal contact. Intrusion into the site (such as digging with a backhoe or drilling) could disturb the soil or unearth the waste and cause a release of contamination. Site access is not restricted by fences or posted with signs, and the potential for inadvertent disturbance exists. If it is determined after sampling that



^a The intrusion release mechanism encompasses present workers and future workers/residents. Any health impacts to current site workers will be discussed in the Site-Specific Health and Safety Plan.

^b "Ingestion of soil" includes general consumption through the mouth or nose and includes inhalation of vapors and dermal contact.

Figure 3-1
 Conceptual Site Model for the Area 9 Landfill, Tonopah Test Range

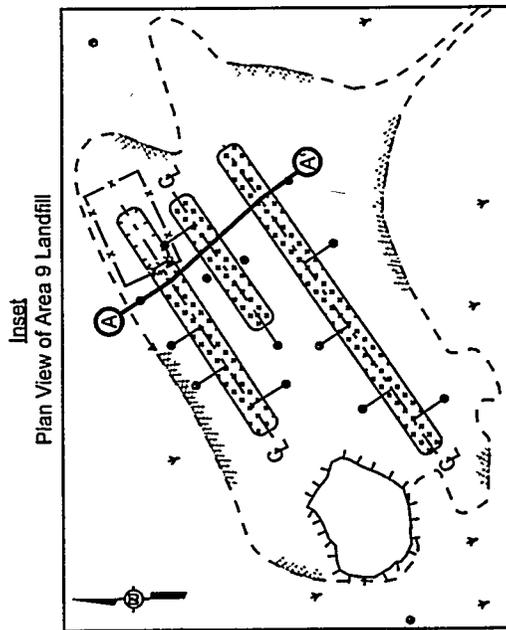
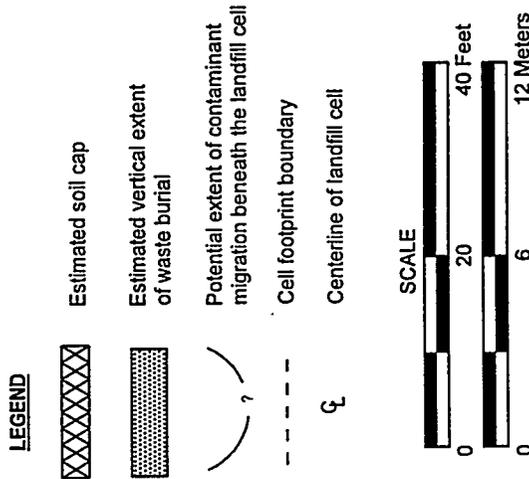
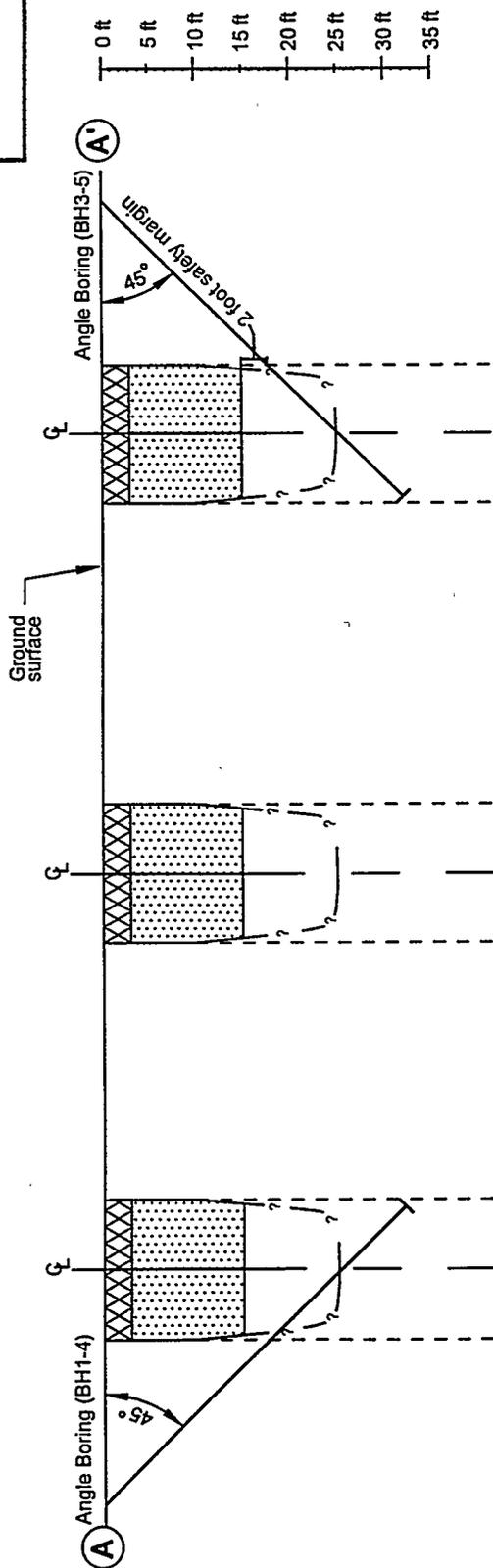


Figure 3-2
Conceptual Transverse Cross-Sectional Schematic of the
Area 9 Landfill Cells with Boreholes

groundwater may be impacted, the site may be rescoped, and the groundwater pathway will be investigated. The landfill cells are not anticipated to contain contaminants or to contain contaminants at concentrations greater than regulatory cleanup action levels; therefore, the likelihood of a significant groundwater impact is not anticipated. In addition, contamination, if present, is anticipated to be managed so that future migration of hazardous constituents is prevented.

3.2 Contaminants of Potential Concern

There is no evidence indicating disposal of hazardous or RCRA material in the landfills. Potential types of contaminants that could be present are based on process knowledge, facility activities within the Area 9 Compound, and range cleanup activities associated with range testing activities. Because the landfill cells, though operated at different times, had similar sources, all the cells have the potential for the following contaminants of concern:

- Volatile organic compounds (VOCs)
- Semivolatile organic compounds (SVOCs)
- Nitroaromatics and Nitroamines
- Inorganics (RCRA metals)
- Polychlorinated biphenyls (PCBs)
- Total petroleum hydrocarbons (TPH) - oil filters (Karas, 1993c)
- Depleted uranium (DU [U^{238}]) - (Karas, 1993a)
- Corrosives - batteries (Karas, 1993a and 1993c)

3.3 Preliminary Action Levels

Preliminary action levels for both on-site field-screening methods and off-site analytical methods will be used to determine the presence of contamination. All action levels were agreed upon during the DQO process (Appendix A). The following on-site field-screening action levels will be used:

- VOC screening levels at 20 parts per million (ppm) or 2.5 times background, whichever is higher
- The analytical concentration of 100-ppm TPH or a field-screening concentration that is comparable to an analytical concentration of 100-ppm TPH
- Radiation (alpha, beta/gamma) levels two times background levels

The preliminary action levels for the off-site laboratory analytical methods will be the values upon which decisions for future action for the landfills will be based. These preliminary action levels are as follows:

- EPA Region 9 Preliminary Remediation Goals (PRGs) (Smucker, 1996) or background concentrations (i.e., metals concentrations), whichever is higher, for initial site characterization. Risk-based levels based on modeling may be used as an alternative.
- 100-ppm TPH
- Background radiological levels or levels listed in the *Offsite Radiation Exposure Review Project (ORERP), Phase II Soils Programs* report (McArthur and Miller, 1989)

3.4 Measurement Objectives

Laboratory analysis of the soil samples will provide the means for a quantitative measurement of the potential contaminants of concern. The analytical methods and minimum reporting limits for each analyte are provided in Table 3-1.

If environmental sample data indicate that no analytes are above the criteria presented in Table 3-1, then no further action or closure in place will be recommended. Modeling for the likelihood of future increases in contaminant concentrations may be required to confirm these recommendations and decisions.

Table 3-1
Site Characterization Laboratory Analytical Requirements for the Area 9 Landfill
 (Page 1 of 2)

Analyte	Medium	Analytical Method ^a	Minimum Reporting Limit	Precision ^b (RPD)	Accuracy ^b (%R)
Total VOCs	Water	8240 ^c or equivalent	Analyte-specific estimated quantitation limits ^d	14	60 - 132
	Soil			24	59 - 172
Total SVOCs	Water	8270 ^c	Analyte-specific estimated quantitation limits ^d	50	5 - 230
	Soil			50	11 - 142
Nitroaromatics and Nitroamines	Water	8330 ^c	45 µg/L	20 ^e	53 - 133 ^e
	Soil		2.5 mg/kg	30 ^e	22 - 157 ^e
Total RCRA Metals Arsenic Barium Cadmium Chromium Lead Mercury Selenium Silver	Water	6010/7470 ^c	10 µg/L 200 µg/L 5 µg/L 10 µg/L 3 µg/L 0.2 µg/L 5 µg/L 10 µg/L	20	75 - 125
	Soil		2 mg/kg 40 mg/kg 1 mg/kg 2 mg/kg 0.6 mg/kg 0.1 mg/kg 1 mg/kg 2 mg/kg		
Total Petroleum Hydrocarbons	Water (gasoline)	8015 modified ^c	1 mg/L	20	25 - 145
	Water (diesel)		1 mg/L	20	25 - 145
	Soil (gasoline)		1 mg/kg	30	30 - 130
	Soil (diesel)		30 mg/kg	30	30 - 130
Total PCBs	Water	8080 ^c	Analyte-specific estimated quantitation limits ^d	30	8 - 160
	Soil			50	8 - 139

Table 3-1
Site Characterization Laboratory Analytical Requirements for the Area 9 Landfill
 (Page 2 of 2)

Analyte	Medium	Analytical Method ^a	Minimum Reporting Limit	Precision ^b (RPD)	Accuracy ^b (%R)
Gamma Spectroscopy (based on Cs ¹³⁷)	Water	EPA 901.1 ^f or equivalent	Background levels or ORERP ⁱ	20 ^e	80 - 120 ^e
	Soil	HASL 300, 4.5.2.3 ^g or equivalent		20 ^e	80 - 120 ^e
Isotopic Uranium (U ²³⁸)	Water	NAS-NS-3050 ^h or equivalent	Background levels or ORERP ⁱ	25 ^e	70 - 120 ^e
	Soil				

^aQC (water) samples are included in table.

^bPrecision and Accuracy requirements were obtained from the *Resource Conservation and Recovery Act Industrial Sites Quality Assurance Project Plan* (DOE, 1994b). Field duplicate sample results are excluded from these requirements due to the heterogeneity of the soil.

^cEPA Test Methods for Evaluating Solid Waste, 3rd edition, Parts 1-4, SW-846 (EPA, 1996)

^dEstimated Quantitation Limit (EQL) as given in SW-846 Method (EPA, 1996)

^ePrecision and Accuracy requirements were obtained from the *Streamlined Approach for Environmental Restoration Plan, CAU No. 400: Bomblet Pit and Five Points Landfill* (DOE, 1996c). Field duplicate sample results are excluded from these requirements due to the heterogeneity of the soil.

^fStandard Methods for the Examination of Water and Wastewater, American Public Health Association (APHA, 1992)

^g*Environmental Measurements Laboratory Procedure Manual*, HASL-300, U.S. Department of Energy (DOE, 1992)

^hNational Academy of Science, Nuclear Science Series, September 1, 1963

ⁱORERP, *Phase II Soils Program* report (McArthur and Miller, 1989)

- mg/kg = Milligrams per kilogram
- PCBs = Polychlorinated biphenyl(s)
- RCRA = Resource Conservation and Recovery Act
- RPD = Relative Percent Difference
- SVOCs = Semivolatile organic compounds
- U = Uranium
- VOCs = Volatile organic compounds
- µg/L = Micrograms per liter
- %R = Percent recovery

4.0 Field Investigation

This section of the CAIP contains the sampling approach for investigating the Area 9 Landfill CAU. All sampling activities shall be conducted in compliance with the Industrial Sites QAPP (DOE, 1996b) and other applicable, approved procedures. Requirements for field and laboratory environmental sampling QA/QC are contained in the Industrial Sites QAPP (DOE, 1996b), Table 3-1, and Table 4-1.

**Table 4-1
 Soil Engineering Analysis for
 Geotechnical Studies at the Area 9 Landfill**

Soil Engineering Analysis	Method
Initial moisture content	ASTM ^a D 2216
Dry bulk density	EM ^b -1110-2-1906
Calculated porosity	EM-1110-2-1906
Saturated/unsaturated hydraulic conductivity	ASTM D 5084
Particle-size distribution (preferred method is hydrometer distribution)	ASTM D 422
Water-release (retention) curve	ASTM D 3152

^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 United States Army Corps of Engineers (USACE), Engineer Manual 1110-2-1906, "Laboratory Soils Testing," Appendix II, 1970

ASTM = American Society for Testing and Materials
 EM = Engineer Manual

4.1 Sampling Approach

The sampling approach for the Area 9 Landfill CAU was developed from the DQO process (included as Appendix A). The sampling plan will consist of the following primary components:

- Depth determination of the landfill cells through geophysical methods
- Drilling multiple angle (slant) boreholes from outside the cell perimeter to a minimum of a bottom hole location below the approximate center of each cell (longitudinal axis or "centerline") to investigate the subsurface soils

- Drilling three vertical boreholes in undisturbed areas to obtain background data
- Conducting field screening and environmental sampling of the unsaturated soil below the landfill cell bottoms

Each landfill cell will be individually investigated. The planned angle borehole locations were selected based on cell length, the geophysical anomalies recorded during the geophysical survey conducted in 1993 (IT, 1997), and spacial constraints between cells. The geophysical anomalies are assumed to correspond to areas of greater density of metallic debris which increases the likelihood of drilling beneath the landfill cell. Due to the potential of UXO within the cells, the drill rig cannot be stationed on top of the landfill cells during drilling (see Appendix A for other assumptions regarding the location of boreholes). The planned number of boreholes to be drilled and their planned locations are shown on Figure 4-1 and Plate 1. These borehole locations are approximated and may be adjusted, and additional locations may be added pending field observations (i.e., surface features, field-screening results).

4.1.1 Landfill Cell Depth Determination

Based on an interview with a current employee, the bottom of the landfill cells is estimated to be approximately 4.6 m (15 ft) to 5.2 m (17 ft) deep (Elliston, 1997). There is other information, however, indicating that the cell bottoms could be shallower (i.e., depth of 3.0 m [10 ft]) (DOE, 1996a; Phelan, 1988). Therefore, to limit uncertainty, the depths of the cells will be determined to within 0.6 m (2 ft) using two different geophysical methods prior to the characterization sampling. These methods include induction electric logging and surface seismic techniques. Activities pertaining to these techniques will be presented in a separate field instruction and will be implemented prior to characterization activities.

4.1.2 Investigative Boreholes

The drilling locations will be spaced as evenly as possible to investigate the length of the cells and to remain biased toward the areas most likely to be contaminated based on an interpretation of geophysical data. The subsurface soil below each landfill cell will be investigated using a drill rig equipped with hollow-stem augers. The potential for buried UXO in the landfill cells prohibits drilling directly into the cells or staging the drill rig over the cell caps. Therefore, directional drilling techniques will be used for the investigation drilling program. The drill rig will be positioned outside the cell perimeter and advanced at a predetermined angle to intersect the approximate centerline below the landfill cell without penetrating the cell. The directional

0,440

100

200

300

400

400

300

200

100

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ψ

IT 67

BH1-2 ⊕

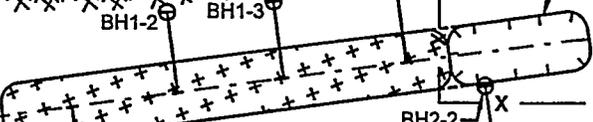
BH1-3 ⊕

BH1-4 ⊕

A9-1

X

X



A9-2

BH2-3 ⊕

BH2-2 ⊕

BH1-1 ⊕

BH2-1 ⊕

BH2-4 ⊕

X

X

BHB-1 ⊕

Approximately
20-ft High
Soil Stockpile

A9-3

BH3-2 ⊕

BH3-3 ⊕

BH3-5 ⊕

BH3-1 ⊕

BH3-4 ⊕

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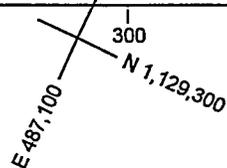
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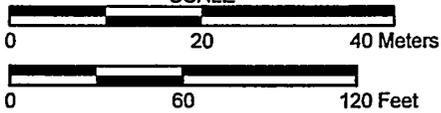
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Note: Coordinates are in Nevada State Plane, NAD 27
Source: IT, 1997
EG&G 7524-44, 1993

