Nevada
Environmental
Restoration
Project

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Corrective Action Decision Document for the Area 3 Landfill Complex, Tonopah Test Range, CAU 424

Controlled Copy No.: Uncontrolled

Revision No.: 0

March 1998

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**CORRECTIVE ACTION DECISION DOCUMENT
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TONOPAH TEST RANGE, CAU 424**

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Las Vegas, Nevada

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**CORRECTIVE ACTION DECISION DOCUMENT
FOR THE AREA 3 LANDFILL COMPLEX,
TONOPAH TEST RANGE, CAU 424**

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List of Acronyms and Abbreviations

AASHTO	American Association of State Highway and Transportation Officials
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>
CLP	Contract Laboratory Program
cm/sec	Centimeter(s) per second
COC	Contaminant(s) of concern
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DU	Depleted uranium
DQO	Data quality objective(s)
dpm	Disintegration(s) per minute
EPA	U.S. Environmental Protection Agency
FFACO	<i>Federal Facility Agreement and Consent Order</i>
ft	Foot (feet)
g/cm ³	Gram(s) per cubic centimeter
in.	Inch(es)
IT	IT Corporation
keV	Kiloelectron volt
KMI	Kirk-Mayer Incorporated
kg	Kilogram(s)
LCS	Laboratory control samples
m	Meter(s)

List of Acronyms and Abbreviations (Continued)

mg/kg	Milligram(s) per kilogram
MS/MSD	Matrix spike/matrix spike duplicate
NAC	<i>Nevada Administrative Code</i>
NDEP	Nevada Division of Environmental Protection
NIST	National Institute for Standards and Technology
O&M	Operation and maintenance
PAL	Preliminary action levels
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCB	Polychlorinated biphenyl(s)
pCi/g	Picocurie(s) per gram
ppm	Part(s) per million
PRG	Preliminary remediation goal(s)
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RCRA	<i>Resource Conservation and Recovery Act</i>
RPD	Relative percent difference(s)
SDG	Sample delivery group
SVOC	Semivolatile organic compound(s)
TPH	Total Petroleum Hydrocarbon(s)
TTR	Tonopah Test Range
U	Uranium
USACE	United States Army Corps of Engineers
VOC	Volatile organic compound(s)
%	Percent
%R	Percent recovery

List of Acronyms and Abbreviations (Continued)

$\mu\text{R/hr}$	Microroentgen(s) per hour
$\mu\text{g/kg}$	Microgram(s) per kilogram

Executive Summary

This Corrective Action Decision Document (CADD) has been prepared for the Area 3 Landfill Complex (Corrective Action Unit [CAU] 424) in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) of 1996.

Corrective Action Unit 424 is located at the Tonopah Test Range (TTR) and is comprised of the following Corrective Action Sites (CASs), each an individual landfill located around and within the perimeter of the Area 3 Compound (DOE/NV, 1996a):

- Landfill A3-1 is CAS No. 03-08-001-A301.
- Landfill A3-2 is CAS No. 03-08-002-A302.
- Landfill A3-3 is CAS No. 03-08-002-A303.
- Landfill A3-4 is CAS No. 03-08-002-A304.
- Landfill A3-5 is CAS No. 03-08-002-A305.
- Landfill A3-6 is CAS No. 03-08-002-A306.
- Landfill A3-7 is CAS No. 03-08-002-A307.
- Landfill A3-8 is CAS No. 03-08-002-A308.

The purpose of this CADD is to identify and provide a rationale for the selection of a recommended corrective action alternative for each CAS.

The scope of this CADD consists of the following:

- Develop corrective action objectives.
- Identify corrective action alternative screening criteria.
- Develop corrective action alternatives.
- Perform detailed and comparative evaluations of the corrective action alternatives in relation to the corrective action objectives and screening criteria.
- Recommend and justify a preferred corrective action alternative for each CAS.

In June and July 1997, a corrective action investigation was performed as set forth in the *Corrective Action Investigation Plan (CAIP) for CAU No. 424: Area 3 Landfill Complex, Tonopah Test Range, Nevada* (DOE/NV, 1997). Details can be found in [Appendix A](#) of this document. The results indicated four groupings of site characteristics as shown in [Table ES-1](#).

**Table ES-1
 Landfill Characteristics**

Landfill	Investigation Results			
	No Debris/No COCs ^a	Debris/No COCs	Debris/Low Level COCs	Debris/High Level COCs
A3-1			X	
A3-2				X
A3-3		X		
A3-4		X		
A3-5		X		
A3-6		X		
A3-7	X			
A3-8		X		

^aCOCs - Contaminants of concern

Based on the potential exposure pathways, the following corrective action objectives have been identified for CAU No. 424:

- Prevent or mitigate human exposure to subsurface soils containing waste.
- Remediate the site per applicable state and federal regulations (NAC, 1996c).
- Prevent adverse impacts to groundwater quality.

Based on the review of existing data, future land use, and current operations at the TTR, the following alternatives were developed for consideration at the Area 3 Landfill Complex CAU:

- Alternative 1 - No Action
- Alternative 2 - Administrative Closure
- Alternative 3 - Partial Excavation, Backfill, and Recontouring

The corrective action alternatives were evaluated based on four general corrective action standards and five remedy-selection decision factors. Based on the results of this evaluation, preferred alternatives were selected for each CAS as indicated in [Table ES-2](#).

The preferred corrective action alternatives were evaluated on their technical merits, focusing on performance, reliability, feasibility, and safety. The alternatives were judged to meet all requirements for the technical components evaluated. These alternatives meet all applicable state and federal regulations for closure of the site and will reduce potential future exposure pathways to the contents of the landfills.

During corrective action implementation, these alternatives will present minimal potential threat to site workers who come in contact with the waste. However, procedures will be developed and implemented to ensure worker health and safety.

Table ES-2
Corrective Action Alternative Element

Alternative	Alternative Elements	Applicable Landfills							
		A3-1	A3-2	A3-3	A3-4	A3-5	A3-6	A3-7	A3-8
1 - No Action	No actions							X	
2 - Administrative Closure	Land-use restrictions	X		X	X	X	X		X
	Signage	X		X	X	X	X		X
	Maintain soil covers	X		X	X	X	X		X
	Backfilling, compaction, and recontouring	X			X				X
3 - Partial Excavation, Backfill, and Recontouring	Removal of petroleum hydrocarbon contamination by excavation		X						
	Backfilling, compaction, and recontouring		X						
	Land-use restrictions		X						
	Signage		X						
	Maintain soil covers		X						

1.0 Introduction

This Corrective Action Decision Document (CADD) has been prepared for the Area 3 Landfill Complex (Corrective Action Unit [CAU] 424) in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) of 1996 that was agreed to by the U.S. Department of Energy, Nevada Operations Office (DOE/NV), the Nevada Division of Environmental Protection (NDEP), and the U.S. Department of Defense (FFACO, 1996). The CADD provides or references the specific information necessary to evaluate possible corrective action alternatives for the Corrective Action Sites (CASs) within CAU 424 and to select a preferred alternative.

Corrective Action Unit 424 is located at the Tonopah Test Range (TTR). The TTR, included in the Nellis Air Force Range Complex, is approximately 255 kilometers (140 miles), northwest of Las Vegas, Nevada ([Figure 1-1](#) and [Figure 1-2](#)). Corrective Action Unit 424 is comprised of eight individual landfill cells located around and within the perimeter of the Area 3 Compound (DOE/NV, 1996a). Each landfill has been designated as a separate CAS and assigned a CAS Number (DOE/NV, 1996a) as follows:

- Landfill A3-1 is CAS No. 03-08-001-A301.
- Landfill A3-2 is CAS No. 03-08-002-A302.
- Landfill A3-3 is CAS No. 03-08-002-A303.
- Landfill A3-4 is CAS No. 03-08-002-A304.
- Landfill A3-5 is CAS No. 03-08-002-A305.
- Landfill A3-6 is CAS No. 03-08-002-A306.
- Landfill A3-7 is CAS No. 03-08-002-A307.
- Landfill A3-8 is CAS No. 03-08-002-A308.

For simplicity, the landfills will hereafter be referred to by their landfill designations. [Plate A-1](#) presents the location of each landfill with respect to the Area 3 Compound.

1.1 Purpose

The purpose of this CADD is to identify and provide a rationale for the selection of a recommended corrective action alternative for each landfill. The need for these alternatives is based on process knowledge and investigation activities as discussed in the *Corrective Action Investigation Plan*

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Figure 1-1
Tonopah Test Range Location Map

LEGEND

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

Source: Adapted from DOE/NV, 1996a

Figure 1-2
Location of the Area 3 Landfill Complex
at the Tonopah Test Range

(CAIP) for CAU No. 424: *Area 3 Landfill Complex, Tonopah Test Range, Nevada* (DOE/NV, 1997).

With the exception of Landfill A3-2, the general characteristics (as discussed in the CAIP [DOE/NV, 1997]) of CAU 424 have not changed. After investigation activities had completed, a rain storm caused a subsidence to occur within the boundaries of Landfill A3-2. Corrective action alternatives will address subsidence at the landfills.

1.2 Scope

The scope of this CADD consists of the identification, evaluation, and recommendation of a preferred corrective action alternative to be implemented at the Area 3 Landfill Complex CAU. To achieve this scope, the following actions have been taken:

- Develop corrective action objectives.
- Identify corrective action alternative screening criteria.
- Develop corrective action alternatives.
- Perform detailed and comparative evaluations of the corrective action alternatives in relation to the corrective action objectives and screening criteria.
- Recommend and justify a preferred corrective action alternative for each landfill.

1.3 CADD Contents

This section summarizes the contents of this CADD. It has been divided into the following sections:

[Section 1.0](#) - Introduction: summarizes the purpose, scope, and contents of this CADD

[Section 2.0](#) - Corrective Action Investigation Summary: summarizes the investigation field activities, the results of the investigation, and the need for corrective action

[Section 3.0](#) - Evaluation of Alternatives: documents the steps taken in determining a preferred corrective action alternative

[Section 4.0](#) - Recommended Alternative: presents the preferred corrective action alternative and the rationale for its selection based on the corrective action objectives and alternative screening criteria

[Section 5.0](#) - References: Presents a list of all referenced documents. All work was performed in accordance with the following documents:

- *Corrective Action Investigation Plan for CAU No. 424: Area 3 Landfill Complex, Tonopah Test Range, Nevada* (DOE/NV, 1997)
- *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1996c)
- *Corrective Action Unit Work Plan, Tonopah Test Range* (DOE/NV, 1996a)
- FFACO (FFACO, 1996)
- *Project Management Plan* (DOE/NV, 1994)

[Appendix A](#) - Corrective Action Investigation Report for CAU 424: Area 3 Landfill Complex

[Appendix B](#) - Cost Estimates

[Appendix C](#) - Nevada Environmental Restoration Project Document Review Sheet

2.0 *Corrective Action Investigation Summary*

The following sections describe and summarize the results of the investigation activities conducted at CAU 424. For detailed investigation results, please refer to [Appendix A](#).

2.1 *Investigation Activities*

In June and July 1997, a corrective action investigation was conducted that consisted of the following activities as set forth in the CAIP (DOE/NV, 1997).

- Drilled 58 investigation borings to total depths ranging from 3 meters (m) (10 feet [ft]) to 16 m (52 ft) and collected samples for field screening and laboratory analysis (Plate 1)
- Collected continuous cores for visual inspection from the surface to total depth at each boring
- Field screened soil samples using headspace analysis for volatile organic compounds (VOC), colorimetric testing for total petroleum hydrocarbons (TPH), and radiological screening for alpha and beta/gamma emitters
- Analyzed environmental samples for VOC, semivolatile organic compounds (SVOC), *Resource Conservation and Recovery Act* (RCRA) metals, TPH, pesticides, polychlorinated biphenyls (PCB), Gamma Spectroscopy, and isotopic plutonium
- Analyzed geotechnical samples from each CAS for initial moisture content, dry bulk density, calculated porosity, saturated/unsaturated hydraulic conductivity, particle size distribution, and water-release curve

In addition, historical documents, interviews, and process knowledge were used to assist in the identification of potential contaminants at each of the landfills (see [Appendix A](#)).

2.2 *Results*

The corrective action investigation results indicated the following:

- An oily sludge was encountered at Landfill A3-2 and sampled for analysis. Other materials encountered in the landfill cells included concrete, asphalt, metal, wire, charred wood, tires, other miscellaneous rubber debris, plastic, cloth rags, and glass ampules.

- Visual inspection and moisture testing indicated that the soils in and below the landfill cells are not saturated.
- Most VOC parameters were not detected. The levels of those parameters which were detected were below the preliminary action levels outlined in the CAIP (DOE/NV, 1997).
- The TPH levels for the soil samples were below the NDEP-established action level of 100 parts per million (ppm) in all landfills except A3-1 and A3-2. Petroleum hydrocarbons were detected in the diesel and gasoline ranges in samples taken from one boring within Landfill A3-1. Gasoline was detected at 200 ppm, and diesel was detected at a maximum of 790 ppm. A constituent closely matching the pattern for waste oil was detected at 48,000 ppm in the sludge sample taken from Landfill A3- 2.
- Most SVOCs were not detected. Those detected were below preliminary action levels or had levels that were quantitatively estimated, some of which were associated with blank contamination.
- All reported levels for RCRA metal samples (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) were below the preliminary action levels established in the CAIP (DOE/NV, 1997). The analytical results are indicative of the naturally occurring background levels for this area.
- Some pesticides and PCBs were detected; however, they were below preliminary action levels or were quantitatively estimated.
- Radiological results were within background levels outlined in the CAIP (DOE/NV, 1997).
- Geotechnical results indicated that the existing covers on landfills A3-1, A3-2, A3-6, and A3-8 had hydraulic conductivities less than native subsurface soils. Further evaluation of the geotechnical data can be found in [Appendix A](#).
- The landfill cells have existing soil covers ranging in thickness from 0.5 m to 1.5 m (1.5 ft to 5 ft).
- Investigation activities revealed fissures in the surface of Landfill A3-4 (due to subsidence) and exposed debris at Landfill A3-8 (due to intrusive activities). Exposed construction debris was found in an uncovered cell at Landfill A3-1. A rain storm caused a subsidence to occur within the boundaries of Landfill A3-2 after investigation activities had culminated. The sinkhole that formed revealed the presence of landfill debris including a diesel storage tank. The void was measured to a maximum depth of 2.4 m (8 ft), a maximum width of 1.8 m (6 ft), and the thickness of the existing cap was measured to be 0.6 m (2 ft). Kirk-Mayer, Incorporated (KMI) backfilled the void space with soil on July 24, 1997.

Details of the methods used and results found during the investigation are presented in [Appendix A](#).

2.3 *Need for Corrective Action*

Investigation activities provided sufficient information to establish a need for corrective action.

The landfills are grouped based on the following characteristics:

- Sites with debris and no contaminants of concern (COCs): Constituents above preliminary action levels were not detected, and hazardous constituents are present only in isolated detections at very low levels at landfills A3-3, A3-4, A3-5, A3-6, and A3-8. Therefore, there is no known source and there are no existing exposure pathways. However, nonhazardous solid waste remains in the landfill cells, and the corrective action alternatives should prevent or mitigate human exposure to subsurface soils containing solid waste. Corrective actions should include those which will protectively cover the debris currently exposed due to subsidence and intrusive activities.
- Sites with debris and COCs: Constituents were detected above preliminary action levels along with nonhazardous solid waste at landfills A3-1 and A3-2. Landfill A3-2 also has a history of subsidence which has exposed subsurface debris. Therefore, potential exposure pathways may be associated with intrusive activities and subsidence. The corrective action alternatives should prevent or mitigate human exposure to subsurface soils containing COCs and solid waste.
- Sites with no evidence of debris or COCs: Constituents above preliminary action levels were not detected, and hazardous constituents are present only in isolated detections at very low levels, if at all, at Landfill A3-7. Therefore, there is no known source and there are no existing exposure pathways. No further actions are required.

The COCs identified above preliminary action levels (i.e., EPA Region IX Preliminary Remediation Goals [EPA, 1996] and *Offsite Radiation Exposure Review Project, Phase II Soil Program* [MacArthur and Miller, 1989]), are limited to the petroleum hydrocarbons in landfills A3-1 and A3-2 ([Table 3-1](#)). Therefore, an evaluation of possible remedial alternatives is required for these two sites to ensure worker, public, and environmental protection against potential exposure to contamination.

During investigation activities, general waste (including concrete, asphalt, metal, wire, charred wood, tires, other miscellaneous rubber debris, plastic, cloth rags, and glass ampules) was found, which confirms that waste remains in the remaining landfills. The landfills received waste prior to

the enactment Nevada Administrative Code [NAC] 444 regulations (NAC, 1996a) pertaining to Class III solid waste facilities and, therefore, do not have to meet these requirements. However, to be protective of human health and the environment from potential hazards associated with the debris, corrective actions will be evaluated. The corrective actions will include activities to repair and maintain the protective soil covers at these sites.

Investigation activities did not indicate the presence of COCs or solid waste at Landfill A3-7; therefore, no corrective action is necessary at Landfill A3-7, and it will not be discussed further in this report.

3.0 *Evaluation of Alternatives*

The purpose of this section is to present the corrective action objectives for CAU 424, to describe the general standards and decision factors used to screen the corrective action alternatives, and to develop and evaluate a set of corrective action alternatives that could be used to meet the corrective action objectives.

3.1 *Corrective Action Objectives*

The corrective action objectives are media-specific goals for protecting human health and the environment. They are expressed in terms of contaminants, media of interest, potential exposure pathways, and cleanup goals so that an appropriate range of waste management options can be developed for analysis.

Based on the potential exposure pathways, the following corrective action objectives have been identified for CAU 424:

- Prevent or mitigate human exposure to subsurface soils containing waste.
- Remediate the site per applicable state and federal regulations (NAC, 1996b).
- Prevent adverse impacts to groundwater quality.

3.1.1 *Contaminants of Potential Concern*

Analyses conducted as the result of the corrective action investigation were evaluated to determine COCs for CAU 424. Based on the results of this evaluation, elevated levels of petroleum hydrocarbons were identified above applicable regulatory limits (NAC, 1996b) at landfills A3-1 and A3-2 as listed in [Table 3-1](#). No other COCs were identified.

3.1.2 *Potential Exposure Pathways*

As part of the CAIP (DOE/NV, 1997), a conceptual model for CAU 424 was developed which identified the potential exposure pathways as inhalation of vapors, dermal contact with soils, and ingestion of soils under residential and occupational scenarios.

Table 3-1
Media Cleanup Standards and Contaminants of Concern

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)	
			Gasoline	Diesel
			TPH Action Level 100 mg/kg	
BH2-3	TTR00472	w/in cell	NA	48000*
BH1-13	TTR00536	7	17	610
	TTR00538	10	200	640
	TTR00543	21.5	1.1	790

NA - Not analyzed

Indicates results detected above action levels

* Diesel was not detected at the retention time of the diesel calibration standard; however, a hydrocarbon whose pattern closely matches that of waste oil was detected at 48,000 mg/kg.

mg/kg - Milligram(s) per kilogram

3.2 Screening Criteria

The screening criteria used to evaluate and select the preferred corrective action alternatives are identified in the U.S. Environmental Protection Agency (EPA) Guidance on *Resource Conservation and Recovery Act* Corrective Action Decision Documents (EPA, 1991) and the Final *Resource Conservation and Recovery Act* Corrective Action Plan (EPA, 1994).

The corrective action alternatives will be evaluated based on four general corrective action standards and five remedy-selection decision factors. All corrective action alternatives must meet the general standards to be selected for evaluation using the remedy-selection decision factors.

The general corrective action standards are:

- Protection of human health and the environment
- Compliance with media cleanup standards
- Control the source(s) of the release
- Comply with applicable federal, state, and local standards for waste management

The remedy-selection decision factors are:

- Short-term reliability and effectiveness
- Reduction of toxicity, mobility, and/or volume
- Long-term reliability and effectiveness
- Feasibility
- Cost

3.2.1 Corrective Action Standards

The following describe the corrective action standards used to evaluate the corrective action alternatives.

Protection of Human Health and the Environment

Protection of human health and the environment is a general mandate of the RCRA statute (EPA, 1994). This mandate requires that the corrective action includes any measures that are needed to be protective. These measures may or may not be directly related to media cleanup, source control, or management of wastes. The closure option is evaluated for the ability to meet closure objectives as defined in [Section 3.1](#).

Compliance with Media Cleanup Standards

Each corrective action alternative must meet the proposed media cleanup standards set forth in applicable state and federal regulations (NAC, 1996b). [Table 3-1](#) contains the media cleanup levels proposed for this CAU.

Control the Source(s) of the Release

An objective of corrective action remedies is to stop further environmental degradation by controlling or eliminating additional releases that may pose a threat to human health and the environment. Unless source control measures are taken, efforts to clean up releases may be ineffective or, at best, will essentially involve a perpetual cleanup. Therefore, each corrective action alternative must use an effective source control program to ensure the long-term effectiveness and protectiveness of the corrective action.

Comply with Applicable Federal, State, and Local Standards for Waste Management

During implementation of any corrective action alternative, all waste management activities must be conducted in accordance with applicable state and federal regulations (e.g., *Nevada Revised Statutes* 459.400 - 459.600 [NRS, 1995]; RCRA 40 CFR 261 - 281 [CFR, 1996]; 40 CFR 268, “Land Disposal;” NAC 459.9974, “Disposal and Evaluation of Contaminated Soil” [NAC, 1996c]). The requirements for management of the waste, if any, derived from the corrective action will be determined based on applicable state and federal regulations, field observations, process knowledge, characterization data, and data collected and analyzed during corrective action implementation. Administrative controls (e.g., decontamination procedures and corrective action strategies) will minimize waste generated during site corrective action activities. Decontamination activities will be performed in accordance with approved procedures as specified in the NDEP-approved TTR work plan (DOE/NV, 1996a) and will be designated according to the COCs present at the site.

3.2.2 Remedy Selection Decision Factors

The following describe the remedy selection decision factors used to evaluate the corrective action alternatives.

Short-Term Reliability and Effectiveness

Each corrective action alternative must be evaluated with respect to its effects on human health and the environment during the construction and implementation phase of the corrective action. The following factors will be addressed for each alternative:

- Protection of the community from potential risks associated with implementation such as fugitive dusts, transportation of hazardous materials, or air-quality impacts from off-gas emissions
- Protection of workers during construction and implementation
- Environmental impacts that may result from construction and implementation
- The amount of time until the corrective action objectives are achieved

Reduction of Toxicity, Mobility, and/or Volume

Each corrective action alternative must be evaluated for its ability to reduce the toxicity, mobility, and/or volume of the contaminated media. Reduction in toxicity, mobility, and/or volume refers to changes in one or more characteristics of the contaminated media by the use of corrective measures that decrease the inherent threats associated with that media.

Long-Term Reliability and Effectiveness

Each corrective action alternative must be evaluated in terms of risk remaining at the CASs after corrective action alternatives have been implemented. The primary focus of this evaluation is on the extent and effectiveness of the controls that may be required to manage risk posed by treatment residuals and/or untreated wastes.

Feasibility

The feasibility criterion addresses the technical and administrative feasibility of implementing a corrective action alternative and the availability of various services and materials needed during implementation. Each corrective action alternative must be evaluated for the following criteria:

- **Construction and Operation:** This refers to the feasibility of implementing a corrective action alternative given the existing set of waste and site-specific conditions.
- **Administrative Feasibility:** This refers to the administrative activities needed to implement the corrective action alternative (e.g., permits, public acceptance, rights of way, off-site approval).
- **Availability of Services and Materials:** This refers to the availability of adequate off-site and on-site treatment, storage capacity, disposal services, outside technical services and materials, and availability of prospective technologies for each corrective action alternative.

Cost

Costs for each alternative are estimated for comparison purposes only. The cost estimate for each corrective action alternative includes both capital and operation and maintenance (O&M) costs, as applicable. The following is a brief description of each component:

- **Capital Costs:** These costs include both direct and indirect costs. Direct costs may consist of materials, labor, mobilization, demobilization, site preparation, construction materials, equipment purchase and rental, sampling and analysis, waste disposal, and health and safety measures. Indirect costs include such items as engineering design, permits and/or fees, start-up costs, and any contingency allowances.
- **Operation and Maintenance:** These costs include labor, training, sampling and analysis, maintenance materials, utilities, and health and safety measures.

Costs associated with potential O&M activities are considered to be minimal for each alternative; therefore, O&M costs were not included in the cost estimates. Cost estimates were developed by Bechtel Nevada. Details of the estimated costs for this CADD are provided in [Appendix B](#).

3.3 Development of Corrective Action Alternatives

This section identifies and briefly describes the viable corrective action technologies and the corrective action alternatives considered for the affected media. Based on the review of existing data, future land use, and current operations at the TTR, the following alternatives have been developed for consideration at the Area 3 Landfill Complex CAU:

- Alternative 1 - No Action
- Alternative 2 - Administrative Controls, Cover Repair and Maintenance
- Alternative 3 - Partial Excavation, Backfill, and Recontouring

Other alternatives, such as *in situ* bioremediation and monitoring, were considered for implementation; however, upon site-specific evaluation, they were not included.

In situ bioremediation was not evaluated because the TPH were only detected in two locations and at levels which were relatively low with the exception of the sludge in Landfill A3-2.

The following information supports the protection of groundwater and eliminates the need for groundwater monitoring:

- The depth to groundwater at the site is approximately 110 to 120 m (361 to 394 ft) (DOE/NV, 1996a).
- The soils used in the landfill cells are native soils consisting of alluvial materials. The geotechnical analysis determined that the alluvial/fill material has very low hydraulic

conductivity and soil moisture content within the low range. Both these factors limit the migration potential through the soils.

- Annual precipitation averages 13 to 15 centimeters (cm) (5 to 6 inches [in.]) at TTR (DOE/NV, 1996a). Annual evaporation is between 147 and 168 cm (58 and 66 in.) (DOE/NV, 1996a). The high evaporation and low precipitation create a negative water balance for the area; therefore, no driving force associated with precipitation is available to mobilize contaminants to groundwater.
- No evidence of COCs above regulatory limits was found except the petroleum hydrocarbons in landfills A3-1 and A3-2. Other waste encountered during the investigation consisted of general waste such as concrete, asphalt, metal, wire, charred wood, tires, other miscellaneous rubber debris, plastic, cloth rags, and glass ampules. The conditions under which the contamination was detected do not present any significant migration potential or associated effect on waters of the state.
- Based on the investigation, the extent of the contamination is limited to the petroleum hydrocarbons in two landfill cells.
- The CAU is located in a government-controlled facility with the potential land use similar to current use. The TTR is a restricted area that is guarded on a 24-hour, 365-day-per-year basis, and unauthorized personnel are not admitted to the facility.
- No COCs were identified at levels with the potential for a hazard related to fire, vapor, or explosion.

No other site-specific information is available that could substantiate the potential for contaminant migration. Existing covers act as additional barriers to water infiltration. Based on this information, neither vadose nor groundwater monitoring is considered necessary for this site.

3.3.1 *Alternative 1 - No Action*

Under the No-Action alternative, no corrective action activities will be implemented. This alternative is used as a starting point to establish a baseline for comparison with the other corrective action alternatives. For landfills A3-1, A3-2, A3-3, A3-4, A3-5, A3-6, and A3-8, this alternative does not meet the general standards for overall protection of human health and the environment and is not a permanent solution (i.e., does not provide site closure); therefore, it will not be compared to the other alternatives using the selection decision factors.

3.3.2 *Alternative 2 - Administrative Controls, Cover Repair and Maintenance*

Administrative controls are used to prevent inadvertent contact with contaminated media. Administrative controls would consist of land-use restrictions to prevent intrusive activities. In addition, signs can be used to further restrict access. Administrative controls are commonly used and can effectively eliminate potential pathways. Under this alternative, some maintenance activities based on visual cover monitoring would be conducted on the existing landfill soil covers to ensure continued protection. Administrative controls would be especially effective since the TTR, which includes CAU 424, is a restricted-access facility. The implementation of administrative controls requires the coordination of all entities at a site to ensure that the restrictions are enforced. Due to the significantly elevated levels of TPH found at Landfill A3-2, this alternative does not meet media cleanup standards and is not a permanent solution (i.e., does not provide site closure); therefore, it will not be compared to the other alternatives using the selection decision factors for Landfill A3-2.

Backfilling, compaction, and site recontouring will be required at landfills A3-1, A3-4, and A3-8 due to surface depressions, subsidence, and/or exposed landfill debris. Native or native-like materials will be used for backfilling. They will be compacted to approximate native soil conditions. Compaction is a physical process used to reduce volume and to make the soil less permeable and less subject to erosion. Compaction consists of using equipment (such as hydraulic rams and sheeps-foot compactors) to compress the soils, thereby removing void space and reducing the volume. Backfilling with native soils and site recontouring minimizes run-on and run-off after compaction is complete.

For landfills A3-3, A3-5, and A3-6, this alternative consists primarily of the installation of placards. Signs will be placed at all landfills to prohibit illegal dumping. Land-use restrictions will be placed on the land to prohibit intrusive activities.

3.3.3 *Alternative 3 - Partial Excavation, Backfilling, and Recontouring*

Alternative 3 consists of partially excavating contaminated materials to address the highest levels of COCs, backfilling the excavation, and recontouring the surface to prevent infiltration and

inadvertent intrusion to the remaining COCs. The highest levels of COCs are found at 3 m (10 ft) in Landfill A3-2 and at 6.6 m (21.5 ft) in Landfill A3-1 (48,000 ppm waste oil and 790 ppm diesel, respectively). Excavation at the location of hydrocarbon contamination at Landfill A3-2 would result in the removal of free liquids encountered during investigation activities along with defining and mitigating its source. The existing cover at Landfill A3-1 has a permeability of 4.63×10^{-06} centimeters per second (cm/sec). Excavation of the contaminated media would disturb the existing cover, and the current level of permeability may be difficult to achieve after disturbance.

Excavation is the process of removing soil and other materials with construction equipment such as front-end loaders, backhoes, and excavators. Excavation is a well-developed technology commonly used in the mining and construction industries and is often used to remove contaminated subsurface soils for remediation. Excavation equipment is commercially available with optional equipment developed for unique situations. Standard excavation equipment is capable of handling a wide range of materials (including rock, gravel, and bulk materials) at relatively high capacities.

The excavated areas will be backfilled with uncontaminated soils and recontoured to eliminate topographic depression. Excavation may also be used to remove clean borrow soil from an on-site location for placement at the landfills as necessary.

Under this alternative, commercially available equipment will be used to excavate contaminated soil at Landfill A3-1 and/or Landfill A3-2. The soils will be placed directly in an appropriate landfill. Based on process knowledge from [Appendix A](#), the soils are assumed to contain only petroleum hydrocarbons above regulatory action levels and to be acceptable for treatment (i.e., landfarming or incineration) and/or direct disposal at an approved landfill.

Clean borrow soil will be placed in the voids left by excavation, then compacted as stated in Section 3.3.2 and graded to minimize surface depressions. After placement and compaction of the borrow material, approximately 0.3 m (1 ft) of clean top soil will be placed over the borrow material. These soil covers will prevent inadvertent intrusion to the remaining solid waste and act as a means to limit infiltration of water into the landfill. These soil covers will be visually monitored.

Signs will be placed around the perimeter of the landfills to prohibit unauthorized access and illegal dumping. Because impacted soils and landfill debris are left in place, land-use restrictions on the land would be required to prevent intrusive activities.

3.4 *Evaluation and Comparison of Alternatives*

The general corrective action standards and remedy-selection decision factors described in [Section 3.2](#) were used to conduct a detailed evaluation of each corrective action alternative. An analysis compared each corrective action alternative to the other alternatives. In this way, the advantages and disadvantages of each alternative are assessed in order to select a preferred alternative for each landfill. [Tables 3-2](#) and [3-3](#) present a summary of the detailed and comparative analyses of the alternatives for Landfill A3-1. [Tables 3-4](#) and [3-5](#) present the detailed and comparative analyses of alternatives for Landfill A3-2. [Tables 3-6](#) and [3-7](#) present the detailed and comparative analyses of alternatives for landfills A3-3, A3-4, A3-5, A3-6, and A3-8. Cost estimate details are provided in [Appendix B](#).

Table 3-2
Detailed Evaluation of Alternatives for Landfill A3-1
(Page 1 of 2)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Administrative Controls, Cover Repair and Maintenance	Alternative 3 Closure in Place by Partial Excavation, Backfilling, and Recontouring
Closure Standards			
Protection of Human Health and the Environment	<ul style="list-style-type: none"> Does not meet closure objectives of preventing inadvertent intrusion to contaminated zone No worker exposure associated with implementation Existing cover prevents infiltration No maintenance to ensure cover integrity COCs do not pose significant risk 	<ul style="list-style-type: none"> Meets closure objectives Prevents inadvertent intrusion to contaminated zone No worker exposure associated with implementation Existing cover prevents infiltration to COCs during precipitation events COCs do not pose significant risk Cover maintenance ensures integrity 	<ul style="list-style-type: none"> Meets closure objectives Reduces exposure pathway by removing highest concentrations of COCs; however, COC levels only slightly elevated over media cleanup standard for TPH COCs do not pose significant risk Prevents inadvertent intrusion Higher risk to workers during implementation Cover maintenance ensures integrity
Compliance with Media Cleanup Standards	<ul style="list-style-type: none"> Does not comply because COCs above media cleanup standards remain in place Inadvertent intrusion is not prevented 	Complies with media cleanup standards by eliminating exposure pathways	Complies by removing COCs above media cleanup standards
Control the Source(s) of Release	Does not control migration of COCs through intrusive activities	Controls migration of COCs through intrusive activities and precipitation events by maintaining existing cover	<ul style="list-style-type: none"> COCs removed to cleanup levels Transportation accidents could release COCs
Comply with Applicable Federal, State, and Local Standards for Waste Management	No wastes generated	No wastes generated	<ul style="list-style-type: none"> Significant volume of waste generated Material will be handled and disposed as waste per applicable standards

Table 3-2
Detailed Evaluation of Alternatives for Landfill A3-1
(Page 2 of 2)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Administrative Controls, Cover Repair and Maintenance	Alternative 3 Closure in Place by Partial Excavation, Backfilling, and Recontouring
Remedy Selection Decision Factors			
Short-Term Reliability and Effectiveness	Not evaluated	<ul style="list-style-type: none"> Limited impacts to workers during implementation associated with cover placement at exposed cell No worker exposure to COCs Public protected by remote location and access control 	<ul style="list-style-type: none"> Potential for worker exposure to COCs during excavation, transportation, and disposal Public exposure and COC release potential associated with transportation Accident potential associated with heavy equipment
Reduction of Toxicity, Mobility, and/or Volume	Not evaluated	<ul style="list-style-type: none"> Natural attenuation of petroleum hydrocarbons may reduce toxicity, mobility, and volume over time Adequate, low permeability cover reduces mobility to groundwater Cover maintenance ensures integrity 	<ul style="list-style-type: none"> Natural attenuation of petroleum hydrocarbons reduces toxicity, mobility, and volume over time All three reduced at the site by removal, but same volume and toxicity in disposal location Existing cover limits infiltration Maintenance ensures integrity
Long-Term Reliability and Effectiveness	Not evaluated	<ul style="list-style-type: none"> Small residual risk associated with COC levels Controls inadvertent intrusion Visual monitoring and maintenance of cover required 	<ul style="list-style-type: none"> Risk reduction associated with partial removal of COCs Visual monitoring and maintenance of cover required
Feasibility	Not evaluated	<ul style="list-style-type: none"> Easily implementable Coordination of all entities is necessary to ensure compliance 	<ul style="list-style-type: none"> Easily implementable Disposal of waste required Coordination of all entities is necessary to ensure compliance
Cost	\$0	\$27,500	\$408,500

**Table 3-3
Comparative Evaluation of Alternatives for Landfill A3-1**

Evaluation Criteria	Comparative Evaluation
Closure Standards	
Protection of Human Health and the Environment	Alternatives 2 and 3 meet closure objectives; Alternative 1 does not. Current risk levels are low for all alternatives because COCs are not significantly high.
Compliance with Media Cleanup Standards	Alternative 2 complies with media cleanup standards by substantially reducing exposure pathways. Alternative 3 complies by partially removing COCs. Alternative 1 does not comply with media cleanup standards because COCs remain above regulatory limits, and no controls are implemented to prevent access to the COCs.
Control the Source(s) of the Release	Alternative 3 controls the source of release by removing COCs and backfilling the excavation. However, Alternative 3 may reduce the integrity of the low-permeability cover and has the potential for release of COCs during excavation and transportation. Alternative 2 controls the source of release because of the existing cover and cover maintenance.
Comply with Applicable Federal, State, and Local Standards for Waste Management	Alternatives 1 and 2 do not generate any waste. Alternative 3 generates waste associated with removal of COC-contaminated soils. All waste will be managed and disposed of per applicable standards.
Remedy-Selection Decision Factors	
Short-Term Reliability and Effectiveness	Alternative 3 has a degree of worker exposure and the potential for public exposure associated with waste transportation. Accident potential associated with heavy equipment usage exists for Alternatives 2 and 3, although Alternative 2 potential is minor (associated with cover installation at the exposed cell).
Reduction of Toxicity, Mobility, and/or Volume	Alternative 3 results in a reduction of all three parameters by removal of COCs. Both Alternatives 2 and 3 have reduced toxicity, mobility, and volume of TPH associated with natural attenuation. However, Alternative 3 may reduce the integrity of the existing low-permeability cover.
Long-Term Reliability and Effectiveness	Residual risk for all alternatives is low. Alternatives 2 and 3 require long-term visual cover monitoring and maintenance.
Feasibility	Alternatives 2 and 3 are feasible and easily implementable. Alternative 3 requires disposal capacity for significant volumes of waste.
Cost	The cost for Alternative 1 is \$0. The cost for Alternative 2 is \$27,500 for implementation of administrative closure. The cost for Alternative 3 is \$408,500 for partial removal and disposal of contaminated material and construction of a cap. Uncertainties include the type of cover material and disposal capacity and cost.