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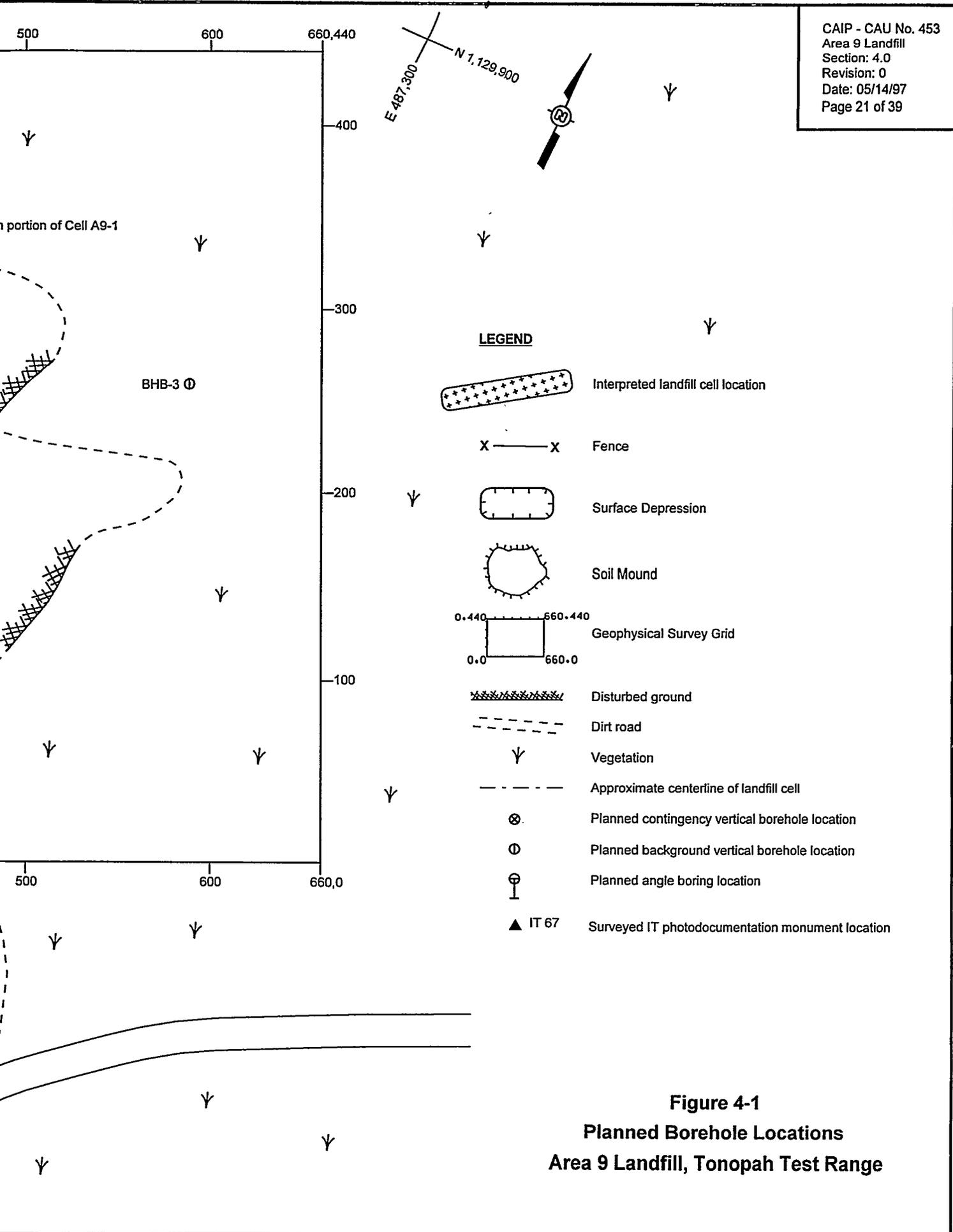
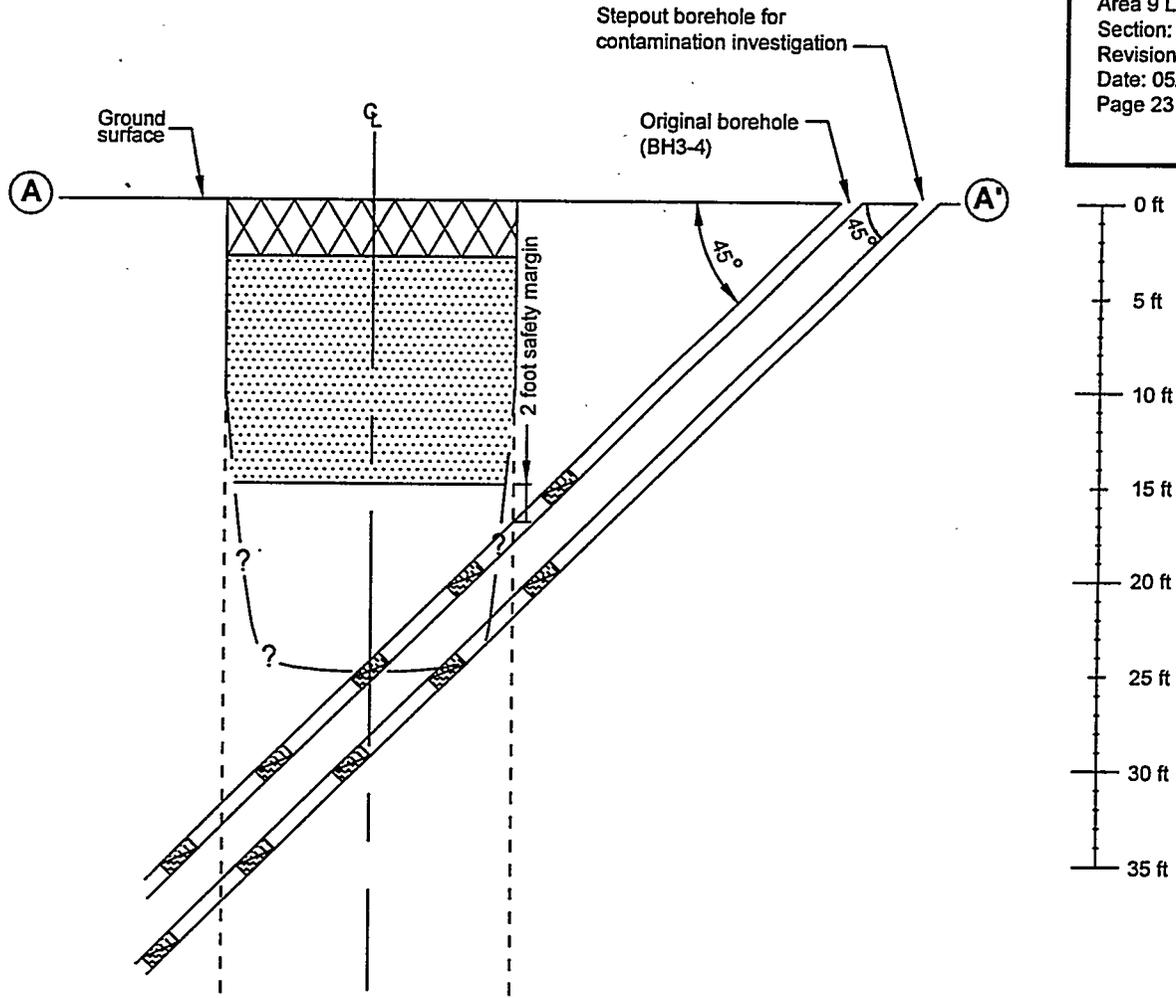


Figure 4-1
Planned Borehole Locations
Area 9 Landfill, Tonopah Test Range

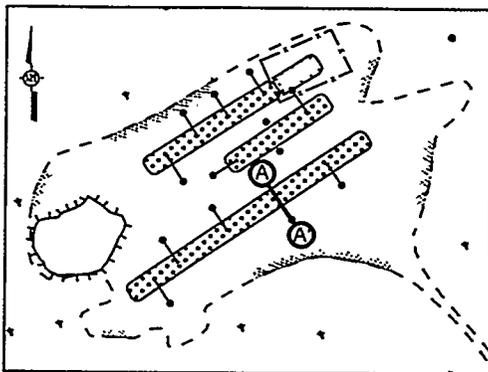
angle for each borehole is planned to be 45 degrees from vertical, but it could vary depending on rig capability. The location for each borehole will be positioned perpendicular to the cell at a distance that will be dependent on the results of the cell depth investigation and the precision of the angle drilling and at a distance that will ensure a minimum 0.6-m (2-ft) safety margin. If the cell depth can only be determined to within a plus/minus depth (i.e., ± 2 ft), the greater, more conservative depth will be used (e.g., if cell depth is recorded at $15 \text{ ft} \pm 2 \text{ ft}$, a cell depth of 17 ft will be used, plus a 2-ft safety margin; therefore, the minimum total vertical depth to drill is 19 ft). At a minimum, all characterization boreholes will be advanced to intersect the centerline beneath each cell (total depth). The depth at which the borehole intersects the centerline is contingent on the determined actual depth of the cell bottoms. A conceptual schematic of this configuration is presented as Figure 4-2.

The drilling program for the A9-2 landfill cell will involve a slightly different approach due to the close proximity of the A9-1 and A9-3 Cells (see Figure 4-2). The limited area between the cells prevents positioning the drill rig perpendicular to A9-2 without being staged on top of Cells A9-1 and A9-3. Therefore, one angle boring will be located at each end of the cell, and two additional vertical holes will be included as contingency holes to be drilled if contamination is detected (by field screening) in the slant holes. Prior to drilling the slant boring on the east, the open portion of A9-1 will be filled in with soil. By doing this, the rig can be placed perpendicular to the north edge of A9-2 and closer to the center of the trench than the western boring. Without filling in the open portion of A9-1, the rig would have to be placed perpendicular to the east edge of A9-2, and the slant boring would have to be drilled from that location (this is not shown on Figure 4-1). Two vertical contingency borings have been proposed for Cell A9-2 and will be advanced if field-screening results from the initial characterization drilling indicate contamination. The two contingency boreholes will enable the vertical investigation of the lowest portion of the cell (the center third of the cell) at a closer proximity than the initial angle borings.

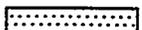
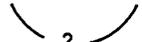
Three vertical holes will be advanced in the vicinity of the Area 9 Landfill to obtain background information for radiological and inorganic parameters. The planned locations, presented on Plate 1 and Figure 4-1, are at a minimum of 30.5 m (100 ft) away from the landfill cells and widely spaced to assess the background variability. One boring will be drilled upgrade from the landfill. The borings will be advanced to approximately 7.6 m (25 ft) below ground surface.



Inset
 Plan View of Area 9 Landfill



LEGEND

-  Estimated soil cap
-  Estimated vertical extent of waste burial
-  Potential extent of contaminant migration beneath the landfill cell
-  Field screen interval
-  Sampling interval
-  Cell footprint boundary
-  Centerline of landfill cell

Note: For this schematic, the samples collected from the contingency boring are based on the contamination detected in the second 5 foot sample collected from the original borehole.

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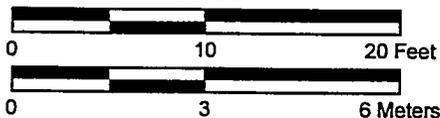


Figure 4-2

Conceptual Schematic of Angle Borehole and Sample Collection at the Area 9 Landfill, Tonopah Test Range

4.1.3 Field Screening

Field-screening tests will be performed at 1.5-m (5-ft) intervals for all boreholes and will begin once the drilling horizon reaches the depth of the cell (as established from geophysical methods) and continue to total depth (centerline). A conceptual schematic of a borehole and sample collection interval is presented in Figure 4-2. The field-screening methods will consist of headspace testing for VOCs, TPH screening, and radiological screening for alpha and beta/gamma emitters. Soil moisture characteristics will also be measured using a Speedy Moisture Tester™; however, this data will only be used for characterization purposes. The field-screening data from the first three methods (VOC, TPH, and radiological) will serve two primary purposes. First, the data will provide environmental measurements of the unsaturated soil beneath the cell for site characterization. Second, the data will provide a mechanism for guiding the investigation deeper, if necessary. If field-screening results exceed the action levels presented in Section 3.3, then drilling will continue past the centerline until two consecutive 1.5-m (5-ft) non-detects (background) intervals are recorded. If contamination is not detected, drilling will stop at the centerline depth.

Upon completion of drilling a contaminated borehole, the NDEP will be notified of the contamination and the proposed stepout borings to further investigate the contamination. The surface location of borings drilled to investigate contamination will be moved 5 ft away from the original borehole (and cell) and drilled at the same angle (or less) as the original borehole. This will enable the detection of contamination, if present, at approximately 5 ft (based on a 45-degree angle) below the original contamination (see Figure 4-2). Field screening will be performed in 1.5-m (5-ft) intervals starting at the depth of the detected contamination. Drilling will be advanced until two consecutive, non-detect, field-screening intervals are obtained. Samples from this borehole will be collected beneath the original area of detection. Sample collection will begin at the depth of contamination from the original hole and continue until the boring intersects the centerline to ensure that the area beneath the landfill all has been investigated and until two consecutive, 1.5-m (5-ft), non-detect intervals are recorded. This method will be repeated until contamination is no longer detected or until drilling advances to the saturated zone. The deeper the contamination advances, the less the angle to be drilled will become (i.e., 30 degree to vertical for a more vertical extent of contamination investigation). If drilling advances to the saturated zone, field investigation will stop; NDEP will be notified; and the site will be rescoped.

4.1.4 Sampling Criteria

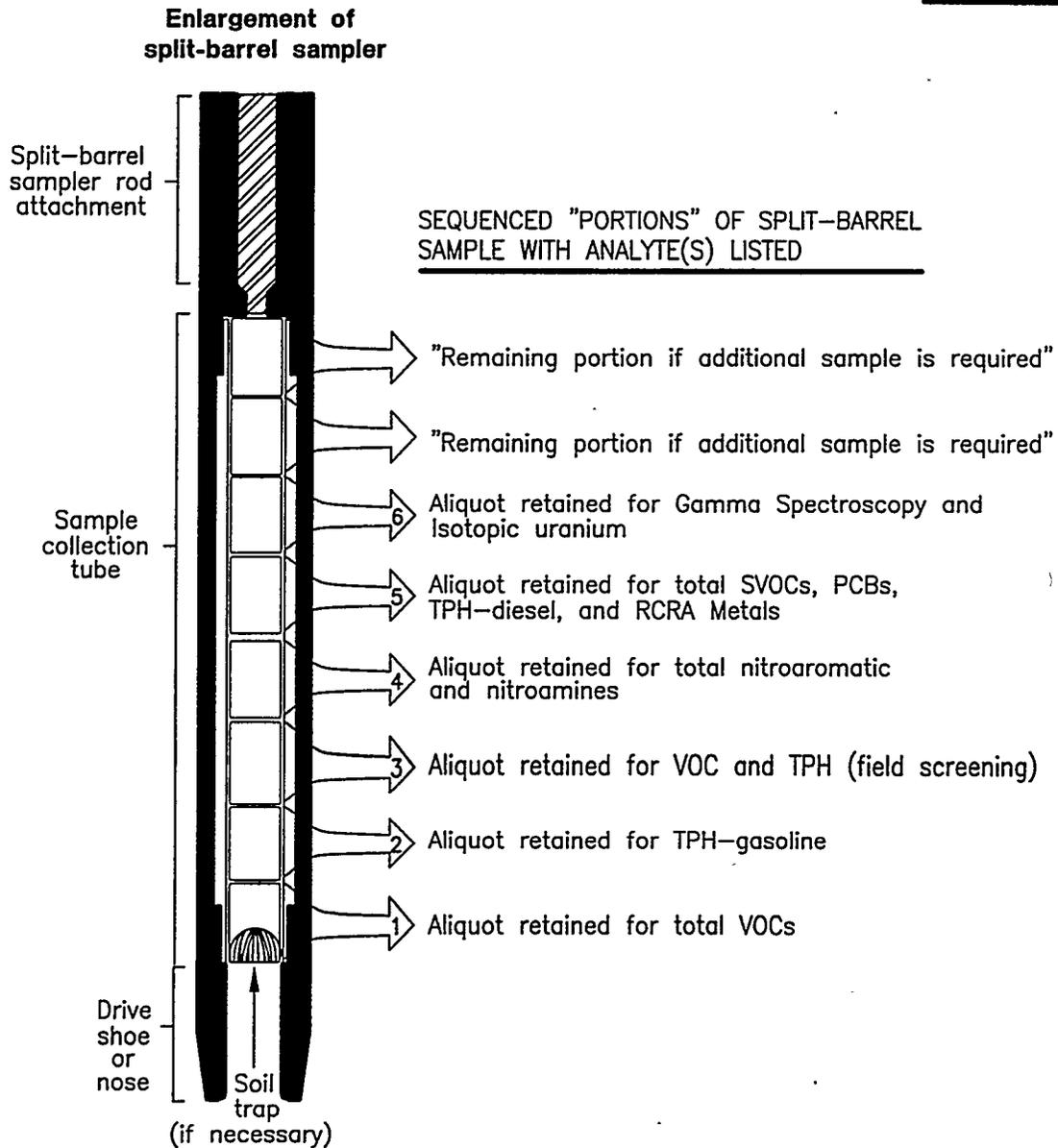
Soil samples for laboratory analysis will be collected from all borings using a stainless steel, 2-ft-long, split-barrel ("split-spoon") sampler fitted with 3-inch (in.) sleeves for sample retention. As shown in Figure 4-3, soil within the 2-ft split-spoon sampler will be retained for both sample collection and field screening. The contents of the split-barrel sampler will be field screened for alpha and beta/gamma radiological contamination prior to sample aliquot collection.

Beginning at the nose of the core barrel, the first two portions will be retained from total VOCs and TPH-gasoline analysis, respectively. The next portion of the core will be retained for VOC and TPH field screening. The fourth portion will be retained for total nitroaromatics and nitroamines analysis. The fifth portion will be retained for total SVOCs, PCBs, TPH-diesel, and RCRA metals analysis. The sixth portion will be retained for gamma spectroscopy and isotopic uranium analysis. Once the sample aliquot is collected for gamma spectroscopy, the remaining sample portion will be archived. If the presence of uranium above background levels is detected from the gamma spectroscopy analysis, the archived sample will be analyzed for isotopic uranium. The remaining portions of the split-barrel sampler will be used (and properly noted) if additional sample volume is needed for samples that are not sensitive to volatilization.

The sample collection for the site characterization holes will be conducted in 1.5-m (5-ft) intervals, beginning at the bottom depth of the landfill cell and continuing to a minimum depth at which the borehole intersects the centerline beneath the landfill cell. Drilling will stop at the centerline depth if two consecutive, non-detect, field-screening results have been obtained. If field-screening results indicate the presence of contamination, drilling and sample collection should continue beyond the centerline as described in Section 4.1.3. Figure 4-4 presents a generalized decision logic chart for sampling. Discretionary sampling points may also be selected for laboratory analysis based on a visual examination by the site supervisor/geologist. Selection criteria for discretionary samples could include:

- Moist or discolored zones
- Significant changes in soil grain size
- Increases in odor

Two soil samples will be collected from the borings designated for background sampling. The first sample will be collected at a depth which is representative of the determined cell depth. The second sample will be collected approximately 3.0 m (10 ft) below the first sample or at 7.6 m (25 ft), whichever comes first. These samples will be analyzed for radiological and inorganic



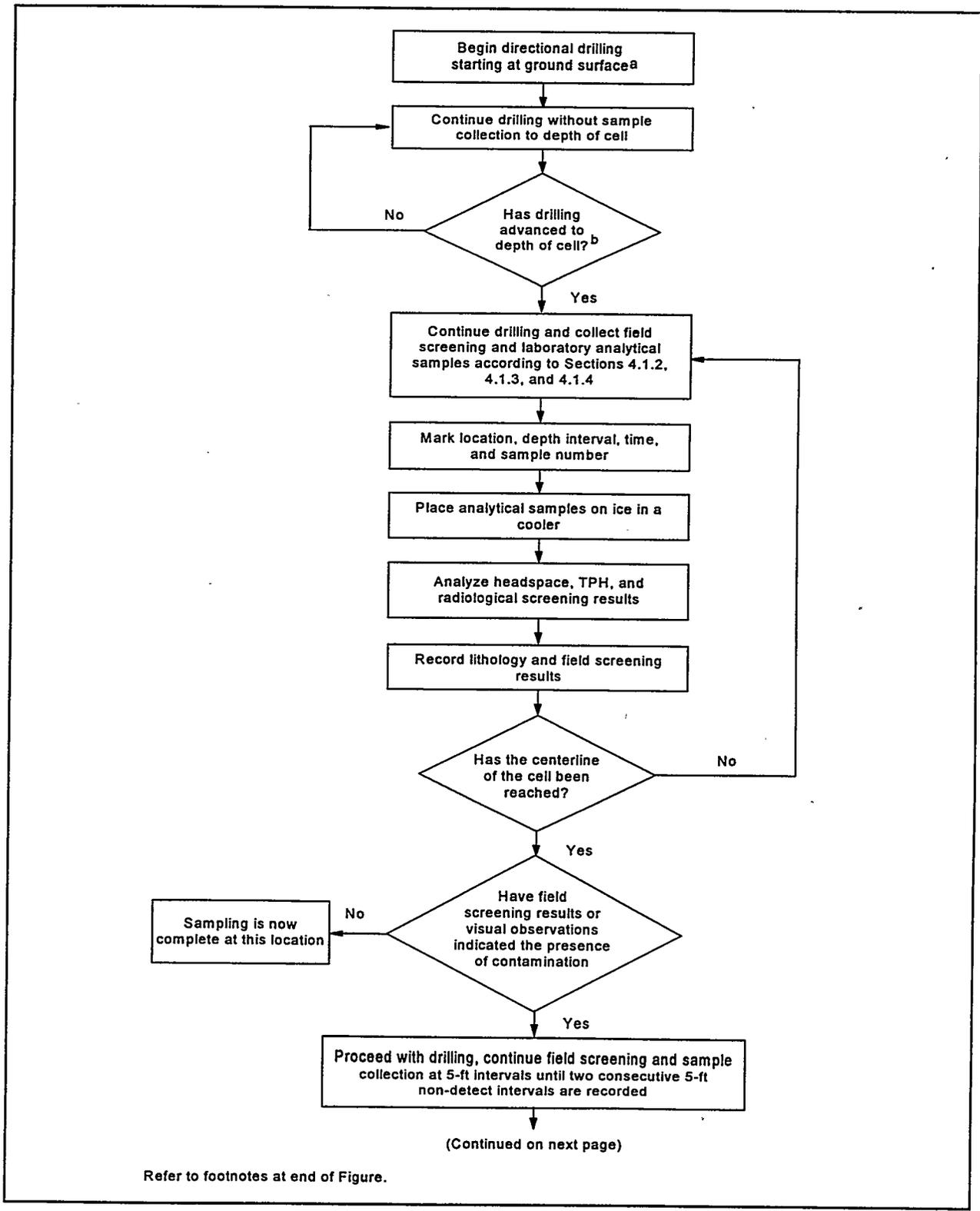
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NOTE

Split-barrel samplers will be fitted with 3-inch brass sleeves.

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**Figure 4-3
 Schematic of the Split-Barrel Sampler**



Refer to footnotes at end of Figure.

Figure 4-4
Generalized Decision Logic for Corrective Action Site Sampling
(Page 1 of 2)

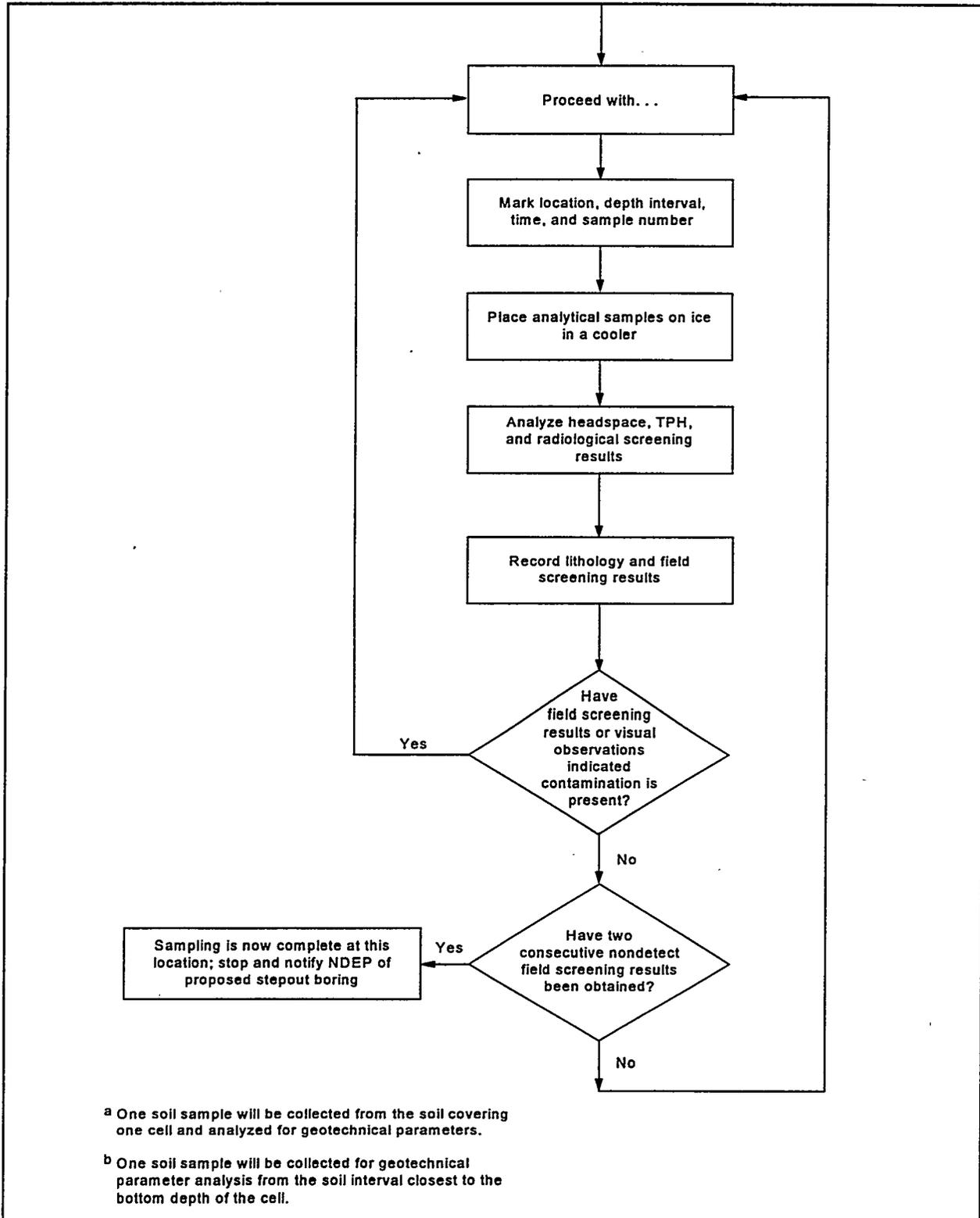


Figure 4-4
Generalized Decision Logic for Corrective Action Site Sampling
(Page 2 of 2)

parameters only. Table 3-1 presents the soil sampling requirements for the Area 9 Landfill cells. One additional soil sample will be collected from the soil covering one of the cells ("cap"). To assess the geotechnical characteristics of the existing cap and the soil beneath the cell bottoms, this sample, plus the sample collected closest to the bottom of the cells within the same borehole, will be analyzed for the soil engineering parameters presented in Table 4-1. The sample collected from beneath the cell will also be analyzed for the chemical parameters presented in Table 3-1.

Each boring will be drilled using approved procedures. All equipment which contacts the soil will be decontaminated in accordance with written and approved procedures consistent with the Environmental Restoration Division (ERD) Procedure ERD-05-701, "Sampling Equipment Decontamination," Rev. 0 (DOE, 1994b), or as appropriate for special equipment being decontaminated (i.e., steam cleaning augers). Clean split-spoon samplers fitted with clean 3-in. sleeves will be used for each sampling event. This will minimize the potential for cross contamination between sample locations. The sample collection sequence will follow approved procedures. Records will be kept of the soil description, field-screening measurements, and all other relevant data. All pertinent and required sampling information (i.e., date, time, and sample interval) shall be documented in accordance with the Industrial Sites QAPP (DOE, 1996b). Approved chain-of-custody procedures will be followed to assure the defensibility of the data.

4.1.5 Stop Points for Notification

The following represent specific stop points that were determined during the DQO process to provide guidance on unexpected situations that may arise during the field investigation:

- If field-screening results indicate that contamination is more extensive than predicted (i.e., drilling advances to the saturated zone), the field investigation will stop; NDEP will be notified; and the site will be rescoped.
- If free liquids are encountered during the drilling operation, drilling will stop, and NDEP will be notified for decision concurrence.
- If radiation is encountered above field-screening action levels (i.e., two times background), drilling will stop; NDEP will be notified; and the need to initiate a Radiological Work Permit will be assessed.
- If operations need to stop because of unexpected site conditions, NDEP will be notified.

- If drilling encounters bit refusal that precludes successful investigation of a cell, NDEP will be notified for decision concurrence.
- If conditions warrant changing the drilling method, NDEP will be notified, and the investigation will be rescoped.

5.0 Waste Management

There is no process knowledge that indicates hazardous (i.e., RCRA-regulated) or radioactive wastes were placed in the landfill, and there is no record that indicates that chemicals or solvents were discarded in the landfill. Potential hazardous wastes found in the landfill would likely be characteristic rather than listed. The soil will be field-screened, sampled, and analyzed to verify that this process knowledge is correct. Waste generated through sampling will be traceable to its source and to individual samples. Administrative controls (e.g., decontamination procedures, drilling methods, and characterization strategies) will minimize waste generated during site characterization activities. Decontamination activities will be performed in accordance with approved procedures as specified in the field sampling instructions (to be written prior to commencement of field work) and will be designated according to the contaminants of concern present at the site.

Should laboratory results indicate that the waste exhibits a hazardous characteristic, the waste will be managed as hazardous waste in accordance with RCRA (DOE, 1994b). If the waste is hazardous (i.e., through field screening or laboratory analyses), the waste will be managed as hazardous with the 90-day accumulation time limit starting when the waste is identified as hazardous. If the waste is radioactive or mixed (i.e., through field screening or laboratory analyses), the waste will be managed in accordance with the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (DOE, 1996d) and the "Mutual Consent Agreement Between the State of Nevada and the U.S. Department of Energy for the Storage of Low-Level Land Disposal Restricted Mixed Waste" (NDEP, 1995), respectively. All waste types, if present, will also be managed according to U.S. Department of Transportation (DOT) regulations (49 CFR 171-180, 1997a; 10 CFR 20.2006, 1997b).

5.1 Waste Minimization

The investigation activities have been designed to minimize the amount of investigation-derived waste (IDW) generated. Waste segregation will be applied to identified waste streams.

5.2 Potential Waste Streams

There are no records that indicate that chemicals or solvents were discarded in the landfill cells. The potential wastes found in the landfill cells are likely to be characteristic, rather than listed, wastes. The determination of whether the waste is characteristic or listed is based on *Code of*

Federal Regulations (CFR) Title 40 Part 261, "Identification and Listing of Hazardous Wastes" (CFR, 1996a). Process knowledge also indicates that there is very little reason to believe that hazardous (i.e., RCRA-regulated) or radioactive wastes were placed in the cells. Based on this process knowledge, generation of hazardous wastes, radioactive wastes, or mixed wastes is not anticipated. In the unlikely event that hazardous or radioactive waste is encountered, drilling will be stopped, and NDEP will be notified. The reagents used in the TPH field-screening methods might produce small quantities of hazardous waste; this small waste stream will be segregated and managed as follows:

- The waste shall be compatible with the container.
- The container shall be in good condition and free from corrosion and dents that impair the integrity of the container.
- At a minimum, the container shall be labeled with the following information:
 - The words "Hazardous Waste"
 - A unique waste stream identification number
 - All applicable EPA and state waste numbers and/or codes
 - A description of the contents
 - Contact name

Wastes generated during the investigation activities may include, but are not limited to, the following:

- Decontamination rinsate
- Contaminated disposable sampling equipment (e.g., plastic, paper, aluminum foil, and sample containers)
- Personal protective equipment (PPE)
- Contaminated soil
- Soil contaminated by TPH field-screening methods

5.3 Waste Management

Proper waste management consists of making a determination of waste status (i.e., RCRA-hazardous) and management based on the waste determination. A waste determination will be

made on the waste as presented in Section 5.3.1. The waste will then be managed according to the determination as discussed in Section 5.3.2.

5.3.1 Waste Determination

Solid materials other than soil wastes are waste only by virtue of contact with contaminated media; the same is true of decontamination rinsate. A waste determination on the soil cuttings will be made per boring according to sample results for that boring. Therefore, sampling and analysis of the IDW (including soil from the borings), separate from site characterization analyses, will not be required. The data generated as a result of site characterization will be used to assign the appropriate waste type (i.e., unregulated TPH, hazardous, LLW, or mixed) to the IDW. The action levels for IDW contaminants are presented in Table 5-1.

**Table 5-1
 Action Levels for IDW Contaminants**

Parameter	Action Level	Source	Comments
TPH ^a	100 ppm ^b	NAC ^c 459.9973	Regulated by the NDEP ^d
Total VOCs ^e , SVOCs ^f , and RCRA ^g metals	See note below	40 CFR ^h 261 ⁱ	_____
Nitroaromatics and Nitroamines	Nitrobenzene - TCLP ^j Limit - 2.0 mg/L ^k	40 CFR 261	_____
Total PCBs ^l	50 ppm	40 CFR 761.1(b) ^m NAC 444.940 to 444.9555	NDEP requires manifesting as hazardous waste for shipping and disposal purposes.
Radiological	Isotope specific	NTS POC ⁿ	_____

^aTotal petroleum hydrocarbons

^bPart(s) per million

^cNevada Administrative Code (NAC)

^dNevada Division of Environmental Protection

^eVolatile organic compound(s)

^fSemivolatile organic compound(s)

^gResource Conservation and Recovery Act

^hCode of Federal Regulations

ⁱ40 CFR 261, 1996a

^jToxicity Characteristic Leaching Procedure

^kMilligrams per liter

^lPolychlorinated biphenyl(s)

^m40 CFR 761.1(b), 1996b

ⁿNevada Test Site Performance Objective for

Certification of Nonradioactive Hazardous Waste (BN, 1995)

Note: Total VOCs, SVOCs, and RCRA metals concentrations of the samples will be determined through laboratory analysis. The laboratory-derived concentrations for soil samples (mg/kg) will be divided by a factor of 20 and compared to the toxicity characteristic (TC) limit (milligrams per liter [mg/L]) for hazardous parameters. If the total value divided by 20 is greater than the TC limit, IDW associated with these samples will be considered hazardous waste.

5.3.2 Waste Management

By adhering to administrative controls, sampling personnel will ensure that no additional contaminants are added to the waste. For administrative purposes, the waste will be managed as three waste streams (at least): soil, contaminated solid trash, and liquid wastes such as decontamination rinsate. Each waste stream will be segregated, and additional segregation may occur within each waste stream. For example, soil cuttings will be segregated per boring; the soil waste and decontamination rinsate will be segregated; and liquid low-level or mixed wastes, if present, will be absorbed or solidified prior to disposal or storage.

Investigation-derived waste streams will be segregated and placed into waste containers such as DOT-compliant drums (i.e., borehole soil, contaminated personal protective equipment, and decontamination rinsates). The contents of each container will be recorded, and each container will be appropriately marked and labeled in accordance with RCRA and DOE requirements (40 CFR 262, 1997c; 49 CFR 172, 1997d). Wastes will be managed on site within the defined site boundaries until analytical results are received to determine the disposition of the waste. Access to wastes temporarily staged at the project site will be controlled through placing the waste within an access-controlled area. All waste containers (e.g., drums) will be covered and/or locked and appropriately labeled. Waste containers will be periodically inspected while awaiting laboratory results to ensure that the waste containers are not leaking or damaged.

If mixed waste is produced, the appropriate data on the status of the waste must also be obtained or developed in accordance with the Transuranic Waste Pad waste storage criteria (DOE Order 460.1A, DOE, 1996e; DOE Order 5820.2A, 1988; DOE, 1996d; NTS SOP 5409, DOE, 1993). The number of samples necessary to satisfy the various mixed waste management requirements (e.g., RCRA [DOE, 1994b], NTSWAC [DOE, 1996d]) will depend on the volume of IDW produced and/or the variability in the analytical values for the IDW produced.