Table 3-4
Detailed Evaluation of Alternatives for A3-2
(Page 1 of 2)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Administrative Closure	Alternative 3 Closure in Place by Partial Excavation and Capping
Closure Standards			
Protection of Human Health and the Environment	<ul style="list-style-type: none"> Does not meet closure objective of preventing inadvertent intrusion into contaminated zone No worker exposure associated with implementation No maintenance to ensure integrity TPH level significantly above regulatory limit of 100 ppm 	<ul style="list-style-type: none"> Does not meet closure objectives Prevents inadvertent intrusion into contaminated zone No worker exposure associated with implementation Cover maintenance and repair ensure integrity TPH level significantly above regulatory limit of 100 ppm 	<ul style="list-style-type: none"> Meets closure objectives Significantly reduces COC levels Prevents inadvertent intrusion Cover maintenance and repair ensure integrity Higher risk to workers during implementation because of intrusion to COCs
Compliance with Media Cleanup Standards	<ul style="list-style-type: none"> Does not comply with media cleanup standards TPH level significantly above regulatory limit of 100 ppm 	Does not comply because TPH level significantly above regulatory limit of 100 ppm	Complies with standards by removing COC levels to media cleanup standards and eliminating exposure pathways
Control the Source(s) of Release	<ul style="list-style-type: none"> No maintenance is provided to ensure cover integrity COCs remain in place at levels significantly above regulatory limit of 100 ppm 	<ul style="list-style-type: none"> Cover maintenance and repair ensure integrity COCs remain in place at levels significantly above regulatory limit of 100 ppm 	<ul style="list-style-type: none"> COCs removed to regulatory level Cover will limit infiltration Cover maintenance and repair ensure integrity Transportation accidents could release COCs
Comply with Applicable Federal, State, and Local Standards for Waste Management	No wastes generated	No wastes generated	<ul style="list-style-type: none"> Significant volume of waste generated Will be handled and disposed of per applicable standards

Table 3-4
Detailed Evaluation of Alternatives for A3-2
(Page 2 of 2)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Administrative Closure	Alternative 3 Closure in Place by Partial Excavation and Capping
Remedy-Selection Decision Factors			
Short-Term Reliability and Effectiveness	Not evaluated	Not evaluated	<ul style="list-style-type: none"> Potential for worker exposure during excavation, transportation, and disposal Public exposure and COC release potential associated with transportation
Reduction of Toxicity, Mobility, and/or Volume	Not evaluated	Not evaluated	<ul style="list-style-type: none"> COCs removed and disposed of in an appropriate facility Natural attenuation may reduce toxicity, mobility, and volume of remaining TPH. Cover limits infiltration; maintenance ensures cover integrity
Long-Term Reliability and Effectiveness	Not evaluated	Not evaluated	<ul style="list-style-type: none"> COCs removed to regulatory limit Controls inadvertent intrusion Visual monitoring and maintenance of cover required
Feasibility	Not evaluated	Not evaluated	<ul style="list-style-type: none"> Easily implementable Disposal of waste required Coordination of all entities is necessary to ensure compliance
Cost	\$0	\$15,250	\$56,000

**Table 3-5
Comparative Evaluation of Alternatives for Landfill A3-2**

Evaluation Criteria	Comparative Evaluation
Closure Standards	
Protection of Human Health Environment	Alternative 3 meets closure objectives; Alternatives 1 and 2 do not because significant levels of COCs remain at the site.
Compliance with Media Cleanup Standards	Alternative 3 meets media cleanup standards by removing levels of COCs to cleanup standards and reducing exposure pathways. Alternatives 1 and 2 do not meet media cleanup standards.
Control the Source(s) of the Release	Alternative 3 controls the source after implementation; however, it has the potential for release during excavation and transportation. Alternatives 1 and 2 do not control the source of release.
Comply with Applicable Federal, State, and Local Standards for Waste Management	Alternatives 1 and 2 do not generate any waste. Alternative 3 generates waste. All waste will be managed and disposed of per applicable standards.
Remedy-Selection Decision Factors	
Short-Term Reliability and Effectiveness	Not analyzed, only Alternative 3 is applicable.
Reduction of Toxicity, Mobility, and/or Volume	Not analyzed, only Alternative 3 is applicable.
Long-Term Reliability and Effectiveness	Not analyzed, only Alternative 3 is applicable.
Feasibility	Not analyzed, only Alternative 3 is applicable.
Cost	The cost for Alternative 1 is \$0. The cost for Alternative 2 is \$15,250 for implementation of administrative closure. The cost for Alternative 3 is \$56,000 for partial removal and disposal of contaminated material and repair of protective cover. Uncertainties include the type of cover material and disposal capacity and cost.

Table 3-6
Detailed Evaluation of Alternatives for Landfills A3-3, A3-4, A3-5, A3-6, and A3-8

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Administrative Closure
Closure Standards		
Protection of Human Health and the Environment	<ul style="list-style-type: none"> Does not meet closure objective of preventing inadvertent intrusion into the landfill debris No worker exposure associated with implementation Existing covers protective for landfills A3-3, A3-5, and A3-6, but no maintenance to ensure cover integrity Inadequate soil covers at A3-4 and A3-8 are not protective 	<ul style="list-style-type: none"> Meets closure objectives Prevents inadvertent intrusion to landfill debris No worker exposure associated with implementation Existing covers limit infiltration during precipitation events for landfills A3-3, A3-5, and A3-6 Soil covers repaired at A3-4 and A3-8 Maintenance insures integrity of covers
Compliance with Media Cleanup Standards	Complies with media cleanup standards because no COCs were identified on these sites.	Complies with media cleanup standards because no COCs were identified on these sites.
Control the Source(s) of Release	No COCs were identified, therefore, no sources for release of COCs.	No COCs were identified, therefore, no sources for release of COCs.
Comply with Applicable Federal, State, and Local Standards for Waste Management	No wastes generated	No wastes generated
Remedy-Selection Decision Factors		
Short-Term Reliability and Effectiveness	Not evaluated	<ul style="list-style-type: none"> Limited impacts to workers during implementation associated with cover repair and maintenance Public protected by remote location and access control
Reduction of Toxicity, Mobility, and/or Volume	Not evaluated	No COCs identified
Long-Term Reliability and Effectiveness	Not evaluated	<ul style="list-style-type: none"> No COCs identified Only risks are hazards associated with solid waste Administrative controls limit inadvertent intrusion Visual monitoring and maintenance of cover required
Feasibility	Not evaluated	<ul style="list-style-type: none"> Easily implementable Coordination of all entities is necessary to ensure compliance
Cost	\$0	\$80,200

Table 3-7
Comparative Evaluation of Alternatives for Landfills A3-3, A3-4, A3-5, A3-6, and A3-8

Evaluation Criteria	Comparative Evaluation
Closure Standards	
Protection of Human Health and the Environment	Alternative 1 does not meet objective because no cover maintenance is provided to ensure cover integrity and no controls are instituted to prevent intrusion to the solid waste. Alternative 2 meets closure objectives by preventing inadvertent intrusion and maintenance of the cover. Current risk levels are low for both alternatives; no COCs were identified.
Compliance with Media Cleanup Standards	Both alternatives comply with media cleanup standards because no COCs were identified.
Control the Source(s) of the Release	No COCs were identified. Both alternatives currently limit intrusion to the solid waste; however, Alternative 1 does not provide maintenance of the cover integrity or repairs to A3-4 or A3-8.
Comply with Applicable Federal, State, and Local Standards for Waste Management	Alternatives 1 and 2 do not generate any waste.
Remedy-Selection Decision Factors	
Short-Term Reliability and Effectiveness	Not analyzed, only Alternative 2 is applicable.
Reduction of Toxicity, Mobility, and/or Volume	No COCs were identified.
Long-Term Reliability and Effectiveness	Not analyzed, only Alternative 2 is applicable.
Feasibility	Not analyzed, only Alternative 2 is applicable.
Cost	The cost for Alternative 1 is \$0. The cost for Alternative 2 is \$80,200 for implementation of administrative closure.

4.0 Recommended Alternative

Based on the results of the detailed and comparative analysis of the potential corrective action alternatives presented in this document, the preferred corrective action alternative selected for implementation at landfills A3-3, A3-4, A3-5, A3-6, and A3-8 is Alternative 2, Administrative Controls, Cover Repair, and Maintenance. Alternative 2 was chosen for the following reasons:

- Existing covers sufficiently prevent contact with the waste and provide erosion control. The covers also help limit precipitation infiltration; however, for these sites, precipitation control is a lessor factor because of the absence of COCs.
- Alternative 2 complies with standards for management of wastes because no wastes are generated.
- There is a minimal risk to workers during implementation associated with minimal exposure to solid waste and heavy equipment operation.
- This alternative is easily implementable using existing resources and technologies with minimal disturbances to surrounding areas.
- Alternative 2 provides the most cost-effective method for achieving protectiveness and for meeting closure requirements.

Alternative 2 was also chosen for implementation at Landfill A3-1 based on the information listed in the last four reasons above as well as the following reasons:

- Disturbing the existing cover would likely increase infiltration.
- Natural attenuation of petroleum hydrocarbons will likely reduce the concentrations.
- TPH were detected in a few samples at levels below 1,000 ppm. A trigger value of 10,000 ppm TPH has been used at other sites to assess alternatives that left contamination in place.

Alternative 3, Partial Excavation, Backfilling, and Recontouring was chosen as the preferred alternative at Landfill A3-2 for the following reasons:

- The isolated area of elevated TPH contamination is removed to below 100 ppm.

- Backfilling and recontouring prevent contact with remaining solid waste, if any, and provide erosion controls.
- Alternative 3 is readily implementable with existing resources and technologies.
- The site is returned to its original grade.
- The alternative provides the most cost-effective method for achieving protectiveness and for meeting closure requirements.

The preferred corrective action alternatives were evaluated on their technical merits, focusing on performance, reliability, feasibility, and safety. During corrective action implementation, these alternatives will present minimal potential threat to site workers in contact with the waste.

However, appropriate safety procedures will be developed and implemented. The alternatives were judged to meet all requirements for the technical components evaluated. These alternatives meet all applicable state and federal regulations for closure of the site and will reduce potential future exposure pathways to the contents of the landfills.

The future use of any land related to this CAU, as described by this CADD, is restricted from any activity that may alter or modify the containment control as approved by the State and identified in the CAU Closure Report or other CAU documentation unless appropriate concurrence is obtained in advance.

5.0 References

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Appendix A

Corrective Action Investigation Report for CAU 424: Area 3 Landfill Complex, Tonopah Test Range

A.1.0 Introduction

The report contained in this appendix presents the investigation activities and analytical results from the corrective action investigation conducted at the eight individual landfill sites which comprise the Area 3 Landfill Complex, Corrective Action Unit (CAU) 424. The Corrective Action Site (CAS) numbers and corresponding names for the eight landfill sites are presented in Table 3-1 of the *Corrective Action Unit Work Plan, Tonopah Test Range, Nevada* (hereafter referred to as the TTR Work Plan) (DOE/NV, 1996a). The corrective action investigation was conducted in accordance with the requirements set forth in the *Corrective Action Investigation Plan (CAIP) for CAU No. 424: Area 3 Landfill Complex, Tonopah Test Range, Nevada* (DOE/NV, 1997a) that were developed under the *Federal Facility Agreement and Consent Order* (FFACO, 1996).

The eight landfill sites are located around and within the perimeter of the Area 3 Compound, Tonopah Test Range (TTR), Nye County, Nevada ([Figure 1-1](#), [Figure 1-2](#) of Section 1.0, and [Plate A-1](#)). The landfill cells associated with CAU 424 were excavated in order to receive waste generated from daily operations conducted at the Area 3 Compound. It is believed that the open cell was excavated as a burn pit for debris buried at Landfill A3-1 (DOE/NV, 1996a). These landfill cells were operated during different time intervals spanning from before 1963 to approximately 1993. Process knowledge regarding the contents of the cells is limited due to the unregulated disposal practices commonly associated with early landfill operations (DOE/NV, 1997a).

Additional information relating to the site history, planning, and scope of the corrective action investigation is presented in the CAIP (DOE/NV, 1997a) and the TTR Work Plan (DOE/NV, 1996a) and is not repeated in this report.

A.1.1 Project Objectives

The primary objectives for this project were to determine the depths to and thicknesses of the landfill cells, to identify contents of the landfill cells, to investigate the subsurface conditions beneath the landfill cells, and to assess the potential for downward migration of potential contaminants of concern.

Prior to starting the Data Quality Objective (DQO) process outlined in the CAIP (DOE/NV, 1997a), a conceptual model was developed to postulate exposure pathways from potential contaminant sources within the landfill cells. The conceptual model was tested by conducting a subsurface drilling program and by collecting environmental samples for both field screening and laboratory analysis. To optimize the sampling program, the drilling locations were selected based on geophysical anomalies located within the cells (DOE/NV, 1997b; IT, 1996). This was done to accomplish the following tasks:

- Investigate the contents of each landfill cell to determine if possible sources for contamination are present.
- Characterize the unsaturated interval beneath the trenches to determine whether a leachate plume has developed.

Fifty-eight boreholes were drilled at the eight landfill CASs to characterize the subsurface soils. Sonic drilling methods provided a continuous core for sampling and analysis. Soil samples were collected from specified core intervals for laboratory- and field-screening analyses and to conduct detailed field observations of the subsurface conditions, including lithologic description of the core.

A.1.2 Report Content

This corrective action investigation report is intended to provide information and data in sufficient detail to support the selection of one of the preferred corrective action alternatives in the Corrective Action Decision Document (CADD). The contents of the report are as follows:

- Section [A.1.0](#) describes the investigation background, objectives, and the report content.
- Section [A.2.0](#) provides information regarding the field activities and sampling method.
- Section [A.3.0](#) summarizes the results of the laboratory analysis from the investigation sampling.
- Section [A.4.0](#) contains the quality assurance (QA) and quality control (QC) procedures that were followed and the results of the QA and QC activities.
- Section [A.5.0](#) is a summary of the significant results and conclusions pertaining to the Area 3 Landfill Complex investigation program.

- Section [A.6.0](#) presents the references.
- [Attachment 1](#) includes the soil boring logs and information pertinent to the corrective action decision process.

To make this report a concise summary, the complete field documentation and laboratory data, including Field Activity Daily Logs, Sample Collection Logs, Analysis Request/Chain-of-Custody Forms, soil sample descriptions, laboratory certificates of analyses, analytical results, and surveillance results are not contained in this report. These documents are retained in project files as both hardcopy files and electronic media and will be supplied upon request.

A.1.3 Summary of Findings in Accordance with NAC 445A.227

Total petroleum hydrocarbon concentrations in soil samples collected from Landfills A3-1 and A3-2 exceeded the soil action level of 100 parts per million established by the State of Nevada. In part, this investigation determined and assessed the site information as specified in the *Nevada Administrative Code* (NAC) 445A.227.2, (a) through (k), and the CAIP (DOE/NV, 1997a). The information corresponding to Sections (a) through (k) is listed in the following text:

- a.) The depth of groundwater is 110 to 120 m (360 to 390 ft) below ground surface.
- b.) The distance to the nearest drinking water well (Sandia 6) is approximately 438 m (1,438 ft) southeast of Landfill A3-7.
- c.) The soil consists of well-sorted sandy gravels and gravels with variable percentages of silts.
- d.) Annual precipitation averages 13 to 15 cm (5 to 6 in.).
- e.) The type of regulated substance released is petroleum hydrocarbons in the form of waste oil at Landfill A3-2 and gasoline and diesel fuel at Landfill A3-1.
- f.) The extent of contamination at Landfill A3-2 appears to be limited to the cell within an approximate area of 3 m by 3 m (10 ft by 10 ft) at an approximate depth of 2.7 m (9 ft) below ground surface (bgs) at borehole location BH2-3. The extent of contamination at Landfill A3-1 appears to be limited to beneath the south end of the second cell from the west within an approximate area of 3 m by 3 m (10 ft by 10 ft) at borehole location BH1-13. Contamination was detected to a total depth of 10.4 m (34 ft) bgs.

- g.) Presently, the two landfills are part of an active military facility with the potential future land use (pending closure of the government facility) similar to current use.
- h.) Potential routes of migration are extremely limited or nonexistent as the point sources of the hydrocarbons are covered by a soil cap and are limited in volume.
- i.) The subsurface hydrocarbons are located within and beneath two landfill cells located at Landfills A3-1 and A3-2. These cells have a 0.9- to 1.5-m (3- to 5-ft) thick soil cover. Exact contents of the cells are unknown.
- j.) The potential for a hazard related to fire, vapor, or explosion is low.
- k.) No other site-specific factors are known at this time.

A.2.0 Field Investigation and Sampling Activities

Field investigation and sampling activities were conducted from June 3, 1997, to July 19, 1997, to collect environmental and geotechnical samples for the Area 3 Landfill Complex corrective action investigation. The primary elements of the field investigation and sampling program included:

- Drilling three background holes and 58 investigation holes by the sonic method
- Conducting continuous field screening for total TPH, radiological constituents, and VOCs
- Collecting environmental quality samples for laboratory analysis
- Collecting soil samples from the cap and directly beneath a landfill cell at each landfill CAS for geotechnical analysis
- Describing the collected core to assess soil and waste characteristics

The investigation and sampling program was managed in accordance with the requirements set forth in the CAIP (DOE/NV, 1997a). The field activities were performed in accordance with an approved Site-Specific Health and Safety Plan (IT, 1997c). The samples were collected and documented by following approved sampling, field activity documentation, sample collection documentation, decontamination, chain of custody, shipping, and radiation screening protocols, procedures, and field sampling instructions as indicated in the CAIP (DOE/NV, 1997a). Quality control samples (e.g., field blanks, rinsate blanks, trip blanks, and sample duplicates) were collected as required by the Industrial Sites Quality Assurance Project Plan (QAPP) (DOE/NV, 1996b) and approved procedures (IT, 1993). During field activities, waste minimization practices were followed, including segregation of the waste from each site, segregation of suspected contaminated items from suspected uncontaminated items, and separation of personal protective equipment into bags.

A.2.1 Soil Sampling Logistics

Drilling, field screening, and sampling logistics are presented in the following subsections.

A.2.1.1 Drilling

The dry-drilling roto-sonic method was selected to advance the drill holes through the landfill cells because it provided, by continuous core, a representative vertical profile of the landfill cell contents and the *in situ* soil beneath the cells for field screening and environmental sampling. The sonic method also provided the capability of drilling through most types of landfill debris which could be encountered within the cells. A representative vertical profile of the landfill cells enabled identification of cell contents, the bottom of the landfill cells, and the first sample collection point directly beneath the bottom of the cells. Fifty-eight investigation holes, including three background holes, were continuously cored from ground surface to a minimum depth of 7.6 m (25 ft) with the exception of BH 2-5, which was only drilled to 3 m (10 ft). The borehole locations are shown on [Plate A-1](#).

A.2.1.2 Field Screening

Field-screening methods were used to collect semiquantitative data and to determine if drilling should continue deeper than the established minimum depth of investigation (7.6 m [25 ft]). Field screening was performed at 1.5-m (5-ft) intervals for all boreholes. The screening methods included:

- Radiological screening over the entire core for alpha and beta/gamma radiation using an Electra and a Ludlum Model 119 instrument
- Headspace screening for VOCs using a Photoionization Detector
- Total Petroleum Hydrocarbon screening using the Hanby field testing kit (a colorimetric analyzer) manufactured by Hanby Environmental Laboratory Procedures, Inc.

The field-screening results recorded at the background borehole locations were designated as “background” levels and used as a baseline for investigation sampling. The background levels established by the VOC field screening fluctuated between 0 and 4.4 parts per million (ppm). Total Petroleum Hydrocarbons were not detected at the background locations. The background level for alpha radiation detected from the core and headspace samples was 0 disintegrations per minute (dpm). Background levels for beta radiation fluctuated from 981 to 2043 dpm. Background levels from gamma radiation collected within the exclusion zone near the point of drilling, fluctuated from 18 to 21 microrentgens per hour ($\mu\text{R/hr}$).

Preliminary field-screening action levels were established to guide the vertical advancement of the borehole and to provide a basis for collecting additional environmental samples. At a minimum, samples for laboratory analysis were collected from directly beneath the landfill cell bottom and at 1.5-m (5-ft) intervals thereafter to a minimum depth of 7.6 m (25 ft). When contamination was detected through field-screening methods, vertical advancement of the borehole was continued until two consecutive non-detects were established. This action was intended to provide a means to establish the vertical extent of potential contamination.

The preliminary action level for TPH field screening results was established at 100 ppm in accordance with the Nevada Division of Environmental Protection (NDEP) screening levels for TPH (NAC, 1996). The preliminary action level for VOC field screening results was determined to be 20 ppm or 2.5 times background, whichever was higher. The preliminary action levels for radiation monitoring results were established at levels listed in the *Offsite Radiation Exposure Review Project (ORERP), Phase II Soil Program* report (MacArthur and Miller, 1989) or two times background levels, whichever was higher (DOE/NV, 1997a).

A.2.1.3 Sample Collection

A routine sample collection procedure was performed for each core interval and type of sample (chemical/radiological or geotechnical) collected. A generalized description of the sampling procedure for chemical and radiological analysis is provided in the following text.

Prior to advancing a borehole and sample collection, drillers decontaminated the core barrels with a high-pressure sprayer. While the core barrel was being advanced to collect soil samples for non-geotechnical analysis, the sample collection team prepared the required sample containers. Upon reaching each sampling interval, the core was extruded into a plastic sleeve. Once the sampling team was ready to obtain the soil for sample collection, a decontaminated razor blade was used to cut open the plastic sleeve and the core was screened for volatile organic and radiological contamination. Upon completing the field screening, soil from within the bottom 0.6 m (2 ft), beginning at the deepest end of the core, was collected for total VOCs and TPH gasoline analysis and VOC headspace and TPH-field screening. Soil was then collected and placed in a decontaminated stainless steel bowl and homogenized using a disposable plastic scoop. Once homogenized, the soil was collected for

total semivolatile organic compounds (SVOCs), total *Resource Conservation and Recovery Act* (RCRA) metals, total pesticides/polychlorinated biphenyls (PCBs), gamma spectroscopy, and isotopic plutonium (Pu) analysis. A photograph was taken of the core to assist the geologist in logging the soil.

Geotechnical soil samples were collected from the soil (cap) above and directly beneath one cell at each landfill. A 6.5-cm (2.5-in.) California Modified split-spoon fitted with 1.1-cm (3-in.) length brass sleeves was attached to the end of a 63-kilogram (kg) (140-pound) drive hammer. The split-spoon sampler was driven by the driller with a 63-kg (140-pound) hammer and 78.7-cm (31-in.) drop to collect the sample. The number of hammer blows required to drive the split-spoon sampler down every 2.4 cm (6 in.) was recorded. Generally, 50 blow counts for less than 2.4 cm (6 in.) were considered refusal, although in some cases additional blow counts were specified to maximize sample recovery. The sample collection time was noted when the sampler was driven to its limit.

Once at the surface, the driller removed the split spoon sampler from the hammer and loosened the shoe (the cutting edge of the sampler) and hammer sub (the device that attaches the sampler to the hammering assembly). The split-spoon was then placed on the table and opened to expose the brass sleeves. The sleeves were collected in order of deepest to shallowest. The ends of each brass sleeve were sealed with TeflonTM sheets and plastic caps.

Immediately upon sample collection, sample labels preprinted with the sample number, sample collection date/time, chain-of-custody number, sampling team members, container preservative, medium type, and requested analysis were attached to each of the sample containers. Each sample container was then sealed with custody tape, wrapped in protective bubble wrap (if applicable), placed into a ZiplocTM bag, and stored in an iced cooler with a trip blank (if applicable). The Sample Collection Log was completed at the end of each sample collected. Section [A.3.0](#) of this report discusses the results of the sample analysis.

A.2.2 Site Description and Conditions

The Area 3 Landfill sites are located around and within the perimeter of the Area 3 Compound, TTR ([Plate A-1](#)). The locations of the landfill cells within the sites were approximated from information

obtained from results of surface geophysical studies performed in 1993 and 1996 by IT Corporation (IT) (DOE/NV, 1997b; IT, 1996), interviews with former and current employees, and historical aerial photographs (DOE/NV, 1997a).

Underground utilities for the Area 3 Compound were identified on “as-built” diagrams and utility maps and verified by Kirk-Mayer Incorporated (KMI) personnel familiar with the area. Little information was available regarding the existence and location of underground utilities outside the Area 3 Compound. To avoid damaging any utilities during drilling, an air knife (digging tool) was used to excavate the upper 1.5 m (5 ft) of soil prior to drilling. Air knife operations were stopped if landfill debris was encountered prior to 1.5 m (5 ft). Landfill debris was encountered at over half of the planned borehole locations, found at depths ranging from 0.5- to 0.9-m (1.5 ft to 3 ft) bgs. On one occasion, a buried cable was encountered but not damaged. In this case the borehole location (BH3-9) was moved to the northeast based on surface geophysical information.

A.2.2.1 Background Boreholes

Three boreholes were widely spaced at undisturbed locations near the Area 3 Landfill Complex CASs ([Plate A-1](#)) to assess the background variability for radiological and inorganic parameters.

Background field-screening results for TPH, VOCs, radiological levels, and geological information as well as background analytical levels for total RCRA metal and radiological parameters were obtained from each location. Field screening was performed at 1.5-m (5-ft) intervals. Soil samples were collected for laboratory analysis at 3 and 4.6 m (10 and 15 ft) bgs. Samples were collected at these depths to best represent background levels at the anticipated cell depths and 1.5 m (5 ft) beneath the cell bottom. Sample numbers TTR00400 through TTR00411 are associated with the subsurface background investigation. Geologic field descriptions were performed by the field geologist of each continuous core interval and recorded on a Visual Classification of Soil log.

A.2.2.2 Landfill A3-1

Landfill A3-1 is located northwest of the Area 3 Compound and consists of four buried north-south elongated cells, one partially covered north-south elongated cell, and one open east-west elongated cell/or trench ([Plate A-1](#) and [Figure A.2-1](#)). The site is nearly level with a slight grade draining

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east-northeast. No overhead hazards exist in the area. Work at the site did not pose a traffic hazard. Fifteen boreholes (borehole numbers BH1-1 through BH1-13 and BH1-19 and BH1-20) were drilled to investigate the four buried cells and the one open trench ([Figure A.2-1](#)). Of the fifteen boreholes drilled, landfill material was encountered in all but the following four boreholes; BH1-2, BH1-12, BH1-19, and BH1-20. The landfill material consisted of foam, wire, metal, wood, rubber, and other construction debris and was encountered from 0.9- to 2.7-m (3- to 9-ft) beneath the landfill caps.

All boreholes, with the exception of BH1-13 were drilled to a total depth of 7.6 m (25 ft). Field-screening results indicated elevated TPH levels at BH1-13 which required advancement of the borehole to a total depth of 15.8 m (52 ft). Asphalt with a strong hydrocarbon odor was observed at 2.1 m (7 ft). Elevated VOC readings, as well as elevated TPH field-screening results were obtained from 2.1 to 11.5 m (7 to 38 ft). At 11 m (36 ft) bgs, casing was placed in the borehole to prevent contamination smearing further downhole. A 7.6-cm (3-in.) diameter core barrel was then used to remove sloughed material at the bottom of the hole and collect additional soil samples. Field screening results at 12.6 m (41.5 ft) were below background levels and found to be negative at 15.8 m (52 ft) bgs.

Boreholes BH1-14 through BH1-18 were planned contingency locations to be drilled if field-screening results indicated extensive contamination at the site. Field-screening results did not indicate extensive contamination; therefore, these locations were not drilled. A total of 75 soil samples were collected from the four buried cells and the open trench. Sample numbers TTR00483 through TTR00579 are associated with the subsurface investigation at A3-1.

The landfill cells are covered by soil varying in thickness from 0.9- to 1.5-m (3- to 5-ft) consisting of light brown well-sorted sandy gravel. Below the landfill cells and to a depth of 7.6 m (25 ft) the soil consists of a light brown sandy silt to sandy gravel with fine to coarse sand. Intermittent lenses of clay were identified at approximately 3.0 to 3.7 m (10 to 12 ft) in various samples. At total depth, soil moisture varies from dry to moist.

A.2.2.3 Landfill A3-2

Landfill A3-2 is located northwest of the Area 3 Compound, approximately 107 m (350 ft) south of A3-1. Based on historical aerial photographs (DOE/NV, 1997a), Landfill A3-2 was believed to consist of two buried, north-south elongated landfill cells ([Figure A.2-1](#)). The site is nearly level with a slight grade draining southeast. No overhead hazards exist in the area. Work at the site did not pose a traffic hazard.

Six boreholes were drilled at this site (BH2-1 through BH2-5 and BH2-3a). Landfill material consisting of wire, metal, burned oil, and rubber from tires were encountered from 0.9 to 3.2 m (3 to 10.5 ft) bgs in boreholes BH2-1 through BH2-3a. Borehole BH2-3 was completed to a depth of 3 m (10 ft) where free liquid/sludge was encountered. According to the stop-drilling requirements in the CAIP (DOE/NV, 1997a), drilling would cease if a free liquid was encountered and the primary decision makers would be notified. A sample of the sludge was obtained (sample number TTR00472) for laboratory analysis. Due to the limited volume of sludge, this sample was not analyzed for TPH gasoline or radiological parameters. It was agreed upon by the primary decision makers not to advance BH2-3 through the cell bottom, but to drill a new borehole location (BH2-3a) to investigate the soil beneath the cell near BH2-3. Drilling at BH2-3 was stopped and a second borehole (BH2-3a) was drilled approximately 0.9 m (3 ft) south of BH2-3.

Borehole BH2-5 was a contingency borehole to be drilled if contamination or landfill debris was encountered in BH2-4. Neither was encountered in BH2-4. However, because of uncertainty about whether BH2-4 was within the potential cell location or south of the cell, borehole BH2-5 was drilled. The soil at this location appeared to be native soil. No contamination or landfill debris was encountered during drilling through the upper 3 m (10 ft) of soil so drilling operations were stopped at 3 m (10 ft). Boreholes BH2-1, BH2-2, BH2-3a, and BH2-4 were drilled to a total depth of 7.6 m (25 ft). Sample numbers TTR00457 through TTR00482 are associated with the subsurface investigation at this site.

Approximately 0.9- to 1.5- m (3- to 5- ft) of soil consisting of light brown, well-sorted sandy gravel covers the cells. Below the landfill cell and to a depth of 7.6 m (25 ft) the soil consists of a light brown, well-sorted sand and gravel. At total depth the soil becomes slightly moist to moist.

During investigation activities at Landfill A3-2, a small depression and surface fissure were observed approximately 2.1 m (7 ft) southeast of BH2-3a. A rain storm caused a subsidence to occur at this location after investigation activities at Landfill A3-2 had culminated. The sinkhole that formed revealed the presence of landfill debris including a diesel storage tank. The sinkhole was measured to a maximum depth of 2.4 m (8 ft) and a maximum width of 1.8 m (6 ft). The thickness of the existing cap was measured to be 0.6 m (2 ft). The hole was backfilled with soil on July 24, 1997, by KMI personnel (IT, 1997a).

A.2.2.4 Landfill A3-3

Landfill A3-3 is located along the western portion of the Area 3 Compound perimeter fence within a highly traveled area and consists of two buried northeast-southwest elongated cells and one buried pit (see [Plate A-1](#) and [Figure A.2-2](#)). The site is nearly level with a slight grade draining west. No overhead hazards exist in the area. Work at the site did pose a slight traffic hazard due to the work traffic through the area.

Nine boreholes (BH3-1 through BH3-9) were drilled to investigate the buried cells and pit at this site. All boreholes were drilled to a total depth of 7.6 m (25 ft). Landfill material consisting of asphalt, concrete, wire, metal, wood, rubber and other construction debris were encountered from 0.3 to 2.3 m (1 to 7.5 ft). No landfill material was encountered in borings BH3-2, BH3-6, and BH3-8. Depths to the landfill bottoms increases from BH3-1 (0.8 m [2.5 ft]) to BH3-7 (2.3 m [7.5 ft]). Sample numbers TTR00588 through TTR00641 are associated with the subsurface investigation at this site.

Approximately 0.3 m (1 ft) of soil consisting of light-brown well-sorted sandy gravel covers the cells. Below the landfill cell and to a depth of 7.6 m (25 ft) the soil consists of a light-brown sandy silt to sandy gravel with fine to coarse sand and angular to subangular well-sorted gravels. At total depth, the soil becomes slightly moist to moist.

A.2.2.5 Landfill A3-4

Landfill A3-4 is the southern most landfill and is located south of the Airport Road southwest of the Area 3 Compound ([Plate A-1](#)). Landfill A3-4 consists of two north-south elongated buried cells and one buried pit (see [Figure A.2-3](#)). The site is nearly level with a slight grade draining south. No

Figure A.2-2
Site Layout and Borehole Locations, Landfill A3-3,
Area 3 Landfill Complex, Tonopah Test Range

Figure A.2-3
Site Layout and Borehole Locations,
Landfills A3-4, Area 3 Landfill Complex,
Tonopah Test Range

overhead hazards exist in the area. Work at borehole BH4-8 posed a traffic hazard because this buried pit is located beneath a heavily traveled road. Investigation activities revealed fissures in the surface of the western-most landfill cell (due to subsidence).

Eight boreholes (BH4-1 through BH4-8) were drilled to investigate this site. Landfill material consisting of asphalt, concrete, wire, metal, wood, rubber, and other construction debris were encountered from 0.6 to 3.0 m (2 to 10 ft) at all boreholes except BH4-8. Borehole BH4-8 was drilled to investigate a geophysical anomaly. The geophysical anomaly could be due to soil moisture caused by frequent ponding north of the road, or from soil consisting of cleaner, coarser sand. All boreholes were drilled to a total depth of 7.6 m (25 ft). Sample numbers TTR00693 through TTR00740 are associated with the subsurface investigation at this site.

The landfill cells are covered by soil varying in thickness from 0.6 to 1.2 m (2 to 4 ft) consisting of light-brown well-sorted sandy gravel. Below the landfill cell and to a depth of 7.6 m (25 ft) the soil consists of a light-brown sandy silt to well-sorted sandy gravel with fine to coarse sand. Soil becomes slightly moist at total depth.

A.2.2.6 Landfill A3-5

Landfill A3-5 is located west of the Area 3 Compound within Area 10. Area 10 is occupied by the United States Air Force (USAF). Landfill A3-5 consists of one buried north-south elongated cell (see [Figure A.2-4](#)). The site is slightly mounded with a slight grade draining south. No overhead hazards exist in the area. Work at the site did not pose a traffic hazard. A special drilling permit was required from the USAF prior to conducting any subsurface activities.

Three boreholes (BH5-1 through BH5-3) were drilled to investigate the buried cell. All boreholes was drilled to a total depth of 7.6 m (25 ft). Landfill material consisting of painted metal and trash was encountered from 0.6 to 2.1 m (2 to 7 ft) in boreholes BH5-2 and BH5-3. Samples numbers TTR00412 through TTR00427 are associated with the subsurface investigation at Landfill A3-5.

The landfill cells are covered by a soil cap varying in thickness from 0.5 to 0.9 m (1.5 to 3 ft) and consisting of well-sorted light-brown sand and gravel. Below the cell and to a depth of 7.6 m (25 ft)

Figure A.2-4
Site Layout and Borehole Locations, Landfill A3-5
Area 3 Landfill Complex, Tonopah Test Range

the soil consists of a light brown to tan well-sorted sandy gravel with some cobbles. A clay-rich sand is present at 3.0 m (10 ft). Below 3.0 m (10 ft) there are only trace amounts of clay and silt. Soil is moist at total depth.