6.0 Time Frame and Records Availability

6.1 Time Frame

Subsequent to approval of this CAIP, the following is a tentative schedule of activities (in working days):

- Day 0: Preparation for field work will begin.
- Day 62: The field work, including field screening and sampling, will begin.
- Day 108: The field work will be completed.
- Day 140: The quality-assured laboratory analytical sample data will be available for NDEP review.
- Day 320: The Corrective Action Decision Document (CADD) will be submitted to NDEP.

The following information will be reported in the CADD:

- Introduction (including purpose, scope, an FFACO cross-walk) and a discussion about the need for further action
- The results of the corrective action investigation
- A corrective measures study (including initial screening of alternatives), evaluation of alternatives, and comparison of alternatives
- The recommended alternative

6.2 Records Availability

Historic information and documents referenced in this plan are retained in IT project files in Las Vegas, Nevada, and can be obtained through written request to the DOE/NV Project Manager.

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Appendix A
Data Quality Objectives Worksheets for the
Area 9 Landfill Characterization Effort

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Notes from the DQO Scoping Meetings Conducted on November 20 and 26 and December 11, 1996.

These notes are based on the "Strawman" outline provided by IT for the meetings and on the discussions held by the Core Decision Team and the Scoping Team members. The notes follow the outline of the DQO guidance (EPA, 1994). The steps systematically build on the data acquired during background research for the Corrective Action Investigation Plan (CAIP). Copies of the background data are in IT project files. To view the operational details of the Sampling Plan, see Step VII of this worksheet.

I. State the Problem

- A. Summarize the contamination problem. Combine the relevant background information into a concise description of the problem to be resolved.**

Problem to be Resolved

Determine whether solid waste in trenches has contaminated or has the potential to contaminate underlying soil or groundwater to the extent that it is a hazard to potential receptors. The extent to which these materials have impacted surrounding and underlying soil and/or groundwater is currently unknown, but it must be determined in order to close the site under Nevada Division of Environmental Protection (NDEP) and DOE requirements per the *Federal Facility Agreement and Consent Order* (FFACO, 1996).

B. Identify the members of the Scoping Team:

1. Scoping Team:

DOE/NV

Kevin Cabble
Lori Arent
Gloyd Green

NDEP

Paul Liebendorfer
Karen Beckley

IT Corp.

Kenneth Beach
Randy Dubiskas
Brad Schier
Mark Unruh
Cheryl Rodriguez
Syl Hersh
Jeanne Wightman

Bechtel

Dave Madsen
Steve Nacht

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2. Core Decision Team:

Kevin Cabble
Paul Liebendorfer
Karen Beckley
Randy Dubiskas
Cheryl Rodriguez
Mark Unruh
Dave Madsen

3. Primary Decision Makers:

Kevin Cabble
Paul Liebendorfer
Karen Beckley

C. Develop/Refine the Conceptual Model.

1. List sources of historic data associated with previous data collection activities.

- a. *Initial Surface Geophysical Survey Report for the Tonopah Test Range Environmental Restoration Sites* (IT, 1997)
- b. Field Activity Daily Logs and Photographs from Voluntary Corrective Action (VCA) activities conducted at the Area 9 Landfill (IT, 1995)
- c. Historic aerial photographs of the Tonopah Test Range at IT Corporation, Las Vegas Office (ITLV) files (see Attachment A)
- d. Process knowledge in the form of personnel interviews conducted with former TTR workers (Karas, 1993a, b; Phelan, 1988)
- e. *Inspection of Building Structures at Sandia National Laboratories/Tonopah Test Range*, August, 1994 (ITLV 3232TTR) (IT, 1994)
- f. Tonopah Test Range Facility Reports (ITLV 1709 TTR) (SNL, 1992)
- g. *1993 Site Environmental Report, Tonopah Test Range, Tonopah, Nevada* (Culp et al., 1994)
- h. *Corrective Action Unit Work Plan, Tonopah Test Range*, Rev. 0 (DOE/NV--43) (DOE, 1996a)

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- i. *Environmental Assessment, Tonopah Test Range, Tonopah, Nevada* (ERDA, 1975)
- j. *Federal Facility Preliminary Assessment Review. Tonopah Test Range, Nye County, Nevada* (Ecology and Environment, Inc., 1989)

2. List known or suspected sources of contamination.

The Area 9 Landfill can be divided into at least three subunits (three separate trenches) with varying waste disposal times. Attachment B, the site map, shows the three subunits. The timeline (Attachment C) shows the approximate time that wastes were disposed of in the trenches. The timeline was prepared using observations from the aerial photographs listed in Attachment A.

Evidence for the contents of the waste trenches includes:

- a. Materials removed from the pit during VCA activities consisted mainly of inert UXO, rocket motor casings, rocket motors shipping containers, and construction debris. Interviews with former and current employees suggest the contents of the cells to be similar to what was removed during the VCA activities.
- b. Descriptions of processes/activities in buildings serving as potential waste sources (from the site inspection report and as-built drawings)

Attachment D presents the hazardous materials observed during a site inventory conducted in each building in 1994 (IT, 1994). There is some potential for these buildings to have contributed hazardous materials to landfill Cells A9-1 and A9-2. However, improved waste management procedures in the late 80s and early 90s limit the potential for hazardous materials in these later cells.

The Sandia National Laboratory "Building Year Built Report" (SNL, 1992) (Attachment E) lists the date of construction for buildings in Area 9. Assuming that operations in 1994 were similar to those in 1980, a partial list of buildings with the potential to contribute hazardous materials to landfill Cell A9-3 includes the following:

- Gun Pit
- Assembly Buildings
- Storage Igloos
- Generator Building
- Alarm System Control Building

DATA QUALITY OBJECTIVES WORKSHEETS

Due to the presence of a septic system and underground discharge points associated with the main buildings in Area 9, it is assumed that wastes were segregated into solid versus liquid waste types. The solid waste was disposed of in the landfill cells while the liquids were disposed of in the sewer/septic system.

c. **Uncertainties:**

The list of potential contaminants is based on the assumption that 1994 processes were similar to earlier hazardous materials used at the site. The following are some of the inherent uncertainties:

- (1) Quantities - Solid waste quantities can be roughly estimated by the volume of the trenches, but there is no way of estimating what percentage is hazardous.
- (2) Physical state - Most of the hazardous materials listed in the building descriptions are in liquid form. It is not likely that large amounts of liquid wastes were disposed of in the trenches. It would have been more convenient for workers to dispose of liquids in the sewer/septic system.

3. List types of contaminants and affected media.

The three landfill cells are currently closed. Aerial photographs indicated they were closed by covering with clean fill. The east end of the north cell, however, was left uncovered and fenced off to prevent use. All debris in the uncovered end of the north cell was removed during VCA activities conducted in 1995. The affected media at the site will, therefore, be subsurface soils around and below the landfill cells. It is assumed that the wastes disposed of in the landfills are nonhazardous solid wastes similar to wastes in municipal or U.S. Department of Defense landfills and debris removed from the open end of the north cell. There is no evidence verifying disposal of hazardous materials. Types of contaminants are based on the sources listed in the previous section (C.2). Even though the landfill cells were filled at different times, they all had similar sources; therefore, all the cells have the potential for the contaminants in the following list.

(See Attachment D for building inspection results)

- a. Corrosives (batteries) - (Karas, 1993b) - likely neutralized
- b. VOCs
- c. RCRA metals - lead, etc.
- d. SVOCs
- e. Radionuclides (depleted uranium)

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- f. Nitroaromatics and Nitroamines
- g. TPH

4. List known or potential routes of migration.

- a. Primary Model
 - (1) Infiltration and concentration of potential contaminants in the form of leachate into the soil directly below the landfill
 - (2) Minor lateral migration (due to anisotropy) of contaminants in the form of leachate into the soil
 - (3) Infiltration limited to less than 25 feet of vertical and 10 feet of lateral migration due to small quantities and low infiltration
- b. Alternate Model
 - (1) Infiltration as described in C.4.a.(1) and C.4.a.(2) above, greater than 25 feet of vertical migration
 - (2) If migration is greater than 130 feet (DOE, 1996a), potentially contaminated groundwater

5. List known human and environmental receptors.

- a. On-site personnel - potential for inadvertent intrusion
- b. Plants and animals - minimum potential/exposure
- c. Future land-use impacts
- d. Groundwater impacts - very low potential, liquids disposed of in building-specific drains septic system, or underground discharge points

D. Define the exposure pathway(s).

1. Define the exposure pathway(s).

- a. Ingestion or inhalation of soil, after excavation, is considered to be the most likely exposure pathway.
- b. Exposure potential related to ingestion of groundwater contamination (if present). Groundwater is estimated to be at least 40 m (131 ft) below the site (DOE, 1996a).

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- 2. Define the current and future land use.**
 - a. Current - unimproved surface, located in a semi-remote area removed from buildings and daily range activity. There is an improved road in the vicinity south of the site.
 - b. Future - likely to be similar or no use - no planned development.

- 3. Define applicable or relevant and appropriate requirements (ARARs) or preliminary remediation goals (PRGs).**

The primary ARARs for the landfill are Chapter 444 Solid Waste Disposal (NAC 444.7481) and 40 CFR Subtitle D.

Other action levels to be considered in order to designate screening levels to establish stop points for the investigation activities include:

- EPA Region 9 PRGs for hazardous, metallic, and PCB constituents, 1996
- NDEP action level for TPH of 100 ppm
- Background radiological levels (as established from background drilling, see Section II) or levels listed in the *Offsite Radiation Exposure Review Project (ORERP), Phase II Soils Programs* report (DOE/NV/10384-23) (McArthur and Miller, 1989)

- 4. Develop the exposure scenario.**
 - a. Excavation of contaminated material
 - b. Migration of contaminants into groundwater is possible, but unlikely to occur.

E. Specify the available resources.

- 1. Specify monetary budget for the field investigation.**

The amount will be determined based on budgetary constraints; however, allocations should be sufficient to address site.
- 2. Define relevant time constraints.**

See Attachment F.

DATA QUALITY OBJECTIVES WORKSHEETS

II. Identify the Decision

It is assumed that the wastes disposed of in the landfill cells are nonhazardous solid wastes, similar to waste in municipal or U.S. Department of Defense landfills. There is no direct evidence indicating disposal of hazardous materials. However, characterization of the wastes is not possible because of the potential for UXO and because solid wastes are very heterogeneous. Therefore, the assessment will focus on the surrounding soils, and the cell contents will not be sampled. Three background borings will be drilled for the collection of representative field screening background levels for VOCs, soil moisture, TPH, and radiological contamination (alpha, beta/gamma) and for the collection of representative analytical background levels for RCRA metals and radiological constituents (gamma spectroscopy and isotopic uranium).

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

The key decision is whether potential contamination has migrated from the cells - not what the cell contents are.

1. Contaminant Identification - Determine, with a Yes or No answer, whether "regulated" contaminants (constituents of concern [COCs]) are present in the area surrounding (beneath) the cells. Contents of the cells will not be investigated through sampling.
2. Action level exceedence - If "regulated" contaminants are present, determine with a Yes or a No answer, whether contamination exceeds EPA Region 9 PRGs, RCRA TC hazardous waste-screening levels, background radiological levels (established from background drilling) and/or levels listed in the ORERP report (DOE/NV/10384-23) (McArthur and Miller, 1989), or the NDEP TPH action level of 100 ppm.
3. Contaminant migration - If "regulated" contaminants exceed screening levels, determine, with a Yes or a No answer, whether regulated contaminant concentrations exceed or have the potential to exceed the spatial boundaries proposed in the conceptual model for the site.

DATA QUALITY OBJECTIVES WORKSHEETS

B. Identify alternative action that may be taken based on the findings of the field investigation. Select the actions that will be taken based on the outcome of the field investigation that corresponds with the selected decision.

Any alternatives will be approved by the Core Decision Team. Alternative actions could include the following:

- Closure in place without further action - If contaminants are not found in the area surrounding the landfill and if it can be demonstrated that no leachate generation or migration will take place in the future
- Preparation of a Corrective Action Decision Document (CADD) which compares alternative corrective actions and selects the most appropriate corrective action - If contaminants are found above regulatory levels in the area surrounding the landfill. Potential remedies the CADD could address are also closure in place with or without monitoring, clean closure (stakeholders agreed that this is not a likely option due to the potential for UXO), or waste treatment.
- Rescoping of the investigation - If the contaminant migration exceeds the spatial boundaries and impacts groundwater

C. Identify relationships among decisions.

1. Prioritize decisions.

From highest to lowest sequence:

IIA.1 > IIA.2 > IIA.3

2. Determine the logical sequence of actions.

1. Contaminant Identification

- a. ("No" answer) Recommend that the site or the current study area is not contaminated (and will not be contaminated in the future) and that further assessment (at this location) is not necessary. This may require modeling or monitoring to provide assurance over the required time.
- b. ("Yes" answer) Recommend that the current study area is contaminated and further assessment (at this location) may be warranted (i.e., determine if action levels have been exceeded). If so, go to Action 2.

DATA QUALITY OBJECTIVES WORKSHEETS

2. Action Level Exceedence
 - a. ("No" answer) Recommend that the site or the current study area is not contaminated above applicable screening levels (and will not be contaminated further) and that further assessment (at this location) is not necessary. This may require modeling or monitoring to provide assurance over the required time.
 - b. ("Yes" answer) Recommend that the current study area is contaminated above applicable screening levels and further assessment (at this location) may be warranted. If so, go to Action 3.
3. Contaminant Migration
 - a. ("No" answer) Recommend that the regulated contaminant concentrations do not exceed the proposed spatial boundaries, that the conceptual model does not need to be modified, and that further assessment (at this location) is not necessary. This may require modeling or monitoring to provide assurance over the required time.
 - b. ("Yes" answer) Recommend that the regulated contaminant concentrations exceed the proposed spatial boundary, that the model must then be modified, and that further assessment is required to evaluate the new (alternate) model. If so, rescope for monitoring wells and/or other alternate methods presented in Attachment G.

III. Identify the Inputs to the Decision

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

1. **Prepare a list of all of the data needed to resolve the decision.**
 - a. Contaminant Identification:
 - Analyses of soils directly beneath the landfill for the parameters listed in I.C.3
 - Analysis of soil gas beneath the landfill - only if laboratory results detect contamination
 - Soil moisture content below the landfill
 - Soil physical characteristics (hydrological and geotechnical)
 - Capacity for waste to generate leachate in the future
 - b. Action Level Exceedence:

Laboratory analyses of soils directly beneath the landfill for the parameters listed in I.C.3

DATA QUALITY OBJECTIVES WORKSHEETS

c. Contaminant Migration:

- Boundaries of contaminant migration from field screening and/or analyses of soils for the parameters listed in I.C.3
- Capacity for migration to continue in the future

d. Waste Management:

Process knowledge indicates that there is no reason to believe that hazardous (i.e., RCRA-regulated) or radioactive wastes were placed in the landfill. There is no record that indicates that chemicals or solvents were discarded in the landfill. Therefore, any potential hazardous wastes placed in the landfill would be characteristic, rather than listed wastes. The soil will be field-screened, sampled, and analyzed to verify that this process knowledge is correct. Waste generated through sampling will be traceable to its source and to individual samples. Should laboratory results indicate that the waste exhibits a hazardous characteristic, the waste will be managed as hazardous waste in accordance with RCRA. As soon as it is known that the waste is hazardous (i.e., through field screening or laboratory analyses), the waste will be managed as hazardous with the 90-day accumulation time limit starting when the waste is identified as hazardous. As soon as it is known that the waste is radioactive (i.e., through field screening or laboratory analyses), the waste will be managed in accordance with the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (Rev. 0), September 1996 (DOE, 1996b). As soon as it is known that the waste is a mixed waste (i.e., through field screening or laboratory analyses), the waste will be managed in accordance with the "Mutual Consent Agreement Between The State of Nevada and the Department of Energy for the Storage of Low-Level Land Disposal Restricted Mixed Waste" (NDEP, 1995).

2. Indicate how to generate the necessary data (e.g., sampling, modeling, etc.).

a. Contaminant Identification (Options):

- Laboratory analyses of soils beneath the landfill for the parameters listed in I.C.3 - soil sampling and analysis
- Analysis of soil gas beneath the landfill - soil gas sampling and analysis - only if laboratory analytical results detect contamination
- Soil moisture content below the landfill - field screening
- Soil physical characteristics (hydrological and geotechnical) - soil sampling and analysis or *in situ* testing

DATA QUALITY OBJECTIVES WORKSHEETS

- Capacity for waste to generate leachate in the future - Water balance/leachate generation modeling. Review of the following historic information: historic photographs, Area 9 building inventory and build dates, hazard analysis of Area 9 facilities, contaminant types, soil characteristics, nearby well records, groundwater maps, etc.
- b. Action Level Exceedance:
See Section III. A. 1. b.
- c. Contaminant Migration:
 - Boundaries of contaminant migration from indicator parameters and/or analyses of soils for the parameters listed in I.C.3 - soil sampling and analysis and/or field screening
 - Capacity for migration to continue in the future - contaminant distribution modeling
- d. Waste Management:
Analytical results and field-screening results will be used to determine if the waste is nonhazardous - soil sampling and analysis and/or field screening

B. Identify sources for each environmental input and list those inputs that are obtained through environmental measurements. Identify existing sources of information that can support the decision.

See Attachment G.

C. Determine the basis for establishing contaminant-specific action level(s). List the possible basis for establishing the action level (e.g., regulatory threshold, risk or exposure assessment, technological limits, reference based, standards, etc.).

1. General:

Establishment of risk-based levels through the implementation of RCRA, CERCLA, and/or ASTM risk assessment techniques, as necessary and/or appropriate

2. Background levels:

Establish analytical background levels for RCRA metals and uranium isotopes and moisture prior to drilling investigation holes. Some constituents (e.g., beryllium) have detection limits higher than risk-based criteria and may need alternate levels such as background. (Typical TTR background levels for specific metals are presented in Culp et al., 1994.)

DATA QUALITY OBJECTIVES WORKSHEETS

3. Screening for the contaminant boundary:

EPA Region 9 PRGs, RCRA TC hazardous waste screening levels, and the NDEP TPH action level of 100 ppm. Radionuclides - application of background radiological levels (established from background drilling) or levels listed in the ORERP report (DOE/NV/10384-23) (McArthur and Miller, 1989) for evaluation of laboratory analysis data.

4. Solid waste regulations:

In accordance with the techniques listed above, the State of Nevada (NAC 444.7481) will allow the suspension of requirements for monitoring groundwater (the primary ARAR) *if the owner or operator can demonstrate that there is no potential for migration of hazardous constituents from that unit to the uppermost aquifer during the life of the unit, including the period of closure and postclosure. The demonstration must be certified by a qualified ground-water scientist and approved by the solid waste management authority. The demonstration must be based upon:*

(a) Measurements collected at specific field sites and the sampling and analysis of physical, chemical and biological processes affecting the fate and transportation of contaminants; and

(b) Predictions of the fate and transportation of contaminants which are based on the maximum possible rate of the migration of the contaminants and a consideration of the impacts on public health and safety and the environment.

5. Waste Management:

Listed wastes - Presence above detection limits for designation (i.e., as hazardous waste) and concentrations above the LDR levels for disposal

Characteristic wastes - Concentrations above the TC levels for designation and disposal

D. Identify potential sampling approaches and appropriate analytical methods.

Biased samples will be collected from drillhole locations determined by geophysical anomalies. The samples will be selected from each drillhole at 5-ft intervals or if field-screening results indicate the presence of contamination. Field screening will include the following: TPH testing, VOC screening, moisture testing, and radiological screening. Soil samples will be collected as described below under sampling.

DATA QUALITY OBJECTIVES WORKSHEETS

1. Sampling:

Sampling through subsurface drilling. The unsaturated interval below each landfill cell will be investigated with multiple drilling locations from the surface to the shallowest depth beneath the cells, closest to the center line of the cells which can be obtained based on the drilling angle (i.e., 15 ft below the cell based on a 45° drilling angle) (area most likely to be impacted by potential contamination); and until two consecutive non-detects (detections not above background levels) results are obtained through field-screening methods.

2. Analytical:

Parameters selected based on process knowledge and requirements specified by the NDEP for "full suite" analysis:

Nitroaromatics and Nitroamines - SW-846 (EPA, 1996) 8330
Total VOCs - SW-846 (EPA, 1996) 8260
Total SVOCs - SW-846 (EPA, 1996) 8270
Total RCRA metals - SW-846 (EPA, 1996) 6010/7470
Total petroleum hydrocarbons - gasoline, diesel, and oil fractions - SW-846 (EPA, 1996) 8015 modified
PCB - SW-846 (EPA, 1996) 8080
Gamma spectroscopy -HASL 300 4.5.2.3 (DOE, 1992)
Isotopic uranium - National Academy of Sciences, Nuclear Science Series (NAS -NS)-3050 (NAS, 1963)

(TC [SW-846 1311] analysis will be performed on samples if waste is determined to be RCRA.)

The following commonly detected laboratory contaminants (constituents) may appear in sample results:

For VOCs:

Acetone
Methylene chloride
MEK
Toluene

For SVOCs:

Phthalate esters (i.e., bis[2-ethylhexyl]phthalate)

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3. Soil Engineering Analysis

An off-site, fixed-base laboratory may be used for soil engineering analysis for the following:

- Initial moisture content
- Dry bulk density
- Calculated porosity
- Saturated/unsaturated hydraulic conductivity
- Particle-size distribution - preferred method is hydrometer distribution
- Water release (retention) curve

or *in situ* testing may be performed for soil characteristics.

IV. 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 Operable Unit).**

The study area is defined by the plan view of the associated geophysical anomalies plus 3 m (10 ft) on each side as a buffer.

2. **Specify the characteristics that define the population of interest.**
Alluvial sediments in the unsaturated zone
3. **When appropriate, divide the population into strata that have relatively homogeneous characteristics.**

The cells can be divided into three strata: (1) soils - surface to 25 ft below ground surface (area most likely to be impacted by potential contamination); (2) unsaturated soil deeper than Strata 1 (less likely to be contaminated due to limited precipitation, lack of liquid disposal at landfills and high evapotranspiration); and (3) groundwater.

The sampling operation will be conducted in 1.5-m (5-ft) intervals for Strata 1 once the drilling depth has advanced past the determined depth of the cell (i.e., 15 ft vertical depth from ground surface). Total depth will be determined by collecting two consecutive non-detect field-screening results (detections not above background levels). Note: Total depth may be groundwater (estimated to be 40 m [131 ft]).

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If contaminants extend to groundwater, the DQOs and project will be rescoped by the Core Decision Team.

4. Define the scale of decision making.

The scale of decision making will be based on the strata into which the site has been divided and the length of time required by ARARs. Precision of the migration into the subsurface soil will be determined within the 5-ft intervals, and modeling will be used to predict future migration potential.

B. Define the temporal boundaries of the decision.

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

The time frame for each landfill cell begins from the date the cell was originally opened (see the Timeline - Attachment C). Study data will include process knowledge to include all available validated documentation (i.e., source of information can be traced and verified) regardless of the age of the information.

The end of the time frame will be contingent on the decision regarding closure status (i.e., No Further Action, clean closure, or closure in place with post-closure monitoring [30 years] or monitoring waivers). The NDEP will be notified if the schedule has been negatively impacted beyond recovery. The NDEP will also be notified weekly of current project schedule status on the Daily Summary (generated during field activities).

2. Determine when to collect data.

Seasonal variations are not expected to affect data quality or representativeness, and activities can be conducted as scheduled. Soil gas monitoring will be affected by short cycle temporal variations and should be designed accordingly.

Characterization activities will be conducted only during favorable weather conditions (i.e., no rain, no significant wind); however, engineering controls may be used to improve conditions.

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C. Identify any practical constraints on data collection.

- Testing operations (TTR security constraints)
- Meteorological
- Health and safety

V. Develop a Decision Rule -- Define a Logical Basis for Choosing Among Alternative Actions

A. Specify the parameter that characterizes the population of interest.

Leachate within unsaturated alluvial soils 25 ft beneath and within 10 ft horizontally from the sides of the landfill cells. Note: The horizontal investigation will take place if contamination is detected and if soil moisture is conducive to anisotropy.

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

The action levels trigger the "yes" decisions described in Step II, and they include:

1. On-site field-screening methods:

- Radiation (alpha, beta/gamma in disintegrations per minute [dpm]) levels two times background levels as established from background drilling
- VOC screening (20 ppm or 2.5 times background, whichever is greater)
- TPH above 100 ppm from a field-screening method that can obtain a comparable reading or above the field-screening level that is comparable to an analytical concentration of 100-ppm TPH

2. Off-site - Analytical (laboratory):

- Contaminant concentrations above the EPA Region 9 PRGs or background, whichever is higher, for initial site screening and characterization and above risk-based levels (modeling - which may be different)
- Laboratory TPH concentrations above 100 ppm
- Application of background radiological levels (established from background drilling) or levels listed in the ORERP report (McArthur and Miller, 1989) (DOE/NV/10384-23)

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C. Develop the decision rule. Combine the outputs of the previous DQO steps into "if ... then ..." decision rules that include the parameters of interest, the action levels, and the alternative actions.

1. Contaminant Identification:

If the field screening and verification samples (laboratory analyses) do not detect potential contaminants above preliminary action levels, then recommend that the current study area (cell) is not contaminated (and will not be contaminated in the future) and that further assessment (at this location) is not necessary. This may require modeling or monitoring to provide assurance over the required time.

If the field screening and verification samples (laboratory analyses) detect contaminants, then further assessment (at this location) may be warranted (i.e., determine if action levels have been exceeded). If so, go to Action Level Exceedence assessment.

2. Action Level Exceedence:

If the verification samples (laboratory analyses) do not detect contaminants above action levels and modeling shows no future increase in concentrations, then recommend that the current study area is not contaminated above applicable levels (and will not be contaminated further) and that further assessment (at this location) is not necessary. This may require modeling or monitoring to provide assurance over the required time.

If the verification samples (laboratory analyses) detect contaminants above action levels or modeling shows future increase in concentrations above action levels, then recommend that the current study area is or may be contaminated above applicable levels and that further assessment (at this location) may be warranted. If so, go to contaminant migration assessment.

3. Contaminant Migration:

If the verification samples (laboratory analyses) do not detect contaminants above action levels beyond the boundaries, recommend that the regulated contaminant concentrations do not exceed the proposed spatial boundaries, that the conceptual model does not need to be modified, and that further assessment (at this location) is not necessary. Prepare a CADD for site closure.

If the verification samples (laboratory analyses) detect contaminants above action levels beyond the boundaries, recommend that the regulated contaminant concentrations exceed the proposed spatial boundary and the

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model must then be modified, and that further assessment is required to evaluate the new (alternate) model. If so, rescope for monitoring wells and/or other alternate methods presented in Attachment G.

VI. Specify Acceptable Limits on Decision Errors. Specify Decision Error Limits Based on the Consideration of the Consequences of Making an Incorrect Decision

Because the sampling approach relies entirely on biased samples, no statistical analysis is proposed. If statistical analysis can be performed, the following will be applied to the decision process.

A. Determine the upper and lower bounds for the parameter of interest using relevant historical site data.

In the unlikely event that contaminants are present, they are expected to be similar to leachate compositions from municipal solid waste landfills.

B. Define both types of decision errors and identify the potential consequences of each.

1. Using the actions, action level, and decision rule(s), define both types of decision errors.

The two types of decision errors are paired results of the decisions discussed in Section V. C.

a. Contaminant Identification:

- (1) "Regulated" contaminants are determined not to be present when they really are.
- (2) "Regulated" contaminants are determined to be present when they really are not.

b. Action Level Exceedence:

- (1) "Regulated" contaminants do not exceed action levels when they really do.
- (2) "Regulated" contaminants exceed action levels when they really do not.

c. Contaminant Migration:

- (1) "Regulated" contaminants are not migrating when they really are.
- (2) "Regulated" contaminants are migrating when they really are not.

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- d. For each set of decision errors described above, the worst-case consequences are that waste constituents will, unintentionally, be left in place. The lesser error will cause resources to be expended unnecessarily.

2. Establish the true state of nature for each decision error.

- a. Contaminant Identification - If regulated contaminants are present, they will be within the current study areas.
- b. Contaminant characterization - The contamination exceeds or will exceed EPA Region 9 PRGs, background radiological levels (established from background drilling) or levels listed in the ORERP report (DOE/NV/10384-23) (McArthur and Miller, 1989), or the NDEP TPH action level of 100 ppm.
- c. Contaminant migration - Regulated contaminant concentrations exceed or will exceed the spatial boundaries proposed in the conceptual model for the site.

3. Define the true state of nature for the more severe decision error as the baseline condition or the null hypothesis (H_0) and define the true state of nature for the less severe decision error as the alternative hypothesis (H_a).

- a. Contaminant Identification:
 - (1) H_0 - Regulated contaminants are or will be present within the current study area.
 - (2) H_a - Regulated contaminants are not and will not be present within the current study area.
- b. Action Level Exceedence:
 - (1) H_0 - The contamination exceeds or will exceed EPA Region 9 PRGs, background radiological levels (established from background drilling), or levels listed in the ORERP report (DOE/NV/10384-23) (McArthur and Miller, 1989), and the NDEP TPH action level of 100 ppm.
 - (2) H_a - The contamination does not and will not exceed EPA Region 9 PRGs, background radiological levels (established from background drilling), or levels listed in the ORERP report (DOE/NV/10384-23) (McArthur and Miller, 1989), and the NDEP TPH action level of 100 ppm.

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c. Contaminant Migration:

- (1) H_0 - Regulated contaminant concentrations exceed or will exceed the spatial boundaries proposed in the conceptual model for the site.
- (2) H_a - Regulated contaminant concentrations do not and will not exceed the spatial boundaries proposed in the conceptual model for the site.

4. Assign the terms "false positive" and "false negative" to the proper decision errors.

a. Contaminant Identification:

- (1) False positive - "Regulated" contaminants are not present within the current study areas when they really are.
- (2) False negative - "Regulated" contaminants are present within the current study areas when they really are not.

b. Contaminant Characterization:

- (1) False positive - "Regulated" contaminants do not exceed action levels when they really do.
- (2) False negative - "Regulated" contaminants exceed action levels when they really do not.

c. Contaminant Migration:

- (1) False positive - "Regulated" contaminant concentrations do not exceed the spatial boundaries proposed in the conceptual model for the site when they really do.
- (2) False negative - "Regulated" contaminant concentrations exceed the spatial boundaries proposed in the conceptual model for the site when they really do not.

C. Specify a range of possible parameter values where the consequences of decision errors are relatively minor (the gray region). Identify the range of points on the false negative side of the action level where the consequences of making decision errors are relatively minor. This range establishes the gray region.

Not applicable. The biased sampling approach is not suitable for statistical analysis. However, the gray area will be those samples just above detection limits or background levels, whichever is higher, for the contaminant identification

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decision. For the action level exceedence and the contaminant migration decisions, the gray area will be those results very close to the action levels.

D. Assign probability values to points above and below the action level that reflect the acceptable probability for the occurrences of decision errors.

Because the sampling approach relies entirely on biased samples, no statistical analysis is proposed. If statistical analysis can be performed (e.g., gridded sampling results), the probability values shall be established at a 95 percent confidence level above and below the gray area.

True Concentration	Correct Decision	Type of Error	Tolerable Probability of Incorrect Decision	Level of Confidence
< 80% action level	Not exceeded	False Negative	5%	95%
80 - 100% action level	Not exceeded	False Negative	Gray Region	Gray Region
> 100% action level	Exceeded	False Positive	5%	95%

E. Check for consistency. Check the limits on decision errors to ensure that they accurately reflect the decision maker's concerns about the relative consequences for each type of decision error.

No statistical analysis is proposed. If statistical analyses are performed, the limits will also require formal approval during the internal and NDEP review process.

VII. Optimize the Design. Outline a Sampling Design, Specifying the Operational Details of the Sampling Plan Which Fall Within the Project Constraints

Note: The information presented in this section is the result of discussions held between the Core Decision Team members and the Scoping Team members on December 11, 1996. Discussions were based on the subsections of Step VII.

The sampling approaches for the Area 9 Landfill cells are presented in the Area 9 Landfill Sampling Program table (located at the end of this Section VII). Recommended boring locations and rationale are described, and the boring locations are shown on Figure 1

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(located at the end of Section VII). Each boring will be screened and sampled for the parameters described in Steps III.D. and V.B. The borings will be sampled at intervals described in IV.A.3.

Key Assumptions:

- The cell contents will be similar to that which was removed from the open east end of Cell A9-1 during VCA activities. Therefore, it is assumed that the cells contain inert UXO and rocket motor casings, wooden rocket motor shipping containers, and construction debris.
- The cells were normally excavated by bulldozer or similar earthmoving equipment; therefore, they have relatively steep, linear sides and at least one end (or both) is gradually sloped ramped.
- The width of the cells is estimated at 20 ft. This is based on the width of the open pit at the east end of Cell A9-1 and information from an interview with an employee (Elliston, 1997).
- The depth of the cells is estimated at 17 ft, which includes an added safety margin of 2 ft (15-ft depth without the safety margin). The open pit at the east end of Cell A9-1 was approximately 6 ft deep; however, the pit is part of the ramp down into the cell.
- The deepest area of the cell is expected to be the middle third of the cell.
- On the magnetic field plots, the anomalies represent magnetic materials (steel, iron, or mafic rocks) and do not necessarily give an accurate indication of the size of the object. Generally, the more distinct the anomaly, the greater the quantity.
- On the conductivity plots, the distinct anomalies generally represent manmade, conductive media (metallic debris), but anomalies can also represent natural conditions (moisture, salts, muds).
- Multiple cell landfills are generally excavated parallel to subparallel.
- The locations described below may need to be adjusted in the field based on additional field observations.
- Cells A9-3 and A9-4 appear to be one cell. They are shown as two cells based on geophysical data. They will be investigated as one cell and referred to as A9-3.
- Cell A9-2 may be shallower since it is not as long as cells A9-1 and A9-3.

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- Borings will be drilled at a 45° angle. If a 45° angle is not obtainable, a 30° angle will be used. The borings will be placed far enough away from the cell edges so that the boring will miss the bottom corners of the cells by a 2-ft safety margin. Assuming that the cell depth is 15 ft and that a 45° angle can be drilled, the borings will be placed approximately 17 ft away from the cell edges. This will enable the boring to miss the bottom corner of the cell and to investigate the center point of the trench as close to the bottom of the cell as possible. Distances will be adjusted based on the angle to be drilled.
- If drilling resistance is encountered, drilling activities will be stopped and moved out accordingly.

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Area 9 Sampling Program			
Boring/ Sample #	Vertical (V) or Angle (A)	Recommended Location	Rationale
Cell A9-1			
A9-1-1	A	~25 ft east of the west end of the cell. North side of cell. To represent the west quarter of the cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
A9-1-2	A	~60 ft east of the west end of the cell. South side of cell. To represent the west middle quarter of the cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
A9-1-3	A	~100 ft east of the west end of the cell. North side of cell. To represent the east middle quarter of the cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
A9-1-4	A	~140 ft east of the west end of the cell. North side of cell. To represent the east quarter of the cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
Cell A9-2			
A9-2-1	A	~17 ft west of west end of the cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
A9-2-2	A	~22 ft west of east end of the cell. North side of cell. (Prior to drilling this location, the open pit on the east end of A9-1 will need to be filled in with soil).	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.