A.2.2.7 Landfill A3-6

Landfill A3-6 is located west of the Area 3 Compound perimeter fence ([Plate A-1](#)) and consists of two buried north-south elongated cells ([Figure A.2-5](#)). The site is nearly level with a slight grade draining south. No overhead hazards exist in the area. Work at the site did not pose a traffic hazard.

Five boreholes (BH6-1 through BH6-5) were drilled to investigate the buried cells. All boreholes were drilled to a total depth of 7.6 m (25 ft). Landfill material consisting of wire, metal, glass, plastic, ash, and miscellaneous trash were encountered from 0.5 to 2.6 m (1.5 to 8.5 ft) in all boreholes. Sample numbers TTR00428 through TTR00456 are associated with the subsurface investigation at Landfill A3-6.

The landfill cells are covered by an approximately 0.5- to 0.6-m (1.5- to 2-ft) thick cap consisting of light-brown well-cemented sand and gravel. Below the cell and to a depth of 7.6 m (25 ft) the soil consist of a light brown to tan well-sorted sand and gravel with very fine to coarse sand. Soil is slightly moist at total depth.

A.2.2.8 Landfill A3-7

Landfill A3-7 is located east of the Area 3 Compound and consists of disturbed soil originally believed to be a landfill ([Figure A.2-6](#)). The site slopes slightly to the east. No overhead hazards exist in the area. Work at the site did not pose a traffic hazard.

One borehole, borehole number BH7-1, was drilled to 7.6 m (25 ft). No landfill material was encountered. Sample numbers TTR00576 through TTR00587 are associated with the subsurface investigation at this site. Two contingency boreholes (BH7-2 and BH7-3) were planned for this area. However, neither landfill debris or contamination was detected at BH7-1 so the contingency boreholes were not drilled.

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Figure A.2-5
Site Layout and Borehole Locations, Landfill A3-6
Area 3 Landfill Complex, Tonopah Test Range

Figure A.2-6
Site Layout and Borehole Locations, Landfill A3-7,
Area 3 Landfill Complex, Tonopah Test Range

The soil consists of a light brown sand and gravel. Gravel is angular to subrounded. Soil is slightly moist at total depth (7.6 m [25 ft]).

A.2.2.9 Landfill A3-8

Landfill A3-8 is located southwest of the Area 3 Compound within an equipment storage area. The site is nearly level with a slight grade draining east. No overhead hazards exist in the area. Work at the site posed a slight traffic hazard due to work traffic in the area. Based on geophysical results (DOE/NV, 1997b), the site was originally believed to consist of three buried northeast-southwest elongated cells and one buried pit ([Figure A.2-7](#)).

During site investigation activities, exposed landfill debris was observed in trenches under two of the boxcars used as storage units. Trenches exist beneath each boxcar to allow ground clearance for the boxcar floor supports. The trenches beneath the two southeast boxcars appear to have been cut through a portion of the western landfill cell exposing landfill debris consisting of paper, bottles, and other sanitary trash (IT, 1997b).

Eight boreholes (BH8-1 through BH8-7 and BH8-9) were drilled to investigate the potential landfill cell locations. All boreholes were drilled to a total depth of 7.6 m (25 ft). Landfill material consisting of wire, metal, glass and burned motor oil was encountered from 0.5 to 3.0 m (1.5 to 10 ft) in boreholes BH8-1, BH8-2, BH8-5, and BH8-6.

Borehole BH8-8 was a contingency borehole to be drilled if extensive contamination was detected by field screening. Contamination was not detected; therefore, borehole BH8-8 was not drilled. Sample numbers TTR00642 through TTR00692 are associated with the subsurface investigation at Landfill A3-8.

The landfill cells are covered by a soil cap approximately 0.5- to 0.9-m (1.5- to 3-ft) thick consisting of light brown, slightly compacted, well-sorted sand and gravel. Below the landfill cell and to a depth of 7.6 m (25 ft), the soil consists of a light brown silty sand to well-sorted gravel. Soil is slightly moist to dry at total depth.

12/23/97
If 8

A.2.3 Area Geology

The Area 3 Landfill Complex is located on Cactus Flat, a northwest-southeast elongated closed basin bounded by exposed tertiary volcanics within the TTR boundary. The landfill complex is located on a layer of alluvial sediment greater than 200 m (700 ft) thick (Ekren et al., 1971). Surface deposits consist of well-sorted to moderately consolidated alluvial silty sands with gravel- and cobble-size volcanic detritus. Field descriptions were performed by the field geologist for each boring and recorded on a Visual Classification of Soil Log ([Attachment 1](#)). Soil samples were collected for geotechnical analysis from the soil above (cover) and directly beneath one landfill cell at each of the landfill sites. Geotechnical results are presented in Section A.3.8.

A.2.3.1 Area Hydrology

The Area 3 Landfill Complex lies within an internally drained valley delineated as the Cactus Flat hydrographic basin. The overall drainage is to the north for all sites with the exception of A3-7, which slopes to the east. The depth to water in Area 3 is 110 to 120 m (361 to 394 ft) (DOE, 1996a). No perched water was encountered within or around the landfill cells. Groundwater flow within the basin is generally to the northwest (DOE, 1996a).

A.3.0 Investigation Results

The analytical results from the samples collected from the Area 3 Landfill Complex CAU have been compiled and analyzed to determine the presence and/or extent of contamination. The analytical results are summarized in the following subsections. The data packages of complete laboratory results are available in the project files. [Section A.4.0](#) of this report presents a discussion and summary of quality control samples (i.e., field blanks, field duplicates).

During the investigation activities, 262 soil samples were collected and submitted for laboratory analysis; 18 soil samples were submitted for hydrologic/geotechnical analysis; and 61 liquid samples were submitted for laboratory analysis. A list of the sample numbers (including field duplicate and other quality control samples) and their relationship to the boreholes and landfill cells is presented in [Table A.3-1](#). The analytical parameters and laboratory analytical methods requested for this investigation are presented in [Table A.3-2](#). The sample analytical parameters were selected through the application of site process knowledge according to the U.S. Environmental Protection Agency's (EPA) *Guidance for the Data Quality Objectives Process* (EPA, 1994c). Preliminary action levels for off-site laboratory analytical methods were also determined during the DQO process. The results of the DQO process are documented, in part, in Appendix A of the CAIP (DOE/NV, 1997a), with the remainder of the documentation retained in the project files. The analytical samples were analyzed at the Quanterra Laboratory in Earth City, Missouri. The hydrologic/geotechnical samples were analyzed by Converse Consultants Southwest, Inc., in Las Vegas, Nevada.

A.3.1 Total Volatile Organic Compound Analytical

The total VOC analytical results detected above method detection limits along with the preliminary action levels are presented in [Table A.3-3](#). The method detection limits are not listed in this report because they differ between each constituent and can also differ for each constituent based on dilution factors that may apply. Preliminary action levels were determined during the DQO process (DOE/NV, 1997a) and are based on the EPA Region 9 Preliminary Remediation Goals (PRGs) (EPA, 1996a). The results of the analyses indicate that constituents were either not present above the method detection limits, or if present, were well below the preliminary action levels. Elevated levels

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 1 of 9)

Borehole Number	Sample Depth	Sample Number	Type
Background			
BHB-1	10	TTR00407	S
	13	TTR00408	S
		TTR00409	ERB
		TTR00410	TB
		TTR00411	FB
BHB-2		TTR00402	TB
	10	TTR00405	S
	15	TTR00406	S
BHB-3		TTR00400	ERB
		TTR00401	TB
	10	TTR00403	S
	15	TTR00404	S
Landfill A3-1			
BH1-1		TTR00511	TB
	10	TTR00512	S
	15	TTR00513	S
	20	TTR00514	S
	25	TTR00515	S
BH1-2	10	TTR00507	S
	15	TTR00508	S
	20	TTR00509	S
	25	TTR00510	S
BH1-3	12	TTR00503	S
	15	TTR00504	S
	20	TTR00505	S
	25	TTR00506	S
BH1-4		TTR00497	FB
		TTR00498	TB
	10	TTR00499	S
	15	TTR00500	S
	20	TTR00501	S
	25	TTR00502	S
BH1-5	10	TTR00528	S
		TTR00529	TB
		TTR00530	FB
	8	TTR00531	S
	15	TTR00532	S
	20	TTR00533	S
	25	TTR00534	S-MS/MSD
	25	TTR00535	S-DUP of TTR00534

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 2 of 9)

Borehole Number	Sample Depth	Sample Number	Type
BH1-6	10	TTR00523	S BGEO for A3-1
	1.5	TTR00527	S SGEO for A3-1
	10	TTR00521	S
	8.5	TTR00522	S
	15	TTR00524	S
	20	TTR00525	S
	25	TTR00526	S
BH1-7		TTR00516	TB
		TTR00517	ERB
	15	TTR00518	S
	20	TTR00519	S
	25	TTR00520	S
BH1-8		TTR00562	TB
	10	TTR00563	S
	8	TTR00564	S
	15	TTR00565	S
	20	TTR00566	S
	25	TTR00567	S-MS/MSD
	25	TTR00568	S-DUP of TTR00567
BH1-9	10	TTR00569	S
	8	TTR00570	S
	15	TTR00571	S
	20	TTR00572	S
	25	TTR00573	S
BH1-10	10	TTR00574	S
	7.5	TTR00575	S
	15	TTR00577	S
	20	TTR00578	S
	25	TTR00579	S
BH1-11	10	TTR00549	S
	15	TTR00550	S
	20	TTR00551	S
	25	TTR00552	S
		TTR00553	TB
BH1-12	10	TTR00545	S
	15	TTR00546	S
	20	TTR00547	S
	25	TTR00548	S

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 3 of 9)

Borehole Number	Sample Depth	Sample Number	Type
BH1-13	7	TTR00536	S
		TTR00537	TB
	10	TTR00538	S
	15	TTR00539	S
		TTR00540	ERB
		TTR00541	TB
	20	TTR00542	S
	21.5	TTR00543	S
	25	TTR00544	S
	30	TTR00554	S
		TTR00555	FB
		TTR00556	TB
	34	TTR00557	S
	36	TTR00558	S
	38	TTR00559	S
	41.5	TTR00560	S
	52	TTR00561	S
BH1-14	Contingency Borehole - Not Drilled		
BH1-15	Contingency Borehole - Not Drilled		
BH1-16	Contingency Borehole - Not Drilled		
BH1-17	Contingency Borehole - Not Drilled		
BH1-18	Contingency Borehole - Not Drilled		
BH1-19 (aka BH1A-2)		TTR00491	TB
	10	TTR00492	S
	15	TTR00493	S
	20	TTR00494	S
	25	TTR00495	S-MS/MSD
	25	TTR00496A	S-DUP of TTR00495
	Deleted	TTR00496	
BH1-20 (aka BH1A-1)	10	TTR00483	S
	13	TTR00484	S BGEO for A3-1
	15	TTR00485	S
	20	TTR00486	S
	25	TTR00487	S
	1.5	TTR00488	S SGEO for A3-1
		TTR00489	ERB
		TTR00490	TB
Landfill A3-2			
BH2-1		TTR00457	TB
	10	TTR00458	S
	15	TTR00459	S
	20	TTR00460	S
	25	TTR00461	S-MS/MSD
	25	TTR00462	S-DUP of TTR00461

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 4 of 9)

Borehole Number	Sample Depth	Sample Number	Type
BH2-2	15.5	TTR00465	S BGEO for A3-2
	1.5	TTR00468	S SGEO for A3-2
		TTR00469	TB
		TTR00470	ERB
		TTR00471	FB
	12.5	TTR00463	S
	14	TTR00464	S
	20	TTR00466	S
	25	TTR00467	S
BH2-3	10	TTR00472	S/SLUDGE
BH2-3A	10	TTR00473	S
	15	TTR00474	S
	20	TTR00475	S
	25	TTR00476	S
BH2-4	10	TTR00477	S
	15	TTR00479	S
	20	TTR00478	S
	25	TTR00480	S
BH2-5		TTR00481	TB
	10	TTR00482	S
Landfill A3-3			
BH3-1	10	TTR00608	S
	15	TTR00609	S
	20	TTR00610	S
	25	TTR00611	S
BH3-2	10	TTR00602	S
	15	TTR00603	S
	20	TTR00604	S
	25	TTR00605	S
		TTR00606	ERB
		TTR00607	TB
BH3-3	4	TTR00596	S
	10	TTR00597	S
	10	TTR00598	S-DUP of TTR00597
	15	TTR00599	S
	20	TTR00600	S
	25	TTR00601	S
BH3-4		TTR00588	TB
		TTR00589	TB
	10	TTR00590	S
	15	TTR00591	S
	20	TTR00592	S
	25	TTR00593	S
		TTR00594	FB
	25	TTR00595	S-MS/MSD

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 5 of 9)

Borehole Number	Sample Depth	Sample Number	Type
BH3-5		TTR00624	FB
		TTR00625	TB
	5	TTR00626	S
	10	TTR00627	S
	15	TTR00628	S
	20	TTR00629	S
	25	TTR00630	S-MS/MSD
	25	TTR00631	S-DUP of TTR00630
BH3-6	10	TTR00619	S
		TTR00620	TB
	15	TTR00621	S
	20	TTR00622	S
	25	TTR00623	S
BH3-7	10	TTR00614	S BGEO for A3-3
	1	TTR00618	S SGEO for A3-3
	10	TTR00612	S
	5	TTR00613	S
	15	TTR00615	S
	20	TTR00616	S
	25	TTR00617	S
BH3-8	10	TTR00638	S
	15	TTR00639	S
	20	TTR00640	S
	25	TTR00641	S
BH3-9	10	TTR00632	S
	8	TTR00633	S
	15	TTR00634	S
	20	TTR00635	S
	25	TTR00636	S
		TTR00637	ERB
Landfill A3-4			
BH4-1	8	TTR00693	S
		TTR00694	TB
	10	TTR00695	S
	15	TTR00696	S
	20	TTR00697	S
	25	TTR00698	S
		TTR00699	ERB
		TTR00700	TB
BH4-2		TTR00702	FB
	15	TTR00703	S
	11	TTR00704	S
	20	TTR00705	S
	25	TTR00706	S

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 6 of 9)

Borehole Number	Sample Depth	Sample Number	Type
BH4-3	11.5	TTR00707	S
	15	TTR00708	S
	20	TTR00709	S
	25	TTR00710	S
BH4-4	12.5	TTR00713	S BGEO for A3-4
	1	TTR00717	S SGEO for A3-4
	10	TTR00711	S
		TTR00712	TB
	15	TTR00714	S
	20	TTR00715	S
	25	TTR00716	S
BH4-5	8	TTR00718	S
	10	TTR00719	S
	15	TTR00720	S
	20	TTR00721	S
	25	TTR00722	S-MS/MSD
	25	TTR00723	S-DUP of TTR 00722
		TTR00724	ERB
		TTR00725	TB
BH4-6	10	TTR00736	S
	8	TTR00737	S
	15	TTR00738	S
	20	TTR00739	S
	25	TTR00740	S
BH4-7	10	TTR00732	S
	15	TTR00733	S
	20	TTR00734	S
	25	TTR00735	S
BH4-8	5	TTR00726	S
	10	TTR00727	S
		TTR00728	FB
	15	TTR00729	S
	20	TTR00730	S
	25	TTR00731	S
Landfill A3-5			
BH5-1	10	TTR00412	S
	15	TTR00413	S
	20	TTR00414	S
	25	TTR00415	S
BH5-2	15	TTR00416	S-MS/MSD
	20	TTR00417	S
	25	TTR00418	S
	25	TTR00419	S-DUP of TTR00418

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 7 of 9)

Borehole Number	Sample Depth	Sample Number	Type
BH5-3	10	TTR00420	S
		TTR00421	TB
	15.5	TTR00422	S BGEO for A3-5
		TTR00423	TB
	17	TTR00424	S
	22	TTR00425	S
	24	TTR00426	S
	1.5	TTR00427	S SGEO for A3-5
Landfill A3-6			
BH6-1	10	TTR00428	S
	15	TTR00429	S
	20	TTR00430	S
	26	TTR00431	S MS/MSD
	26	TTR00432	S DUP of TTR00431
		TTR00433	ERB
BH6-2		TTR00434	TB
		TTR00435	TB
	10	TTR00436	S
	15	TTR00437	S
	20	TTR00438	S
	25	TTR00439	S
BH6-3		TTR00440	FB
		TTR00441	TB
	13	TTR00443	S BGEO for A3-6
	10	TTR00442	S
	15	TTR00444	S
	20	TTR00445	S
BH6-4	25	TTR00446	S
	1.5	TTR00447	S SGEO for A3-6
	10	TTR00448	S
	8	TTR00449	S
	15	TTR00450	S
BH6-5	20	TTR00451	S
	25	TTR00452	S
	10	TTR00453	S
	15	TTR00454	S
	20	TTR00455	S
	25	TTR00456	S

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 8 of 9)

Borehole Number	Sample Depth	Sample Number	Type
Landfill A3-7			
BH7-1		TTR00576	ERB
		TTR00580	TB
	10	TTR00581	S
	6.5	TTR00582	S
	15	TTR00583	S
	20	TTR00584	S
	25	TTR00585	S
BH7-1A	1.5	TTR00586	S SGEO for A3-7
	10	TTR00587	S BGEO for A3-7
Landfill A3-8			
BH8-1	1.5	TTR00665	S SGEO for A3-8
	10	TTR00669	S BGEO for A3-8
	10	TTR00666	S
		TTR00667	TB
	5	TTR00668	S
	15	TTR00670	S
		TTR00671	ERB
		TTR00672	TB
	20	TTR00673	S
	25	TTR00674	S-MS/MSD
	25	TTR00675	S-DUP of TTR00674
BH8-2	5	TTR00676	S
	10	TTR00677	S
		TTR00678	FB
	15	TTR00679	S
	20	TTR00680	S
	25	TTR00681	S
BH8-3	10	TTR00642	S
		TTR00643	TB
	5	TTR00644	S
	15	TTR00645	S
	20	TTR00646	S
BH8-4	25	TTR00647	S
	5	TTR00648	S
	10	TTR00649	S
		TTR00650	FB
		TTR00651	TB
	15	TTR00652	S
	20	TTR00653	S
	25	TTR00654	S

Table A.3-1
Samples Collected During the Area 3 Landfill Complex
Corrective Action Investigation Activities
(Page 9 of 9)

Borehole Number	Sample Depth	Sample Number	Type
BH8-5	5	TTR00655	S
	10	TTR00656	S
	15	TTR00657	S
	20	TTR00658	S
	25	TTR00659	S
BH8-6	5	TTR00660	S
	10	TTR00661	S
	15	TTR00662	S
	20	TTR00663	S
	25	TTR00664	S
BH8-7	5	TTR00682	S
	10	TTR00683	S
	15	TTR00684	S
	20	TTR00685	S
	25	TTR00686	S
BH8-8	Contingency Borehole - Not Drilled		
BH8-9	5	TTR00687	S
	10	TTR00688	S
	15	TTR00689	S
	20	TTR00690	S
	25	TTR00691	S-MS/MSD
	25	TTR00692	S-DUP of TTR00691

S = Soil
ERB = Equipment Rinsate Blank
TB = Trip Blank
FB = Field Blank

BGEO = Bottom Geotech
SGEO = Surface Geotech
MS/MSD = Matrix Spike/Matrix Spike Duplicate
DUP = Field Duplicate

of total xylene were detected in samples TTR00536 and TTR00538 from borehole BH1-13 at Landfill A3-1. Samples TTR00536 and TTR00538 were also detected above the action levels for TPH gasoline and diesel. The presence of xylene, which is a constituent of gasoline and diesel, is consistent with and can be attributed to elevated TPH concentrations. Levels of 1,1,1-trichloroethane, chlorobenzene, chloromethane, and tetrachloroethene were detected at or just above the method detection limits in 12 soil samples (sample numbers TTR00444 through TTR00456). The levels are below the action levels for these constituents. These samples correspond to boreholes BH6-3 through BH6-5 at Landfill A3-6. Landfill A3-6 is one of the older landfill cells used at TTR.

Table A.3-2
Laboratory Analytical Methods Used for
Area 3 Landfill Complex Investigation Samples

Analytical Parameter	Analytical Method
Total Volatile Organic Compounds	EPA 8260 ^a
Total Petroleum Hydrocarbons - Gasoline and Diesel	EPA 8015 (modified) ^a
Total Semivolatile Organic Compounds	EPA 8270 ^a
Total RCRA Metals (Arsenic, Barium, Cadmium, Chromium, Lead, Selenium, Silver, and Mercury)	EPA 6010/7470 ^a
Total Pesticides/Polychlorinated Biphenyls	EPA 8080 ^a
Gamma Spectroscopy	HASL 300, 4.5.2.3 ^b
Isotopic Plutonium	NAS-NS-3058 ^c
Radium 226	EPA 903 ^d
Geotechnical Requirements	Method
Initial moisture content	ASTM ^e D 2216
Dry bulk density	EM ^f -1110-2-1906
Calculated porosity	EM ^f -1110-2-1906
Saturated/unsaturated hydraulic conductivity	ASTM ^e D 5084
Particle-size distribution	ASTM ^e D 422
Water-release (retention) curve	ASTM ^e D 3152

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

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

^c National Academy of Science, *Nuclear Science Series*, September 1, 1962

^d EPA 1992, *Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, Method 903.0, Alpha Emitting Radium Isotopes in Drinking Water, EPA 600/4-30-032, Section 6.

^e Annual Book of American Society for Testing and Materials (ASTM) Standards, Section 4, Construction, Volume 04.08, Soil and Rock (1), and Volume 04.09, Soil and Rock (11), 1996

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

Levels of acetone, methylene chloride, and toluene were detected above method detection levels, but were far below the preliminary action levels. These samples do not correspond to any other elevated constituents detected during this investigation and are considered common laboratory contaminants.

Table A.3-3
Total Volatile Organic Compound Results Detected
Above Method Detection Limits, Soil Sample Results, Area 3 Landfill, TTR
(Page 1 of 3)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (µg/kg)							
			1,1,1-Trichloroethane	Acetone	Chlorobenzene	Chloromethane	Methylene Chloride	Tetrachloroethene	Toluene	Xylene (total)
			Action Levels (µg/kg) (PRGs ^a Residential Soil/Industrial Soil)							
			1,200,000/ 3,000,000	2,100,000/ 8,800,000	65,000/ 220,000	1,200/ 2,600	7,800/ 18,000	5,400/ 17,000	790,000/ 880,000	320,000/ 320,000
BH5-1	TTR00413	15	--	--	--	--	18	--	--	--
	TTR00414	20	--	--	--	--	25	--	--	--
	TTR00415	25	--	--	--	--	13	--	--	--
BH5-2	TTR00416	15	--	--	--	--	26	--	--	--
	TTR00417	20	--	--	--	--	28	--	--	--
	TTR00418	25	--	--	--	--	20	--	--	--
	TTR00419 (Dup of TTR00418)	25	--	--	--	--	17	--	--	--
BH5-3	TTR00420	10	--	--	--	--	21	--	--	--
	TTR00425	22	--	33	--	--	--	--	--	--
BH6-1	TTR00431 (MS/MSD)	26	--	--	--	--	--	--	5	--
	TTR00432	26	--	--	--	--	--	--	5	--
BH6-3	TTR00444	15	6	--	--	11	--	--	--	--
	TTR00445	20	5	--	--	--	--	--	--	--
	TTR00446	25	5	--	--	--	--	5	--	--
BH6-4	TTR00448	10	5	--	--	--	--	--	--	--
	TTR00449	8	5	--	--	--	--	--	--	--
	TTR00450	15	5	--	--	--	--	--	--	--
	TTR00451	20	5	--	--	--	--	--	--	--
	TTR00452	25	5	--	--	--	--	--	--	--
BH6-5	TTR00453	10	5	--	--	--	--	--	--	--
	TTR00454	15	5	--	--	--	--	--	--	--
	TTR00455	20	5	--	7	--	--	--	--	--
	TTR00456	25	--	--	--	11	--	--	--	--
BH2-1	TTR00458	10	--	22	--	--	--	--	--	--
	TTR00461	25	--	99 (J)	--	--	--	--	--	--
BH2-3	TTR00472	w/in Cell	--	68 (J)	--	--	--	--	10	--

Table A.3-3
Total Volatile Organic Compound Results Detected
Above Method Detection Limits, Soil Sample Results, Area 3 Landfill, TTR
(Page 2 of 3)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (µg/kg)							
			1,1,1-Trichloroethane	Acetone	Chlorobenzene	Chloromethane	Methylene Chloride	Tetrachloroethene	Toluene	Xylene (total)
			Action Levels (µg/kg) (PRGs ^a Residential Soil/Industrial Soil)							
			1,200,000/ 3,000,000	2,100,000/ 8,800,000	65,000/ 220,000	1,200/ 2,600	7,800/ 18,000	5,400/ 17,000	790,000/ 880,000	320,000/ 320,000
BH2-4	TTR00479	20	--	31	--	--	--	--	--	--
	TTR00480	25	--	110	--	--	--	--	--	--
BH1-7	TTR00520	25	--	--	--	--	11	--	--	--
BH1-6	TTR00521	10	--	--	--	--	5	--	--	--
	TTR00526RE1 (lab rerun)	25	--	--	--	--	10	--	--	--
BH1-8	TTR00563	10	--	--	--	--	7	--	--	--
	TTR00564	8	--	--	--	--	7	--	--	--
	TTR00566	20	--	50	--	--	18	--	--	--
	TTR00567 (MS/MSD)	25	--	--	--	--	7 (J)	--	--	--
	TTR00568 (Dup of TTR00567)	25	--	50	--	--	24	--	--	--
BH1-9	TTR00571	15	--	--	--	--	7	--	--	--
BH1-10	TTR00574	10	--	46 (J)	--	--	17	--	--	--
	TTR00577	15	--	--	--	--	17	--	--	--
	TTR00578	20	--	53	--	--	9	--	--	--
BH1-13	TTR00536	7	--	--	--	--	--	--	--	38
	TTR00538	10	--	--	--	--	--	--	--	670
BH3-4	TTR00590	10	--	48	--	--	--	--	--	--
	TTR00592	20	--	33	--	--	--	--	--	--
	TTR00593	25	--	97	--	--	--	--	--	--
	TTR00595 (MS/MSD)	25	--	37	--	--	--	--	--	--
BH3-2	TTR00604	20	--	81	--	--	--	--	--	--
BH3-1	TTR00609	15	--	90	--	--	--	--	--	--
	TTR00611	25	--	130	--	--	--	--	--	--
BH3-7	TTR00612	10	--	67	--	--	--	--	--	--
	TTR00613	5	--	76	--	--	--	--	--	--
	TTR00616	20	--	96	--	--	--	--	--	--

Table A.3-3
Total Volatile Organic Compound Results Detected
Above Method Detection Limits, Soil Sample Results, Area 3 Landfill, TTR
(Page 3 of 3)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (µg/kg)							
			1,1,1-Trichloroethane	Acetone	Chlorobenzene	Chloromethane	Methylene Chloride	Tetrachloroethene	Toluene	Xylene (total)
			Action Levels (µg/kg) (PRGs ^a Residential Soil/Industrial Soil)							
			1,200,000/ 3,000,000	2,100,000/ 8,800,000	65,000/ 220,000	1,200/ 2,600	7,800/ 18,000	5,400/ 17,000	790,000/ 880,000	320,000/ 320,000
BH3-6	TTR00619	10	--	22	--	--	--	--	--	--
	TTR00621	15	--	30	--	--	--	--	--	--
BH3-5	TTR00626	5	--	34	--	--	--	--	--	--
	TTR00627	10	--	28	--	--	--	--	--	--
BH3-9	TTR00632	10	--	25	--	--	--	--	--	--
	TTR00633	8	--	20	--	--	--	--	--	--
	TTR00634	15	--	23	--	--	--	--	--	--
	TTR00635	20	--	33	--	--	--	--	--	--
	TTR00636	25	--	25	--	--	--	--	--	--
BH7-1	TTR00581	10	--	48	--	--	18	--	--	--
	TTR00585	25	--	49	--	--	23	--	--	--
BH8-2	TTR00681	25	--	25	--	--	--	--	--	--
BH8-7	TTR00682	5	--	27	--	--	--	--	--	--
	TTR00683	10	--	23	--	--	--	--	--	--
	TTR00684	15	--	22	--	--	--	--	--	--
	TTR00685	20	--	25	--	--	--	--	--	--
BH8-9	TTR00687	5	--	25	--	--	--	--	--	--
	TTR00688	10	--	33	--	--	--	--	--	--
	TTR00689	15	--	24	--	--	--	--	--	--

^a U.S. Environmental Protection Agency, Region 9 Preliminary Remediation Goals (PRG), 1996 (EPA, 1996a)

-- Constituent not detected above method detection limit

µg/kg - Microgram(s) per kilogram

J - Estimated Value

A.3.2 Total Semivolatile Organic Compound Analytical Results

The total SVOC analytical results detected above method detection limits along with the preliminary action levels are presented in Table A.3-4. Elevated levels of 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, diethylphthalate, naphthalene, and pyrene were detected in sample numbers TTR00538, TTR00543, TTR00557 from borehole BH1-13 at Landfill A3-1, TTR00592 from borehole BH3-4 at Landfill A3-4, and TTR00472 from borehole BH2-3 at Landfill A3-2. None of these levels exceed the preliminary action levels set for these parameters. Naphthalene, 2-methylnaphthalene, and pyrene are SVOCs associated with hydrocarbons. These samples correspond to the samples which had elevated TPH concentrations. There is no established preliminary remediation goal for 2-methylnaphthalene.

Table A.3-4
Total Semivolatile Organic Compounds Detected
Above Method Detection Limits, Soil Sample Results, Area 3 Landfill, TTR

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (µg/kg)				
			2-Methylnaphthalene	bis(2-Ethylhexyl)Phthalate	Diethylphthalate	Naphthalene	Pyrene
			Action Levels (µg/kg) (PRGs ^a - Residential Soil/Industrial Soil)				
			--b	32,000/ 140,000	52,000,000/ 100,000,000	240,000/ 240,000	100,000/ 100,000
BH2-3	TTR00472	10	--	--	--	--	3300
BH1-13	TTR00538	10	840	--	--	--	--
	TTR00543	21.5	870	--	--	400	--
	TTR00557	34	--	340	--	--	--
BH3-4	TTR00592	20	--	--	820	--	--

^a U.S. Environmental Protection Agency Region 9 Preliminary Remediation Goals (PRGs), 1996 (EPA, 1996a)

^b No established action level.

-- Constituent not detected above method detection limit

µg/kg - Microgram(s) per kilogram

A.3.3 Total Petroleum Hydrocarbon Analytical Results

The TPH analytical results detected above the method detection limits along with the preliminary action levels are presented in [Table A.3-5](#). In samples TTR00536, TTR00538, and TTR00543, TPH gasoline and diesel were detected above action levels. These sample numbers correspond to borehole BH1-13 at Landfill A3-1 which was advanced to a total depth of 15.8 m (52 ft) due to the elevated TPH field screening concentrations. A substance similar to waste oil was detected at a level of 48,000 mg/kg in sample number TTR00472. This sample number corresponds to the sludge sample collected from BH2-3 from within Landfill A3-2. Field observations noted that the substance appeared to be oily in appearance (see [Attachment A](#) - Visual Classification of Soils log for BH2-3).

Table A.3-5
Total Petroleum Hydrocarbons Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)	
			Gasoline	Diesel
			TPH Action Level 100 mg/kg	
BH2-3	TTR00472	w/in cell	NA	48000*
BH1-13	TTR00536	7	17	610
	TTR00538	10	200	640
	TTR00543	21.5	1.1	790
	TTR00557	34	0.79	72

NA - Not analyzed

Indicates results detected above action levels

* Diesel was not detected at the retention time of the diesel calibration standard; however, a hydrocarbon whose pattern closely matches that of waste oil was detected at 48,000 mg/kg.

mg/kg - Milligram(s) per kilogram

A.3.4 Total Pesticides/PCB Analytical Results

[Table A.3-6](#) presents the total pesticides/PCB analytical results detected above the method detection limits along with the preliminary action levels. Eleven different types of pesticides and one pesticide-related PCB (aroclor-1248) were detected at or above the method detection limits. A regulatory action level could not be established for delta-BHC. No PRG exists for delta-BHC, and

Table A.3-6
Total Pesticide/PCB Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (µg/kg)											
			4,4'-DDE	Aldrin	alpha-BHC	Aroclor-1248	beta-BHC	delta-BHC	Dieldrin	Endosulfan Sulfate	Endrin	gamma-BHC (Lindane)	Heptachlor	Heptachlor Epoxide
			Action Levels (µg/kg) (PRGs ^a - Residential Soil/Industrial Soil)											
			1,300/ 5,600	26/11	71/300	50,000 ^b	250/1,100	-- ^c	28/120	390,000/ 4,100,000	20,000/ 200,000	340/1,500	99/420	49/210
BH2-3	TTR00472	w/in cell	230 (J)	--	--	--	--	--	--	3.4	--	--	--	4
BH1-13	TTR00536	7	1.9	3.4	4	--	9	--	--	--	8.4	11	4.1	--
	TTR00538	10	--	3.6	3.4	--	11	--	--	--	5.2	8.4	2.9	--
	TTR00543	21.5	--	4.1	--	--	3.2	--	2.2	--	--	2.6	2.2	--
	TTR00557	34	--	--	--	--	--	--	2.3	--	--	--	--	--
BH3-4	TTR00590	10	--	--	--	--	--	1.7	--	--	--	--	--	--
BH8-2	TTR00676	5	--	--	--	120	--	--	--	--	--	--	--	--

^a U.S. Environmental Protection Agency Region 9 Preliminary Remediation Goals (PRGs), 1996 (EPA, 1996a)

^b 40 CFR 761.60, *Toxic Substance Control Act*, 1996

^c No established action level

-- Constituent not detected above method detection limit

µg/kg - Microgram(s) per kilogram

J - Estimated value

nonsufficient data exist in the U.S. EPA Integrated Risk Information System (IRIS) database (EPA, 1997) to determine risks associated with delta-BHC. Delta-BHC was detected at the method detection limit. All other constituent concentrations are below the preliminary action levels.

A.3.5 Total RCRA Metals Analytical Results

The analytical results detected above the method detection limits are presented in [Table A.3-7](#). The results of the RCRA metals analyses were all below the preliminary action levels, except for arsenic. Arsenic was detected above the Industrial PRG (2.4 mg/kg) in many samples; however, arsenic was only detected above the maximum background concentration in three samples. These samples, TTR00582, TTR00581, and TTR00583, were all taken from borehole BH7-1 at Landfill A3-7. The arsenic concentrations were 24.1, 16.9, and 14.1 mg/kg, respectively. Arsenic was detected in background borehole BHB-3 at a concentration of 13.8 mg/kg. Borehole BHB-3 is located 62.4 m (205 ft) from BH7-1. Historical information regarding Landfill A3-7 does not contain any physical evidence that a landfill exists here. A survey was performed at A3-7 because there was evidence of surface disturbance at this site. The geophysical survey results indicated an area of higher conductivity estimated to be at total depth (DOE/NV, 1997a). Drilling activities revealed no landfill debris or subsurface disturbance. Based on this information, the concentrations of arsenic are believed to be representative of ambient conditions.