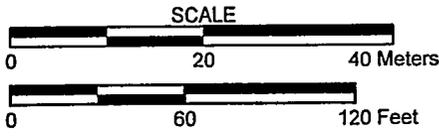
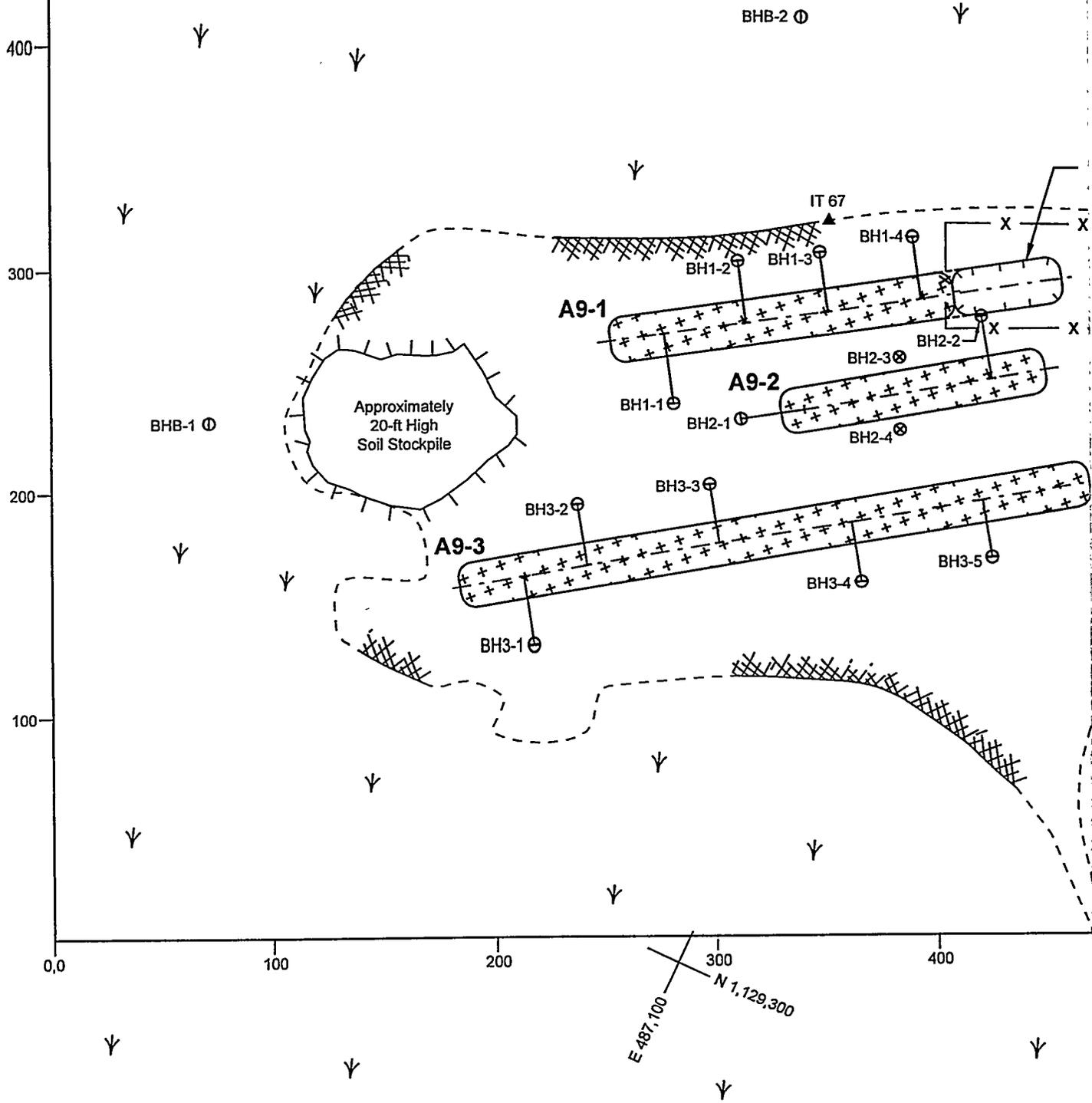
DATA QUALITY OBJECTIVES WORKSHEETS

Area 9 Sampling Program			
Boring/ Sample #	Vertical (V) or Angle (A)	Recommended Location	Rationale
<i>Boring Options (Cell A9-2 cont):</i>			
A9-2-3	V	~50 ft east of the west end of the cell. North side of cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. The drill rig will be positioned parallel to the cell to avoid being on top of cell A9-1. The side of the rig closest to the north edge of the cell will be raised as much as possible to create an angle for drilling. This will allow for investigation under the deeper portion of the cell.
A9-2-4	V	~6 ft' west of the east end of the cell. South side of cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. The drill rig will be positioned parallel to the cell to avoid being on top of cell A9-3. The side of the rig closest to the south edge of the cell will be raised as much as possible to create an angle for drilling. This will allow for investigation under the deeper portion of the cell.
<i>Cell A9-3</i>			
A9-3-1	A	~30 ft east of the west end of the cell. South side of cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
A9-3-2	A	~60 ft east of the west end of the cell. North side of cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
A9-3-3	A	~120 ft east of the west end of the cell. North side of cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.

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Area 9 Sampling Program			
Boring/ Sample #	Vertical (V) or Angle (A)	Recommended Location	Rationale
A9-3-4	A	~180 ft east of the west end of the cell. South side of cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
A9-3-5	A	~240 ft east of the west end of the cell. South side of cell.	Fairly consistent geophysical readings; therefore, evenly spaced borings to be representative of cell. To be drilled at an angle of 45°. If a 45° angle is not possible, a 30° will be used.
Background Boring Location: ^{a, b}			
B-1	V	Minimum of 100 ft west of the Area 9 Landfill area in an undisturbed area.	Samples will be collected at ~10-ft and 15-ft depth to determine a background for subsurface soil below the bottom of the landfill.
B-2	V	Minimum of 100 ft north of the Area 9 Landfill area in an undisturbed area.	Samples will be collected at ~10-ft and 15-ft depth to determine a background for subsurface soil below the bottom of the landfill.
B-3	V	Minimum of 100 ft east of the Area 9 Landfill area in an undisturbed area.	Samples will be collected at ~10-ft and 15-ft depth to determine a background for subsurface soil below the bottom of the landfill.
Note: ^a At least one background boring location will be drilled upgrade from the landfill. ^b Background boreholes will be drilled and sampled prior to the investigation boreholes. The sample collection depths will reflect the estimated depth of the trenches.			

0,440 100 200 300 400



Note: Coordinates are in Nevada State Plane, NAD 27
 Source: IT, 1997
 EG&G 7524-44, 1993

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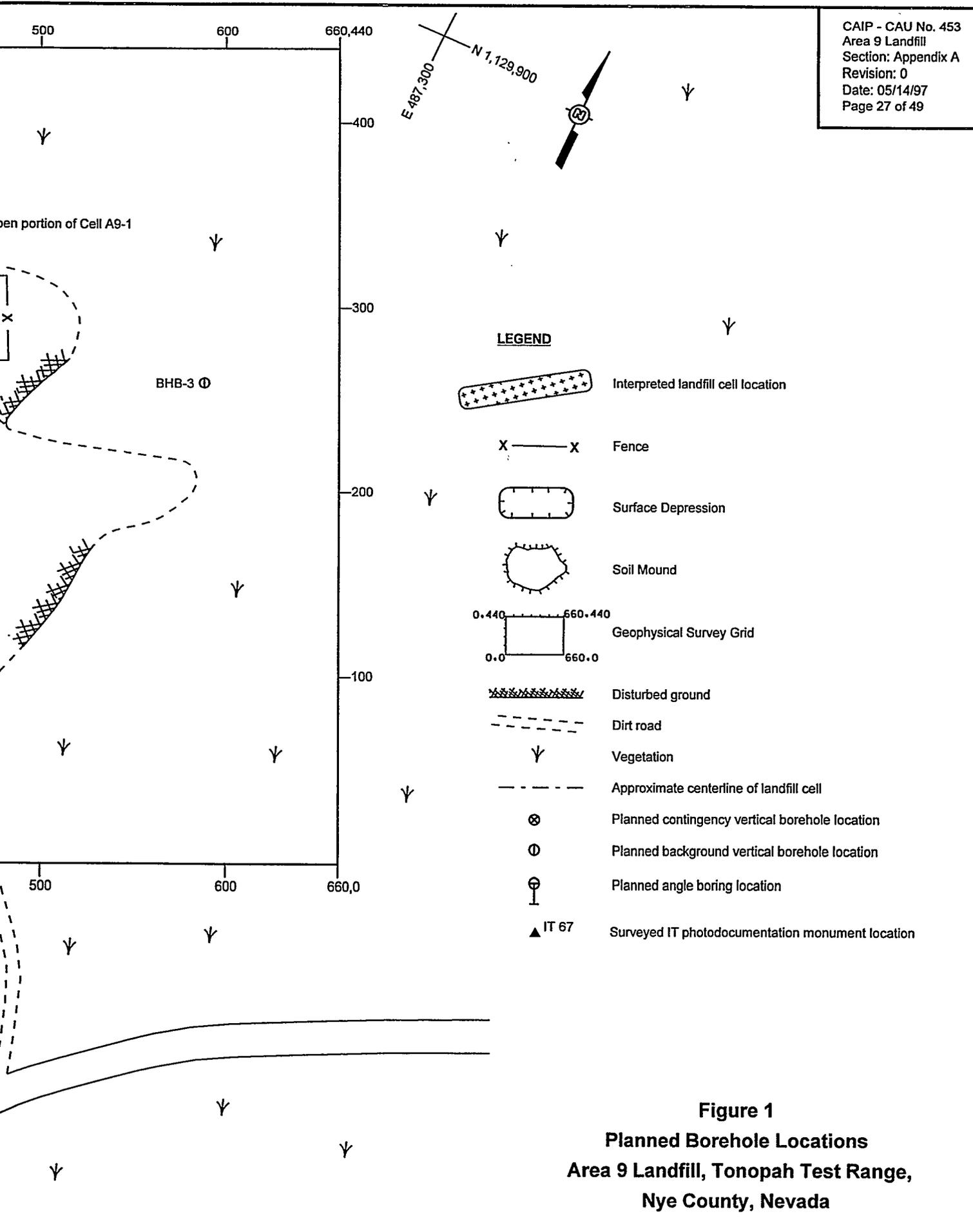


Figure 1
Planned Borehole Locations
Area 9 Landfill, Tonopah Test Range,
Nye County, Nevada

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Attachment A

Area 9 Landfill, Historical Aerial Photos

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**Table 1
Historic Aerial Photos for the Area 9 Landfill,
Tonopah Test Range**

Aerial Photo Number	Year Flown
ITLV 5511	Approximately 1962
EG&G 3310 - 028	1980
EG&G 4107-21, -22	1982
EG&G 5065 - 009	1985
EG&G 5376 - 63, 5438 - 064	1986
EG&G 5956 - 034	1988
EG&G 6360 - 017	1989
EG&G 7524 - 44	1993

References:

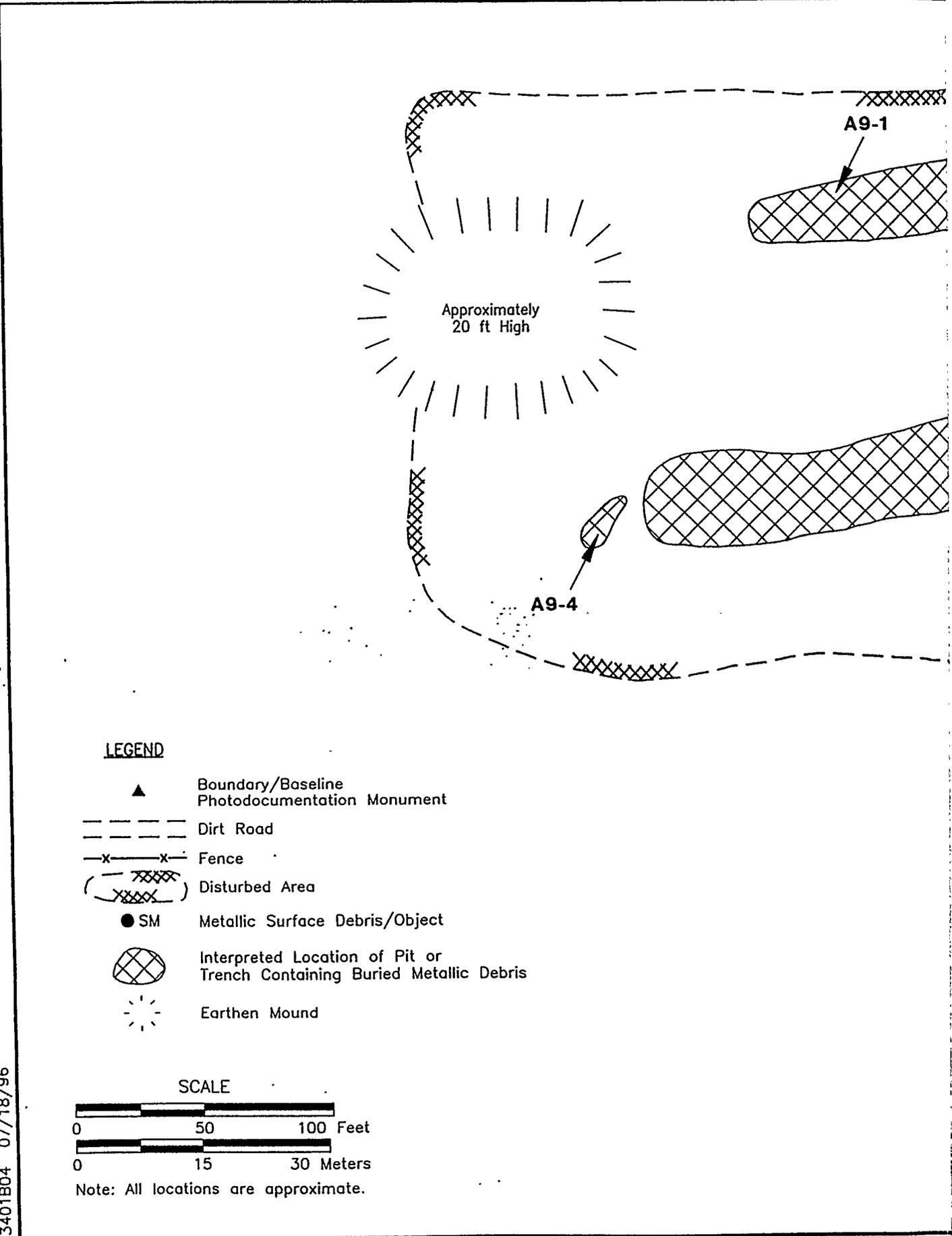
EG&G, 1980 - 1993 - Photos from EG&G archives, Las Vegas, NV (number indicates the perf. and frame number).
ITLV, 1962 - Photos from IT Corporation Library, Las Vegas, NV (number indicates the library reference number).

DATA QUALITY OBJECTIVES WORKSHEETS

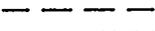
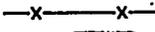
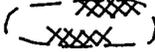
Attachment B

Map of Landfill Cells

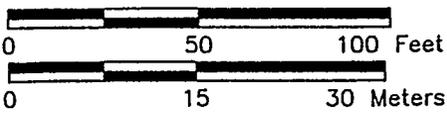
3401B04 07/18/96



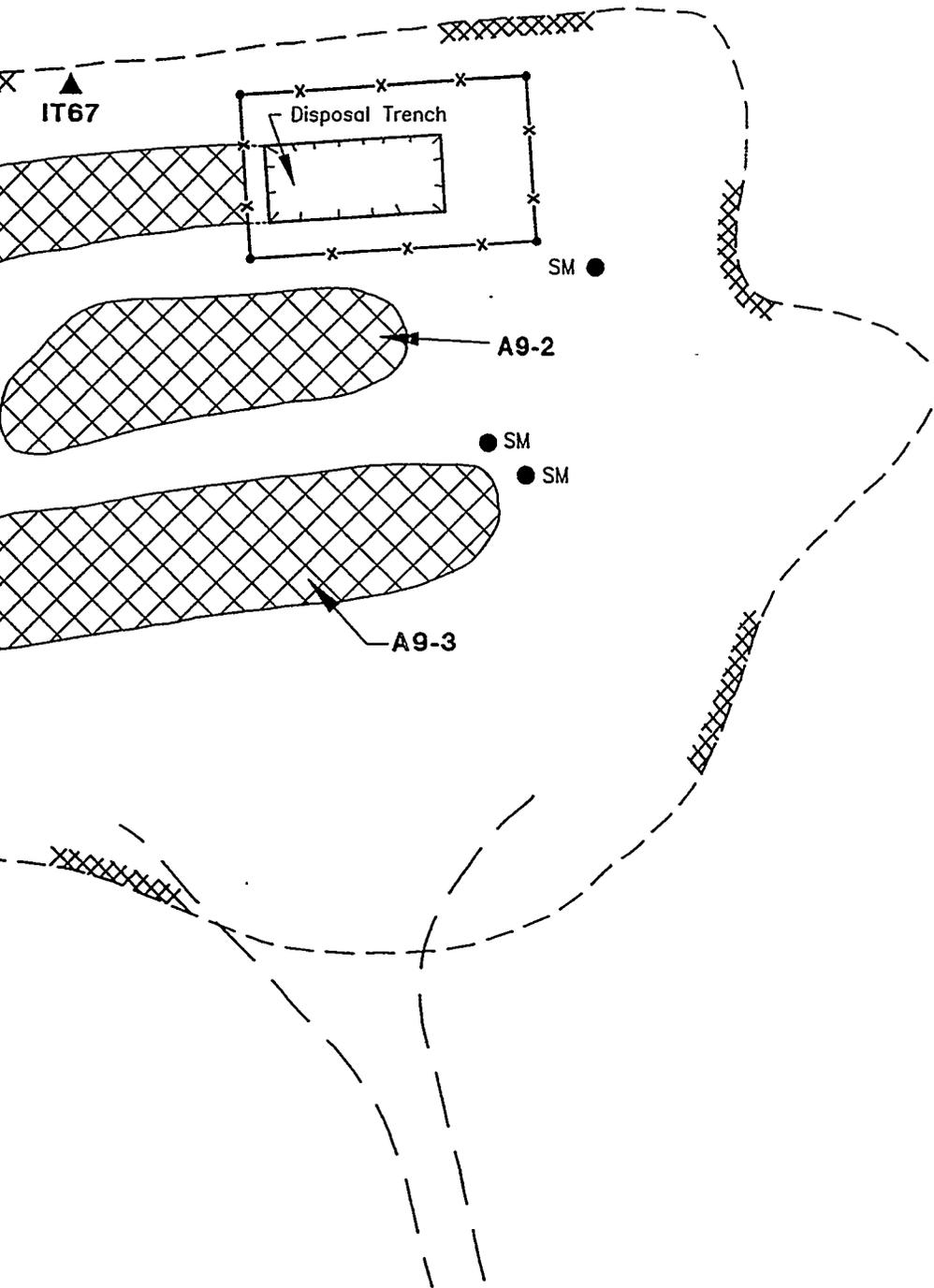
LEGEND

-  Boundary/Baseline Photodocumentation Monument
-  Dirt Road
-  Fence
-  Disturbed Area
-  SM Metallic Surface Debris/Object
-  Interpreted Location of Pit or Trench Containing Buried Metallic Debris
-  Earthen Mound

SCALE



Note: All locations are approximate.