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
(Page 1 of 9)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BHB-3	TTR00403	10	13.8	107	2.4	7.5	--	--
	TTR00404	15	9.4	149	5.1	7	--	--
BHB-2	TTR00405	10	4	82.8	2.9	5.5	--	--
	TTR00406	15	5.6	128	4.9	7.6	--	--
BHB-1	TTR00407	10	5.8	173	6.9	8.6	--	--
	TTR00408	13	5	106	5.4	8.2	--	--
BH5-1	TTR00412	10	4.7	81.5	3.7	8.8	--	--
	TTR00413	15	4.8	121	4.6	6.8	0.55	--
	TTR00414	20	6.3	100	4.6	6.8	--	--
	TTR00415	25	6	127	6.3	9.8	--	--
BH5-2	TTR00416	15	7.4	153	6	8	--	--
	TTR00417	20	5.4	88.6	8.5	7.9	--	--
	TTR00418	25	5.5	104	8.7	8.1	--	--
	TTR00419	25	4.7	98.6	7.7	8.1	--	--
BH5-3	TTR00420	10	6.9	63.6	4.5	7.9	--	--
	TTR00424	17	4.6	189	5	7.7	--	--
	TTR00425	22	5.2	116	7.2	10.4	--	--
	TTR00426	24	5.5	55	7.6	9.1	--	--
BH6-1	TTR00428	10	6	203	7.4	9.1	--	--
	TTR00429	15	5.2	151	5.3	8.5	--	1
	TTR00430	20	6	143	6.1	9.2	--	--
	TTR00431	26	2.8	72.3	2.5	6.8	--	1.9
	TTR00432	26	4.5	303	4.4	35.1	--	1.1
BH6-2	TTR00436	10	4.8	144	5.7	8.6	--	--
	TTR00437	15	4.7	114	5.7	7.3	--	--
	TTR00438	20	4.6	101	4.2	7.5	--	--
	TTR00439	25	4.4	70.6	3.4	6	--	--
BH6-3	TTR00442	10	4.8	132	4.9	8.7	--	--
	TTR00444	15	5.1	99.2	4.7	6.7	--	--
	TTR00445	20	5.2	128	4.3	7.1	--	--
	TTR00446	25	5.1	114	5.9	9	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
(Page 2 of 9)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH6-4	TTR00448	10	4.9	99.5	5.5	7.6	--	--
	TTR00449	8	3.8	108	4.5	6.5	--	--
	TTR00450	15	4.9	134	5.6	8.5	--	--
	TTR00451	20	4.9	156	6.3	8.4	--	--
	TTR00452	25	3.9	65.9	3.7	7	--	--
BH6-5	TTR00453	10	5.4	122	5.8	8	--	--
	TTR00454	15	6	111	4.2	5.6	--	--
	TTR00455	20	4.7	120	4.4	6.7	--	--
	TTR00456	25	4.3	73.2	3.8	7.8	--	--
BH2-1	TTR00458	10	3.5	85.7	4.3 (J)	7.9	--	--
	TTR00459	15	3.8	118	3.8 (J)	6.5	--	--
	TTR00460	20	4.3	114	5.5(J)	10.1	--	--
	TTR00461	25	3.6	83.8	3.3 (J)	7.4	--	--
	TTR00462	25	3.8	91.7	4.0 (J)	7.2	--	--
BH2-2	TTR00463	12.5	5.5	117	3.9 (J)	7.2	--	--
	TTR00464	14	4.6	113	3.7 (J)	6.9	--	--
	TTR00466	20	4.1	102	3.9 (J)	8.6	--	--
	TTR00467	25	4.3	93.9	5.2 (J)	8.1	--	--
BH2-3	TTR00472	w/in cell	4.7	115	8.8	16.6	--	--
BH2-3A	TTR00473	10	4.2	111	5.1 (J)	9.8	--	--
	TTR00474	15	3.6	104	4.7 (J)	7.5	--	--
	TTR00475	20	4.7	85.6	5.9 (J)	8.2	--	--
	TTR00476	25	3.6	74	3.5 (J)	5.7	--	--
BH2-4	TTR00477	10	4.4	176	6.7 (J)	9	--	--
	TTR00478	15	4.6	76	4.4 (J)	6.9	--	--
	TTR00479	20	3.7	83	3.8 (J)	7.7	--	--
	TTR00480	25	4.5	101	5.9 (J)	9.8	--	--
BH2-5	TTR00482	10	4.3	108	5.1 (J)	9.2	--	--
BH1-20	TTR00483	10	5.8	88.9	4.4 (J)	15.7	--	--
	TTR00485	15	5.6	109	4.7 (J)	8.2	--	--
	TTR00486	20	4.9	90.7	4.8 (J)	7.1	--	--
	TTR00487	25	3.3	59.4	3.2 (J)	7.4	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
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Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH1-19	TTR00492	10	5.5	144	6.2	9.6	--	--
	TTR00493	15	7.2	145	8.7	10.1	--	--
	TTR00494	20	6.9	125	6.8	8	--	--
	TTR00495	25	5.1	85.6	7.4	8.7	--	--
	TTR00496A	25	4.9	72.6	6.7	7.8	--	--
BH1-4	TTR00499	10	5.7	134	4.9	7.4	--	--
	TTR00500	15	7.3	102	5	7.2	--	--
	TTR00501	20	8.5	114	5.8	8.8	--	--
	TTR00502	25	4.9	86.4	4.7	7.3	0.56	--
BH1-3	TTR00503	12	9	117	5.1	11.5	--	--
	TTR00504	15	7.8	140	4.6	8.4	--	--
	TTR00505	20	5.6	89.2	3.8	7.3	--	--
	TTR00506	25	5.4	104	4.4	7.3	--	--
BH1-2	TTR00507	10	8.3	190	9.3	9.6	--	--
	TTR00508	15	6.5	128	6.7	9.2	0.69	--
	TTR00509	20	6	105	4.3	6.9	--	--
	TTR00510	25	3.1	46.5	2.7	4.7	--	--
BH1-1	TTR00512	10	5.1	102	4.4	6.5	--	--
	TTR00513	15	7.2	116	7.5	9	--	--
	TTR00514	20	6.4	142	6	7.1	--	--
	TTR00515	25	5	86.7	4.5	9.4	--	--
BH1-7	TTR00518	15	8.7	143	5.3	8.4	--	--
	TTR00519	20	7.6	244	7.2	11.4	--	--
	TTR00520	25	8.1	77.1	5.1	6.7	--	--
BH1-6	TTR00521	10	6.9	190	5.2	8.3	--	--
	TTR00522	8.5	6.6	153	5.7	8.2	--	--
	TTR00524	15	6.4	160	4.7	7.8	--	--
	TTR00525	20	5.8	109	5.4	8	--	--
	TTR00526	25	5.7	109	4.5	6.3	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
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Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH1-5	TTR00528	10	7.9	114	8.5	9.5	--	--
	TTR00531	8	6.5	233	6.2	7	--	--
	TTR00532	15	7.2	163	8.2	9.9	--	--
	TTR00533	20	6.1	123	4.8	8.4	--	--
	TTR00534	25	7.8	109	7.3	8.3	--	--
	TTR00535	25	7.2	157	6.9	8.8	--	--
BH1-13	TTR00536	7	5.9	182	7.3	9	--	--
	TTR00538	10	13.4	186	6.5	10.7	--	--
	TTR00539	15	6	126	4.5	8.3	--	--
	TTR00542	20	7.2	138	5.7	7.7	--	--
	TTR00543	21.5	7.6	129	7.3	11.8	--	--
	TTR00544	25	9.3	156	4.9	6.7	--	--
BH1-12	TTR00545	10	4.6	124	5	8	--	--
	TTR00546	15	6.9	156	6.9	8.8	--	--
	TTR00547	20	7	119	5.6	8.6	--	--
	TTR00548	25	5.7	95.7	4.8	7.7	--	--
BH1-11	TTR00549	10	7.6	242	6.2	10	--	--
	TTR00550	15	7.6	122	4.1	7.1	--	--
	TTR00551	20	5.7	156	5.1	8.2	--	--
	TTR00552	25	5.8	114	4.6	7.1	--	--
BH1-13	TTR00554	30	7	117	6.5	7.9	--	--
	TTR00557	34	7.4	132	10.7	9.4	--	--
	TTR00558	36	4.9	65.3	5.6	7.1	--	--
	TTR00559	38	8.2	97.3	6.8	8.5	--	--
	TTR00560	41.5	6.8	123	5.8	9.1	--	--
	TTR00561	52	5.1	110	5.2	10.1	--	--
BH1-8	TTR00563	10	6.9	89.9	4.8	6.2	--	--
	TTR00564	8	9.5	180	5.5	9.6	--	--
	TTR00565	15	6.7	107	6.7	8.3	--	--
	TTR00566	20	6	164	6.3	8.9	--	--
	TTR00567	25	6	115	6.2	8.3	--	--
	TTR00567DUP	25	6	118	6.2	8.2	--	--
	TTR00568	25	6.4	128	7.6	8.6	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
(Page 5 of 9)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH1-9	TTR00569	10	7.6	156	6.5	9	--	--
	TTR00570	8	5.9	154	7.4	10.2	--	--
	TTR00571	15	7.1	157	6.8	10	--	--
	TTR00572	20	7.7	155	6.2	10.1	--	--
	TTR00573	25	6.5	67.6	4.3	6.3	--	--
BH1-10	TTR00574	10	5.7	131	6.2	9.9	--	--
	TTR00575	7.5	5.5	146	7.3	10.7	--	--
	TTR00577	15	7.1	109	4.8	7.8	--	--
	TTR00578	20	7.1	118	5.6	9	--	--
	TTR00579	25	6.5	97.9	4.7	7	--	--
BH7-1	TTR00581	10	16.9	269	2.6	5.9	--	--
	TTR00582	6.5	24.1	219	2.9	6.3	--	--
	TTR00583	15	14.1	166	4.8	4.6	--	--
	TTR00584	20	12	310	4.5	6.7	--	--
	TTR00585	25	9.2	235	5.6	4.7	--	--
BH3-4	TTR00590	10	4.2	114	5.2	7.4	--	--
	TTR00591	15	4.7	167	5	7.8	--	--
	TTR00592	20	4	78	4.1	6.8	--	--
	TTR00593	25	5	94.8	4.7	8.1	--	--
	TTR00595	25	4.5	111	3.4	7.7	--	--
BH3-3	TTR00596	4	3.5	71.5	4.3	6	--	--
	TTR00597	10	4.7	111	6.1	8.7	--	--
	TTR00598	10	5.1	124	7.1	9.9	--	--
	TTR00599	15	4.2	87.6	3.6	5	--	--
	TTR00600	20	5.6	202	6.9	9.4	--	--
	TTR00601	25	4.1	102	5	7.5	--	--
BH3-2	TTR00602	10	5.9	140	8.1	9.8	--	--
	TTR00603	15	5.5	132	5.4	7.4	--	--
	TTR00604	20	4.6	94	6.2	8.4	--	--
	TTR00605	25	4.2	114	6.2	7.8	--	--
BH3-1	TTR00608	10	5	144	7.3	10.2	--	--
	TTR00609	15	4.8	147	6.5	8.3	--	--
	TTR00610	20	4.1	91	4.4	8.9	--	--
	TTR00611	25	4.6	108	8.3	9.3	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
(Page 6 of 9)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH3-7	TTR00612	10	9.3	110	4	7.9	--	--
	TTR00613	5	4.5	107	4.2	7.9	--	--
	TTR00615	15	5	157	4.9	7.7	--	--
	TTR00616	20	4	100	4.1	7.7	--	--
	TTR00617	25	3.5	84.1	2.8	6.9	--	--
BH3-6	TTR00619	10	4.6	95.3	3.9	7.1	--	--
	TTR00621	15	5.3	149	6.2	9	--	--
	TTR00622	20	4.2	89.5	4.4	7.9	--	--
	TTR00623	25	3.8	184	3.7	11.4	--	--
BH3-5	TTR00626	5	6.1	104	5.2	7.9	--	--
	TTR00627	10	5.5	127	5.8	7.8	--	--
	TTR00628	15	4.9	170	6.7	8.6	--	--
	TTR00629	20	4.3	95.2	3.4	5.2	--	--
	TTR00630	25	5.3	134	5.5	9.3	--	--
	TTR00631	25	4.6	107	5.4	8.1	--	--
BH3-9	TTR00632	10	3.4	60.1	2.9	4.7	--	--
	TTR00633	8	3.6	63.9	3.8	5	--	--
	TTR00634	15	4.1	110	4.4	6.7	--	--
	TTR00635	20	4.6	145	5.6	9.2	--	--
	TTR00636	25	4.1	80.8	4.4	6.4	--	--
BH3-8	TTR00638	10	5.6	128	6.7	7.8	--	--
	TTR00639	15	3.2	71.1	4	6.7	--	--
	TTR00640	20	1.3	29.6	1.6	2.1	--	--
	TTR00641	25	6.3	122	9.5	9	--	--
BH8-3	TTR00642	10	3.7	68.3	2.8	5.3	--	--
	TTR00644	5	6.5	123	6.5	9.3	--	--
	TTR00645	15	4.5	81	4.1	6.6	--	--
	TTR00646	20	5.1	81	3	5.7	--	--
	TTR00647	25	4.5	87.5	4.5	7.9	--	--
BH8-4	TTR00648	5	4.8	65.1	4.8	7.5	--	--
	TTR00649	10	5	95.9	4.9	7.4	--	--
	TTR00652	15	4.1	152	4.9	6.4	--	--
	TTR00653	20	4.7	117	6.3	8	--	--
	TTR00654	25	4	125	3.7	6.6	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
(Page 7 of 9)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH8-5	TTR00655	5	4.2	85.4	4.2	6.1	--	--
	TTR00656	10	9	139	5.3	8.4	--	--
	TTR00657	15	2.8	92.3	2.9	5.5	--	--
	TTR00658	20	4.4	126	4.9	7.5	--	--
	TTR00659	25	5	116	7.8	9.2	--	--
BH8-6	TTR00660	5	4.6	76.1	3.6	8.1	--	--
	TTR00661	10	5	77.5	3.8	7.3	--	--
	TTR00662	15	7.9	120	4.4	7.6	--	--
	TTR00663	20	6.3	143	6.6	8.7	--	--
	TTR00664	25	5.3	118	6.2	9.1	--	--
BH8-1	TTR00666	10	6.5	130	7.9	9.8	--	--
	TTR00668	5	6.2	95.1	5	6.4	--	--
	TTR00670	15	4.9	128	3.6	6.8	--	--
	TTR00673	20	6.1	129	5.1	7.6	--	--
	TTR00674	25	5.6	94.4	6.9	8.8	--	--
	TTR00675	25	4.9	95.4	5.1	9	--	--
BH8-2	TTR00676	5	5.3	127	5.9	18.9	--	--
	TTR00677	10	4.8	97	4.6	6.7	--	--
	TTR00679	15	5.3	118	5.1	8.4	--	--
	TTR00680	20	5.8	146	6.3	8.4	--	--
	TTR00681	25	3.6	77	3.5	6.1	--	--
BH8-7	TTR00682	5	5.1	84.5	6.2	8.5	--	--
	TTR00683	10	5.8	91.9	5.5	8	--	--
	TTR00684	15	4.7	103	5.6	7.5	--	--
	TTR00685	20	5.2	110	5.6	9.4	--	--
	TTR00686	25	4.9	149	5.7	9	--	--
BH8-9	TTR00687	5	7.7	109	5.1	7	--	--
	TTR00688	10	4.4	119	4.5	7.3	--	--
	TTR00689	15	4.8	446	6.1	9.4	--	--
	TTR00690	20	5.4	138	7.2	9.5	--	--
	TTR00691	25	3.6	101	3.8	7.6	--	--
	TTR00691DUP		4.7	94	3.6	8	--	--
	TTR00692	25	3.1	80.4	2.8	6.6	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
(Page 8 of 9)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH4-1	TTR00693	8	4.3	108	4.6	7.9	--	--
	TTR00695	10	4.8	112	6.8	7.3	--	--
	TTR00696	15	4.4	116	5.9	7.6	--	--
	TTR00697	20	4.5	99.5	4.1	7.8	--	--
	TTR00698	25	4.6	88.3	4	7.7	--	--
BH4-2	TTR00703	15	4.8	66.5	3.1	6.4	--	--
	TTR00704	11	5	113	5.1	8.4	--	--
	TTR00705	20	4.3	117	3.8	7.2	--	--
	TTR00706	25	5.2	70.3	4.8	7.8	--	--
BH4-3	TTR00707	11.5	4.4	88.9	3.8	6.3	--	--
	TTR00708	15	3.6	72.8	3.3	6.9	--	--
	TTR00709	20	5	91.8	4.6	8.7	--	--
	TTR00710	25	4.1	100	4.6	9.3	--	--
BH4-4	TTR00711	10	3.5	61.7	4	7.2	--	--
	TTR00714	15	4.2	86.9	3.8	6.5	--	--
	TTR00715	20	4.1	3.3	92.8	6.7	--	--
	TTR00716	25	3.9	79	2.8	6.2	--	--
BH4-5	TTR00718	8	4.6	90.1	4.9	7	--	--
	TTR00719	10	4.1	87.2	3.2	6.2	--	--
	TTR00720	15	5	137	5.1	8.1	--	--
	TTR00721	20	4.6	152	5.1	7.9	--	--
	TTR00722	25	4.8	111	4.3	7.6	--	--
	TTR00723	25	5.1	109	4.5	7.1	--	--
BH4-8	TTR00726	5	11.7	137	5.8	7.3	--	--
	TTR00727	10	5.3	86	3.5	5.9	--	--
	TTR00729	15	4	85.7	4.4	7.2	--	--
	TTR00730	20	4.6	118	7	8.6	--	--
	TTR00731	25	5.1	213	6.7	9.2	--	--
BH4-7	TTR00732	10	5.4	116	5.1	8.2	--	--
	TTR00733	15	4.4	113	4.2	7.1	--	--
	TTR00734	20	4.5	99.4	5.4	8	--	--
	TTR00735	25	4.7	115	5.2	8.2	--	--

Table A.3-7
Total Metal Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill, TTR
(Page 9 of 9)

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (mg/kg)					
			Arsenic	Barium	Chromium	Lead	Selenium	Silver
			Action Levels (mg/kg) (PRGs ^a Residential Soil/Industrial Soil)					
			0.38/2.4/13.8 ^b	5300/100000	210/450	400/1000	380/8500	380/8500
BH4-6	TTR00736	10	5	130	6.1	8	--	--
	TTR00737	8	3.1	68.2	2.5	6.2	--	--
	TTR00738	15	5.2	106	6.8	8.6	--	--
	TTR00739	20	4.5	109	5.7	7.8	--	--
	TTR00740	25	5.2	118	5	8.6	--	--

^a United States Environmental Protection Agency Region 9 Preliminary Remediation Goals (PRGs) 1996 (EPA, 1996a)

^b Maximum arsenic background concentration

J-Estimated value.

mg/kg - Milligram(s) per kilogram

-- Constituent not detected above method detection limit

Concentration detected above preliminary action level

A.3.6 Gamma Spectroscopy Results

The gamma spectroscopy results detected above the method detection limits are presented in Table A.3-8. Gamma spectroscopy results were used to determine if man-made gamma emitting radionuclides exceeding the preliminary action levels (PAL) were present in the Area 3 Landfill Complex. In addition, if the gamma spectroscopy results demonstrated radionuclide concentrations greater than the PALs, then uranium-specific analysis of the samples would be performed. The PALs were established by background sample collection during this investigation and data obtained from a study of radionuclide concentration in soil performed in low background areas in the State of Nevada (McArthur and Miller, 1989).

Table A.3-8
Gamma Spectroscopy Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill Complex, TTR
(Sheet 1 of 7)

Borehole Number	Sample Depth (ft)	Sample No.	Constituents (pCi/g)														
			Lead-210	Lead-212	Lead-214	Radium-223	Radium-224	Radium-228	Thorium-234	Thallium-208	Bismuth-212	Bismuth-214	Potassium-40	Actinium-228	Cesium-137	Francium-223	Cobalt-57
BHB-3	10	TTR00403	--	1.94±0.69	1.31 ± 0.51	--	--	2.09±1.04	--	--	--	--	34.1 ± 7.5	--	--	--	--
	15	TTR00404	--	--	--	--	--	--	--	1.03 ± 0.38	--	--	41.3 ± 9.4	--	--	--	--
BHB-2	10	TTR00405	--	2.85±0.81	1.71 ± 0.53	--	--	--	--	0.62 ± 0.30	--	--	42.8 ± 9.2	--	--	1.71 ± 0.53	--
	15	TTR00406	--	2.10±0.50	1.40 ± 0.60	--	--	--	--	0.99 ± 0.31	--	--	39.7 ± 7.9	--	--	1.40 ± 0.60	--
BHB-1	10	TTR00407	--	2.28±0.47	1.40 ± 0.51	--	--	--	--	--	--	--	34.0 ± 7.5	2.05±0.93	--	1.40 ± 0.51	--
	13	TTR00408	--	2.36±0.50	1.28 ± 0.49	--	--	--	--	--	--	--	39.8 ± 8.9	--	--	1.28 ± 0.49	--
BH5-1	10	TTR00412	6.50±3.44	2.38±0.71	1.48 ± 0.60	--	--	--	--	0.80 ± 0.26	--	1.29±0.58	37.4 ± 8.0	--	--	1.48 ± 0.60	--
	15	TTR00413	--	--	--	--	--	--	--	0.49 ± 0.30	--	--	39.5 ± 9.1	--	--	--	--
	20	TTR00414	--	1.71±0.46	1.65 ± 0.46	--	--	--	--	0.64 ± 0.24	--	--	35.0 ± 6.9	--	--	1.65 ± 0.46	--
	25	TTR00415	--	2.39±0.49	1.69 ± 0.59	0.77±0.50	--	--	--	0.62 ± 0.29	--	--	31.6 ± 7.7	--	--	0.42 ± 0.29	--
BH5-2	15	TTR00416	--	--	1.42 ± 0.54	--	--	2.65±1.13	--	--	--	--	35.6 ± 8.2	--	--	--	--
	20	TTR00417	--	2.61±0.63	1.42 ± 0.91	--	--	--	--	0.82 ± 0.28	--	--	34.7 ± 7.9	--	--	--	--
	25	TTR00418	--	2.94±0.71	--	--	--	--	--	--	--	--	33.9 ± 7.7	--	--	--	--
	25	TTR00419	--	2.00±0.56	1.45 ± 0.71	--	--	--	2.63±2.32	0.57 ± 0.27	--	--	36.6 ± 8.5	--	--	--	--
BH5-3	10	TTR00420	--	2.33±0.58	1.80 ± 0.61	--	--	--	--	0.79 ± 0.30	--	--	35.4 ± 7.9	--	--	--	--
	17	TTR00424	--	2.86±0.64	1.54 ± 0.59	--	--	--	--	0.682 ± 0.303	--	--	35.8 ± 8.2	--	--	--	--
	22	TTR00425	--	2.43±0.51	1.19 ± 0.50	--	--	--	3.91±3.08	0.747 ± 0.270	--	1.64±0.56	33.3 ± 8.2	--	--	--	--
	24	TTR00426	--	2.01±0.45	1.03 ± 0.54	--	--	--	--	0.458 ± 0.316	--	--	40.3 ± 8.5	--	--	--	0.168±0.09
BH6-1	10	TTR00428	--	2.14±0.94	1.40 ± 0.75	--	--	2.71±1.16	--	0.800 ± 0.417	--	--	43.8 ± 10.1	2.71±1.16	--	--	--
	15	TTR00429	--	2.30±0.51	1.62 ± 0.51	--	--	--	--	--	--	1.61±0.51	36.7 ± 7.8	--	--	--	--
	20	TTR00430	2.38±2.12	1.89 ± 0.49	1.57 ± 0.48	--	--	2.65±1.06	--	0.552 ± 0.237	--	1.18±0.62	35.5 ± 7.3	2.65±1.06	--	--	--
	26	TTR00431	--	2.29±0.50	1.37 ± 0.48	--	--	2.65±1.10	--	0.652 ± 0.254	--	1.52±0.64	37.6 ± 9.4	2.63±1.10	--	--	--
	26	TTR00432	--	2.20±0.56	0.970 ± 0.525	--	--	3.53±1.34	--	0.763 ± 0.286	7.08±2.90	1.56±0.62	38.1 ± 8.03	3.53±1.34	--	--	--
BH6-2	10	TTR00436	--	2.59±0.74	--	--	--	--	--	0.80 ± 0.27	--	--	37.9 ± 8.0	--	--	--	--
	15	TTR00437	--	2.20±0.49	1.12 ± 0.49	--	--	--	--	0.78 ± 0.23	--	--	--	--	--	--	--
	20	TTR00438	--	2.10±0.47	1.70 ± 0.45	--	--	--	--	0.74 ± 0.31	--	--	41.3 ± 8.6	--	--	--	--
	25	TTR00439	--	2.09±0.46	1.51 ± 0.43	--	--	--	--	0.66 ± 0.26	4.81±2.31	--	39.5 ± 7.9	--	--	--	--
BH6-3	10	TTR00442	--	2.37±0.54	1.62 ± 0.63	--	--	--	2.70±1.86	0.59 ± 0.33	--	--	36.0 ± 8.7	--	--	--	--
	15	TTR00444	4.65±3.78	1.91±0.47	1.17 ± 0.50	--	--	--	--	0.52 ± 0.32	--	--	33.4 ± 7.3	--	--	--	--
	20	TTR00445	--	2.41±0.73	1.37 ± 0.72	--	--	--	--	0.75 ± 0.25	--	--	35.6 ± 7.0	--	--	--	--
	25	TTR00446	--	1.94±0.62	1.25 ± 0.50	--	--	--	--	--	5.81±2.89	--	36.3 ± 7.0	--	--	--	--
BH6-4	10	TTR00448	--	2.21±0.60	1.38 ± 0.53	--	--	--	--	0.84 ± 0.38	--	--	38.8 ± 9.0	--	--	--	--
	8	TTR00449	--	2.28±0.60	1.40 ± 0.56	--	--	--	4.71±2.29	0.71 ± 0.31	--	--	33.9 ± 8.8	--	--	--	--
	15	TTR00450	--	2.08±0.48	1.18 ± 0.44	--	--	--	--	--	--	--	37.9 ± 8.0	--	--	--	--
	20	TTR00451	--	2.18±0.68	1.52 ± 0.57	--	--	--	--	--	--	--	41.2 ± 8.0	--	--	--	--
	25	TTR00452	3.97±2.65	2.18±0.45	0.85 ± 0.60	--	--	2.83±1.09	--	--	--	--	39.8 ± 8.0	--	--	--	--
BH6-5	10	TTR00453	--	2.43±0.58	1.64 ± 0.68	--	--	--	--	--	--	--	37.1 ± 9.05	--	--	--	--
	15	TTR00454	--	1.99±0.46	1.08 ± 0.58	--	--	--	--	0.70 ± 0.31	--	--	36.3 ± 7.6	--	--	--	--
	20	TTR00455	--	2.21±0.53	1.34 ± 0.53	--	--	--	--	0.55 ± 0.32	--	--	39.3 ± 8.9	--	0.325	--	--
	25	TTR00456	--	2.29±0.50	1.92 ± 0.52	--	--	--	--	0.68 ± 0.30	--	--	38.1 ± 8.3	--	--	--	--
BH2-1	10	TTR00458	--	2.09±0.50	1.73 ± 0.60	--	--	--	--	--	--	--	32.8 ± 8.3	--	--	--	--

Table A.3-8
Gamma Spectroscopy Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill Complex, TTR
(Sheet 2 of 7)

Borehole Number	Sample Depth (ft)	Sample No.	Constituents (pCi/g)														
			Lead-210	Lead-212	Lead-214	Radium-223	Radium-224	Radium-228	Thorium-234	Thallium-208	Bismuth-212	Bismuth-214	Potassium-40	Actinium-228	Cesium-137	Francium-223	Cobalt-57
BH2-1	15	TTR00459	--	1.69±0.44	1.54 ± 0.52	--	--	--	--	0.735 ± 0.258	--	--	27.7 ± 6.4	--	--	--	--
	20	TTR00460	--	2.60±0.53	1.37 ± 0.46	--	--	--	--	0.684 ± 0.201	--	1.55±0.44	32.6 ± 5.06	--	--	--	--
	25	TTR00461	--	1.96±0.49	1.17 ± 0.50	--	--	--	--	--	--	--	31.4 ± 6.6	--	--	--	--
BH2-2	12.5	TTR00463	--	1.78±0.60	1.39 ± 0.62	--	--	--	--	0.646 ± 0.293	--	1.16±0.52	31.0 ± 7.5	--	--	--	--
	14	TTR00464	3.63±3.14	2.04±0.46	1.34 ± 0.45	--	--	2.08±0.94	--	0.734 ± 0.245	--	1.38±0.64	44.5 ± 8.8	2.08±0.94	--	--	--
	20	TTR00466	3.27±2.69	2.27±0.48	0.800 ± 0.414	--	--	--	--	0.715 ± 0.308	0.973±0.574	--	39.5 ± 7.6	--	0.127 ± 0.110	--	--
	25	TTR00467	5.29±3.38	2.62± 0.717	1.76 ± 0.49	--	--	2.76±1.29	--	0.520 ± 0.284	--	0.963±0.405	34.2 ± 7.2	2.76±1.29	--	--	--
BH2-3A	10	TTR00473	--	2.29±0.50	1.53 ± 0.57	--	--	--	--	0.722 ± 0.309	--	1.83±0.72	37.6 ± 8.6	--	--	--	--
	15	TTR00474	4.24±3.30	2.28±0.54	1.43 ± 0.45	--	--	--	--	0.773 ± 0.330	--	1.38±0.67	38.1 ± 8.9	--	--	--	--
	20	TTR00475	--	1.74±0.62	1.41 ± 0.59	--	--	--	--	0.849 ± 0.296	--	1.14±0.404	35.3 ± 7.3	--	--	--	--
	25	TTR00476	--	2.14±0.54	1.46 ± 0.46	--	--	2.34±1.01	--	0.792 ± 0.227	--	1.28±0.41	34.5 ± 7.0	2.34±1.01	--	--	--
BH2-4	10	TTR00477	--	1.94±0.43	1.10 ± 0.48	--	--	--	--	0.546 ± 0.265	--	1.43±0.54	27.6 ± 7.0	--	--	--	--
	15	TTR00478	--	2.38 ± 0.52	1.74 ± 0.55	--	--	2.38±1.26	--	0.542 ± 0.301	7.68±3.97	--	37.0 ± 8.5	--	--	--	--
	20	TTR00479	--	2.32±0.77	2.14 ± 0.56	--	--	--	--	0.757 ± 0.280	--	1.58±0.54	34.8 ± 8.3	--	--	--	--
	25	TTR00480	--	2.82±0.59	0.947 ± 0.556	--	--	--	--	0.630 ± 0.324	--	1.09±0.52	36.4 ± 7.3	--	--	--	--
BH2-5	10	TTR00482	--	2.26 ± 0.50	1.13 ± 0.48	--	--	--	10.2±4.09	--	--	--	38.8 ± 8.4	--	--	--	--
BH1-20	10	TTR00483	--	1.79±0.57	1.40 ± 0.66	--	--	2.47±1.13	--	0.765 ± 0.246	--	1.10±0.58	37.8 ± 7.8	--	--	--	--
	15	TTR00485	--	--	--	--	--	--	--	--	--	--	35.4 ± 7.37	--	--	--	--
	20	TTR00486	--	2.08±0.56	1.77 ± 0.68	--	--	--	--	--	--	--	28.6 ± 6.6	--	--	--	--
	25	TTR00487	--	2.40±0.47	1.49 ± 0.47	--	--	--	--	0.672 ± 0.276	--	--	33.7 ± 7.5	1.76±0.94	--	--	--
BH1-19	10	TTR00492	--	1.82±0.47	1.24 ± 0.57	--	--	--	--	0.80 ± 0.26	--	--	31.4 ± 7.1	--	--	--	--
	15	TTR00493	--	--	--	--	--	--	--	0.61 ± 0.32	--	--	38.2 ± 7.9	--	--	--	--
	20	TTR00494	--	1.94±0.59	1.77 ± 0.55	--	--	--	--	0.77 ± 0.25	--	--	25.7 ± 6.1	--	--	--	--
	25	TTR00495	--	2.34±0.49	2.17 ± 0.52	--	--	--	--	--	--	--	35.4 ± 8.1	--	--	--	--
	25	TTR00496A	--	2.12±0.64	1.67 ± 0.56	--	--	--	--	0.78 ± 0.33	--	--	31.9 ± 7.0	--	--	--	--
BH1-4	10	TTR00499	--	1.85±0.43	1.61 ± 0.53	--	--	--	--	0.89 ± 0.29	--	--	36.7 ± 7.9	--	--	--	--
	15	TTR00500	--	1.84±0.53	1.30 ± 0.68	--	--	--	--	0.54 ± 0.22	--	--	30.6 ± 8.3	--	--	--	--
	20	TTR00501	--	1.93±0.48	--	--	--	--	--	--	--	--	38.9 ± 7.7	--	--	--	--
	25	TTR00502	--	2.00±0.53	1.59 ± 0.82	--	--	--	--	0.98 ± 0.36	--	--	36.1 ± 7.4	--	--	--	--
BH1-3	12	TTR00503	--	1.73±0.42	1.69 ± 0.45	--	--	--	--	0.61 ± 0.29	--	--	30.7 ± 6.8	--	--	--	--
	15	TTR00504	--	1.76±0.62	1.59 ± 0.54	--	--	--	--	0.70 ± 0.28	--	--	37.4 ± 7.9	--	--	--	--
	20	TTR00505	--	1.91±0.45	1.50 ± 0.56	--	6.30±4.99	--	--	0.68 ± 0.31	--	--	30.8 ± 7.6	--	--	--	--
	25	TTR00506	4.62±3.24	2.26±0.49	1.19 ± 0.43	--	--	--	--	0.77 ± 0.29	--	--	32.4 ± 7.2	--	--	--	--
BH1-2	10	TTR00507	--	2.71±0.79	--	--	--	--	--	--	--	--	27.8 ± 7.7	--	--	--	--
	15	TTR00508	--	1.71±0.55	1.32 ± 0.47	--	--	--	--	0.74 ± 0.33	--	--	34.1 ± 6.8	2.06±0.86	--	--	--
	20	TTR00509	--	1.86±0.43	1.62 ± 0.52	--	--	--	--	0.77 ± 0.27	--	--	28.3 ± 7.2	2.52±1.08	--	--	--
	25	TTR00510	--	2.51±0.60	1.54 ± 0.57	--	--	--	3.39±1.90	0.60 ± 0.43	--	--	29.5 ± 7.7	--	--	--	--
BH1-1	10	TTR00512	--	2.41±0.54	1.54 ± 0.56	--	--	--	2.80±1.74	--	--	--	36.6 ± 8.4	--	--	--	--
	15	TTR00513	--	1.18±0.63	1.38 ± 0.53	--	--	--	--	0.59 ± 0.29	--	--	32.1 ± 7.4	--	--	--	--
	20	TTR00514	--	1.96±0.57	1.90 ± 0.68	--	--	--	--	--	--	--	52.2 ± 9.7	--	--	--	--
	25	TTR00515	--	2.38±0.54	1.76 ± 0.60	--	--	--	--	0.89 ± 0.28	--	--	28.8 ± 7.0	2.98±1.10	--	--	--

Table A.3-8
Gamma Spectroscopy Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill Complex, TTR
(Sheet 3 of 7)

Borehole Number	Sample Depth (ft)	Sample No.	Constituents (pCi/g)														
			Lead-210	Lead-212	Lead-214	Radium-223	Radium-224	Radium-228	Thorium-234	Thallium-208	Bismuth-212	Bismuth-214	Potassium-40	Actinium-228	Cesium-137	Francium-223	Cobalt-57
BH1-7	15	TTR00518	3.07±2.51	2.33±0.50	1.78 ± 0.53	--	--	--	--	--	--	--	30.5 ± 7.0	--	--	--	--
	20	TTR00519	3.02±2.65	2.06±0.48	1.86 ± 0.51	--	--	--	4.00±1.80	0.57 ± 0.21	--	--	41.2 ± 8.4	2.24±1.28	--	--	--
	25	TTR00520	--	2.17±0.52	1.68 ± 0.56	--	--	--	3.90±3.07	0.67 ± 0.29	--	--	23.8 ± 6.9	2.17±1.08	--	--	--
BH1-6	10	TTR00521	--	--	1.71 ± 0.63	--	--	--	--	--	--	--	41.3 ± 7.9	--	--	--	--
	8.5	TTR00522	--	1.54±0.58	2.00 ± 0.52	--	--	--	--	--	--	--	32.8 ± 6.9	--	--	--	--
	15	TTR00524	--	2.24±0.47	1.69 ± 0.54	--	--	--	--	0.75 ± 0.35	--	--	33.4 ± 7.4	--	--	--	--
	20	TTR00525	--	2.41±0.50	1.49 ± 0.43	--	--	--	--	0.68 ± 0.35	--	--	39.3 ± 8.1	--	--	--	--
	25	TTR00526	--	2.44±0.52	--	--	--	--	--	0.93 ± 0.29	--	--	36.7 ± 7.4	1.79±1.29	--	--	--
BH1-5	10	TTR00528	--	2.08±0.59	2.00 ± 0.94	--	--	--	--	0.66 ± 0.37	--	--	38.2 ± 8.6	--	--	--	--
	8	TTR00531	--	2.36±0.51	1.62 ± 0.55	--	--	--	--	--	--	--	35.3 ± 7.0	--	--	--	--
	15	TTR00532	--	1.88±0.46	1.46 ± 0.56	--	--	--	--	0.53 ± 0.26	--	--	32.7 ± 7.2	--	--	--	--
	20	TTR00533	2.86±2.78	2.11±0.50	1.36 ± 0.57	--	--	--	--	--	--	--	27.2 ± 7.5	--	--	--	--
	25	TTR00534	--	2.22±0.51	1.26 ± 0.54	--	--	--	--	--	--	--	33.3 ± 7.2	--	--	--	--
	25	TTR00535	--	2.23±0.50	1.72 ± 0.58	--	--	--	--	--	--	--	32.9 ± 6.9	--	--	--	--
BH1-13	7	TTR00536	--	2.85±0.82	--	--	--	--	--	--	--	--	38.9 ± 8.0	--	--	--	--
	10	TTR00538	--	2.10±0.58	1.44 ± 0.50	--	--	--	--	--	--	--	36.1 ± 7.4	--	--	--	--
	15	TTR00539	--	1.69±0.39	1.12 ± 0.49	--	--	--	--	0.88 ± 0.33	--	--	41.4 ± 8.3	--	--	--	--
	20	TTR00542	5.35±3.08	1.80±0.48	1.76 ± 0.66	--	--	--	--	--	--	--	25.6 ± 7.2	--	--	--	--
	21.5	TTR00543	--	2.08±0.52	1.60 ± 0.56	--	--	--	--	0.55 ± 0.32	--	--	35.6 ± 7.3	--	--	--	--
	25	TTR00544	--	--	--	--	--	--	--	1.00 ± 0.33	--	--	27.7 ± 7.4	2.69±1.08	--	--	--
BH1-12	10	TTR00545	--	2.15±0.48	1.21 ± 0.42	--	--	--	--	0.50 ± 0.26	--	--	34.7 ± 7.1	2.06±1.10	--	--	--
	15	TTR00546	2.79±2.69	2.43±0.50	1.85 ± 0.55	--	--	--	--	0.65 ± 0.27	--	--	32.4 ± 7.6	--	--	--	--
	20	TTR00547	--	2.01±0.55	1.69 ± 0.50	--	--	--	--	0.84 ± 0.33	--	--	34.5 ± 8.5	2.79±1.25	--	--	--
	25	TTR00548	--	2.29±0.51	1.34 ± 0.54	--	--	--	--	--	--	--	36.9 ± 7.9	--	--	--	--
BH1-11	10	TTR00549	--	2.57±0.68	--	--	--	--	--	0.88 ± 0.32	--	--	36.1 ± 7.2	--	--	--	--
	15	TTR00550	--	1.80±0.42	1.91 ± 0.64	--	--	--	--	--	4.36±2.25	--	32.7 ± 7.2	--	--	--	--
	20	TTR00551	--	1.7±0.44	1.27 ± 0.58	--	--	--	--	0.88 ± 0.30	--	--	34.0 ± 7.6	2.61±1.19	--	--	--
	25	TTR00552	--	2.49±0.58	2.21 ± 0.72	--	--	--	--	--	--	--	40.3 ± 8.8	--	--	--	--
BH1-13	30	TTR00554	--	--	--	--	--	--	--	--	--	--	36.5 ± 8.4	--	--	--	--
	34	TTR00557	--	2.00±0.51	1.31 ± 0.58	--	--	--	--	0.84 ± 0.28	--	--	35.6 ± 7.3	--	--	--	--
	36	TTR00558	3.43±2.03	2.36±0.48	1.93 ± 0.53	--	--	--	--	--	--	--	31.3 ± 6.8	2.30±0.96	--	--	--
	38	TTR00559	--	2.34±0.52	1.76 ± 0.53	--	--	--	4.38±2.11	0.83 ± 0.31	--	--	26.0 ± 7.0	2.60±1.13	--	--	--
	41.5	TTR00560	--	1.99±0.52	1.53 ± 0.53	--	--	--	--	0.52 ± 0.31	--	--	33.3 ± 7.4	--	--	--	--
	52	TTR00561	--	2.47±0.68	--	--	--	--	--	0.51 ± 0.25	--	--	34.9 ± 7.8	--	--	--	--
BH1-8	10	TTR00563	--	2.00±0.50	1.30 ± 0.69	--	--	--	--	0.63 ± 0.28	--	--	32.8 ± 6.7	1.63±0.85	--	--	--
	8	TTR00564	--	--	--	--	--	--	--	0.83 ± 0.29	--	--	39.8 ± 8.6	--	--	--	--
	15	TTR00565	--	2.54±0.67	1.31 ± 0.42	--	--	--	--	0.54 ± 0.24	--	--	32.5 ± 6.6	--	--	--	--
	20	TTR00566	--	--	--	--	--	--	--	--	--	--	38.8 ± 7.7	--	--	--	--
	25	TTR00567	4.83±2.66	2.13±0.57	1.34 ± 0.53	--	--	--	--	--	--	--	34.6 ± 6.7	--	--	--	--
	25	TTR00568	--	2.03±0.51	1.55 ± 0.44	--	--	--	--	0.55 ± 0.28	--	--	37.0 ± 7.2	1.45±1.01	--	--	--
BH1-9	10	TTR00569	--	--	--	--	--	--	--	--	--	--	30.5 ± 6.6	--	--	--	--

Table A.3-8
Gamma Spectroscopy Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill Complex, TTR
(Sheet 4 of 7)

Borehole Number	Sample Depth (ft)	Sample No.	Constituents (pCi/g)														
			Lead-210	Lead-212	Lead-214	Radium-223	Radium-224	Radium-228	Thorium-234	Thallium-208	Bismuth-212	Bismuth-214	Potassium-40	Actinium-228	Cesium-137	Francium-223	Cobalt-57
BH1-9	8	TTR00570	--	2.41±0.57	1.53 ± 0.60	--	--	--	--	0.62 ± 0.25	--	--	29.9 ± 6.9	--	--	--	--
	15	TTR00571	--	--	--	--	--	--	--	1.09 ± 0.28	--	--	29.6 ± 6.5	--	--	--	--
	20	TTR00572	--	1.86±0.46	1.78 ± 0.51	--	--	--	--	0.69 ± 0.34	--	--	30.2 ± 6.7	--	--	--	--
	25	TTR00573	--	2.18 ± 0.48	1.85 ± 0.54	--	--	--	--	0.74 ± 0.28	--	--	37.0 ± 7.6	--	--	--	--
BH1-10	10	TTR00574	4.57±3.41	1.90 ± 0.49	1.35 ± 0.43	--	--	--	--	--	--	--	30.4 ± 7.3	--	--	--	--
	7.5	TTR00575	--	1.83 ± 0.59	1.56 ± 0.43	--	--	--	--	--	--	--	38.0 ± 7.4	--	--	--	--
	15	TTR00577	--	--	--	--	--	--	--	0.88 ± 0.32	--	--	34.0 ± 6.9	--	--	--	--
	20	TTR00578	--	2.17 ± 0.47	1.53 ± 0.52	--	--	--	--	--	--	--	31.1 ± 6.1	--	--	--	--
	25	TTR00579	--	1.63 ± 0.43	1.49 ± 0.49	--	--	--	4.12 ± 2.14	--	--	--	27.4 ± 6.9	1.21±1.13	--	--	--
BH7-1	10	TTR00581	--	1.92 ± 0.56	1.36 ± 0.47	--	--	--	2.72 ± 2.01	--	--	--	33.8 ± 8.4	--	--	--	--
	6.5	TTR00582	--	2.05 ± 0.46	1.43 ± 0.42	--	--	--	--	0.59 ± 0.23	--	--	35.7 ± 7.2	--	--	--	--
	15	TTR00583	--	--	--	--	--	--	--	0.45 ± 0.27	--	--	32.0 ± 6.8	--	--	--	--
	20	TTR00584	--	1.81 ± 0.48	0.80 ± 0.42	--	--	--	--	0.58 ± 0.22	--	--	22.2 ± 5.7	--	--	--	--
	25	TTR00585	--	1.78 ± 0.44	1.02 ± 0.49	--	--	--	--	--	--	--	25.2 ± 6.6	--	--	--	--
BH3-4	10	TTR00590	--	1.74 ± 0.45	1.14 ± 0.58	--	--	--	--	--	--	--	34.2 ± 8.0	--	--	--	--
	15	TTR00591	--	1.99 ± 0.54	1.34 ± 0.76	--	--	--	--	--	--	--	36.5 ± 8.1	--	--	--	--
	20	TTR00592	--	1.67 ± 0.74	1.47 ± 0.58	--	--	--	--	0.62 ± 0.43	--	--	35.0 ± 8.2	--	--	--	--
	25	TTR00593	--	2.09 ± 0.49	1.24 ± 0.45	--	--	--	--	0.54 ± 0.28	--	--	32.6 ± 8.0	--	--	--	--
	25	TTR00595	--	1.99 ± 0.51	1.56 ± 0.58	--	24.3±16.1	--	--	0.58 ± 0.29	--	--	33.9 ± 8.4	--	--	--	--
BH3-3	4	TTR00596	--	2.17 ± 0.48	1.36 ± 0.46	--	--	--	--	0.63 ± 0.35	--	--	30.2 ± 7.3	--	--	--	--
	10	TTR00597	--	2.11 ± 0.48	--	--	--	--	--	--	--	--	27.3 ± 7.1	--	--	--	--
	10	TTR00598	--	--	--	--	--	--	--	0.71 ± 0.28	--	--	28.4 ± 7.3	--	--	--	--
	15	TTR00599	--	1.94 ± 0.51	1.59 ± 0.70	--	--	--	--	0.65 ± 0.29	--	--	24.0 ± 6.0	--	--	--	--
	20	TTR00600	--	2.00 ± 0.52	1.34 ± 0.56	--	--	--	--	0.75 ± 0.36	--	--	43.3± 9.3	--	0.21±0.19	--	--
	25	TTR00601	--	2.52 ± 0.68	0.97 ± 0.73	--	--	--	--	0.76 ± 0.30	--	--	35.2 ± 7.6	--	--	--	--
BH3-2	10	TTR00602	--	2.71 ± 0.63	1.29 ± 0.47	--	--	--	--	0.56 ± 0.31	--	--	30.8 ± 6.9	--	--	--	--
	15	TTR00603	808±1280	--	--	--	--	--	--	--	--	--	33.2 ± 7.6	--	--	--	--
	20	TTR00604	--	2.14 ± 0.53	1.00 ± 0.66	--	--	--	--	--	5.48 ± 3.15	--	34.6 ± 7.2	--	--	--	--
	25	TTR00605	--	--	--	--	--	--	--	--	--	--	36.8 ± 7.8	--	--	--	--
BH3-1	10	TTR00608	--	2.32 ± 0.58	1.21 ± 0.49	--	--	--	--	0.64 ± 0.35	--	--	27.6 ± 6.2	--	--	--	--
	15	TTR00609	--	1.46 ± 0.63	1.32 ± 0.53	--	--	--	--	0.63± 0.35	--	--	36.0 ± 7.7	--	--	--	--
	20	TTR00610	--	2.28 ± 0.50	0.96 ± 0.42	--	--	--	--	0.81 ± 0.24	--	--	36.3 ± 7.3	--	--	--	--
	25	TTR00611	--	1.74 ± 0.54	--	--	--	--	--	0.76 ± 0.35	--	--	28.4 ± 7.3	--	--	--	--
BH3-7	10	TTR00612	--	2.07 ± 0.47	1.51 ± 0.45	--	--	--	--	0.60 ± 0.25	--	--	40.4 ± 7.7	2.09±0.97	--	--	--
	5	TTR00613	--	--	1.62 ± 0.50	--	--	--	--	--	--	--	39.6 ± 7.9	--	--	--	--
	15	TTR00615	--	1.49 ± 0.57	1.45 ± 0.51	--	--	--	--	0.71 ± 0.26	--	--	30.1 ± 6.8	--	--	--	--
	20	TTR00616	--	1.91 ± 0.76	1.23 ± 0.58	--	--	--	--	0.72 ± 0.36	--	--	38.6 ± 7.8	--	--	--	--
	25	TTR00617	--	2.11 ± 0.53	1.20 ± 0.61	--	--	--	--	0.66 ± 0.27	--	--	39.0 ± 8.0	--	--	--	--
BH3-6	10	TTR00619	5.35±4.29	2.03 ± 0.50	1.43 ± 0.52	--	--	--	--	--	--	--	40.2 ± 9.0	2.16±1.16	--	--	--
	15	TTR00621	--	2.43 ± 0.78	1.22 ± 0.73	--	--	--	--	--	--	--	38.1 ± 8.5	--	--	--	--
	20	TTR00622	--	1.80 ± 0.54	1.11 ± 0.57	--	--	--	--	0.63 ± 0.26	--	--	39.1 ± 7.8	--	--	--	--

Table A.3-8
Gamma Spectroscopy Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill Complex, TTR
(Sheet 5 of 7)

Borehole Number	Sample Depth (ft)	Sample No.	Constituents (pCi/g)														
			Lead-210	Lead-212	Lead-214	Radium-223	Radium-224	Radium-226	Thorium-234	Thallium-208	Bismuth-212	Bismuth-214	Potassium-40	Actinium-228	Cesium-137	Francium-223	Cobalt-57
BH3-6	25	TTR00623	--	2.56 ± 0.58	1.68 ± 0.59	--	--	--	--	0.69 ± 0.32	--	--	40.0 ± 8.7	--	--	--	--
BH3-5	5	TTR00626	5.82±4.80	2.44 ± 0.56	1.49 ± 0.54	--	--	--	--	--	--	--	31.0 ± 7.8	--	--	--	--
	10	TTR00627	--	1.56 ± 0.50	1.34 ± 0.49	--	--	--	--	0.67 ± 0.33	--	--	39.0 ± 8.6	--	--	--	--
	15	TTR00628	--	--	--	--	--	--	--	--	--	--	38.7 ± 8.8	--	--	--	--
	20	TTR00629	--	1.94 ± 0.51	1.82 ± 0.68	--	--	--	--	0.51 ± 0.34	--	--	31.8 ± 7.1	--	--	--	--
	25	TTR00630	--	1.84 ± 0.45	0.98 ± 0.48	--	--	--	--	0.59 ± 0.31	--	--	38.5 ± 8.3	1.93±0.91	--	--	--
	25	TTR00631	3.87±3.13	1.68 ± 0.53	1.60 ± 0.55	--	--	--	--	0.69 ± 0.30	--	--	34.5 ± 8.5	1.54±0.80	--	--	--
BH3-9	10	TTR00632	4.12±2.54	2.20 ± 0.54	1.51 ± 0.57	--	--	--	--	0.64 ± 0.24	--	--	34.6 ± 7.9	--	--	--	--
	8	TTR00633	--	1.99 ± 0.72	1.73 ± 0.54	--	--	--	--	0.52 ± 0.22	--	--	44.9 ± 9.1	--	--	--	--
	15	TTR00634	--	2.05 ± 0.59	1.29 ± 0.60	--	--	--	--	0.74 ± 0.37	--	--	32.1 ± 8.2	--	--	--	--
	20	TTR00635	--	2.03 ± 0.54	1.36 ± 0.55	--	--	--	--	--	--	--	34.0 ± 7.3	--	--	--	--
	25	TTR00636	--	2.08 ± 0.55	1.88 ± 0.55	--	--	--	--	0.62 ± 0.29	--	--	36.1 ± 8.6	--	--	--	--
BH3-8	10	TTR00638	--	2.31 ± 0.54	1.48 ± 0.59	--	--	--	--	0.53 ± 0.40	--	--	30.9 ± 7.6	--	--	--	--
	15	TTR00639	--	2.16 ± 0.49	1.26 ± 0.49	--	--	--	--	0.69 ± 0.31	--	--	35.7 ± 7.7	1.79±0.99	--	--	--
	20	TTR00640	--	2.36 ± 0.63	0.78 ± 0.65	--	--	--	--	0.69 ± 0.26	--	--	40.5 ± 8.2	--	--	--	--
	25	TTR00641	--	2.63 ± 0.62	1.46 ± 0.56	--	--	--	--	0.72 ± 0.36	--	--	29.4 ± 7.9	--	--	--	--
BH8-3	10	TTR00642	--	2.72 ± 0.53	1.51 ± 0.60	--	--	--	--	0.78 ± 0.30	--	--	43.5 ± 8.7	--	--	--	--
	5	TTR00644	--	2.23 ± 0.70	--	--	--	--	--	0.68 ± 0.29	--	--	33.8 ± 7.4	--	--	--	--
	15	TTR00645	--	2.78 ± 0.65	--	--	--	--	--	--	--	--	40.5 ± 8.6	--	--	--	--
	20	TTR00646	--	2.04 ± 0.53	1.38 ± 0.54	--	--	--	--	0.69 ± 0.27	6.79±2.82	--	32.3 ± 7.0	2.51±1.04	--	--	--
	25	TTR00647	--	2.29 ± 0.50	1.46 ± 0.51	--	--	--	--	0.58 ± 0.28	--	--	37.5 ± 8.07	2.81±1.23	--	--	--
BH8-4	5	TTR00648	--	2.16 ± 0.50	1.12 ± 0.53	--	--	--	--	0.56 ± 0.27	--	--	29.7 ± 7.4	--	--	--	--
	10	TTR00649	--	1.76 ± 0.60	0.86 ± 0.54	--	--	--	--	0.53 ± 0.31	--	--	30.3 ± 7.1	--	--	--	--
	15	TTR00652	--	2.50 ± 0.66	--	--	--	--	--	--	--	--	37.0 ± 8.9	--	--	--	--
	20	TTR00653	4.59±3.69	2.30 ± 0.67	1.24 ± 0.52	--	--	--	--	--	--	--	42.6 ± 8.2	--	--	--	--
	25	TTR00654	--	2.26 ± 0.52	1.22 ± 0.44	--	--	--	--	0.74 ± 0.27	--	--	37.4 ± 7.9	--	--	--	--
BH8-5	5	TTR00655	4.88±3.24	1.80 ± 0.47	1.36 ± 0.64	--	--	--	--	0.89 ± 0.34	--	--	33.4 ± 8.3	--	--	--	--
	10	TTR00656	--	1.97 ± 0.56	1.33 ± 0.59	--	--	--	--	0.49 ± 0.39	--	--	36.1 ± 8.1	--	--	--	--
	15	TTR00657	--	2.14 ± 0.57	1.32 ± 0.82	--	--	--	--	0.72 ± 0.34	--	--	34.4 ± 7.7	--	--	--	--
	20	TTR00658	--	2.21 ± 0.58	1.60 ± 0.46	--	--	--	--	0.54 ± 0.33	--	--	33.5 ± 7.2	1.66±0.89	--	--	--
	25	TTR00659	--	2.05 ± 0.53	0.87 ± 0.52	--	--	--	--	--	--	--	42.4 ± 9.1	--	--	--	--
BH8-6	5	TTR00660	--	2.30 ± 0.58	1.57 ± 0.54	--	--	--	--	0.82 ± 0.41	--	--	30.6 ± 9.2	--	--	--	--
	10	TTR00661	--	2.25 ± 0.55	1.72 ± 0.51	--	--	--	--	--	--	--	30.6 ± 7.2	--	--	--	--
	15	TTR00662	--	--	--	--	--	--	--	--	--	--	35.6 ± 7.8	--	--	--	--
	20	TTR00663	--	2.08 ± 0.52	1.31 ± 0.55	--	--	--	--	0.47 ± 0.29	--	--	37.1 ± 7.4	--	--	--	--
	25	TTR00664	--	2.33 ± 0.50	1.30 ± 0.49	--	--	--	--	0.80 ± 0.33	--	--	33.2 ± 7.4	2.49±1.32	--	--	--
BH8-1	10	TTR00666	2.96±2.44	1.88 ± 0.50	1.07 ± 0.52	--	--	--	--	--	--	--	35.4 ± 8.2	--	--	--	--
	5	TTR00668	--	1.99 ± 0.50	1.41 ± 0.53	--	--	--	--	0.48 ± 0.32	--	--	35.6 ± 8.2	2.81±1.21	--	--	--
	15	TTR00670	--	1.40 ± 0.50	1.36 ± 0.52	--	--	--	--	0.63 ± 0.30	--	--	34.1 ± 7.4	--	--	--	--
	20	TTR00673	--	2.22 ± 0.64	1.43 ± 0.58	--	--	--	--	--	--	--	34.1 ± 7.9	--	--	--	--
	25	TTR00674	--	2.11 ± 0.52	1.57 ± 0.68	--	--	--	--	0.62 ± 0.25	--	--	31.7 ± 7.1	--	--	--	--

Table A.3-8
Gamma Spectroscopy Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill Complex, TTR
(Sheet 6 of 7)

Borehole Number	Sample Depth (ft)	Sample No.	Constituents (pCi/g)														
			Lead-210	Lead-212	Lead-214	Radium-223	Radium-224	Radium-228	Thorium-234	Thallium-208	Bismuth-212	Bismuth-214	Potassium-40	Actinium-228	Cesium-137	Francium-223	Cobalt-57
BH8-1	25	TTR00675	--	2.09 ± 0.53	1.53 ± 0.56	--	--	--	--	0.79 ± 0.29	--	--	36.4 ± 7.5	--	--	--	--
BH8-2	5	TTR00676	--	2.26 ± 0.50	1.15 ± 0.64	--	--	--	--	--	--	--	35.0 ± 7.7	1.30±0.95	--	--	--
	10	TTR00677	--	2.00 ± 0.51	1.18 ± 0.44	--	--	--	--	0.69 ± 0.35	--	--	35.1 ± 8.2	--	--	--	--
	15	TTR00679	--	2.19 ± 0.59	1.23 ± 0.54	--	--	--	--	0.51 ± 0.29	--	--	33.2 ± 7.7	--	--	--	--
	20	TTR00680	--	2.34 ± 0.74	--	--	--	--	--	0.60 ± 0.25	--	--	30.6 ± 7.0	--	--	--	--
	25	TTR00681	--	2.11 ± 0.65	--	--	--	--	--	--	--	--	33.5 ± 7.6	--	--	--	--
BH8-7	5	TTR00682	--	2.06 ± 0.48	1.72 ± 0.60	--	--	--	--	--	--	--	35.9 ± 8.5	--	--	--	--
	10	TTR00683	--	2.45 ± 0.76	0.94 ± 0.43	--	--	--	--	0.85 ± 0.29	--	--	45.2 ± 9.7	--	--	--	--
	15	TTR00684	--	2.09 ± 0.53	--	--	--	--	--	0.71 ± 0.25	--	--	26.7 ± 6.6	--	--	--	--
	20	TTR00685	--	--	--	--	--	--	--	0.91 ± 0.28	--	--	38.6 ± 8.1	--	--	--	--
	25	TTR00686	--	2.80 ± 0.59	--	--	--	--	--	--	--	--	34.2 ± 7.1	--	--	--	--
BH8-9	5	TTR00687	3.88±2.80	2.10 ± 0.46	1.37 ± 0.46	--	--	--	--	0.42 ± 0.32	--	--	31.4 ± 7.2	--	--	--	--
	10	TTR00688	--	2.09 ± 0.55	1.18 ± 0.54	--	--	--	--	0.82 ± 0.32	--	--	33.4 ± 8.7	--	--	--	--
	15	TTR00689	4.5 ± 3.19	2.06 ± 0.53	1.01 ± 0.64	--	--	--	--	0.86 ± 0.31	--	--	33.5 ± 7.6	--	--	--	--
	20	TTR00690	--	2.21 ± 0.48	1.60 ± 0.48	--	--	--	10.0 ± 4.3	--	--	--	35.3 ± 8.0	2.15±1.12	--	--	--
	25	TTR00691	--	1.90 ± 0.76	1.26 ± 0.62	--	--	--	--	1.03 ± 0.35	--	--	33.4 ± 7.8	--	--	--	--
	25	TTR00692	--	2.84 ± 0.63	--	--	--	--	--	0.67 ± 0.26	--	--	39.2 ± 8.1	--	--	--	--
BH4-1	8	TTR00693	--	1.92 ± 0.45	2.00 ± 0.52	--	--	--	--	--	--	--	32.1 ± 6.6	--	--	--	--
	10	TTR00695	--	2.26 ± 0.46	1.01 ± 0.41	--	--	--	--	0.46 ± 0.23	--	--	37.4 ± 8.1	--	--	--	--
	15	TTR00696	4.62±3.60	1.84 ± 0.47	1.40 ± 0.57	--	--	--	--	--	--	--	34.4 ± 7.7	--	--	--	--
	20	TTR00697	--	2.36 ± 0.67	1.17 ± 0.56	--	--	--	--	0.73 ± 0.29	--	--	35.7 ± 7.5	--	--	--	--
	25	TTR00698	--	--	--	--	--	--	--	--	7.62 ± 3.01	--	39.7 ± 8.2	--	--	--	--
BH4-2	15	TTR00703	--	2.14 ± 0.66	1.48 ± 0.50	--	--	--	--	--	--	--	38.2 ± 7.7	--	--	--	--
	11	TTR00704	--	2.14 ± 0.52	1.35 ± 0.56	--	--	--	3.42 ± 2.17	0.75 ± 0.29	--	--	31.9 ± 7.5	--	--	--	--
	20	TTR00705	3.93±3.19	2.14 ± 0.54	1.23 ± 0.60	--	--	--	2.93 ± 2.13	--	--	--	40.8 ± 9.7	--	--	--	--
	25	TTR00706	--	2.00 ± 0.52	1.09 ± 0.51	--	--	--	--	1.15 ± 0.37	--	--	38.5 ± 9.2	--	--	--	--
BH4-3	11.5	TTR00707	--	1.55 ± 0.56	0.98 ± 0.61	--	--	--	--	0.94 ± 0.34	--	--	29.2 ± 8.7	--	--	--	--
	15	TTR00708	--	2.52 ± 0.73	1.69 ± 0.53	--	--	--	--	--	--	--	45.0 ± 8.9	--	--	--	--
	20	TTR00709	--	2.71 ± 0.56	1.06 ± 0.44	--	--	--	--	0.66 ± 0.28	--	--	41.6 ± 9.3	--	--	--	--
	25	TTR00710	--	2.09 ± 0.54	1.39 ± 0.61	--	--	--	--	--	--	--	38.4 ± 9.4	--	--	--	--
BH4-4	10	TTR00711	--	2.05 ± 0.53	1.75 ± 0.63	--	--	--	2.80 ± 1.77	--	--	--	37.4 ± 9.5	--	--	--	--
	15	TTR00714	3.79 ± 3.17	2.05 ± 0.63	1.58 ± 0.60	--	--	--	--	--	--	--	32.0 ± 8.0	--	--	--	--
	20	TTR00715	--	2.32 ± 0.57	1.78 ± 0.57	--	--	--	2.33 ± 1.93	0.78 ± 0.35	--	--	47.2 ± 9.6	--	--	--	--
	25	TTR00716	--	--	--	--	--	--	--	--	--	--	38.4 ± 8.2	--	--	--	--
BH4-5	8	TTR00718	--	2.01 ± 0.53	1.10 ± 0.56	--	--	--	--	1.05 ± 0.34	--	--	37.4 ± 7.9	--	--	--	--
	10	TTR00719	3.06 ± 2.71	1.84 ± 0.55	1.15 ± 0.46	--	--	--	--	0.63 ± 0.25	--	--	34.2 ± 7.5	2.99±1.26	--	--	--
	15	TTR00720	--	--	1.64 ± 0.55	--	--	--	--	0.73 ± 0.30	--	--	44.1 ± 10.0	--	--	--	--
	20	TTR00721	--	1.86 ± 0.48	1.02 ± 0.55	--	--	--	--	--	--	--	39.6 ± 8.0	--	--	--	--
	25	TTR00722	--	--	--	--	--	--	--	--	--	--	38.5 ± 8.8	--	--	--	--
BH4-8	25	TTR00723	--	--	--	--	--	--	--	--	--	--	39.1 ± 8.2	--	--	--	--
	5	TTR00726	--	2.59 ± 0.62	1.64 ± 0.68	--	--	--	--	0.79 ± 0.41	--	--	34.2 ± 7.7	--	--	--	--

Table A.3-8
Gamma Spectroscopy Constituents Detected Above Method Detection Limits,
Soil Sample Results, Area 3 Landfill Complex, TTR
(Sheet 7 of 7)

Borehole Number	Sample Depth (ft)	Sample No.	Constituents (pCi/g)														
			Lead-210	Lead-212	Lead-214	Radium-223	Radium-224	Radium-228	Thorium-234	Thallium-208	Bismuth-212	Bismuth-214	Potassium-40	Actinium-228	Cesium-137	Francium-223	Cobalt-57
BH4-8	10	TTR00727	--	2.07 ± 0.48	1.62 ± 0.49	--	--	--	--	0.77 ± 0.30	--	--	39.1 ± 8.2	--	--	--	--
	15	TTR00729	--	--	--	--	--	--	--	0.51 ± 0.29	--	--	44.1 ± 9.5	--	--	--	--
	20	TTR00730	3.20 ± 2.67	1.93 ± 0.61	--	--	--	--	--	--	--	--	37.4 ± 8.69	--	--	--	--
	25	TTR00731	--	2.31 ± 0.51	1.73 ± 0.56	--	--	--	--	0.83 ± 0.41	--	--	36.7 ± 8.5	1.58±1.38	--	--	--
BH4-7	10	TTR00732	--	2.24 ± 0.52	1.17 ± 0.52	--	--	--	--	--	--	--	34.0 ± 7.8	--	--	--	--
	15	TTR00733	--	--	--	--	--	--	--	--	--	--	45.5 ± 9.1	--	--	--	--
	20	TTR00734	--	2.42 ± 0.57	1.59 ± 0.77	--	--	--	--	1.08 ± 0.37	--	--	37.4 ± 7.7	--	--	--	--
	25	TTR00735	--	2.36 ± 0.52	0.97 ± 0.54	--	--	--	3.65 ± 2.01	0.57 ± 0.38	--	--	39.0 ± 8.4	--	--	--	--
BH4-6	10	TTR00736	--	1.71 ± 0.51	1.25 ± 0.51	--	--	--	--	--	--	--	38.0 ± 8.3	--	--	--	--
	8	TTR00737	--	1.70 ± 0.46	1.22 ± 0.75	--	--	--	--	0.71 ± 0.28	--	--	36.3 ± 7.7	--	--	--	--
	15	TTR00738	--	--	--	--	--	--	--	0.72 ± 0.40	--	--	37.8 ± 8.2	--	--	--	--
	20	TTR00739	--	2.14 ± 0.72	1.59 ± 0.57	--	--	--	--	--	--	--	40.7 ± 8.4	--	--	--	--
	25	TTR00740	--	2.46 ± 0.53	1.55 ± 0.52	--	--	--	4.66 ± 2.42	0.76 ± 0.31	--	--	36.1 ± 8.8	--	--	--	--

Gamma spectroscopy analysis for ^{226}Ra results in large statistical errors in the measurement, in the range of 25 to 36 percent. In addition, the minimum detectable concentration is often near or above the expected background concentrations because the 186 keV gamma is emitted during only 3.28 percent of the ^{226}Ra decays (Shleien, 1998). Therefore, four samples with relatively high ^{226}Ra concentration (TTR00455, TTR00475, TTR00616, TTR00676) along with one sample per background borehole (sample numbers TTR00404, TTR00405, and TTR00408) were analyzed for total radium using EPA method 903 (EPA, 1992). In this method the radium is chemically separated from other elements and analyzed using gross alpha counting. In three of the four samples with the high ^{226}Ra concentration, the ^{226}Ra concentration measured using EPA method 903 was significantly lower than the concentration measured using gamma spectroscopy. In the fourth sample, there was no significant difference in the ^{226}Ra concentration for the two methods (see Table A.3-9). The mean ^{226}Ra concentration in soil samples taken from the TTR Area 3 background locations was 5.16 ± 0.33 pCi/g. The mean ^{226}Ra concentration in the soil samples taken from the TTR Area 3 Landfill was 4.99 ± 1.25 pCi/g. The analytical results demonstrate that the ^{226}Ra concentration in the TTR Area 3 Landfill soil samples is not significantly different from the concentrations found in soil samples taken from background locations and is less than the preliminary action level of twice background. The analytical evidence demonstrates that there is no radium contamination in the Area 3 Landfill.

The gamma spectroscopy results indicate that there are no man-made gamma emitters in the soil samples collected at the Area 3 Landfill. All results are below the PALs established by background sample collection during this investigation and lower than background levels established for the State of Nevada. As a result, no samples were analyzed for isotopic uranium.

A.3.7 Isotopic Plutonium Results

The positive isotopic plutonium results detected above the analytical method concentration limits are presented in [Table A.3-10](#). The analytical method is based upon the guidance in the National Academy of Sciences publication NAS-NS-3004 (Coleman, 1965). The method includes acid digestion of the sample, precipitation of alpha-emitting heavy metals, the sequential separation of plutonium from the other alpha-emitting radionuclides by elution from anion exchange resin columns, followed by alpha spectroscopy. Three plutonium isotopes are identified, plutonium-238

Table A.3-9
Summary of Radium-226 Results for Soil Samples
Collected from the Area 3 Landfill
(Page 1 of 2)

Borehole Number	Sample Number	Sample Depth (feet)	Gamma Spectroscopy ^a	Radium-226 ^b (EPA 903)
			Constituent (pCi/g)	
			Radium-226	Radium-226
BHB-3	TTR00404	15	--	4.80±0.5
BHB-2	TTR00405	10	--	5.23±0.55
	TTR00406	15	5.11±4.49	NA
BHB-1	TTR00408	13	--	5.45±0.57
BH5-1	TTR00415	25	5.18±4.06	NA
BH5-2	TTR00417	20	7.85±4.72	NA
	TTR00419	25	4.94±3.75	NA
BH5-3	TTR00420	10	5.94±3.58	NA
BH6-2	TTR00438	20	5.36±3.43	NA
BH6-3	TTR00445	20	6.84±5.81	NA
BH6-5	TTR00454	15	6.50±4.01	NA
	TTR00455	20	4.86±3.23	5.47±0.57
BH2-1	TTR00460	20	3.53±2.74	NA
	TTR00461	25	7.21±5.37	NA
BH2-3A	TTR00475	20	7.58±3.73	4.43±0.47
	TTR00476	25	6.20±4.19	NA
BH2-4	TTR00477	10	6.89±5.42	NA
	TTR00478	15	4.06±3.27	NA
BH1-20	TTR00486	20	6.30±4.03	NA
	TTR00487	25	4.40±3.26	NA
BH1-19	TTR00495	25	5.74±3.95	NA
	TTR00496A	25	5.16±4.67	NA

Borehole Number	Sample Number	Sample Depth (feet)	Gamma Spectroscopy ^a	Radium-226 ^b (EPA 903)
			Constituent (pCi/g)	
			Radium-226	Radium-226
BH1-10	TTR00575	7.5	4.25±3.48	NA
	TTR00578	20	6.63±3.57	NA
	TTR00579	25	5.37±2.91	NA
BH3-4	TTR00590	10	4.56±3.24	NA
BH3-7	TTR00612	10	4.3±4.2	NA
	TTR00616	20	7.30±5.27	6.46±0.66
BH3-6	TTR00623	25	4.91±3.23	NA
BH3-5	TTR00626	5	4.80±3.03	NA
	TTR00627	10	4.51±3.03	NA
BH3-9	TTR00632	10	7.34±4.87	NA
	TTR00636	25	4.60±4.04	NA
BH3-8	TTR00638	10	5.90±3.18	NA
	TTR00639	15	4.89±3.89	NA
	TTR00641	25	7.12±4.04	NA
BH8-3	TTR00642	10	4.12±2.85	NA
	TTR00646	20	5.27±5.04	NA
	TTR00647	25	4.57±3.77	NA
BH8-4	TTR00648	5	8.79±6.69	NA
	TTR00649	10	7.86±3.40	NA
BH8-5	TTR00658	20	4.45±3.69	NA
BH8-6	TTR00660	5	4.68±3.54	NA
	TTR00661	10	7.92±4.95	NA

Table A.3-9
Summary of Radium-226 Results for Soil Samples
Collected from the Area 3 Landfill
(Page 2 of 2)

Borehole Number	Sample Number	Sample Depth (feet)	Gamma Spectroscopy ^a	Radium-226 ^b (EPA 903)
			Constituent (pCi/g)	
			Radium-226	Radium-226
BH1-4	TTR00500	15	6.31±3.56	NA
BH1-3	TTR00504	15	4.15±3.31	NA
BH1-2	TTR00508	15	5.48±4.49	NA
	TTR00509	20	4.99±3.41	NA
BH1-1	TTR00514	20	9.09±6.91	NA
BH1-7	TTR00520	25	5.40±4.44	NA
BH1-6	TTR00522	8.5	4.51±3.18	NA
	TTR00524	15	5.35±2.99	NA
	TTR00526	25	7.07±3.39	NA
BH1-5	TTR00535	25	6.32±4.37	NA
BH1-13	TTR00538	10	7.32±4.62	NA
	TTR00542	20	7.54±4.42	NA
BH1-12	TTR00546	15	3.90±3.12	NA
	TTR00547	20	5.38±4.25	NA
	TTR00548	25	8.98±3.84	NA
BH1-13	TTR00554	30	6.83±4.68	NA
	TTR00559	38	5.38±3.34	NA
BH1-9	TTR00569	10	7.30±4.18	NA
	TTR00573	25	4.55±4.11	NA

Borehole Number	Sample Number	Sample Depth (feet)	Gamma Spectroscopy ^a	Radium-226 ^b (EPA 903)
			Constituent (pCi/g)	
			Radium-226	Radium-226
BH8-1	TTR00674	25	9.80±5.53	NA
BH8-2	TTR00676	5	6.87±3.96	3.59±0.39
BH8-7	TTR00683	10	5.33±4.30	NA
	TTR00684	15	5.10±3.70	NA
	TTR00685	20	5.58±4.51	NA
	TTR00686	25	4.39±3.04	NA
BH8-9	TTR00687	5	3.64±3.60	NA
BH4-1	TTR00695	10	4.35±3.34	NA
	TTR00697	20	4.57±4.29	NA
BH4-2	TTR00704	11	5.03±4.10	NA
BH4-3	TTR00708	15	7.62±6.30	NA
	TTR00709	20	5.09±3.80	NA
BH4-4	TTR00714	15	3.92±3.03	NA
	TTR00715	20	4.24±3.14	NA
BH4-5	TTR00720	15	5.79±3.63	NA
	TTR00721	20	5.27±3.73	NA
BH4-8	TTR00726	5	6.94±4.55	NA
	TTR00730	20	4.50±3.32	NA
BH4-6	TTR00737	8	3.76±3.32	NA

^a HASL 300, 4.5.2.3., *Environmental Measurements Laboratory Procedures Manual*, HASL-300, U.S. Department of Energy (DOE, 1992)

^b EPA 903, *Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, Method 903.0, Alpha-Emitting Radium Isotopes in Drinking Water. Results shown are a contribution from Radium-224 and Radium-226 (EPA, 1992)

NA - Not analyzed

-- Constituent not detectable, less than the listed minimum detectable concentration

pCi/g is picocuries/gram

(²³⁸Pu), ²³⁹Pu, and ²⁴⁰Pu. The energy of the alpha particles emitted by ²³⁹Pu and ²⁴⁰Pu are so close that they cannot be resolved using alpha spectroscopy. Therefore, these two plutonium isotopes are reported as one, ^{239/240}Pu. The Area 3 Landfill soil plutonium concentration is not significantly different from that found in background locations. This demonstrates that there is no plutonium

Table A.3-10
Summary of Isotopic Plutonium Results for Soil Samples
Collected from the Area 3 Landfill, TTR

Borehole Number	Sample Number	Sample Depth (feet)	Constituents (pCi/g)	
			Plutonium-238	Plutonium-239/240
BH6-1	TTR00428	10	0.239 ± 0.104	--
BH1-13	TTR00558	36	0.081 ± 0.052	--
BH1-8	TTR00566	20	0.49 ± 0.17	--
BH8-3	TTR00645	15	0.17 ± 0.08	--
BH8-6	TTR00661	10	--	0.11 ± 0.05
	TTR00662	15	0.075 ± 0.044	--
BH8-9	TTR00689	15	0.18 ± 0.09	--
BH4-1	TTR00695	10	0.666 ± 0.172	--

pCi/g - Picocuries/gram

-- Constituent not detected above method detection limits

contamination in the Area 3 Landfill. Additional details on the plutonium analysis are described below.