Attachment B
SITE LOCATION MAP,
AREA 9 LANDFILL,
TONOPAH TEST RANGE,
NYE COUNTY, NEVADA

DATA QUALITY OBJECTIVES WORKSHEETS

Attachment C

Area 9 Landfill Time Line

DATA QUALITY OBJECTIVES WORKSHEETS

Attachment C Area 9 Landfill Timeline

Landfill Cell	Available Historic Aerial Photographs of Area 9 Landfill																																					
	Year	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94			
Cell 9-1		<input type="checkbox"/>																																				
Cell 9-2		<input type="checkbox"/>																																				
Cell 9-3/9-4		<input type="checkbox"/>																																				

EXPLANATION:
 = Cell not excavated at this time
 = Cell open on photo
 = Cell closed on photo

REFERENCES:
 EG&G, 1980-1993 = Photos from EG&G archives, Las Vegas, NV (number indicates perf. and frame number)
 ITLV, 1962 = Photos from IT Corporation Library, Las Vegas, NV (number indicates library reference number)

DATA QUALITY OBJECTIVES WORKSHEETS

Attachment D

**Chemical, Biological, and Radiological Hazards at Building
Structures Inspected at Sandia National Laboratories,
Tonopah Test Range**

(This document has been reprinted as it was received in the ITLV office)

ATTACHMENT D

Table 2 (Continued)

Chemical, Biological, and Radiological Hazards at Building Structures Inspected at Sandia National Laboratories/Tonopah Test Range

Building No.	Building Name	PHA ^a	CI '93 ^b	Asbestos ^c Materials	Chemicals Used ^d		Chemicals Documented in Past Inspections ^g		Stained Area ^j	Radioactive Materials ^k	Other ^l Materials
					Type ^e	Qty. ^f	Type ^h	Qty. ⁱ			
03-82T	Drafting	Y	Y	Floor tiles	Compressed gas	<1 qt.	Solvents	<1 qt.			
03-83T	Auto parts storage		Y		Compressed gas, oil/grease, solvent, paint	12 gals.	Cleaning supplies, oil/grease, paint, propane	5 gals.	Not identifiable		
03-84T	Drafting storage				Oil/grease, solvents, paint	1 gal.					
03-85T	Fire equipment storage										
03-87	Drum containment facility		Y		Oil/grease, solvents	>55 gals.	Antifreeze, diesel, oil/grease, solvents	>55 gals			
03-88	Electrical storage										
03-89	Freezer locker										
03-90	Freezer locker										
03-91	Boiler equipment			Pipe insulation							
09-01	ASI practice AMO storage										
09-02	Storage (unused)										
09-03	Power supply/Zener lights										
09-04	Camera tower										
09-05	Area 9 storage										
09-06	Storage shelter										
09-12	Antenna power shelter								Solvent	Unknown ⁿ	

Source: IT, 1994

Refer to footnotes at end of table.

Table 2 (Continued)
Chemical, Biological, and Radiological Hazards at Building Structures Inspected at
Sandia National Laboratories/Tonopah Test Range

Building No.	Building Name	PHA ^a	CI '93 ^b	Asbestos ^c Materials	Chemicals Used ^d		Chemicals Documented in Past Inspections ^g		Stained Area ^j	Radioactive Materials ^k	Other ^l Materials
					Type ^e	Qty. ^f	Type ^h	Qty. ⁱ			
09-13	Test equipment shelter										
09-15	X-ray lab										
09-16	Linac control building										
09-17	Linac target building										Lead bricks
09-18	Area 9 guard shack										
09-19	Rocket launcher TV tower										
09-20	Lightning warning tower										
09-21	PA and warning horn tower										
09-22	Cable pit										
09-23	Gun pit		Y		Oil/grease, solvents, paint	15 gals.	Kerosene, oil/grease, paint, solvents	18 gals.	Oil/grease		
09-24	Lightning warning system										
09-50	Observation bunker	Y		Floor tiles			Adhesives/sealants, solvents	<1 qt.			
09-51	Rocket control bunker	Y	Y	Floor tiles			Adhesives/sealants, solvents Solder	<1 qt. 4 lbs.			
09-52	Assembly building (nonhazardous)	Y	Y	Brakes, cover base, exterior, floor tile, fittings	Oil/grease, solder, solvents, unknown fuel	>55 gals.	Adhesives/sealants, oil/grease Solder	1 qt. 5 lbs.	Oil/grease		Compressor

Refer to footnotes at end of table.

Table 2 (Continued)
Chemical, Biological, and Radiological Hazards at Building Structures Inspected at
Sandia National Laboratories/Tonopah Test Range

Building No.	Building Name	PHA ^a	CI '93 ^b	Asbestos ^c Materials	Chemicals Used ^d		Chemicals Documented in Past Inspections ^g		Stained Area ^j	Radioactive Materials ^k	Other ^l Materials
					Type ^e	Qty. ^f	Type ^h	Qty. ⁱ			
09-54	Assembly building (explosives)	Y		Pipe insulation, exterior			Oil/grease, paint, solvents	Unknown		Depleted uranium	
09-55	Assembly building (high-explosives)	Y					Oil/grease, paint, solvents	Unknown		Depleted uranium	
09-56	Storage igloo	Y	Y		Explosives	10,000 lbs	Propellants	11,300 lbs.		Depleted uranium, SNM ⁿ	
09-57	Storage igloo	Y			Explosives, cleaning supplies	Unknown				Depleted uranium, SNM ⁿ	
09-58	Generator building	Y	Y		Diesel	>55 gals.	Diesel	>55 gals.	Oil/grease		Batteries, AST/UST, Transformer
09-59	Explosives storage igloo	Y			Cleaning supplies, explosives, beryllium	Unknown				Depleted uranium ^o	
09-60	Gun control bunker	Y	Y	Floor tiles, ventilation system			Adhesives/ sealants, oil/grease, solvents Solder Helium	2 gals. 2 lbs. 2 bottles			
09-62	Environmental building		Y	Floor tiles, pipe insulation			Cleaning supplies, oil/grease, paint, solvents	12 gals.	Oil/grease		
09-63	Secure storage facility ^p	Y		Ventilation system	Oil/grease	5 gals.	Cleaning supplies, oil/grease	5 gals.		Depleted uranium, SNM ^o	
09-64	Powder assembly building ^p			Ventilation system							

F refer to footnotes at end of table.

Table 2 (Continued)
Chemical, Biological, and Radiological Hazards at Building Structures Inspected at Sandia National Laboratories/Tonopah Test Range

Building No.	Building Name	PHA ^a	CI '93 ^b	Asbestos ^c Materials	Chemicals Used ^d		Chemicals Documented in Past Inspections ^g		Stained Area ^j	Radioactive Materials ^k	Other ^l Materials
					Type ^e	Qty. ^f	Type ^h	Qty. ⁱ			
09-65	Propellant storage building ^p										
09-67	Alarm system control building ^p	Y		Roof			Corrosives	Unknown			
13-00	ME-16 shelter										
13-01	Instrument shelter										
13-03	ME-16 shelter ^m										
16-00	ME-16 shelter								Oil/grease		Generator, transformer
18-00	Radar 5 antenna ^m	Y					Oil/grease, solvent Solder	Unknown 1 roll			
18-01	Radar 5	Y	Y				Gasoline, oil/grease, solvents	>55 gals.			
18-02	Camera tower										
18-50	Weather balloon building	Y	Y	External, floor tiles, roof, wall	Compressed gas, oil/grease	>55 gals.	Cleaning supplies, solvents Helium	1.5 gals. 90,000 cf.		Cesium-137 check source	AST/UST, transformer
18-51	Lightning warning system			External, floor tiles, roof, wall	Propane	>55 gals.				Cesium-137 and Cobalt-60 source ⁿ	Transformer
19-00	Contraves tower				Oil/grease	Unknown					
22-00	Contraves tower				Oil/grease	Unknown					
23-11	Telemetry storage										
23-16	Telemetry equipment storage										Transformer

Refer to footnotes at end of table.

Table 2 (Continued)
Chemical, Biological, and Radiological Hazards at Building Structures Inspected at Sandia National Laboratories/Tonopah Test Range

^aPHA = Preliminary hazard assessment performed in the building/facility/site (SNL/NM, 1993b; SNL/NM, 1992c; SNL/NM, 1990). Codes: Y = PHA performed.
^bChemical Inventory = Chemical inventory performed in 1993 (SNL/NM, 1994b). Codes: Y = inventory performed.
^cAsbestos suspected to be present: Refer to asbestos survey report (BCM, 1992) for more information.
^dChemicals = chemicals that are currently present in the building/facility/site (August, 1994).
^eType = type or description of chemicals present during inspection in August 1994.
^fQuantity = Quantity of chemicals present during inspection conducted in August 1994. This quantity represents an estimated total volume of all chemicals present.
^gChemicals present during past preliminary hazard assessments or chemical inventories (SNL/NM, 1993b; SNL/NM 1992c; SNL/NM, 1990; SNL/NM, 1994b).
^hType = type or description of chemical present during past assessments or inventories.
ⁱQuantity = estimated maximum amount of chemicals present during past inspections.
^jStains = Stains, discoloration, or evidence of past spill(s) in an area found during building inspection in August 1994.
^kRadioactivity = Radioactive materials that have been or are currently present in the building/facility/site (SNL/NM, 1994d; SNL/NM 1993b; SNL/NM, 1992c; SNL/NM; 1990).
^lOther = Any other materials identified during the inspection of the building/facility/site in August 1994 that may pose a risk to personnel or environment.
^mBuilding removed or destroyed prior to inspection.
ⁿRadiological survey was performed in August 1994.
^oRadiological survey performed by SNL/Tonopah (SNL/NM, 1994d).
^pUnable to access building. Exterior inspection only.
AST/UST = aboveground storage tank/underground storage tank 1-25

cf = cubic feet
qt. = quart
gals. = gallons
lbs. = pounds
oz. = ounces
SNM = Special nuclear materials.

Source: JT, 1994

DATA QUALITY OBJECTIVES WORKSHEETS

Attachment E

**Tonopah Test Range, Area 9
Building Year Built Report**

(This document has been reprinted as it was received in the ITLV office)

TONOPAH TEST RANGE
 AREA 9
 BUILDING YEAR BUILT REPORT

CAIP - CAU No. 453 Area 9 Landfill
 Section: Appendix A
 Revision: 0
 Date: 05/14/97
 Page 44 of 49

BLDG. NO.	DESCRIPTION	YEAR BUILT
09-01	ASI PRACTICE AMO STORAGE	1962
09-02	STORAGE (UNUSED)	1962
09-03	POWER SUPPLY FOR ZENER LIGHTS	1962
09-04	CAMERA TOWER	1942
09-05	AREA 9 STORAGE	1962
09-06	STORAGE SHELTER	1973
09-07	HEATING PLANT SHELTER	1961
09-08	PUMP HOUSE	1962
09-09	X-RAY SOURCE STORAGE BLDG.	1973
09-10	CAMERA TOWER	1977
09-11	CAMERA TOWER	1977
09-12	ANTENNA POWER SHELTER	1962
09-13	TEST EQUIPMENT SHELTER	1962
09-15	X-RAY LAB	1956
09-16	LINAC CONTROL BLDG.	1962
09-17	LINAC TARGET BLDG.	1962
09-18	AREA 9 GUARD SHACK	1962
09-19	ROCKET LAUNCHER TV TOWER	1958
09-20	LIGHTNING WARNING TOWER	1958
09-21	PA & WARNING HORN TOWER	1958
09-22	CABLE PIT	1958
09-23	GUN PIT	1975
09-24	LIGHTNING WARNING SYSTEM	1991
09-50	OBSERVATION BUNKER	1960
09-51	R.F. CONTROL BUNKER	1964
09-52	ASSEMBLY BLDG. (NON-HAZ) (9A)	1960
09-54	ASSEMBLY BLDG. (EXPLO) (9B)	1960
09-55	ASSEMBLY BLDG. (HI-EXPLO) (9C)	1964
09-56	STORAGE IGLOO	1960
09-57	STORAGE IGLOO	1965
09-58	GENERATOR BLDG.	1963
09-59	EXPLOSIVES STORAGE IGLOO	1968
09-60	GUN CONTROL BUNKER	1971
09-62	ENVIRONMENTAL BLDG. (9D)	1973
09-63	SECURE STORAGE FACILITY	1986
09-64	POWDER ASSEMBLY	1991
09-65	PROPELLANT STORAGE BUILDING	1991
09-67	ALARMS SYSTEM CONTROL BLDG.	1987

Source: SNL, 1992.

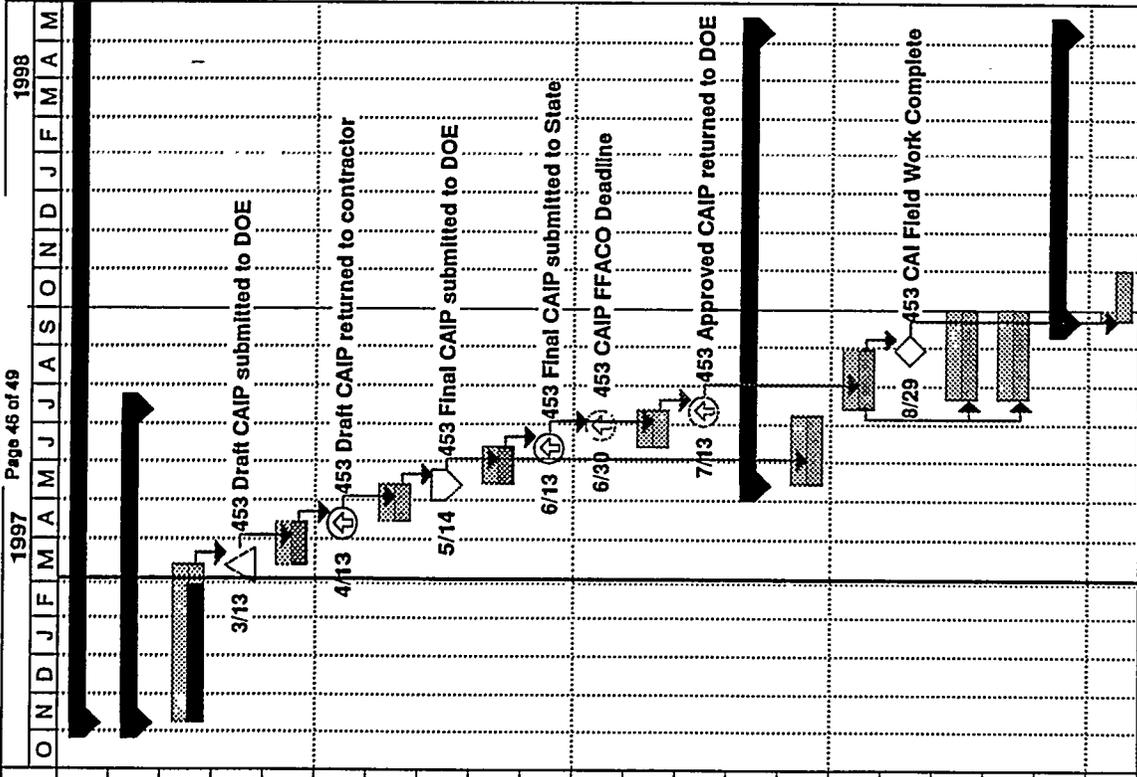
DATA QUALITY OBJECTIVES WORKSHEETS

Attachment F

**FY 97 Industrial Sites Schedule
CAU 453 - Area 9 Landfill**

Tonopah Test Range

ID	WBS	Task Name	Dur	Start	Finish	%	Resp
352	14121307.04	453 UXO Landfill - A9 (TTR)	148w	11/8/96	9/10/99	3%	
353	14121307.0401	453 Corr Act Inv Plan (CAIP)	35.2w	11/8/96	7/13/97	18%	
354	14121307.040101	453 Prepare draft CAIP	18w	11/8/96	3/13/97	88%	IT
355	14121307.040101M	453 Draft CAIP submitted to DOE	0w	3/13/97	3/13/97	0%	IT
356	14121307.0401D	453 DOE reviews draft CAIP	30ed	3/14/97	4/13/97	0%	DOE
357	14121307.0401D	453 Draft CAIP returned to contractor	0d	4/13/97	4/13/97	0%	DOE
358	14121307.040102	453 Revise CAIP per DOE comments	30ed	4/14/97	5/14/97	0%	IT
359	14121307.040102I	453 Final CAIP submitted to DOE	0w	5/14/97	5/14/97	0%	IT
360	14121307.0401D	453 DOE review/approve final CAIP	30ed	5/14/97	6/13/97	0%	DOE
361	14121307.0401D	453 Final CAIP submitted to State	0w	6/13/97	6/13/97	0%	DOE
362	14121307.0401D	453 CAIP FFACO Deadline	0w	6/30/97	6/30/97	0%	DOE
363	14121307.0401N	453 State review/approve final CAIP	30ed	6/13/97	7/13/97	0%	NV
364	14121307.0401N	453 Approved CAIP returned to DOE	0w	7/13/97	7/13/97	0%	NV
365	14121307.0402	453 Corr Act Dec Doc (CADD)	51.6w	5/14/97	5/10/98	0%	
366	14121307.040201	453 CAI Field Work Prep	8w	5/14/97	7/8/97	0%	IT
367	14121307.040202	453 CAI Field Work	7w	7/14/97	8/29/97	0%	IT
368	14121307.040202M	453 CAI Field Work Complete	0w	8/29/97	8/29/97	0%	IT
369	14121307.040203	453 CAI Analytical Work	10.3w	7/21/97	9/30/97	0%	IT
371	14121307.040204	453 CAI Waste Mgmt/Disposal	10.3w	7/21/97	9/30/97	0%	IT
373	14121307.040205	453 Prepare CADD	33w	9/22/97	5/10/98	0%	
374	14121307.04020501	453 Prepare Char. Report	6w	9/22/97	10/31/97	0%	IT