The mean concentration for ²³⁸Pu in the soil samples was 0.032 ± 0.135 pCi/g. The median ²³⁸Pu concentration is 0.0195 pCi/g. The mean minimum detectable concentration was 0.11 pCi/g while the median minimum detectable concentration was 0.10 pCi/g. Of the 276 soil samples analyzed for ²³⁸Pu, only seven were positive. Of the seven positive samples, only four had concentrations that exceeded their two-sigma counting error by more than a factor of two. Only two of the 54 boreholes, BH1-3 and BH4-1, had mean ²³⁸Pu concentrations that exceeded the minimum detectable concentration and the estimated ²³⁸Pu concentration found at background locations. One elevated sample result in each of these two boreholes resulted in the mean ²³⁸Pu concentration exceeding the mean background concentration. The analytical results demonstrate that there is no ²³⁸Pu contamination in the soil samples.

The mean concentration for ^{239/240}Pu in the soil samples was 0.0063 ± 0.068 pCi/g. The median ^{239/240}Pu concentration is 0.005 pCi/g. The mean minimum detectable concentration was 0.105 pCi/g while the median minimum detectable concentration was 0.098 pCi/g. Of the 276 soil samples analyzed for ^{239/240}Pu, only one was positive. None of the boreholes had a mean ^{239/240}Pu concentration that exceeded the minimum detectable concentration. The analytical results

demonstrate that the $^{239/240}\text{Pu}$ at the Area 3 Landfill Complex is not significantly different from that found at the background locations.

The plutonium concentrations in the soil samples taken at the Area 3 Landfill Complex are not significantly different from the concentrations measured in samples taken from the background locations. The radioanalysis of the Area 3 Landfill samples demonstrates that there is no plutonium contamination.

A.3.8 Geotechnical Results

Eighteen soil samples were collected from the eight landfill sites for geotechnical analysis. The samples were comprised of one soil sample from the soil cap at each landfill site and one soil sample from the soil directly beneath one of the cells within each site. The additional two samples came from the open trench at Landfill A3-1 (A3-1a). The data were collected to provide input for closure options. In summary, the data indicate the following:

- Particle size distribution of the Area 3 Landfill Complex soil indicated well-sorted material ranging from small gravel to fine silt and clay, consisting mostly of sand ([Table A.3-11](#)).
- The evaluation of dry bulk density indicated a range of densities for the surface and subcell soils ([Table A.3-12](#)). The surface soil ranged from 1.18 grams per cubic centimeter (g/cm^3) to 1.75 g/cm^3 . The subcell soils ranged from 1.57 g/cm^3 to 1.81 g/cm^3 . The subcell densities were greater than the surface densities with the exception of Landfills A3-1 and A3-3.
- Results of the soil moisture content measurements indicated that the soil was well below saturation ([Table A.3-12](#)).
- Porosities in the surface soils ranged from 16 to 33% while porosities in the subcell soils ranged from 21 to 38% ([Table A.3-12](#)). The subcell porosities were greater than the surface porosities with the exception of Landfills A3-3, A3-5, A3-6, and A3-7.
- Based on the saturated hydraulic conductivity measurements, the surface soils of Landfills A3-1, A3-1A, A3-2, A3-6, and A3-8 had lower permeabilities than the subcell soils (see [Table A.3-13](#)). The surface soils of cells A3-3, A3-4, A3-5, and A3-7 had higher permeabilities than the subcell soils.

Table A.3-11
Summary of Particle Size Characteristics

Borehole Number	Sample Number	Depth (ft)	d ₁₀ (mm) ^a	d ₁₅ (mm)	d ₃₀ (mm)	d ₅₀ (mm)	d ₆₀ (mm)	d ₈₅ (mm)	C _u	C _c	Gravel %	Sand%	Silt & Clay %
BH5-3	TTR00422	15.5	ND	ND	0.1	0.4	0.8	4.1	--	--	13	67	21
	TTR00427	1.5	ND	ND	0.1	0.2	0.5	3.7	--	--	12	65	23
BH6-3	TTR00443	13	0.2	0.4	1.0	2.6	3.6	9.1	17.3	1.5	32	64	4
	TTR00447	1.5	ND	ND	0.1	0.3	0.6	3.7	--	--	11	63	25
BH2-2	TTR00465	15.5	ND	0.1	0.4	1.4	2.2	6.3	--	--	22	67	12
	TTR00468	1.5	ND	ND	0.1	0.5	0.9	4.7	--	--	15	63	22
BH1-20	TTR00484	13	0.2	0.3	0.8	1.8	2.6	7.4	15.7	1.5	23	70	6
	TTR00488	1.5	ND	ND	0.1	0.2	0.3	2.5	--	--	9	62	29
BH1-6	TTR00523	10	ND	ND	0.1	0.4	0.7	2.9	--	--	7	66	26
	TTR00527	1.5	ND	0.1	0.3	0.9	1.4	5.1	--	--	16	74	10
BH7-1A	TTR00586	1.5	ND	ND	0.2	0.5	0.9	3.9	--	--	12	66	22
	TTR00587	10	ND	ND	0.2	1.2	2.4	11.3	--	--	30	50	19
BH3-7	TTR00614	10	ND	ND	0.1	0.2	0.3	2.0	--	--	7	64	30
	TTR00618	1	ND	ND	0.1	0.5	1.0	5.0	--	--	16	63	21
BH8-1	TTR00665	1.5	ND	ND	0.1	0.5	1.1	6.1	--	--	18	61	21
	TTR00669	10	ND	0.1	0.4	1.5	2.4	8.1	--	--	25	64	12
BH4-4	TTR00713	12.5	ND	ND	0.2	0.9	1.6	6.4	--	--	21	62	17
	TTR00717	1	ND	ND	0.3	1.1	1.8	6.0	--	--	19	65	15

^aMillimeter(s)

d₁₀ = Median particle size

C_u = d₆₀/d₁₀

C_c = (d₃₀)²/(d₁₀)(d₆₀)

ND = Not detected at specified sieve size (i.e., d₁₀)

-- = No d value available for calculation

Table A.3-12
Summary of Initial Moisture Content, Dry Bulk Density,
Wet Bulk Density, and Calculated Porosity Results

Borehole Number	Sample Number	Depth (ft)	Initial Moisture Content	Dry Bulk Density (g/cm ³) ^b	Wet Bulk Density (g/cm ³)	Calculated Porosity (%) ^c
			Gravimetric (% g/g) ^a			
BH5-3	TTR00422	15.5	4.7	1.70	1.79	25
	TTR00427	1.5	5.0	1.60	1.68	33
BH6-3	TTR00443	13	4.0	1.80	1.88	22
	TTR00447	1.5	4.8	1.68	1.76	31
BH2-2	TTR00465	15.5	8.1	1.56	1.69	34
	TTR00468	1.5	5.5	1.18	1.24	27
BH1-20	TTR000484	13	4.1	1.70	1.77	38
	TTR00488	1.5	8.8	1.57	1.71	32
BH1-6	TTR00523	10	5.4	1.56	1.65	33
	TTR00527	1.5	4.8	1.75	1.83	23
BH7-1A	TTR00586	1.5	6.1	1.49	1.58	33
	TTR00587	10	11.1	1.62	1.80	29
BH3-7	TTR00614	10	9.3	1.65	1.81	22
	TTR00618	1	5.6	1.68	1.78	25
BH8-1	TTR00665	1.5	5.1	1.44	1.52	21
	TTR00669	10	8.4	1.66	1.80	31
BH4-4	TTR00713	12.5	8.0	1.62	1.75	21
	TTR00717	1	4.9	1.26	1.32	16

^aPercent, gram per gram

^bGram(s) per cubic centimeter

^cPercent

Table A.3-13
Summary of Saturated Hydraulic Conductivity Test

Borehole Number	Sample Number	Depth (ft)	Ksat ^a (cm/s) ^b
BH5-3	TTR00422	15.5	7.61E-06
	TTR00427	1.5	9.59E-06
BH6-3	TTR00443	13	1.87E-05
	TTR00447	1.5	1.28E-06
BH2-2	TTR00465	15.5	3.04E-05
	TTR00468	1.5	2.00E-05
BH1-20	TTR00484	13	1.95E-05
	TTR00488	1.5	4.63E-06
BH1-6	TTR00523	10	2.70E-05
	TTR00527	1.5	4.19E-06
BH7-1A	TTR00586	1.5	1.05E-04
	TTR00587	10	1.30E-06
BH3-7	TTR00614	10	1.93E-05
	TTR00618	1	4.51E-05
BH8-1	TTR00665	1.5	2.59E-06
	TTR00669	10	3.72E-05
BH4-4	TTR00713	12.5	6.93E-06
	TTR00717	1	2.84E-05

^aSaturated permeability

^bCentimeter(s) per second

A.4.0 Quality Assurance

The results of QA/QC activities for the Area 3 Landfill Complex Corrective Action Investigation sampling event are summarized in the following text. The QA/QC procedures related to the geotechnical samples and analyses are contained in the *Standard Specifications for Transportation Materials and Methods of Sampling and Testing* (AASHTO, 1995) and are not discussed further in this text. Detailed information on the QA program for this sampling event is contained in the *Industrial Sites Quality Assurance Project Plan* (QAPP), Revision 1 (DOE/NV, 1996b).

Quality control results are typically judged in terms of the five PARCC parameters (precision, accuracy, representativeness, completeness, and comparability), as described in the following sections.

A.4.1 Precision

Precision is a quantitative measure of the variability of a group of measurements from their average value. Precision is assessed by collecting and analyzing duplicate field samples and comparing the results with the original sample. Precision is also assessed by creating, analyzing, and comparing laboratory duplicates from one or more field samples. Precision is reported as relative percent difference (RPD), which is calculated as the difference between the measured concentrations of duplicate samples, divided by the average of the two concentrations, and multiplied by 100.

A.4.2 Accuracy

Analytical accuracy is defined as the nearness of a measurement to the true or accepted reference value. It is the composite of the random and systematic components of the measurement system and measures bias in the measurement system. The random component of accuracy is measured and documented through the analyses of spiked samples. Sampling accuracy is assessed by evaluating the results of spiked samples and laboratory control samples. Accuracy measurements are calculated as percent recovery by dividing the measured sample concentration by the true concentration and multiplying the quotient by 100.

Field accuracy is assessed by confirming that the documents of record track the sample from origin, through transfer of custody, to disposal. The goal of field accuracy is for all samples to be collected from the correct locations at the correct time, placed in a correctly labeled container with the correct preservative, and sealed with custody tape to prevent tampering. All samples in this sampling event were properly collected and forwarded to the laboratory as described above.

A.4.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition (EPA, 1987). Sample representativeness was achieved through the implementation of a sampling program designed to ensure proper sampling locations, number of samples, and the use of validated analytical methods. Representativeness was assessed through analysis of duplicate samples. Representativeness of the samples taken in this sampling event was assured by collecting the required samples shown in Section A.2.0 and by analyzing them by the approved analytical methods shown in Table A.3-2.

A.4.4 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid. A sampling and analytical requirement of 80 percent completeness was established for this project (DOE/NV, 1996b). The Area 3 Landfill Complex sampling data exhibit a high degree of completeness. The specified sampling locations were utilized as planned. All specified samples were collected, and all sample containers reached the laboratory intact and properly preserved (when applicable). For all samples, sample temperature was maintained during shipment to the laboratory, and sample chain of custody was maintained during sample storage and/or shipment.

A.4.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another (EPA, 1987). To ensure comparability, the Area 3 Landfill Complex field sampling activities were performed and documented in accordance with approved procedures, and all samples were collected in accordance with the CAIP (DOE/NV, 1997a). Approved standardized

methods and procedures were also used to analyze and report the data (e.g., Contract Laboratory Program [CLP] and/or CLP-like data packages). This approach ensures that the data from this project can be compared to other data sets. Based on the minimum comparability requirements specified in the Industrial Sites QAPP (DOE/NV, 1996b), all requirements were met.

Sample-handling documentation, laboratory nonconformance reports, and the precision and accuracy of quality-control sample results were evaluated for their effect on the results of the associated environmental soil samples. The environmental sample results were then qualified according to processes outlined in the following section. Documentation of the data qualifications resulting from these reviews is retained in project files as both hard copy and electronic media and will be supplied upon request.

A.4.6 Tier I and Tier II Data Evaluations

All laboratory data from samples collected at TTR Area 3 Landfill have been evaluated for data quality, according to the procedures outlined in IT-Las Vegas Standard Quality Practices (IT, 1993). These procedures, performed in a tiered process, which are based upon EPA data validation guidelines and presented in the following text, resulted in modifications to the laboratory-generated qualifiers or results. No data rejected during the data evaluation process were used to draw the conclusions presented in Section A.3.0. Only detections, whether estimated (i.e., J-qualified) or not, were used.

The changes resulting from the data evaluation process were documented in project files and were summarized in memoranda for each sample delivery group (SDG). These memoranda are maintained in project files and are available for inspection upon request.

Tier I evaluation for both chemical and radiological analysis examines (but is not limited to):

- Sample count/type consistent with chain of custody
- Analysis count/type consistent with chain of custody
- Correct sample matrix
- Significant problems stated in cover letter or case narrative
- Completeness of certificates of analysis
- Completeness of CLP or CLP-like packages

- Completeness of signatures, dates, and times on chain of custody
- Condition-upon-receipt variance form included
- Requested analyses performed on all samples
- Date received/analyzed given for each sample
- Correct concentration units indicated
- Correct detection limits achieved
- Electronic data transfer supplied
- Results reported for field and laboratory QC samples
- Whether or not the deliverable met the overall objectives of the project

Tier II evaluation for both chemical and radiological analysis examines (but is not limited to):

Chemical

- Sample date, preparation date and analysis date for each sample
- Holding time criteria met
- QC batch association for each sample
- Cooler temperature upon receipt
- Sample pH for aqueous samples, as required
- Detection limits properly adjusted for dilution, as required
- Blank contamination evaluated and applied to sample results/qualifiers
- Matrix spike/matrix spike duplicate percent recoveries (%R) and RPDs evaluated and applied to laboratory results/qualifiers
- Field duplicate RPDs evaluated and applied to laboratory results/qualifiers
- Laboratory duplicate RPDs evaluated and applied to laboratory results/qualifiers
- Surrogate %Rs evaluated and applied to laboratory results/qualifiers
- Laboratory control sample %Rs evaluated and applied to laboratory results/qualifiers

Radiological analysis

- Blank contamination evaluated and applied to sample results/qualifiers
- Certificate of analysis is consistent with data package documentation.
- QC sample results (duplicates, laboratory control samples, matrix spikes and matrix spike duplicates) evaluated and applied to laboratory result qualifiers
- Sample results, uncertainty, and minimum detectable activity evaluated and applied to laboratory result qualifiers
- Detector system calibration to National Institute for Standards and Technology (NIST) traceable sources
- Calibration source preparation is documented and demonstrates proper preparation and is appropriate for sample matrix, emission energies, and concentrations
- Detector system response to daily, weekly, and monthly background and calibration checks for peak energy, peak centroid, peak full width half maximum, and peak efficiency

- Tracers are NIST-traceable, are appropriate for the analysis performed, and with recoveries that meet QC requirements.
- Documentation of all QC sample preparation is complete and properly performed.
- Spectra lines, emissions, particle energies, peak areas, and background peak areas supports the identified radionuclide and its concentration.

Data quality considerations that are included in EPA data review functional guidelines as a Tier III review include the following evaluations:

Chemical

- Mass spectrometer tuning criteria
- Initial and continuing calibration verification
- Internal standard evaluation
- Organic compound quantitation
- Inductively coupled plasma interference check sample evaluation
- Graphite furnace atomic absorption quality control
- Inductively coupled plasma serial dilution effects
- Recalculation of all laboratory results from raw data

Radiological analysis

- Verify QC sample results, e.g., calibration source concentration, percent recovery and RPD
- Radionuclides and their concentration appropriate considering their decay schemes, half-lives, and process knowledge and history of the facility and site
- Each identified line in spectra and verify against emission libraries and calibration results
- Independent identification of spectra lines, area under the peaks, and quantification of radionuclide concentration in a random number of sample results

Tier I and II data evaluations are summarized in a memorandum for each sample delivery group showing what results and qualifiers were changed and why these changes were made.

A Tier III review of five percent of the analytical data was performed by Lockheed Analytical Services in Las Vegas, Nevada. Changes to the data resulting from this review have been documented in project files and are included in the analytical summary tables in Section A.3.0.

A.4.7 Quality Control Samples

Thirty-six trip blanks, 12 field blanks, 13 rinsate blank, 11 matrix spike/matrix spike duplicates, and 11 field duplicates were collected and submitted for laboratory analysis, as shown in [Table A.3-1](#). The samples and duplicates were assigned individual sample numbers and sent to the laboratory blind. Additional samples were selected by the laboratory to be analyzed as laboratory duplicates. The field blanks were taken by placing distilled water into appropriate sample bottles and preserving them according to the requirements specified in the Industrial Sites QAPP (DOE/NV, 1996b). The equipment rinsate blank was obtained by collecting the final rinse solution (i.e., distilled water), which was poured over the decontaminated sampling equipment into the appropriate sample bottles and preserved as applicable. The trip blanks, which were received sealed and preserved from the laboratory, were placed in each cooler containing samples for VOC analysis. The results of the QC samples are discussed in the following sections.

A.4.7.1 Field Quality Control Samples

All blanks (i.e., field blanks, rinsate blanks, and trip blanks) were analyzed for the parameters listed in [Table A.3-2](#) (trip blanks were analyzed for VOCs only), and showed only contamination associated with common laboratory contaminants (acetone, methylene, chloride, 2-butanone, toluene, and phthalate esters as defined in the EPA Functional Guidelines) with the exception of bromodichloromethane in sample TTR00433, a rinsate blank, and chloroform in several field blanks and rinsate blanks. These blank detections were used to qualify the results of the associated environmental samples according to EPA Functional Guidelines (EPA, 1994a; 1994b).

The EPA Functional Guidelines state that no qualification action is taken if a compound is found in an associated blank but not in the sample, or if a compound is found in the sample but not in an associated blank. The action taken when a compound is detected in both the sample and the associated blank varies depending upon the analyte involved, and is known as “The 5X/10X Rule.”

For most VOCs, SVOCs, pesticides, and PCBs, an analyte detected in the sample that was also detected in an associated blank is qualified as undetected (U) if the sample concentration is less than five times (5X) the blank concentration. For the common laboratory contaminants (methylene

chloride, acetone, 2-butanone [methylethyl ketone or MEK], toluene, and phthalate esters [especially bis(2-ethylhexyl)phthalate]), the factor is raised to ten times (10X) the blank concentration. The sample result is elevated to the quantitation limit if it is not already reported at that level.

For inorganics (metals), sample results greater than the instrument detection limit but less than five times (5X) the amount found in an associated blank are qualified as undetected (U). There are no metallic common laboratory contaminants, so there is no “10X Rule” for metals, and the sample result is never altered.

Documentation of the data qualifications resulting from the application of these guidelines is retained in project files as both hardcopy and electronic media and will be supplied upon request.

During the sampling event, 11 field duplicate soil samples were sent as blind samples to the laboratory to be analyzed for the investigation parameters listed in [Table A.3-2](#). For these samples, the duplicate results precision (i.e., relative percent differences between the environmental sample results and their corresponding field duplicate sample results) were compared to criteria set forth in EPA Functional Guidelines (EPA, 1994b; 1994c), and the associated environmental sample results were qualified accordingly.

The EPA Functional Guidelines give no required review criteria for field duplicate analyses comparability, but allow the data reviewer to exercise professional judgement. Both detections and nondetections have been qualified as estimated (J and UJ, respectively) if the relative percent difference between an environmental sample and its field duplicate fell outside established criteria. Documentation of these data qualifications is retained in project files as both hardcopy and electronic media and will be supplied upon request.

Eleven field samples were selected for use as matrix spike/matrix spike duplicate samples. The percent recoveries of these samples (a measure of accuracy) and the relative percent differences in these sample results (a measure of precision) were compared to EPA Functional Guideline criteria (EPA, 1994b; 1994c). The results were used to qualify associated environmental sample results accordingly.

The Functional Guidelines for review of organic data state that no data qualification action is taken on the basis of matrix spike/matrix spike duplicate results alone. The data reviewer exercises professional judgement in considering these results in conjunction with the results of laboratory control samples (LCSs) and other QC criteria in applying qualifications to the data. Generally, if recovery criteria are greater than the upper acceptance limit, then positive sample results for the affected compounds are qualified as estimated (J) and nondetections are not qualified. If recovery criteria are less than the lower acceptance limit, then positive sample results for the affected compounds are qualified as estimated (J) and nondetections are qualified as unusable (R). The relative percent difference results of matrix spike/matrix spike duplicate samples that fall outside established criteria are applied to qualify detections and nondetections as estimated (J and UJ, respectively).

The inorganic data review Functional Guidelines allows professional judgement to be applied in evaluating the results of both matrix spikes and laboratory duplicates. Generally, if spike recoveries are greater than the upper acceptance limit or less than the lower acceptance limit, positive results are qualified as estimated (J) and nondetections are either unqualified or qualified as estimated (UJ), respectively. If spike recoveries are grossly low (less than 30%), positive results are unqualified, and nondetections are unusable (R). The relative percent difference between the environmental sample and its laboratory duplicate are compared to established criteria to qualify detections and nondetections as estimated (J and UJ, respectively).

Documentation of the data qualifications resulting from the application of these guidelines is retained in project files as both hardcopy and electronic media and will be supplied upon request.

A.4.7.2 Laboratory Quality Control Samples

Analysis of method QC blanks and laboratory control samples was performed for each parameter analyzed by Quanterra Laboratory. In addition, laboratory duplicate analysis was performed on one metals analysis environmental sample per SDG. The results of these analyses were used to qualify associated environmental sample results according to EPA Functional Guidelines (EPA, 1994a; 1994b). The complete QC sample results are maintained in the project files.

A.4.8 *Field Deficiencies/Nonconformance*

During the Area 3 Landfill Complex corrective action investigation activities, one health and safety surveillance and one QA surveillance were conducted by the contractor to verify that sampling activities were performed in accordance with applicable requirements. The results of the surveillances indicated no findings, deficiencies, or nonconformances with sampling activities as they met the requirements of the plans and procedures governing the activities at the site. Documentation of these results is retained in project files and will be supplied upon request.

A.5.0 Summary

Analysis of the data generated from sampling activities conducted during corrective action investigation activities at the Area 3 Landfill Complex indicates the following:

- Total petroleum hydrocarbon concentrations for gasoline, diesel, and waste oil were detected above the preliminary action levels set for the Area 3 Landfill Complex corrective action investigation. These levels were detected at Landfills A3-1 and A3-2 in borings BH1-13 and BH2-3, respectively.
- Arsenic concentrations were detected above the background and PRG levels for arsenic in samples collected from Landfill A3-7. Based on historical evidence and lack of debris encountered during drilling activities, Landfill A3-7 is no longer considered to be a landfill. Therefore, arsenic is believed to be naturally occurring at the detected levels.
- No other total RCRA metals were detected above PRGs in the samples.
- Semivolatile organics were not detected above preliminary action levels in any of the samples collected from the Area 3 Landfill Complex.
- Gamma spectroscopy results indicate that there is no man-made, gamma-emitting contamination in the Area 3 Landfill Complex. As a result, no samples were analyzed for isotopic uranium. All results are below the preliminary action levels established through background sample collection during this investigation and background levels established for the State of Nevada. Almost all radionuclide concentrations from the samples collected from the landfills are at or below background concentrations.
- The plutonium concentrations in the borehole samples taken at the landfill are not significantly different from the concentrations measured in samples taken from background locations. The radiological analysis of Area 3 Landfill Complex soil samples demonstrates there is no plutonium contamination.

A.6.0 References

AASHTO, see American Association of State Highway and Transportation Officials

American Association of State Highway and Transportation Officials. 1995. *Standard Specifications for Transportation Materials and Methods of Sampling and Testing*. Washington, DC.

American Society of Testing and Materials. 1996. *Annual Book of ASTM Standards*, 0408 and 0409(11). W. Philadelphia, PA.

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CFR, see *Code of Federal Regulations*.

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Attachment 1

Soil Boring Logs

SOIL BORING LOG		BORING NUMBER: BHB-1	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 06/24/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 06/24/97	
HOLE SURFACE ELEVATION (feet): 5477.63		EASTING: 472859.20	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1106341.50	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, loose, well graded			
	1.0						
5.0				Rock encountered from 1.5 to 1.8 m (5 to 6 ft). Extruded fine to very coarse sand with gravel (45% to 50%), low moisture.			
	2.0			Gravely sand, tan, dry, very fine to very course, Sandy gravels (45%), partly sorted, angular to subrounded.			
				Gravels (60%); sand, fine to course, low moisture.	2.6		TTR00407
10.0	3.0			Well graded gravels sand, poor sorting, gravels to 2.5 cm (1-in.), sand fine to very coarse, low moisture content, tan, subangular to subrounded, tan.			
	4.0			No recovery	4.1		TTR00408
15.0	5.0			Decreasing gravel to 6.1 m (20 ft), Sand with gravel, well graded, gravels <35%, slightly moist, loose, no clodding, < 5% cobbles.			Hot sample.
	6.0			Sand, well graded, gravel, very fine to course, some clay, loose.			
20.0				Band with pebbles, moist, pebbles <20%, gravels 15 to 20%, moderate cement, angular to subangular, clodded.			
	7.0						

SOIL BORING LOG

BORING NUMBER: BHB-2

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 06/24/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 06/24/97

HOLE SURFACE ELEVATION (feet): 5480.91

EASTING: 473058.80

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1105261.10

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Mike Doe

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, loose material.			
	1.0						
5.0				Well graded sand with pebbles, pebbles to 5.1 cm (2-in) (45%), sand, medium to very coarse, angular to subangular, slight moisture, tan to dark brown, loose to moderately cemented.			
	2.0						
10.0	3.0			Well rounded pebbly sand, pebbles to 1 inch, angular to subrounded, (65% to 70%), sand fine to very coarse, partly sorted. A 5.1 cm (2-in) moderately cemented dark paleosol present at 3.5 m (11.5 ft).	4.0		TTR00405
	4.0						
15.0	5.0			Well graded gravely sand, gravel to 1.3 cm (1/2-in.), sand, fine to course, partly sorted, moderately sorted at 5.8 to 6.1 m (19 to 20 ft), mottled moisture, periodic zones of gray. Gravels 55% to 65%, loose. At 6.1 m (20 ft) some grading.	3.5		Hot sample. TTR00406
	6.0		GM	As above, some grading, moisture, carbonate.			3.0 m (10 ft) core extruded, headspace only.
20.0	7.0			Low moisture			

SOIL BORING LOG		BORING NUMBER: BHB-3	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-82 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 06/23/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 06/23/97	
HOLE SURFACE ELEVATION (feet): 5497.32		EASTING: 475164.80	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1105000.90	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird	COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.
DRILLING CONTRACTOR: Soils Exploration			
ELEVATION DATUM: Mean Sea Level			

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed			
	1.0						
	5.0			Well graded pebbly sand, brown, poorly sorted, pebbles are well rounded to angular and about 65%, sand medium to very coarse (>35%).			
	2.0				2.0		
				Well graded pebbles to 5.1 cm (2-in), 60% to 65% pebbles, angular to subrounded, partly sorted.			
10.0	3.0			Well graded, pebbly sand, pebbles (60%) up to 5.1 cm (2-in), angular to subrounded; sands moderate to very coarse, weak to moderate cement, no moisture.			TTR00403
	4.0						Driller running in with 10.2 cm (4-in.) before sampling with a smaller tube Rock in the shoe, tight drilling.
15.0				Well graded gravelly sand as above.			TTR00404. Stopped drilling on 06/23/97. Sample is hot.
	5.0						Resumed drilling on 06/24/97. 3.0 m (10 ft) core, hot, tight, extruded separately
				Well graded gravel sand.			
				Gray clay sand to sand, very fine to very coarse, well graded.			
20.0	6.0		GC	Fine gravel sand, brown, well graded.			
			GM	Well graded gravelly sand, brown.			
				Well graded gravelly sand, gravel (45%); sand very fine to coarse, partly sorted, angular to subrounded, moderately cemented.			
7.0				Dark gray gravel with fine component sand, silty, some clay, occasional cobble.			

SOIL BORING LOG		BORING NUMBER: BH1-1	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/08/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/08/97	
HOLE SURFACE ELEVATION (feet): 5467.45		EASTING: 473397.10	
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1107169.90	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GC	Air knifed. Well graded sand and gravel, well cemented. Concrete in hole. No distinctive bottom.			
1.0			GM	Clay aggregate (gravel) in upper [1.8 to 2.1 m (6 to 7 ft)] section, plastic behavior, dark brown; 2.4 to 2.7 m (8 to 9 ft) is well cemented gravel (gravels to 60%) to 1.3 cm (0.5-in.). Less clay			Hard drilling, debn encountered, sample is hot.
5.0			SW	Well graded sand 3.0 to 3.7 m (10 to 12 ft), minor gravels, brown, moist, (gravels <20%). 3.7 to 4.6 m (12 to 15 ft) gravels increase to 30%; sand fine to coarse, low clay, loose packing [3.0 to 3.7 m (10 to 12 ft)] is moderately indurated.	3.3		TTR00512 Easy consistent drilling.
10.0			GM	Well graded sand and gravel, brown [4.6 to 5.2 m (15 to 17 ft)], gray tan 5.2 to 6.1 m (17 to 20 ft), gravels to 5 cm (2-1n.), cobbles; 40 to 60 %, 4.6 to 5.2 (15 to 17 ft), moist gravels, subangular to subrounded; sand is silt to very coarse, clay component (<10%), loose, CaCo3 in lower 0.9 m (3 ft).	3.4		TTR00513
15.0			GM	Well graded sand and gravel, gray tan, slightly moist, gravel (50 to 65%) to 1.3 cm (0.5-in.). CaCo3 crust; sand, silt to very coarse, loose induration.	3.0		TTR00514
20.0			GM	Well graded sand and gravel, gray tan, slightly moist, gravel (50 to 65%) to 1.3 cm (0.5-in.). CaCo3 crust; sand, silt to very coarse, loose induration.	3.2		TTR00515
7.0			GM	Well graded sand and gravel, gray tan, slightly moist, gravel (50 to 65%) to 1.3 cm (0.5-in.). CaCo3 crust; sand, silt to very coarse, loose induration.			

SOIL BORING LOG

BORING NUMBER: BH1-3

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/07/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/07/97

HOLE SURFACE ELEVATION (feet): 5470.73

EASTING: 473416.20

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1107025.40

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Dave Poley

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knifed, well graded sand and gravel.			
	1.0			Concrete.			
5.0				Concrete and fill.			
	2.0			Asphalt, bottom of fill.			
10.0	3.0			Silty sand with gravel, mostly fine sand; gravel (45%), angular to subrounded to 1.3 cm (.5-in.), loose packing, light brown, dry.	3.2		
					3.2		TTR00503
	4.0						
							TTR00504
15.0	5.0			Same as above, more gravel (50 to 55%), very slight moisture.	3.2		
	6.0						
							TTR00505
20.0	7.0			Silty sand with gravel, more coarse sand; Gravel (55 to 60%), angular to subrounded, trace cobbles, light brown, very slight moisture.	3.3		
							TTR00506

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5474.02

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH1-4

DATE HOLE STARTED: 07/07/97

DATE HOLE COMPLETED: 07/07/97

EASTING: 473422.60

NORTHING: 1106966.30

GEOLOGIST: Mike Doe

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, well graded sand and gravel, no fill material observed during drilling.			
1.0							
5.0							
2.0				Well graded sand and gravel, light brown, gravel (55 to 65%), subangular to subrounded, to 1.9 cm (.75-in.), some cobbles to 6.4 cm (2.5-in.); sand very fine to medium, partially sorted, possibly some silts, loose low moisture, trash in slough.			
3.0			SC	Poor to well graded sand with gravel, light brown; sand, silt to medium; some coarse (very minor) gravels (25 to 45%), angular to subrounded, to 6.5 cm (1.5-in.) (rare), loose to moderate packing (induration), very slight moisture, minor traces of CaCo3.	3.1		TTR00499 Hot drill pipe
4.0							
15.0							
5.0				Poor to well graded sand with gravel and trace cobbles, light brown; sand, silt to medium; some coarse (minor) gravels (25 to 40%), angular to subrounded to 2.54 cm (1-in.), very slight moisture.	3.0		TTR00500
6.0			SC	Poor to well graded clayey sand with gravel, light brown; gravels (25 to 35%), angular to subrounded, to 1.9 cm (.75-in.) (rare), very slight moisture.	3.6		TTR00501 No sample
7.0				Same as above.	4.0		TTR00502

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX
 PROJECT NUMBER: 771050.03020200
 HOLE SURFACE ELEVATION (feet): 5487.14
 TOTAL DEPTH DRILLED (feet): 25.00
 ENVIRONMENTAL CONTRACTOR: IT Corporation
 DRILLING METHOD: ROTOSONIC
 DRILLING CONTRACTOR: Soils Exploration
 ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH1-5

DATE HOLE STARTED: 07/08/97
 DATE HOLE COMPLETED: 07/08/97
 EASTING: 473396.30
 NORTHING: 1106950.00
 GEOLOGIST: Dave Poley
 QA CHECK: F. Baird

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COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SW	Air knifed to 2.5 ft, sandy gravel.			
				Asphalt and fill, bottom of fill at 6 ft.			
1.0							
5.0							
	2.0		CL	Sandy gravel, fine to coarse sand, well graded, angular to subrounded; trace silt, light brown, dry.			TTR00531
			SM	Sandy clay, low plasticity, fine to coarse grained sand, poorly graded, mostly medium, light brown, dry.			
10.0	3.0			Silty sand, well graded, fine to coarse, mostly fine; trace gravel, angular to subrounded (<20%), light brown, dry.	2.8		TTR00528
	4.0						
15.0				Same as above.	3.2		TTR00532
	5.0						
	6.0			Same as above, little gravel, trace cobbles.	3.2		TTR00533
20.0							
	7.0						
					3.3		TTR00534 (MS/MSD), TTR00535 (DUP)

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5474.02

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH1-6

DATE HOLE STARTED: 07/08/97

DATE HOLE COMPLETED: 07/08/97

EASTING: 473399.80

NORTHING: 1107009.10

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, sandy gravel, fine to coarse grained, little silt, angular to subrounded, well graded, light brown, dry.			TTR00527 (GEOTECH) Blows=11/20/28
	1.0						
5.0				Ash, burn material, charcoal, wood, concrete, approximate 5.1 to 7.6 cm (2 to 3-1 m.) layer of burned ash material at 2.1 to 2.2 m (7 to 7.5 ft). Approximate bottom of fill at 2.1 m (7 ft).			
	2.0						
				Silty sand-sandy gravel, well graded, fine to coarse mostly fine; gravel (55 to 65%), angular top subrounded, light brown, dry.	3.2		TTR00522
					3.2		TTR00521
10.0	3.0		SM-GM	Same as above.			TTR00523 (GEOTECH) Blows=38/51/48
					3.0		
	4.0						
							TTR00524
15.0			SM	Silty sand, well graded, fine to coarse, mostly fine; gravel, (30 to 40%), light brown, dry.	3.0		
	5.0						
							TTR00525
20.0	6.0			Same as above, trace cobbles up to 6.4 cm (2.5-in.).	3.5		
	7.0						TTR00526

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX	BORING NUMBER: BH1-7	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-89 of A-137
PROJECT NUMBER: 771050.03020200	DATE HOLE STARTED: 07/08/97	
HOLE SURFACE ELEVATION (feet): 5474.02	DATE HOLE COMPLETED: 07/08/97	
TOTAL DEPTH DRILLED (feet): 25.00	EASTING: 473390.20	
ENVIRONMENTAL CONTRACTOR: IT Corporation	NORTHING: 1107084.60	
DRILLING METHOD: ROTASONIC	GEOLOGIST: Mike Doe	
DRILLING CONTRACTOR: Soils Exploration	QA CHECK: F. Baird	COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.
ELEVATION DATUM: Mean Sea Level		

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, well graded sand and gravel, moderate to well cemented.			
				No sample, piece of metal caught in bit - clogged the end, push pipe to bottom of hole - no recovery. Landfill material caught in bit.			
1.0							
5.0							Piece of iron caught in bit.
	2.0
10.0	3.0			Well graded sand and gravel with minor clay component; gravel, (20 to 30%), decreasing to 15%; sands, silt to coarse, slight moisture.			Moderate drilling.
	4.0				3.2		
15.0	5.0			Well graded sand and gravel, tan to brown; gravel to 1.9 cm (0.75-in), (60 to 70%), slight moisture increasing slightly to 6.1 m (20 ft), subangular to subrounded, loose; sand, silt to very coarse, partially sorted.			TTR00518 Loose sample
					3.2		
	6.0
20.0				Well graded sand and gravel, tan, slight moisture; gravel (50 to 70%); sand, silt to very coarse, some clay (<15%), loose.			TTR00519
	7.0				3.2		
							TTR00520

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX	BORING NUMBER: BH1-8	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-90 of A-137
PROJECT NUMBER: 771050.03020200	DATE HOLE STARTED: 07/10/97	
HOLE SURFACE ELEVATION (feet): 5477.30	DATE HOLE COMPLETED: 07/10/97	
TOTAL DEPTH DRILLED (feet): 25.00	EASTING: 473363.40	
ENVIRONMENTAL CONTRACTOR: IT Corporation	NORTHING: 1106943.50	
DRILLING METHOD: ROTASONIC	GEOLOGIST: Mike Doe	
DRILLING CONTRACTOR: Soils Exploration	QA CHECK: F. Baird	
ELEVATION DATUM: Mean Sea Level	COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-C	Air knifed, well graded sand and gravel.			
	1.0		GM-L	Sand and gravel, trash, wire.			
5.0			GM	Well graded sand and gravel, moderate clay, brown; gravels 50 to 60%, Subangular to subrounded, low moisture, loose, moderately indurated.	4.0		TTR00564
10.0	3.0			Well graded sand and gravel, tan, slight moisture, loose; gravel (50 to 60%), angular to subrounded, up to 0.7 cm (.25-in.); sand, silt to moderate sand, low clay content.	4.1		TTR00563 Variable winds, diesel exhaust.
15.0	4.0			Well graded sand and gravel, tan to brown; gravels increase size to 1.3 cm (1/2-in.), angular to subrounded (60 to 65%), Subangular to subrounded, low moisture, loose, moderately indurated.	3.6		TTR00565 Winds variable, no diesel exhaust.
20.0	6.0			Well graded sand and gravel as above.	3.1		TTR00566
	7.0				3.3		TTR00567 (MS/MSD) TTR00568

SOIL BORING LOG		BORING NUMBER: BH1-9	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/10/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/10/97	
HOLE SURFACE ELEVATION (feet): 5477.30		EASTING: 473357.10	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1107009.20	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-C	Air knifed
		GM-L	Well graded sand and gravel, landfill, nails, metal, plastics, some wire.			
1.0							
5.0			GM	Well graded sand and gravel; gravel (50 to 60%) to .6 cm (.25-in.); sand, silt to coarse, all are angular to subangular, brown, loose to moderate induration, low moisture.	3.1		TTR00570
2.0							
10.0				Well graded sand and gravel, tan, loose; gravel (40 to 50%), to .6 cm (.25-in.), angular to subangular; sand, silt to coarse, low clay, clay is powdery when dry, very slight moisture.	3.1		TTR00559
3.0							
4.0				Well graded sand and gravel with cobbles (<5%) to 5.1 cm (2-in.), tan to dark brown; sand, silt (some clay) to very coarse, angular to subrounded; gravels to 1.3 cm (0.5-in.), angular to subrounded, mostly loose, slight moisture, loose induration.	3.3		TTR00571 Sample cool
15.0							
5.0				Well graded gravelly sand, tan to light brown; gravel (60 to 70%), to 1.3 cm (0.5-in.); Cobbels (5%) to 6.4 cm (2.5-in.), angular to subrounded; sand, fine to very coarse, low clay, slight moisture.	3.4		TTR00572
6.0							
20.0					3.1		TTR00573
7.0							

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

BORING NUMBER: BH1-10

PROJECT NUMBER: 771050.03020200

DATE HOLE STARTED: 07/10/97

HOLE SURFACE ELEVATION (feet): 5477.30

DATE HOLE COMPLETED: 07/10/97

TOTAL DEPTH DRILLED (feet): 25.00

EASTING: 473341.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

NORTHING: 1107101.20

DRILLING METHOD: ROTOSONIC

GEOLOGIST: Dave Poley

DRILLING CONTRACTOR: Soils Exploration

QA CHECK: F. Baird

ELEVATION DATUM: Mean Sea Level

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		ML	Air knifed			
	1.0			Asphalt and concrete			
5.0				Sandy gravel, fine to coarse, mostly medium gravel, fine to coarse, mostly medium gravel, 1.3 to 5.1 m (0.5 to 2.0-in.), angular to subrounded; metal.			TTR00575
2.0				Sandy silt, compact, low density, trace gravel, fine to coarse sand mostly fine; gravel, angular to subrounded, light brown, dry.	3.6		
	3.0			Same as above, less compact.	3.7		TTR00574
10.0			GM				TTR00577
4.0							
	5.0			Sandy gravel, fine to coarse sand, mostly fine, gravel (40 to 50%), 1.3 to 5.1 cm (0.5 to 2-in.), angular to subrounded, light brown, dry.	3.1		
15.0					3.2		TTR00578
	6.0			Same as above.			
20.0
	7.0				3.3		TTR00579

SOIL BORING LOG

BORING NUMBER: BH1-11

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/09/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/09/97

HOLE SURFACE ELEVATION (feet): 5477.30

EASTING: 473370.40

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1107061.70

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Dave Poley

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knife			
	1.0			Asphalt, charcoal, burnt motor oil, wood, black staining.			
5.0							
	2.0			Gravel, concrete, metal, bottom of fill.			TTR00549
10.0	3.0		GM-SM	Silty sand, fine to coarse mostly fine, gravel (25 to 30%), angular to subrounded, light brown, dry.			
	4.0						TTR00550
15.0				Sandy gravel, fine to coarse grained, mostly fine; gravel (50 to 70%); trace cobbles, angular to subrounded, light brown, dry, 1.3 to 5.1 cm (0.5 to 2.0-in.) gravel.	3.4		
	5.0						TTR00551
20.0	6.0			Same as above.	2.9		
	7.0						

SOIL BORING LOG

BORING NUMBER: BH1-12

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/09/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/09/97

HOLE SURFACE ELEVATION (feet): 5480.58

EASTING: 473380.10

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1107025.50

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Dave Poley

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knifed, Sandy gravel, fine to coarse sand well graded.			
1.0							
5.0				Silty sand, fine to coarse grained mostly fine; well graded, trace gravel (35 to 40%), angular to subrounded, light brown, dry.			
2.0							
10.0				Same as above	2.8		TTR00545
4.0							
15.0			SM-GM	Silty sand to sandy gravel, fine to coarse sand; gravel (50 to 60%), angular to subrounded, 1.3 to 5.1 cm (0.5 to 2.0-in.), light brown, dry, mostly well graded sand.	2.9		TTR00546
5.0							
20.0			SM	Silty sand, fine to coarse mostly fine, well graded; trace gravel (25 to 30%) angular to subrounded, light brown, dry.	2.9		TTR00547
6.0							
7.0					2.8		TTR00548

SOIL BORING LOG		BORING NUMBER: BH1-13	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/09/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/09/97	
HOLE SURFACE ELEVATION (feet): 5401.83		EASTING: 473337.40	
TOTAL DEPTH DRILLED (feet): 52.00		NORTHING: 1106996.20	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks	Sample Number
0.0	0.0		SM	Air knifed, sandy gravel, well graded, fine to coarse grained sand.				
	1.0							
5.0	2.0			Asphalt with strong hydrocarbon odor, bottom of fill at 7.0 ft.	10.1	200.0		TTR00536
	3.0			Silty sand, fine to coarse mostly fine well graded; trace gravel, angular to subrounded, light brown, dry.	102.0	500.0		TTR00538
	4.0			Same as above.				
	5.0			Same as above	91.1	50.0		TTR00539
	6.0			Sandy gravel, fine to coarse mostly medium to coarse, angular to subrounded, cemented, dark brown stained, dry.	91.1	10.0		TTR00542
20.0	7.0	GW	GM	Well graded gravel 1.3 cm (0.5-in.)	5.7	100.0		TTR00543
	8.0	SM		Silty sand, fine to coarse mostly fine, well graded; trace gravel, angular to subangular, light brown, dry.	4.8	50.0		TTR00544
25.0	9.0	GM		Sandy gravel, fine to coarse, mostly fine, well graded; gravel angular to subrounded 1.3 to 5.1 cm (0.5 to 2.0-in.), light brown, dry.	3.1	50.0		TTR00554
	10.0			Same as above.				
	11.0			Silty gravel, with fine to coarse sand mostly fine, well graded; 1.3 to 5.1 cm (0.5 to 2.0-in.) gravel, light brown, dry. At 37ft encountered a 6-in. cemented sand fine to coarse gravel, poorly graded, light brown layer.	10.1 3.3	100.0 10.0	Wait 10 minutes to cool, hot out.	TTR00557 TTR00558
	12.0				3.2	10.0	Tight drilling, when tripping out noticed hot drill bit. Wait 10 minutes to cool.	TTR00559
40.0	13.0	SM		Silty sand, fine to coarse grained, mostly fine, well graded; gravel (25 to 35%), angular to subrounded, light brown, dry.	3.1			TTR00560
	14.0			Sandy gravel, fine to coarse grained, mostly fine, well graded; gravel angular to subrounded, light brown, dry.				
45.0	15.0			Same as above	3.0			
50.0								

SOIL BORING LOG

BORING NUMBER: BH1-19

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/07/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/07/97

HOLE SURFACE ELEVATION (feet): 5470.70

EASTING: 473376.20

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1106845.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Mike Doe

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knifed, well graded sand and gravel, better cemented.			
	1.0			Poorly graded sand, fine to coarse, some silt, brown, low clay content, very weak plasticity, very minor gravel, no trash.			
5.0					3.2		
	2.0		GM	Well grade sand and gravel with fine sand, some silt; brown gravels (50 to 60%), subangular to subrounded, no trash or landfill material noted.			TTR00492
10.0					3.3		Hard drilling
	3.0			Well graded sand and gravel, brown; gravels increase from 50 to 70% at 4.0 m (13 ft), induration increases to very well at 4.3 (14 ft); 4.3 to 4.6 m (14 to 15 ft) is well cemented (CaCo3 with minor clay); gravels to 0.6 cm (.25-in.); sand very fine to coarse, slight moisture.			Warm drill pipe, plastic melted.
	4.0						TTR00493
15.0					3.5		Hard drilling to 5.3 m (17.5 ft).
	5.0			Well graded sand and gravel, brown to dark brown, moderate induration; gravels (55 to 65%) to 2.54 cm (1-in.), subangular to subrounded; sand, fine to coarse, partially sorted, angular to subrounded, slight moisture (may be affected by heat).			Hot pipe plastic desintegrated
							TTR00494
20.0					4.3		Hard drilling, hot pipe
	6.0			Sample is very hot to touch, well graded sand and gravel, brown, moist; gravel (60 to 70 %), subangular to subrounded, some cobbles to 5.1 cm (2.0-in.); sand very fine to very coarse, partially sorted, loose to moderate induration,			TTR00495 (MS/MSD)
							Drilling break, sand?
	7.0						TTR00496 (Dupe)
					2.9		

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5470.70

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH1-20

DATE HOLE STARTED: 07/02/97

DATE HOLE COMPLETED: 07/02/97

EASTING: 473435.30

NORTHING: 1106854.70

GEOLOGIST: Mike Doe

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-C	Air knifed. Moderate induration, well graded, sand and gravel, light tan.			
1.0	1.0			Well graded sand and gravel, light tan, some wire noted, loose, dry.			Soft drilling
5.0	5.0		SC	Well graded silty sand with minor gravel. Sand includes a low clay content; sand very fine to medium (75%); gravels (<5%), loose to weakly moderate induration. No trash noted, no bottom of landfill distinguished.	3.5		
10.0	10.0		GM	Well graded sand and gravel, tan, moist, gravel (50 to 65%); sand, silt to very coarse, some clay, loose to moderate induration.			TTR00483 Geotech sample hit rock on first run. Geotech sample. TTR00484 15/15/23
15.0	15.0			As above with moderate (only slight) induration as above, moist.	3.8		TTR00485
20.0	20.0		SC	Well graded silty sands, grayish tan in 15.2 cm (6-in.) beds (alternating color), low to medium induration, gravel (<5%), slight moisture.	3.8		TTR00486 No sample collected hard drilling
7.0	7.0		GM	Sand w/low % gravel grades to a well graded sand and gravel, tan, slight moisture, loose to moderate induration.	4.0		TTR00487

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5506.83

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH2-1

DATE HOLE STARTED: 07/01/97

DATE HOLE COMPLETED: 07/01/97

EASTING: 473447.00

NORTHING: 1106441.10

GEOLOGIST: Mike Doe

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, cavity detected no cuttings to the surface, well graded, well cemented sand and gravel at bottom.			
	1.0			Trash (metal, oxidized copper, steel, some plastic, copper tubing.	2.0	200.0	Metal and pieces of wood to 0.9 m (3 ft)
5.0	2.0			Trash, cable, metals in gravel and sand mixture.	2.1		Sample is warm.
	2.0			Landfill bottom.			
				Well graded sand and gravel, moist, brown gravels (45%), angular to subangular up to (1/4-in); sand fine to very course, low clay.	2.0		
10.0	3.0		SM	Well graded sand with thin beds 15.2 cm (6-in.) of gravels, sands are very fine to course, with some silt, loose to moderate induration, brown, moist, occasional pebbles.	2.7		TTR00458
	4.0						
15.0	5.0		GM	Well graded sand and gravel interbedded with coarse sands, brown, moist. Sample point has gravels (30%) and cobbles (<5%) to 5.1 cm (2-in) and a low clay content, weakly plasticity.	2.4		
	6.0						TTR00460
20.0	7.0			Well graded sand and gravel, brown, moist, some bedding with a slight silt component, loose to moderate induration, gravel 20% to 60%.	2.9		TTR00461 MS/MSD
					3.6		TTR00462

SOIL BORING LOG

BORING NUMBER: BH2-2

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/01/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/01/97

HOLE SURFACE ELEVATION (feet): 5483.86

EASTING: 473437.00

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1106401.80

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Mike Doe

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-C	Air knifed from surface to 1.1 m (3.5 ft). Well graded sand and gravels, well cemented.			Geotech sample, blow counts per six inches: 9/27/29
		GM-L	Well graded sand and gravel, dark brown, low clay content, weak to moderate induration, some wood fragments.	2.1	100.0	Headspace and Hanby samples collected.
5.0				Landfill materials, metal, foam, painted metals, dark brown, moist, possible oil staining. Approximate bottom of landfill at 10.5 ft.			
	2.0			Soil immediately below the landfill bottom. Well graded sand and gravel, brown, moist; gravels (20-50%); sands are very fine to coarse, loose packing, 4.3 to 4.6 m (14-15 ft) contains some clay (grayish) with the sand.	2.5		Soft drilling, headspace and Hanby samples collected.
10.0	3.0		GM
		GM-GC		2.7		TTR00463
	4.0			Geotechnical sample: upper brass sleeve has slough (trash), lower two collected, sand catcher stuck in the first sleeve.			TTR00464
15.0			SC				Geotech sample, blow counts per six inches: 31/66/68
		GM				
	5.0			Well graded sand and gravel, brown to grayish tan (dry); gravels (40-65%) to 0.64 cm (1/4-in.); sand, very fine to coarse, moist.	14.1		TTR00466
20.0	6.0

GC	Well graded sand and gravel to 5.8 m (22 ft), brown clay sand with gravels to 6.0 (23 ft). Well graded sand to 7.6 m (25 ft), brown, moist, some pebbles to (1-in.), moderate induration.			
	7.0		GM		3.0		TTR00467

SOIL BORING LOG		BORING NUMBER: BH2-3	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-100 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/01/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/01/97	
HOLE SURFACE ELEVATION (feet): 5483.86		EASTING: 473427.00	
TOTAL DEPTH DRILLED (feet): 10.00		NORTHING: 1106359.20	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

SOIL BORING LOG		BORING NUMBER: BH2-3	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-100 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/01/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/01/97	
HOLE SURFACE ELEVATION (feet): 5483.86		EASTING: 473427.00	
TOTAL DEPTH DRILLED (feet): 10.00		NORTHING: 1106359.20	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

SOIL BORING LOG		BORING NUMBER: BH2-3	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-100 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/01/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/01/97	
HOLE SURFACE ELEVATION (feet): 5483.86		EASTING: 473427.00	
TOTAL DEPTH DRILLED (feet): 10.00		NORTHING: 1106359.20	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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SOIL BORING LOG

BORING NUMBER: BH2-3A

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/01/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/01/97

HOLE SURFACE ELEVATION (feet): 5483.86

EASTING: 473427.00

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1106359.20

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Mike Doe

DRILLING METHOD: ROTASONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-C	Air knife, well graded sand and gravel, loose, brown.
		GM-L	Trash, carpet, plastic, well graded sand and gravel, predominately carpet for the last foot.			
5.0	1.0				6.1	1000.0
		Minimal recovery, trash, plastic, wood (plywood), plate of steel on the landfill bottom.			
	2.0						Bit dropped from 2.1 to 2.4 m (7 to 8 ft).
		GC	Well graded sand and gravel, brown, moist, some clay.	3.2		TTR00473, cool pipe.
10.0	3.0		GM	Well graded sand and gravel; Gravel (<50%); sand, fine to very coarse, moist, brown, well indurated from 4.1 to 5.6 m (13.5 to 15 ft), increasing silt and clay content to 5.6 m (15 ft).			
	4.0

GC	Well graded sand and gravel, brown, with silt and very low clay.	4.3		TTR00474, cool sample
15.0	5.0		GM	Well graded sand and gravel, brown, moist; gravels to 0.6 cm (.25-in.) (45 to 55%); sand, medium to very coarse, no silts or clay.
		3.8		
	6.0		GC	Well graded sand and gravel, brown, moist; at 6.4 to 6.7 m (21 to 22 ft) clay increases; gravels (40 to 60%) to 1.3 cm (0.5-in.); sand fine to very coarse, partly sorted, moist.			TTR00475, hot sample.
20.0	7.0		GM
		3.3		TTR00476

SOIL BORING LOG		BORING NUMBER: BH2-4	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/01/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/01/97	
HOLE SURFACE ELEVATION (feet): 5467.46		EASTING: 473397.30	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1106306.80	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-C	Air knifed cap to 1.1 m (3.5 ft). Well graded sand and gravel, well cemented.			
	1.0		GM	No drilling, bit settled to 1.5 m (5 ft).			
5.0				Well graded sand and gravel. Gravels (65%); sand, fine to very coarse. 2.7 to 3.0 m (9-10 ft) is moderate to well indurated, slight moisture. No landfill section noted.			
	2.0						Hard drilling 2.4-2.7 m (8-9 ft).
10.0	3.0			Well graded sand and gravel, brown, moist - as above.	3.9		TTR00477
	4.0						Hard drilling, hot pipe
15.0	5.0			As above, continuous.	3.6		TTR00478
	6.0		GC	Well graded clay sand and gravel, moderate induration, brown, moist.	4.6		Cool pipe. TTR00479
	7.0		GM	Well graded sand and gravel with decreased (from 65%) gravel, 7.0 to 7.3 m (23-24 ft) (<20%), brown, moist, loose.			TTR00480, Total Depth = 7.6 m (25 ft).

SOIL BORING LOG		BORING NUMBER: BH2-5	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/02/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/02/97	
HOLE SURFACE ELEVATION (feet): 5496.99		EASTING: 473397.50	
TOTAL DEPTH DRILLED (feet): 10.00		NORTHING: 1106369.10	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed section, well graded sand and gravels, moderately indurated.			
							Loose slough, no trash.
1.0				Well graded sand and gravel, loose, cobbles to 3-in.			
5.0				Well graded sand and gravel, well indurated (especially near the bottom); gravels(60%), angular to subangular; sand fine to coarse. No trash or disturbed soil encountered.	2.9		
2.0							
					3.5		TTR00482
3.0							

SOIL BORING LOG		BORING NUMBER: BH3-1	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-104 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/14/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/14/97	
HOLE SURFACE ELEVATION (feet): 5484.19		EASTING: 473686.90	
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1105623.10	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knifed, metal and fill material.			
	1.0			Silty sand, fine to coarse, mostly medium, well graded, trace gravel, angular to subrounded, light brown, dry.	2.8		
5.0	2.0		GM	Sand and gravel fine to coarse, mostly medium, well graded gravel (50% to 60%), angular to subrounded, trace cobbles up to 15.2 cm (6-in), light brown, dry.			
	3.0		ML	Sandy silt, fine sand, trace to medium, compact, dry.	2.7		
10.0	3.0		SW	Sand, fine to coarse, mostly fine, well graded, light brown, slightly moist.			TTR00608
	4.0		GM	Sand fine to coarse, mostly medium, well graded; gravel (50% to 55%), angular to subrounded, light brown dry.			
	4.0		ML	Sandy silt, fine sand, trace to medium, compact dry.	2.6		TTR00609
15.0	5.0		SM	Silty sand fine to coarse, mostly fine, well graded; trace gravel (15% to 20%) 1.3 to 5.0 cm (0.5 to 2-in), angular to subrounded, light brown, moist.			
	6.0		SW	Sand, fine to coarse, mostly medium, well graded, light brown slightly moist.	2.4		TTR00610
20.0	7.0		ML	Sandy silt, fine to coarse, mostly fine.	2.7		Soil is moist at 23 to 25 ft.
			SM-GM	Silty sand gravel, fine to coarse, mostly fine.			TTR00611

SOIL BORING LOG		BORING NUMBER: BH3-2		CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-105 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/14/97		
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/14/97		
HOLE SURFACE ELEVATION (feet): 5437.92		EASTING: 473686.80		
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1105593.60		
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley		
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird		
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.		
ELEVATION DATUM: Mean Sea Level				

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, no fill material encountered.			
1.0							
5.0				Sandy gravel, fine to coarse, mostly fine, well graded; gravel (50% to 60%), angular to subangular, trace cobbles to 10.2 cm (4-in), light brown, slightly moist, well compacted.			
2.0							
			ML	Sandy silt, fine to coarse, mostly fine, well graded, highly compacted, light brown, dry.	2.7		Hot sample at silt. TTR00602
10.0	3.0		SW	Silty sand, fine to coarse, mostly fine, well graded, gravel (20% to 30%), angular to subrounded, light brown to moist, well compacted.			
4.0					3.2		TTR00603
15.0				Same as above.			
					3.1		TTR00604
20.0	6.0		GM	Sand, fine to coarse, mostly coarse, well graded, light brown, dry slightly moist.			
				Sand and gravel, fine to coarse, mostly medium, well graded (50 to 60%), angular to subrounded, light brown, dry.			
7.0			ML	Silty sand, fine to coarse, well graded, highly compacted, light brown to moist.	3.4		TTR00605

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5487.47

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH3-3

DATE HOLE STARTED: 07/14/97

DATE HOLE COMPLETED: 07/14/97

EASTING: 473670.20

NORTHING: 1105537.80

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0			Air knifed, metal, charcoal. Bottom of landfill at 2.3 ft.			
1.0	1.0		GM	Sand and gravel, fine to coarse, mostly coarse, well graded gravel 1.3 to 5.1 cm (0.5 to 2-in), angular to subangular, light brown, dry, trace cobbles up to 7.6 cm (3-in).	3.3		TTR00596
2.0	2.0		ML	Sandy silt, low plasticity, fine to coarse sand, well compacted, light brown, moist.			
3.0	3.0		SM-GM	Silty sand and gravel, mostly fine to coarse sand, well graded; gravel (20%-30%), angular to subangular, 1.3 to 2.54 cm (0.5 to 1-in.), trace cobbles, light brown, moist, well compacted.	3.1		TTR00597, TTR00598
4.0	4.0				3.5		TTR00599
6.0	6.0		ML	Silt, fine sand, low density, moist.	3.4		TTR00600
7.0	7.0		SM-GM	Silty sand and gravel, fine to coarse, mostly fine; medium well graded gravel (40% to 55%), 1.3 to 2.5 cm (0.5 to 1-in.), angular to subangular, light brown, moist, trace cobbles, well compacted.	3.4		TTR00601

SOIL BORING LOG		BORING NUMBER: BH3-4	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/14/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/14/97	
HOLE SURFACE ELEVATION (feet): 5484.19		EASTING: 473666.70	
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1105491.90	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed, sand and gravel, fine to coarse, mostly medium; gravel 1.3 to 2.5 cm (0.5 to 1-in.), angular to subangular, dry, metal present. Bottom of fill at 3.0 ft.			
	1.0		SM	Sand and gravel, fine to coarse mostly fine to medium, well graded; gravel 1.3 to 2.5 cm (0.5 to 1-in.), angular to subangular, loose, slightly moist, light brown.	2.8		TTR00595
5.0	2.0			Same as above	2.8		
	3.0				3.8		TTR00590
10.0	4.0		ML	Sandy silt, fine to coarse sand, mostly fine, well graded, low plasticity, moist.	3.3		TTR00591
15.0	5.0		SM	Sand and gravel, fine to coarse, mostly fine, well graded; gravel 1.3 to 2.5 cm (0.5 to 1-in.), angular to subangular, light brown, moist.			
	6.0		GM	Sand and gravel, fine to coarse, mostly medium, well graded.			
			CL	Sandy clay, fine to coarse, mostly medium, low plasticity, moist to wet.	3.9		TTR00592
20.0	6.0		GM	Sandy gravel, fine to coarse, mostly medium, well graded; gravel (50% to 60%), 1.6 to 2.5 cm (0.5 to 1-in.), slightly moist, light brown, trace cobbles up to 7.6 cm (3-in.).			
	7.0				4.2		TTR00593

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5503.88

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH3-5

DATE HOLE STARTED: 07/15/97

DATE HOLE COMPLETED: 07/15/97

EASTING: 473703.20

NORTHING: 1105577.10

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knifed to 0.9 m (3 ft), metal debris observed, bottom of fill at 0.9 m (3 ft).			
	1.0			Silty sand, fine to coarse, mostly fine, well graded; gravel (30%-40%) 1.3 to 5.1 cm (.5 to 2-in.); trace cobbles to 10 cm (4-in.), angular to subrounded, light brown, slightly moist to moist, compact.			
5.0	2.0						TTR00626
	3.0				4.4		TTR00627
10.0	4.0			Silty sand, fine to coarse, mostly fine, well graded; gravel (15% to 25%); trace cobbles to 7.6 cm (3-in.), light brown, compact, moist to wet.			Wet silt observed at 14 ft.
	5.0				3.6		TTR00628
15.0	6.0		SW	Sand, fine to coarse, mostly medium, well graded; gravel (25% to 30%), angular to subrounded, compact, light brown, slightly moist.			
	7.0				3.6		TTR00629
20.0			SW-SM	Same as above, slightly moist to very slightly moist.			
			GM	Same as above, more gravel.			
			SW-SM	Same as above, more silt.	4.9		
					4.6		TTR00630
							TTR00631

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5480.91

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH3-6

DATE HOLE STARTED: 07/15/97

DATE HOLE COMPLETED: 07/15/97

EASTING: 473706.20

NORTHING: 1105501.60

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 3.0 ft.			
	1.0			Sand and gravel, fine to coarse, mostly medium, well graded; gravel (40% to 50%), angular to subrounded, 1.3 to 5.1 cm (0.5 to 2-in.), light brown, dry to very slightly moist.			
	2.0		ML	Sandy silt, fine to coarse, mostly fine, well graded, medium density, compact, light brown, slightly moist.			
	3.0		SM	Silty sand, fine to coarse, mostly fine, well graded; trace gravel (10% to 15%), angular to subangular, light brown, moist, compact.	4.4		TTR00619
	4.0				4.6		TTR00621
	5.0			Silty sand, fine to coarse, mostly fine; gravel (15% to 20%), angular to subangular, light brown, moist, compacted.			
	6.0				4.4		TTR00622
	7.0		SW	Sand, fine to coarse, mostly medium, trace silt and gravel, well graded, light brown, slightly moist, compact.			
				No fill encountered when drilling or when looking down the borehole.	4.4		TTR00623

SOIL BORING LOG

BORING NUMBER: BH3-7

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/14/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/14/97

HOLE SURFACE ELEVATION (feet): 5484.19

EASTING: 473706.10

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1105478.60

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Dave Poley

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		ML	Air knifed.			TTR00618 (GEOTECH) 30/35/70
	1.0			Metal, concrete, burnt motor oil, sand and gravel. Bottom of fill at 5 ft.	2.3		
5.0	2.0			Silty sand, fine to coarse mostly fine, well graded; trace gravel, angular to subrounded, light brown, dry to very slightly moist, compact.	2.2		TTR00613
	3.0		SW	Sand, fine to coarse, mostly medium, well graded, light brown, dry.			TTR00612
10.0	3.0		SM	Silty sand, fine to coarse, mostly fine, well graded; trace gravel, angular to subangular, light brown, dry to very slightly moist, compact.			TTR00614 (GEOTECH) 30/43/33
	4.0				2.2		TTR00615
15.0	5.0			Sand, fine to coarse, mostly fine, well grade; trace gravel (15% to 20%), angular to subangular, light brown, moist.			
	6.0			Same as above, dry to slightly moist.	2.2		TTR00615
20.0	6.0		SM-GM	Same as above, more gravel (40% to 55%).			
	7.0				3.0		TTR00617

SOIL BORING LOG		BORING NUMBER: BH3-8		CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-111 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/15/97		
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/15/97		
HOLE SURFACE ELEVATION (feet): 5487.47		EASTING: 473854.10		
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1105586.40		
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley		
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird		
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.		
ELEVATION DATUM: Mean Sea Level				

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Depth: Feet	Depth: Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Sand and gravel, fine to coarse mostly fine, well graded; gravel (50% to 60%), (trace cobbles), angular to subangular, 1.3 to 5.1 cm (0.5 to 2.0-in.), loose, light brown, dry.			
	1.0		SM	Silty sand, fine to coarse, mostly fine, well graded, light brown, wet.			
	2.0		SM				
	3.0		GM	Sandy gravel fine to coarse, well graded; gravel, (50% to 60%), angular to subrounded, 1.3 to 5.1 cm (0.5 to 2.0-in.), loose, light brown, moist.	4.4		TTR00638
5.0	4.0		SM	Sand, fine to coarse, mostly coarse, compact, well grade, light brown, moist.			
	5.0		GM	Sandy gravel fine to coarse, well graded; gravel, (50% to 60%), angular to subrounded, 1.3 to 5.1 cm (0.5 to 2.0-in.), loose, light brown, moist.	4.6		TTR00639
	6.0		SM	Silty sand, fine to coarse, mostly medium, well graded; gravel (50% to 60%), angular to subrounded, 1.3 to 5.1 cm (0.5 to 2.0-in.), light brown, dry.			
	7.0		GM	Sandy gravel, fine to coarse, well graded, gravel (50% to 60%) angular to subrounded, 1.6 to 5.1 cm (0.5 to 2.0 ft) light brown, dry.	4.4		TTR00640
	8.0		SM	Sandy silt, fine to coarse mostly fine, medium density, compact, light brown, very slightly moist.			
	9.0		SM	Silty sand, fine to coarse, well graded, mostly fine to medium, very compact; gravel (30% to 40%), angular to subangular, 1.6 to 5.1 cm (0.5 to 2.0-in.).	4.5		Hard drilling, hot sample.
	10.0		SM				TTR00641

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

BORING NUMBER: BH3-9

PROJECT NUMBER: 771050.03020200

DATE HOLE STARTED: 07/15/97

HOLE SURFACE ELEVATION (feet): 5480.91

DATE HOLE COMPLETED: 07/15/97

TOTAL DEPTH DRILLED (feet): 25.00

EASTING: 473831.10

ENVIRONMENTAL CONTRACTOR: IT Corporation

NORTHING: 1105570.10

DRILLING METHOD: ROTOSONIC

GEOLOGIST: Dave Poley

DRILLING CONTRACTOR: Soils Exploration

QA CHECK: F. Baird

ELEVATION DATUM: Mean Sea Level

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SW	Air drilled.			
				Sand and gravel, fine to coarse, well graded, metal, rubber from tires, steel bolt, wire, black burnt motor oil. Bottom of fill at 7.5 ft.			
1.0							
5.0							
	2.0				4.3		TTR00633
				Sand, fine to coarse, mostly fine to medium, well graded; gravel (30% to 40%), angular to subrounded, light brown, dry, loose.	4.3		TTR00632
10.0	3.0		SM	Silty sand, fine to coarse, mostly fine, well graded, trace gravel (5%-10%), angular to subrounded, 1.3 to 5.1 cm (0.5 to 2.0-in.), loose, compact, light brown, slightly moist.			
	4.0				4.3		TTR00634
15.0			SW	Sand and gravel, fine to coarse, mostly medium, well graded, trace gravel (10% to 15%), angular to subrounded, light brown, loose, slightly moist.			
	5.0		GM	Sand and gravel, fine to coarse, mostly medium, well graded; gravel (50% to 60%), angular to subrounded, loose, light brown, dry.			
			SM		4.4		TTR00635
20.0	6.0			Silty sand, fine to coarse, mostly fine, well graded, loose to compact, light brown, slightly moist.			
			SW	Sand, fine to coarse, mostly medium, well graded, light brown, loose, dry.			
	7.0		SM	Silty sand, fine to coarse, mostly fine, well graded, light brown very slightly moist.	4.4		TTR00636

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5530.13

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH4-1

DATE HOLE STARTED: 07/16/97

DATE HOLE COMPLETED: 07/16/97

EASTING: 473093.70

NORTHING: 1103098.20

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Sand and gravel, fine to coarse, mostly fine, well graded, angular to subrounded, loose, light brown, dry, trace cobbles.			
1.0							
5.0							
2.0			FL	Concrete, wood, rubber, construction type debris, no evidence of burn material or fill.	3.8		TTR00693
3.0			GM	Sandy gravel, fine to coarse, mostly fine, well graded; loose gravel (50% to 60%), angular to subrounded; trace cobbles; silt (25% to 30%), light brown, dry.			TTR00695
10.0							Hard drilling
4.0							
15.0				Same as above.	3.9		Hard drilling
5.0							
6.0							TTR00697
20.0			SM-SP	Silty, gravelly sand, fine to coarse, moist; well graded gravel (30% to 40%), angular to subrounded, loose, light brown, dry.	4.0		Hard Drilling
7.0					4.0		TTR00698