DATA QUALITY OBJECTIVES WORKSHEETS

Attachment G

**Drilling/Investigation Options for
the Area 9 Landfill**

Attachment G
Drilling/Investigation Options for the Area 9 Landfill, TTR
 Page 1 of 2

DATA SOURCE	EXPLANATION	ADVANTAGES	DISADVANTAGES	TRIGGER POINTS
<p><i>Preferred Methods:</i></p> <p>Angle boring outside of cell</p>	<p>Position the drill rig near one side of the cell (distance dependent on rig capability and the estimated depth of cell bottom), and drill angle holes to intersect a point below the cell bottom without intersecting cell contents</p>	<ul style="list-style-type: none"> - Avoids problems associated with direct cell intrusion (see above) - Provides samples of <i>in situ</i> soil for background characterization - Cost effective - Wide selection of drilling methods 	<ul style="list-style-type: none"> - Limits the vertical characterization of the soil below the cell - Will not penetrate a significant section immediately below the cell bottom - Cannot directly define the vertical extent of contamination - Dependent on accurate estimates of cell dimensions 	<ol style="list-style-type: none"> 1. Stop drilling if trench contents are found. Move drilling location over (5 to 10 feet) and continue drilling. 2. Notify NDEP if anything not anticipated is encountered (i.e., RCRA constituents, radiological contamination, free liquid, drums). 3. Continue drilling upon concurrence from the Core Decision Team to do so and how to continue. If free liquid is encountered, one start-up method may be to move the drilling location (5 to 10 ft) and continue drilling. 4. If refusal is met, move to a new location.
<p>Existing hydrologic data</p>	<p>Review existing USGS hydrologic data from TTR water wells.</p>	<ul style="list-style-type: none"> - Provides data to determine the probability of impacting groundwater at each cell 	<ul style="list-style-type: none"> - Data is not always complete and up to date. 	
<p>Additional hydrologic data for the zone immediately below the contamination. Note: NDEP is to be notified if performed in the field.</p> <p><i>Alternate/Additional Methods:</i></p>	<p>Collect <i>in situ</i> soil samples for hydrologic/geotech. analysis.</p>	<ul style="list-style-type: none"> - Provides input for closure strategies 	<ul style="list-style-type: none"> - Difficult to collect undisturbed, <i>in situ</i> sample with conventional drilling methods 	
<p>Vertical boring adjacent to cell along with trenches/test pits along the edge of the cell to define the cell boundaries.</p>	<ul style="list-style-type: none"> - Advance a vertical boring as close to the edge of the cell as possible without intruding the cell. - Use a backhoe to scrape ground surface near the estimated cell boundary to determine the fill/native soil contact. 	<ul style="list-style-type: none"> - Avoids problems associated with direct cell intrusion - Used to determine cell dimensions - Inexpensive 	<ul style="list-style-type: none"> - Requires an accurate delineation of cell boundaries - Does not characterize the area directly beneath the cell - Creates extra IDW - Potential for inadvertent cell intrusion 	<ol style="list-style-type: none"> 1. Stop drilling if trench contents are found. Move drilling location over (5 to 10 feet) and continue drilling. 2. Notify NDEP if anything not anticipated is encountered (i.e., RCRA constituents, radiological contamination, free liquid, drums). 3. Continue drilling upon concurrence from the Core Decision Team to do so and how to continue. If free liquid is encountered, one start-up method may be to move the drilling location (5 to 10 ft) and continue drilling. 4. If refusal is met, move to a new location.

Attachment G
Drilling/Investigation Options for the Area 9 Landfill, TTR
 Page 2 of 2

DATA SOURCE	EXPLANATION	ADVANTAGES	DISADVANTAGES	TRIGGER POINTS
Alternate/Additional Methods cont.:				
Neutron probe monitoring	Install wells to access neutron probe for soil moisture monitoring.	<ul style="list-style-type: none"> - Monitors a wide area - Provides an early warning of leachate migration 	<ul style="list-style-type: none"> - Does not characterize constituents (moisture content only) 	
Passive soil gas survey	Usually placed on or just below the surface to measure flux	<ul style="list-style-type: none"> - Able to detect very low levels of volatile organics - Inexpensive 	<ul style="list-style-type: none"> - Limited to VOCs 	
Active soil gas survey	Install monitoring points at or near the landfill boundaries. Commonly a direct push technology	<ul style="list-style-type: none"> - Able to detect very low levels of volatile organics - Inexpensive 	<ul style="list-style-type: none"> - Limited to VOCs - Depth limited 	
Groundwater monitoring wells	Install groundwater monitoring wells as needed.	<ul style="list-style-type: none"> - Monitor contaminated aquifer 	<ul style="list-style-type: none"> - Expensive 	

DATA QUALITY OBJECTIVES WORKSHEETS

Appendix B

**Nevada Environmental Restoration Project
Document Review Sheet
Nevada Division of Environmental Protection
Comments and Responses**

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

Section: Appendix B
Revision: 0
Date: 05/14/97
Page 2 of 2

1. Document Title/Number Corrective Action Investigation Plan for CAU No. 453: 2. Document Date March 1997
Area 9 Landfill, Tonopah Test Range, Nevada

3. Revision Number Draft 4. Originator/Organization IT Corporation

5. Responsible DOE/NV ERP Subproject Mgr. Janet Appenzeller-Wing 6. Date Comments Due 4/13/97

7. Review Criteria Technical Review

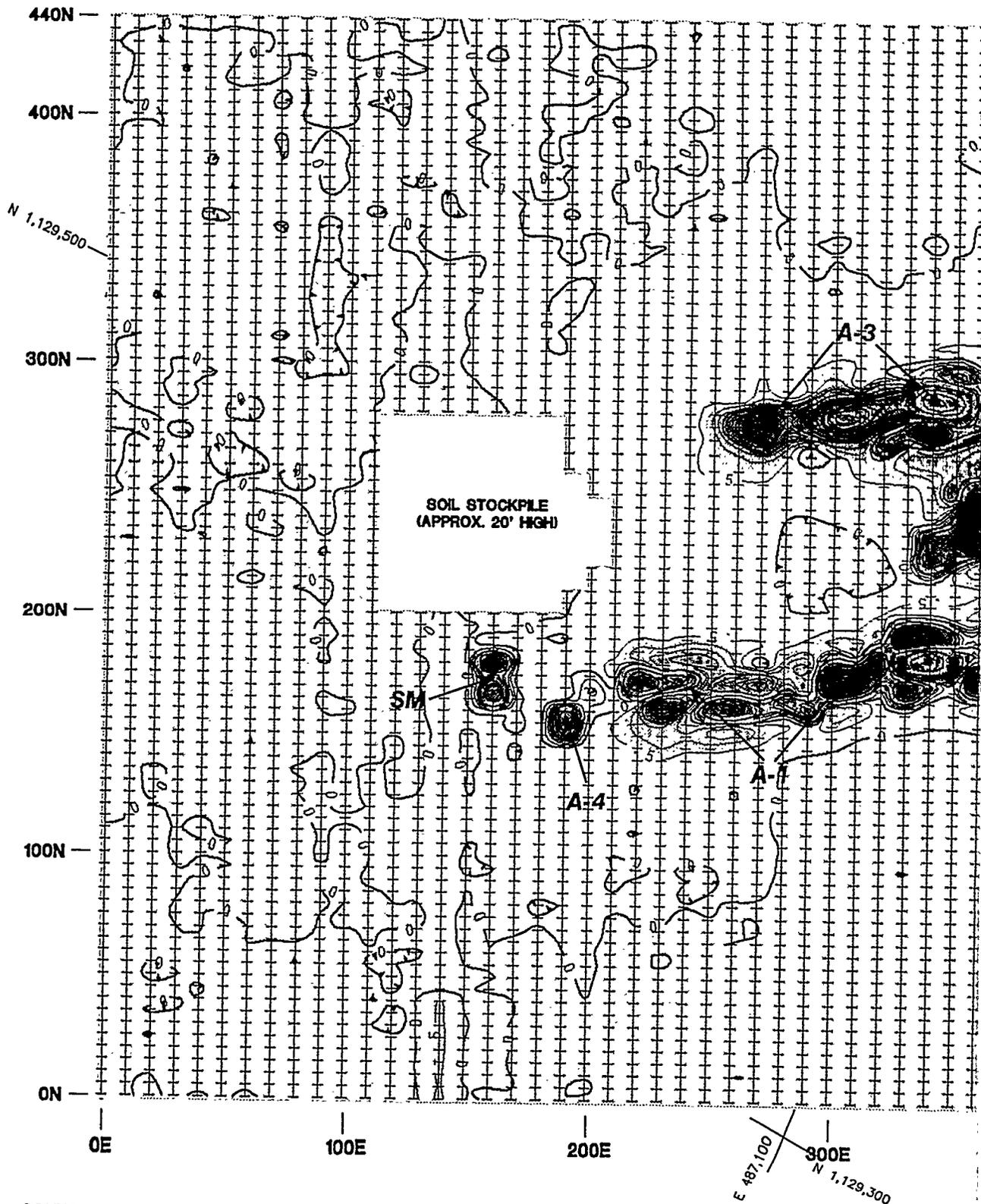
8. Reviewer/Organization/Phone No. Karen Beckley/NDEP/(702) 687-4670 9. Reviewer's Signature _____

10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
1. Page 3-6	M	NDEP has requested a copy of the Offsite Radiation Exposure Review Project (ORERP), Phase II Soils Programs report as referenced in the CAIP.	A copy of the report was provided to NDEP on April 10, 1997, per the same request for the Cactus Spring Waste Trenches CADD comment resolution.	
2. Pages 2-3 & 5-1, Sections 2.2 & 5.0	M	Sections 2.2 (Waste Inventory) and 5.0 (Waste Management), need to provide clarification of waste identification between listed and characteristic wastes. It is not appropriate to determine if a waste is characteristic or listed based on a conclusion that there are no records to indicate that wastes were discarded in the landfills.	The 1st sentence of paragraph 1 on page 2-4 was changed to specify types of RCRA-regulated constituents that are not expected to be a primary component as follows: "... (RCRA)-regulated hazardous constituents and containerized liquids are not..." The second sentence was reworded, and a third sentence was added as follows: The potential wastes found in the landfill are likely to be characteristic, rather than listed, wastes. The determination of whether the waste is characteristic or listed is based on Code of Federal Regulations (CFR) Title 40 Part 261, "Identification and Listing of Hazardous Wastes" (CFR, 1996a).	

^a Comment Types: M = Mandatory, S = Suggested.

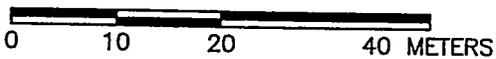
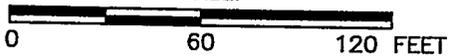
DATA QUALITY OBJECTIVES WORKSHEETS

Appendix C
Geophysical Survey-Result Figures



CONTOUR INTERVAL: 0.5 PARTS PER THOUSAND

SCALE:



0N,0E RELATIVE COORDINATE SYSTEM OF GEOPHYSICAL SURVEY

----- GEONICS EM-31 SURVEY LINE

A-1 GEOPHYSICAL ANOMALY DISCUSSED IN

NOTE: COORDINATES ARE IN NEVADA STATE PLANE COORDINATE SYSTEM, NAD. 27

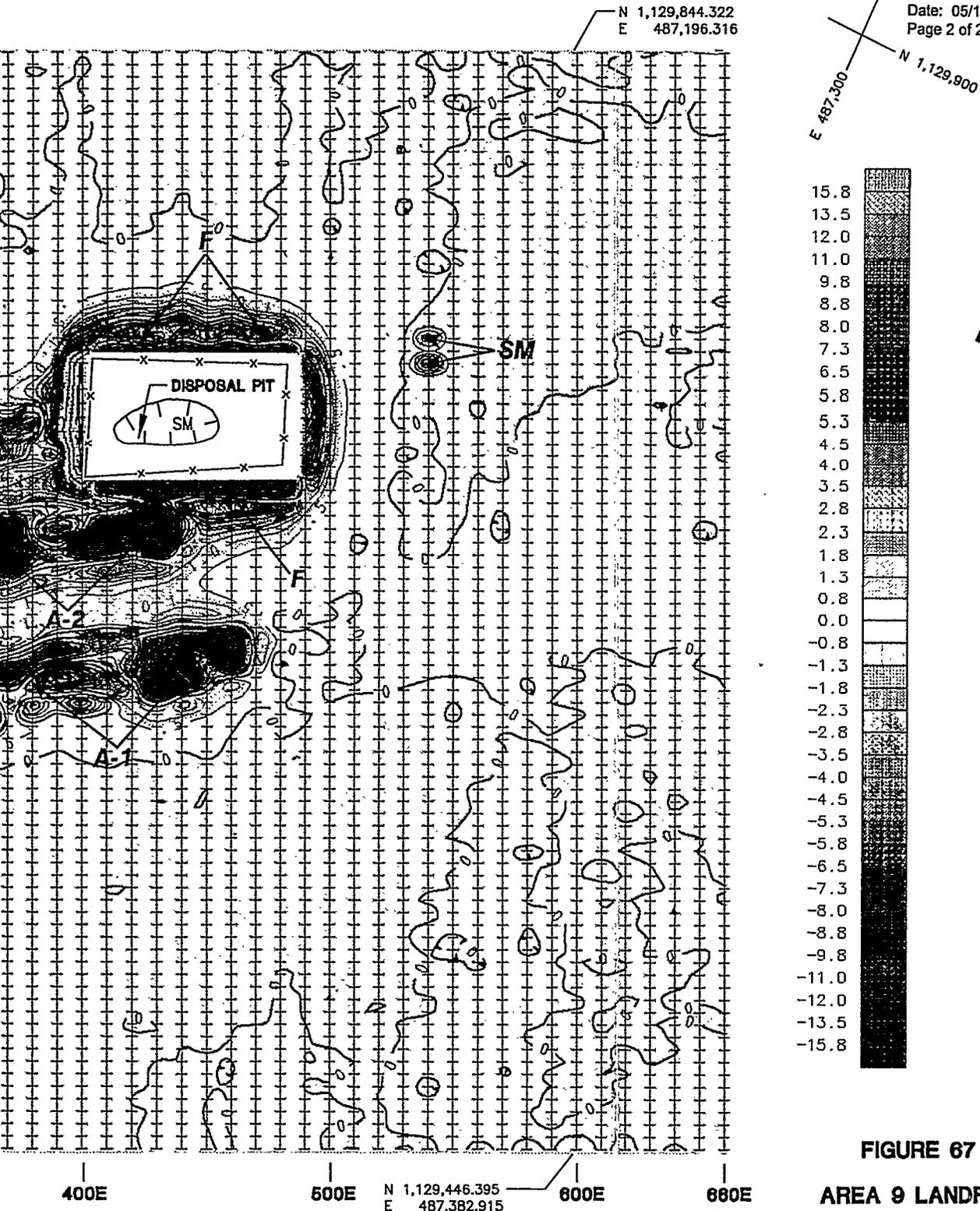


FIGURE 67

**AREA 9 LANDFILL
 CONTOUR MAP OF IN-PHASE COMPONENT
 GEONICS EM-31 SURVEY
 TONOPAH TEST RANGE**

PREPARED FOR

**U.S. DEPARTMENT OF ENERGY
 LAS VEGAS, NEVADA**



**INTERNATIONAL
 TECHNOLOGY
 CORPORATION**

LEGEND

- F** ANOMALY CAUSED BY METALLIC FENCE
- SM** ANOMALY CAUSED BY METALLIC SURFACE OBJECT/DEBRIS
- x— FENCE

TEXT

DATA QUALITY OBJECTIVES WORKSHEETS

Plate 1

**Site Location Map and Planned Borehole Locations,
Area 9 Landfill, Tonopah Test Range**

Notice

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