SOIL BORING LOG		BORING NUMBER: BH4-2	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/16/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/16/97	
HOLE SURFACE ELEVATION (feet): 5520.28		EASTING: 473113.80	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1103196.60	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 1.2 m (4 ft), metal, paper, concrete, wood, empty voids, and construction debris. Bottom of fill at 5.5 ft.			No evidence of burn material in fill from 3 to 10.4 ft. Collected field blank (TTR00702)
1.0							
5.0							
	2.0			Silty sand, fine to coarse, mostly fine, well graded; gravel (10% to 20%), angular to subrounded, loose, light brown, dry.			
10.0	3.0			Wood, fiberglass, metal sheeting, wire. Bottom of fill at 3.2 m (10.5 ft).	4.1		TTR00701
							TTR00704
							Insufficient recovery from geotechnical sample at 10 ft.
	4.0			Sandy gravel, fine to coarse, mostly fine, well graded; gravel (50% to 60%); trace cobbles to 10.2 cm (4-in.), angular to subrounded, loose, light brown, dry.			
15.0	5.0		SW-G	Gravelly sand, fine to coarse, mostly medium, well graded; gravel (35% to 45%), angular to subrounded, 1.3 to 5.1 cm (0.5 to 2.0-in.); cobbles to 10.2 cm (4-in.); loose to compact light brown, dry.	4.1		TTR00703
20.0	6.0		GM	Sandy gravel, fine to coarse, mostly coarse, well graded, angular to subrounded.	4.1		TTR00705
	7.0		CL	Sandy clay, coarse sand, low plasticity, very slightly moist.	4.2		TTR00706

SOIL BORING LOG		BORING NUMBER: BH4-3	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-115 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/16/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/16/97	
HOLE SURFACE ELEVATION (feet): 5769.64		EASTING: 474130.70	
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1103990.50	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 4.5 ft.			
1.0							
5.0				Sand and gravel, fine to coarse, mostly fine, well graded; gravel, angular to subrounded, light brown, loose, dry.			
2.0							
10.0	3.0		SM-GM	Sandy gravel, fine to coarse, mostly coarse to medium, well graded; gravel, angular to subrounded, dry, light brown, loose. Wood and rags found at 10 ft. Very little fill material found at 10 ft; no evidence of burning.	4.0		TTR00707
4.0							
15.0	5.0			Silty sand-sandy gravel, fine to coarse, mostly fine, well graded, consolidated, slightly moist; gravel, 1.3 to 2.5 cm (0.5 to 1.0-in.) light brown.	3.7		TTR00708
6.0							
20.0	6.0		CL	Same as above.	4.0		TTR00709
				Sandy clay, fine to coarse, plasticity, light brown, wet.			
7.0			SW	Gravelly sand, fine to coarse, well graded; gravel (20 to 30%), angular to subrounded, consolidated, light brown, slightly moist.	4.1		TTR00710

SOIL BORING LOG

BORING NUMBER: BH4-4

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/17/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/17/97

HOLE SURFACE ELEVATION (feet): 5576.06

EASTING: 473144.10

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1103422.90

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Dave Poley

DRILLING METHOD: ROTASONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 4.5 ft.	4.2		TTR00717 (GEOTECH)
1.0							
5.0				Sand and gravel, fine to coarse mostly medium, well graded, loose; gravel, light brown, very slightly moist.			
2.0				Wood, sand, fine to coarse, mostly medium, well graded, light brown, very slightly moist. Bottom of fill at 9.0 ft.			
10.0	3.0		SW-GM	Sand-gravelly sand, fine to coarse, mostly fine, well graded, compact, light brown, very slightly moist; Gravel (40 to 50%), angular to subrounded.	4.1		TTR00711
					3.9		TTR00713 (GEOTECH) 36/41/40
15.0	4.0		SW	Sand, fine to coarse, mostly fine, well graded; gravel (25 to 35%), angular to subrounded, compact, trace cobbles, light brown, dry.	4.1		TTR00714
	5.0						Warm sample, TTR00715
					4.1		
20.0	6.0			Sand, fine to coarse, mostly fine, well graded, trace gravel, angular to subrounded to 2.5 cm (1-in.), compact-loose, light brown, dry.			
	7.0				4.3		Warm Sample, TTR00716

SOIL BORING LOG

BORING NUMBER: BH4-5

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/17/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/17/97

HOLE SURFACE ELEVATION (feet): 5569.50

EASTING: 473144.50

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1103528.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Dave Poley

DRILLING METHOD: ROTOSONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SW	Air knifed to 4.5 ft.			
	1.0						
5.0				Sand and gravel, fine to coarse, mostly fine, loose, light brown, dry, concrete, wood, metal, copper, cable.			
	2.0			Sand and gravel, fine to coarse, mostly fine, well graded, gravel (20 to 30%), angular to subrounded, loose, light brown, dry.	4.0		TTR00718
					4.0		TTR00719
10.0	3.0			Same as above more gravel (30 to 40%).			
	4.0		SM	Silt sand, fine to coarse, mostly fine, well graded; gravel (20 to 30%), angular to subrounded, loose, light brown, dry-very slightly moist.	4.3		TTR00720
15.0			SW	Sand, fine to coarse, mostly fine to medium, well graded, trace gravel, compact, light brown, very slightly moist.			
	5.0						Hard drilling, hot sample.
					4.2		TTR00721
20.0	6.0			Same as above.			
					4.3		
	7.0				4.3		TTR00722, TTR00723

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

BORING NUMBER: BH4-6

PROJECT NUMBER: 771050.03020200

DATE HOLE STARTED: 07/17/97

HOLE SURFACE ELEVATION (feet): 5520.28

DATE HOLE COMPLETED: 07/17/97

TOTAL DEPTH DRILLED (feet): 25.00

EASTING: 473199.80

ENVIRONMENTAL CONTRACTOR: IT Corporation

NORTHING: 1103376.80

DRILLING METHOD: ROTOSONIC

GEOLOGIST: Dave Poley

DRILLING CONTRACTOR: Soils Exploration

QA CHECK: F. Baird

ELEVATION DATUM: Mean Sea Level

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knifed			
	1.0						
5.0				Silty sand, fine to coarse, mostly fine; asphalt, bottom of fill at 7.0 ft.			
	2.0				4.0		TTR00737
				Same as above.			
					4.0		TTR00738
10.0	3.0		ML	Sandy silt, fine to coarse, mostly fine, medium density, dry.			
			GM	Sandy gravel, fine to coarse, well graded, angular to subrounded.			
	4.0		ML	Sandy silt, fine to coarse, mostly fine, well graded, consolidated, light brown dry.	3.8		TTR00738
15.0			SM	Silty sand, fine to coarse, mostly fine, well graded, dry, consolidated.			
	5.0		GM-SW	Sandy gravel to gravely sand, fine to coarse, mostly coarse, well graded, consolidated, light brown, trace gravel, angular to subrounded, 1.3 to 2.54 cm (0.5 to 1.0-in.), very slightly moist.	4.0		TTR00739
20.0	6.0		SM				
	7.0				3.8		TTR00740

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX
 PROJECT NUMBER: 771050.03020200
 HOLE SURFACE ELEVATION (feet): 5513.72
 TOTAL DEPTH DRILLED (feet): 25.00
 ENVIRONMENTAL CONTRACTOR: IT Corporation
 DRILLING METHOD: ROTOSONIC
 DRILLING CONTRACTOR: Soils Exploration
 ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH4-7
 DATE HOLE STARTED: 07/17/97
 DATE HOLE COMPLETED: 07/17/97
 EASTING: 473223.00
 NORTHING: 1103458.80
 GEOLOGIST: Dave Poley
 QA CHECK: F. Baird
 COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 4 ft.			Approximately 1.5 ft of recovery over 6 ft of drilling. 1.5 ft of GM from 4 to 10 ft. Predominantly asphalt and voids. Drill pipe pushed down hole, sonicator not used.
1.0							
5.0				Silty sand and gravel, asphalt, voids, bottom of fill at 10 ft.			
2.0							
10.0	3.0		SM	Silty sand, fine to coarse, well graded, trace gravel, angular to subrounded, light brown, loose, dry.	4.0		TTR00732
4.0					4.0		TTR00733
15.0				Same as above.			
5.0				Same as above; gravel (20-30%), consolidated.			
20.0	6.0			Silty sand, fine to coarse, mostly fine, well graded; gravel (20-30%), angular to subrounded, 1.3 to 2.5 cm (0.5 to 1.0-in.), light brown, loose to consolidated, dry.	3.8		TTR00734
7.0					3.9		TTR00735

SOIL BORING LOG

BORING NUMBER: BH4-8

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 07/17/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 07/17/97

HOLE SURFACE ELEVATION (feet): 5514.00

EASTING: 473226.30

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1103462.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Dave Poley

DRILLING METHOD: ROTASONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Silty sand, fine to coarse, mostly fine, well graded; gravel (20-30%), 1.3 to 2.5 cm (0.5 to 1.0-in.), angular to subrounded, very loose, light brown.			Asphalt 1.9 cm (75-in.) thick (paved road)
	1.0				4.3		TTR00726
5.0			SW	Sand, fine to coarse, mostly fine, well graded; trace gravel, angular to subrounded, very loose, light brown, moist.			Very loose, poor drilling
	2.0				4.2		TTR00727
10.0	3.0			Sand, fine to coarse, mostly medium, well graded; trace gravel, angular to subrounded, very loose, light brown, moist.			
	4.0			Same as above, dry to very slightly moist.	4.1		TTR00729
15.0				Same as above, dry.			
	5.0						
			SM	Silty sand, fine to coarse, mostly fine, well graded, trace gravel, angular to subrounded, consolidated, light brown, dry.	4.3		TTR00730
20.0	6.0		SW	Sand, fine to coarse, mostly medium, well graded; trace gravel, angular to subrounded, loose, light brown, very slightly moist.			
	7.0		ML	Sandy silt, fine to coarse, mostly fine, well graded, compact, light brown, dry.	4.2		TTR00731

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5490.75

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH5-1

DATE HOLE STARTED: 06/24/97

DATE HOLE COMPLETED: 06/24/97

EASTING: 472463.30

NORTHING: 1105771.90

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

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COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed section. Cap is well graded sand and gravel, well indurated.			
	1.0						
	5.0			Sandy gravel, well graded, angular to subrounded; gravel (60%), sand and silts, vf-c; slight moisture, moderate packing and cementation, clodding, hard packed sand and gravels in shoe.			1.5 to 2.4 m (5 to 8 ft) extruded. Samples are hot. Need to cool - see FADL. Native soil
	2.0				2.1		
				Well graded sand and gravel; gravel (25%); sand, fine to very coarse, subangular to subrounded, moist, loose.			
10.0	3.0		GC	Clay-rich sand and gravel, moist, malleable, gritty, gravel (<15%),	4.8		
			GM	Sandy gravel, well-graded; gravels (55%) to 3.4 cm (1.4-in.), angular-subangular; sand, fine to very coarse, loose.			Sample is cool. TTR00412
	4.0				4.7		
15.0				Well graded pebble sand, dark tan, moderately indurated, moist; sand, fine to very coarse, increasing coarse sands and pebbles, decreased moisture to 20 ft.			Sample is cool. TTR00413
	5.0						
	6.0			Well graded gravelly sand; same as above.	2.1		Sample is cool. No photo. TTR00414
20.0							
	7.0				2.9		TTR00415

SOIL BORING LOG		BORING NUMBER: BH5-2	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-122 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 06/24/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 06/24/97	
HOLE SURFACE ELEVATION (feet): 5494.03		EASTING: 472473.00	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1105729.20	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed section.			
	1.0						
	5.0			Landfill section: Well graded sand and gravel with cement Approximate location of the landfill bottom at 6 ft.	2.8		Soft drilling
	2.0			Well graded sandy gravel, tan, moderate induration. No landfill material observed. Soil appears native.	2.9		Out of landfill - Native Soil
10.0	3.0						
				Well graded sand with pebbles to 0.6 cm (1/4-in.).	4.1		TTR00416 MS/MSD
		GC	Clay with coarse sand (paleosol), moist, dark brown, malleable.			
	4.0		GM	Well graded sand with pebbles, dark brown, moist.			
15.0				Well graded pebble and gravel sand, increasing induration to 5.4 m (17.5 ft).			
	5.0
		Well graded gravelly sand, dark tan, moist.			
20.0	6.0						TTR00417. Shoe is hot
				Well graded gravel and sand. Grey mottle at 6.4 m (21 ft), then dark brown to 7.0 m (23 ft); tan and loose 7.3 to 7.6 m (24 to 25 ft. Well indurated 6.4 to 7.0 m (21 to 23 ft). with clodding (slight clay increase in the matrix).			
	7.0		GM				TTR00418 and TTR00419 (duplicate)

SOIL BORING LOG		BORING NUMBER: BH5-3		CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-123 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 06/25/97		
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 06/26/97		
HOLE SURFACE ELEVATION (feet): 5494.03		EASTING: 472486.00		
TOTAL DEPTH DRILLED (feet): 26.00		NORTHING: 1105699.60		
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe		
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird		
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.		
ELEVATION DATUM: Mean Sea Level				

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	6-26-97 Geotech sample 0 to 0.5 m (0 to 1.5 ft). Two sleeves collected.			
5.0	1.0		SM	Well graded fine sand with minor gravel. Some trash (metals with paints) noted Metals with orange paint in fine silt.			Screening sample only.
	2.0		GM	Landfill bottom			
10.0	3.0			Well graded sand with decreasing gravels to 3.0 m (10 ft)., brown, moderate induration; sand, fine to coarse, partially sorted, angular to subrounded.			
	4.0		SM	Well graded, fine sand and minor gravel with 1 ft interbedded fine sand well sorted 3.4 to 3.7 m (11 to 12 ft), Well cemented gravel 3.0 to 3.4 m (10 to 11 ft).			TTR00420
15.0	5.0		GM	Well graded, gravelly sand; sand is very fine to coarse; sand and gravel is angular to subrounded.			Trip blank, TTR00421 0750 - Sonic head on drilling failed at 13.5 ft. 6-26-97 Geotechnical samples (TTR00422 and TTR00423) 13.8 to 15.3 ft. Blow counts 17/36/67.
	6.0			Well graded, sandy gravel, loose to moderate induration.			
	7.0		GC	Well graded, clay sands and gravel with carbonate veins. Clods. Some cobbles to 5.1 cm (2-in.)			TTR00424
20.0	6.0		GM	Well graded, sandy gravel with traces of silt and clay, brown, moderate induration; clods, gravels (65-70%), angular to subangular, full range sand.	3.5		
	7.0			As above, moist, brown.			TTR00425
25.0				Well graded, sand and gravel, brown, less clay, moist; gravels are angular, loose to moderate induration.			TTR00426 No photo. Description only. Total depth = 26 ft.

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5487.47

TOTAL DEPTH DRILLED (feet): 26.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH6-1

DATE HOLE STARTED: 06/26/97

DATE HOLE COMPLETED: 06/26/97

EASTING: 473339.50

NORTHING: 1105755.60

GEOLOGIST: Mike Doe

QA CHECK: F. Baird

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COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed zone. Apparent cavity zone. Well graded, well cemented cap, dry. Minor cavity, well graded sand and gravel moist.			Note: light reflected down the boring reveals part of a tire, plastic, lots of wire
	1.0			Trash			
5.0				Air knifed or cavity collapse.			
	2.0						
10.0	3.0		GC	Bottom of landfill cell, native soil. Well graded clayey sand and gravel, well indurated, compacted, moist, brown.	2.4		TTR00428
			GM	Well graded sand and gravel, tan, loose, slight moisture. Gravels are angular to subrounded. Sand (65-70%) ranges from very fine to coarse. Some silt component.			
	4.0				2.4		
15.0				As above, slightly dry, light tan.			TTR00429
	5.0						
20.0	6.0			As above	2.2		TTR00430, wire noted in sample from 18 to 20 ft, probably from wire caught on the bit on entry.
				Well graded sand and gravel, brown, slight increase in moisture from the unit above.			
	7.0			Well graded gravel with sand, grayish tan, gravels (75%) to 0.6 cm (1/4-in.) sands are fine to coarse grained.			TTR00431 (MS/MSD) and TTR00432 (duplicate)
25.0							

SOIL BORING LOG		BORING NUMBER: BH6-2	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 06/30/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 06/30/97	
HOLE SURFACE ELEVATION (feet): 5494.03		EASTING: 473342.70	
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1105726.10	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Mike Doe	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed section, cap section is well graded, well cemented sand and gravel to 0.5 m (1.5 ft).			
	1.0		LF	Cavity encountered. No cuttings received to surface. Landfill debris noted visually in the hole. Approximate landfill bottom.			
5.0			GM	Well graded sand and gravel, brown, slight moisture, some pebbles (15 %) to 5.1 cm (2-in.), gravels (55%), sand, fine to coarse, angular to subrounded.			
	2.0						
10.0	3.0			Well graded sand and gravel, brown, slight moisture, loose, gravel (45 to 60%), subangular to subrounded; sand, silt to coarse. No trash observed.	2.1		TTR00436
	4.0						
15.0					2.2		TTR00437
	5.0
		GC
		GM	Well graded sand and gravel, tan, loose, gravels (45%), angular to subrounded, to 0.2 cm (0.5-in.); sand, fine to coarse increasing in percentage to 6.1 m (20 ft). Poorly graded clayey sand and gravels from 5.4 to 5.5 m (17.5 to 18 ft).	2.3		TTR00438
20.0	6.0		GM-GC	Well graded sand and gravel, tan; gravels to .6 cm (.25-in.), increasing to 1.3 cm (.5-in.) 7.3 to 7.6 m (24 to 25 ft); sand, silt to coarse, some minor clay.			
	7.0		GM		2.5		TTR00439, TTR00440 - field blank

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX	BORING NUMBER: BH6-3	CAU 424 CADD
PROJECT NUMBER: 771050.03020200	DATE HOLE STARTED: 06/30/97	Appendix A
HOLE SURFACE ELEVATION (feet): 5444.82	DATE HOLE COMPLETED: 06/30/97	Revision: 0
TOTAL DEPTH DRILLED (feet): 25.00	EASTING: 473319.50	Date: 03/03/98
ENVIRONMENTAL CONTRACTOR: IT Corporation	NORTHING: 1105676.90	Page: A-126 of A-137
DRILLING METHOD: ROTOSONIC	GEOLOGIST: Mike Doe	
DRILLING CONTRACTOR: Soils Exploration	QA CHECK: F. Baird	
ELEVATION DATUM: Mean Sea Level	COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-LF	Air knifed, hard cap of well cemented sand and gravel to 0.5 m (1.5 ft).			2-ft offset to collect geotechnical sample blow counts 6/9/27
	1.0		GM	Ash and clayey sand and gravel, metal and glass.			
5.0	2.0			Well graded sand and gravel, brown, loose to moderate packing, bottom of landfill cell is difficult to determine, material may be fill dirt, very slight moisture.	2.2	10.0	Handby only
	3.0			Split spoon sample.	2.1		Easy drilling TTR00442
10.0	4.0		S-SP	Bottom sleeve headspaced, middle and upper sleeves capped, well graded sand and gravel, tan.			Split spoon geotechnical- No sample, refusal at 10.5 ft. TTR00443, Blow count 18/15/16
	5.0		GM	Well graded sand and gravel, tan to light brown; gravel (50 to 60%), angular to subrounded; sand, silt to clay, thin banding (3 to 5 cm) occasionally.	2.3		TTR00444
15.0	6.0			Well graded sand and gravel; gravel (75%) decreases at 5.2 m (17 ft) (<45%) and increases (70%) 5.7 to 6.1 m (17.5 to 20 ft); moist tan sand 5.2 to 5.8 (17 to 19 ft) is silt to coarse, some clay (<5%), all angular to subrounded, some pebbles to 6.4 cm (2.5-in.), CaCo3 cemented gravel.	2.5		TTR00445
20.0	7.0		GC	Well graded silt, sand and gravel, gray to 23.5 ft, tan to 25 ft; gravels (25 to 30%), silt and sand to coarse, low to slight moisture.	2.3		TTR00446

SOIL BORING LOG

BORING NUMBER: BH6-4

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

DATE HOLE STARTED: 06/30/97

PROJECT NUMBER: 771050.03020200

DATE HOLE COMPLETED: 06/30/97

HOLE SURFACE ELEVATION (feet): 5477.63

EASTING: 473385.30

TOTAL DEPTH DRILLED (feet): 25.00

NORTHING: 1105716.10

ENVIRONMENTAL CONTRACTOR: IT Corporation

GEOLOGIST: Mike Doe

DRILLING METHOD: ROTASONIC

QA CHECK: F. Baird

DRILLING CONTRACTOR: Soils Exploration

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

ELEVATION DATUM: Mean Sea Level

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM-LF	Air knifed section, well graded sand and soil.			
1.0							
5.0				Well to poorly graded sand and gravel, tan-brown, moist. Gravel, angular to subrounded. Minor amounts of plastic and landfill material.			
2.0			GM	Well graded sand and gravel, loose. Cobbles to 5.1 cm (2-in.)			
			GC	Approximate bottom of landfill at 7 ft.			
				Well graded sand and gravel, brown, moist, well indurated. Minor clay increasing in abundance and induration down section.			
10.0	3.0		GM	Well graded sand and gravel, tan-brown, moist to slightly moist. Gravel (45%), some pebbles to 1.5-in., angular to subrounded; sand, fine to coarse.			
4.0							
15.0				Well graded sand and gravel, tan, moderate induration, moist. Loose from 15 to 17 ft, low clay content increasing to 20 ft max.			
5.0							
20.0	6.0		SW	Well graded sand and gravel to 6.7 m (22 ft). Medium sized sand from 6.7 to 6.9 m (22 to 22.5 ft), back to well graded, angular to subrounded, slight moisture, loose to moderate packing.			
	7.0		GM	Well graded sand and gravel with increasing gravel to 25 ft. Grayish tan, moist, cobbles to 5.1 cm (2-in.) (10%), subangular to subrounded. Some CaCO3 coatings.	2.2		

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5474.35

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTASONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH6-5

DATE HOLE STARTED: 06/30/97

DATE HOLE COMPLETED: 06/30/97

EASTING: 473368.80

NORTHING: 1105676.70

GEOLOGIST: Mike Doe

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed. Cap is well graded sand and gravel with moderate induration.			
			CONC	Concrete with dark tar material, ground vibrated while drilling circular pattern. Dark to brown concrete; black oily with rusty color; loose sand and gravel.			
5.0	1.0		GM-LF	Landfill bottom at 8.5 ft.		500.0	Hard drilling on object, break thru at 1.5 m (5 ft). Handby only.
	2.0		GM	Well indurated sand and gravel with CaCo3 cement and low clay, hard to sample from sleeve.			
10.0	3.0			Well graded sand and gravel (50%) to 1.3 cm (0.5-in.) most at 0.7 cm (0.25-in.), angular to subrounded; sand, silt to coarse, tan to brown, moist, loose induration.			TTR00453, Drill pipe is hot.
	4.0						
15.0	5.0			Well graded sand and gravel; gravel (25% to 40%); sand, silt to coarse, loose induration, brown to tan (dry), slight moisture.			TTR00454, Drill pipe is hot.
	6.0						
20.0				Well graded sand and gravel, as above, coarse gravels at 7.3 to 7.6 m (24 to 25 ft); As above from 6.1 to 7.0 m (20 to 23 ft). Finer gravel and silty sand at 7.0 to 7.6 m (23 to 24 ft).			TTR00455, very windy.
	7.0						
							TTR00456

SOIL BORING LOG		BORING NUMBER: BH7-1	CAU 424 CADD Appendix A Revision: 0 Date: 03/03/98 Page: A-129 of A-137
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/10/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/10/97	
HOLE SURFACE ELEVATION (feet): 5490.75		EASTING: 475090.00	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1105191.50	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GW-G	Gravel, 1.3 to 6.4 cm (.5 to 2.5-in.), fine to coarse; sand with cobbles up to 12.7 cm (5-in.), light grey, dry.			
1.0							
5.0			GM	Same as above, slightly moist.			
2.0							TTR00581
10.0	3.0			Sandy gravel, fine to coarse grained sand, well graded, mostly fine; gravel (50 to 60 %), angular to subrounded, light gray, slightly moist. A 1.3 cm (.5-in.) purple horizon at 4.3 m (14 ft). Matrix dries out at 4.0 m (13 ft).	3.3		TTR00582
4.0							
15.0				Same as above, dry.	3.6		TTR00583
5.0
		Same as above, light brown at 5.2 m (17 ft).			
6.0							TTR00584
20.0				Same as above.	3.7		
7.0							TTR00585
					4.2		

SOIL BORING LOG		BORING NUMBER: BH8-1	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/16/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/16/97	
HOLE SURFACE ELEVATION (feet): 5500.60		EASTING: 473317.90	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1104311.70	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 3 feet. Sand and gravel, fine-coarse, well graded, angular-subrounded loose, dry. Silt, loose, dry. Wire at approximately 3 feet. Burn material at 5 ft.			TTR00665, Geotechnical sample.
			ML	Silt, loose, dry, wire at 3 ft. Burn material at 5 ft.			
1.0			SM-GM	Sand and gravel, mostly fine to coarse sand. Gravel 30-40%, angular to subrounded, loose, light brown, slightly moist.	3.5		TTR00668
5.0			ML	Sandy, silt, fine to coarse, medium density, compact, trace gravel, light brown slightly moist.	3.4		TTR00666
10.0	3.0		SM	Silty sand, fine to coarse, mostly fine to medium, well graded, gravel 30-40%, angular to subrounded, compact slightly moist to dry.	3.4		TTR00669, Geotechnical sample. Blow counts 14/30/38
				Same as above, dry.	3.4		TTR00670
15.0	5.0			Silty sand, fine to coarse, mostly fine grained, trace gravel, well graded, dry, loose to compact.	3.6		TTR00673
20.0	6.0			Same as above with 20-30% gravel, compact, dry.			
	7.0				3.5		TTR00674 MS/MSD, TTR00675 (Duplicate)

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5503.88

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH8-2

DATE HOLE STARTED: 07/16/97

DATE HOLE COMPLETED: 07/16/97

EASTING: 473370.60

NORTHING: 1104341.00

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air drill to 0.8 m (2.5 ft). Sand and gravel, fine to coarse, angular to subrounded. Cement at .9 m (3 ft) followed by .2 m (.5 ft) thick layer of burn material, ash to 1.2 m (4 ft). Bottom of landfill at 4 ft.			
1.0	1.0		SM	Silty sand, fine to coarse, mostly fine to medium, gravel 15-20%, angular to subrounded, loose light brown, slightly moist. Trace cobbles to 10.1 cm (4-in.).	4.0		TTR00676
2.0	2.0						
3.0	3.0			Same as above, compact, slightly moist.	4.1		TTR00677
4.0	4.0		ML	Sandy clay, mostly fine, well graded, low porosity, moist.			
5.0	5.0		GM	Sand and gravel, fine to coarse, mostly fine, well graded, gravel angular to subrounded 1.3 to 2.5 cm (0.5 to 1-in.), slightly moist, grey.	4.0		TTR00679
6.0	6.0		SM	Silty sand, fine to coarse, mostly fine, well graded trace gravel, angular to subrounded to 2.5 cm (1-in.).	4.1		TTR00680
7.0	7.0			Silty sand, fine to coarse mostly fine to medium, well graded, gravel (25-35%), angular to subrounded, 1.3 to 2.5 cm (0.5 to 1-in.), light brown, dry.	4.1		TTR00681

SOIL BORING LOG		BORING NUMBER: BH8-3	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/15/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/15/97	
HOLE SURFACE ELEVATION (feet): 5503.88		EASTING: 473423.30	
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1104413.10	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SW	Air knifed to 1.1 m (3.5 ft.), well graded sand and gravel, fine to coarse, mostly medium, gravel (50-60%), angular to subrounded, loose light brown, dry. No fill material observed in borehole cuttings.			
1.0							
5.0				Sand, fine to coarse, mostly fine, well graded, trace gravel, loose, dry.	4.2		TTR00644
2.0			GM	Sand and gravel, fine to coarse, mostly coarse, well graded, compact, gravel 50-60%, angular to subrounded, trace cobbles to 10.2 cm (4-in.), light brown, dry.	4.2		TTR00642
10.0	3.0			Sand and gravel, fine to coarse, mostly fine to medium, gravel 40-50%, angular to subrounded 1.3 to 2.5 cm (0.5-1 inch), compact, light brown, slightly moist.			
4.0					4.5		TTR00645
15.0				Same as above.			
5.0					4.2		TTR00646
20.0	6.0						
7.0				Sand and gravel, fine to coarse, mostly fine to medium, well graded, gravel 30-40%, silt 30%, loose, light brown, dry.	4.2		TTR00647

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5500.65

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH8-4

DATE HOLE STARTED: 07/15/97

DATE HOLE COMPLETED: 07/15/97

EASTING: 473449.50

NORTHING: 1104383.40

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM-GM	Air knifed. No fill encountered.			
	1.0						
5.0				Silty sand, fine to coarse, mostly fine, well grade; gravel (30 to 40%), angular to subrounded, (0.5 to 2.0-in.), compact, light brown, dry.			TTR00648
	2.0						
	3.0				4.5		TTR00649
10.0			GM	Same as above, dry.			
	4.0		ML	Sandy silt, mostly fine, compact, medium density, very slightly moist to slightly moist.	4.2		Hard drilling, TTR00652
15.0			GM	Sandy gravel, fine to coarse, mostly fine to medium, well graded; gravel (60 to 70%), angular to subrounded, loose, light brown, very slightly moist to slightly moist, trace cobbles to 10.1 cm (4-in.).	4.2		TTR00653
	5.0						
20.0							
	6.0			Same as above.			TTR00654
	7.0				4.2		

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX
 PROJECT NUMBER: 771050.03020200
 HOLE SURFACE ELEVATION (feet): 5503.88
 TOTAL DEPTH DRILLED (feet): 25.00
 ENVIRONMENTAL CONTRACTOR: IT Corporation
 DRILLING METHOD: ROTASONIC
 DRILLING CONTRACTOR: Soils Exploration
 ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH8-5

DATE HOLE STARTED: 07/15/97
 DATE HOLE COMPLETED: 07/15/97
 EASTING: 473413.20
 NORTHING: 1104331.00
 GEOLOGIST: Dave Poley
 QA CHECK: F. Baird

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COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 2 ft.			
	1.0			Sand and gravel, fine to coarse, mostly medium, well graded, angular to subrounded, 1.3 to 5.1 cm (0.5 to 2.0-in.). Wire, metal, and rags from 0.6 to 0.8 m (1.5 to 2.5 ft).			
5.0	2.0			Silty sandy gravel (50 to 60% gravel), fine to coarse, mostly medium to coarse gravel; sand (20% fine to coarse); silt (20%); trace cobbles to 7.6 cm (3-in.), angular to subrounded, compact, light brown, very slightly moist.	4.3		TTR00655
	3.0				4.2		TTR00656
10.0	4.0		SM	Silty sand, fine to coarse, mostly fine, well graded; gravel (20 to 30%); angular to subrounded, compact, light brown, very slightly moist, loose at 4.0 to 4.6 m (13 to 15 ft).			
	5.0			Same as above, trace cobbles to 10.1 cm (4-in.), more gravel (30 to 40%)	4.2		TTR00657
15.0	6.0		SW	Sand, fine to coarse, well graded, mostly medium, light brown, loose, dry.	4.1		TTR00658
20.0	7.0		SM	Silty sand, fine to coarse, mostly fine, well graded; gravel (20 to 30%), angular to subangular, compact, light brown, very slightly moist.	4.2		TTR00659

SOIL BORING LOG		BORING NUMBER: BH8-6	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/15/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/15/97	
HOLE SURFACE ELEVATION (feet): 5497.32		EASTING: 473380.10	
TOTAL DEPTH DRILLED (feet):25.00		NORTHING: 1104265.50	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTASONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		GM	Air knifed to 2.5 ft.			
	1.0			Metal, rubber, brass ampule, burnt motor oil (charcoal). Approximate bottom of landfill at 5 ft.			
5.0	2.0			Sandy gravel, fine to coarse, mostly fine, well graded, gravel (50 to 60%), angular to subrounded, compact, light brown, dry; 1.3 to 5.2 cm (0.5 to 2.0-in.) gravel; trace cobbles; silt (20%).	4.1		TTR00660
					4.2		TTR00661
10.0	3.0			Same as above			
	4.0				4.1		TTR00662
15.0	5.0			Silty gravel, fine to coarse, mostly fine, well graded (sand 20 to 30%), angular to subrounded, loose; 1.3 to 5.1 cm (0.5 to 2.0 ft) gravel, dry.	4.2		TTR00663
	6.0			Same as above.			
20.0	7.0				4.6		TTR00664

SOIL BORING LOG		BORING NUMBER: BH8-7	
PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX		DATE HOLE STARTED: 07/16/97	
PROJECT NUMBER: 771050.03020200		DATE HOLE COMPLETED: 07/16/97	
HOLE SURFACE ELEVATION (feet): 5507.16		EASTING: 473475.60	
TOTAL DEPTH DRILLED (feet): 25.00		NORTHING: 1104340.70	
ENVIRONMENTAL CONTRACTOR: IT Corporation		GEOLOGIST: Dave Poley	
DRILLING METHOD: ROTOSONIC		QA CHECK: F. Baird	
DRILLING CONTRACTOR: Soils Exploration		COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.	
ELEVATION DATUM: Mean Sea Level			

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM	Air knifed to 2.5 ft.			No fill observed in cuttings of borehole
	1.0			Silty sand, fine to coarse, mostly fine; gravel (30 to 40%), angular to subrounded, 1.6 to 5.1 cm (0.5 to 1.5-in.), loose, light brown, dry.			
5.0	2.0			Silty sand, same as above.	4.1		TTR00682
					4.0		TTR00683
10.0	3.0		SM-ML	Silty sand to sandy silt, mostly fine sand, well graded, trace, coarse, loose, light brown, dry.			
	4.0				4.1		TTR00684
15.0	5.0		SM	Silty sand, fine to coarse, mostly fine; gravel (30 to 40%), angular to subrounded, 1.3 to 2.5 cm (0.5 to 1.0-in.), light brown, dry, well graded.			
					4.3		TTR00685
20.0	6.0		GM	Silty gravel, fine to coarse, mostly coarse, angular to subrounded, trace cobbles, loose.			
	7.0				4.4		TTR00686

SOIL BORING LOG

PROJECT NAME: TTR - AREA 3 LANDFILL COMPLEX

PROJECT NUMBER: 771050.03020200

HOLE SURFACE ELEVATION (feet): 5494.03

TOTAL DEPTH DRILLED (feet): 25.00

ENVIRONMENTAL CONTRACTOR: IT Corporation

DRILLING METHOD: ROTOSONIC

DRILLING CONTRACTOR: Soils Exploration

ELEVATION DATUM: Mean Sea Level

BORING NUMBER: BH8-9

DATE HOLE STARTED: 07/16/97

DATE HOLE COMPLETED: 07/16/97

EASTING: 473391.70

NORTHING: 1104741.30

GEOLOGIST: Dave Poley

QA CHECK: F. Baird

COMMENTS: Only values >0.0 are shown for the VOC and TPH onsite monitoring results.

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Depth Feet	Depth Meters	Legend	USCS	Classification (Description)	VOC (ppm)	TPH (mg/kg)	Remarks
0.0	0.0		SM-GM	Air knifed to 4 ft.			No fill encountered in borehole or cuttings.
5.0	1.0			Silty sand to sandy gravel (gravel 40 to 50%), fine to coarse, well graded; gravel 1.3 to 5.1 cm (0.5 to 2.0-in.), angular to subrounded, loose, light brown, dry.	4.3		TTR00687
10.0	2.0				4.4		TTR00688
15.0	3.0		SW	Sand, fine to coarse, mostly fine to medium, well graded, gravel (20 to 30%), angular to subrounded, loose, light brown, very slightly moist; silt (20 to 30%)			
	4.0				4.2		TTR00689
	5.0			Same as above, dry.			
	6.0		SM	Sandy silt, fine to coarse; sand mostly fine, well graded; gravel (20 to 30%), angular to subrounded, loose, light brown, dry.	4.2		TTR00690
20.0	7.0			Sand, fine to coarse; trace silt (20%); trace gravel (20%), angular to subrounded, well graded, loose, light brown, dry.	4.3		TTR00691 (MS/MSD), TTR00692 (Duplicate)

Appendix B

Cost Estimates

(As received from Bechtel Nevada)

EST: 424-A3-1.XLS	BN ENVIRONMENTAL RESTORATION COST ESTIMATE SUMMARY	DATE: 12/16/97
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TO: DAVE MADSEN - Environmental Restoration Task Manager	FROM: BRUCE WILCOX - ER Project Controls
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SITE: TTR LANDFILL A3-1	TEC: (see totals below)
WORK PKGE: CAU 424 - A-3 LANDFILL TTR ASSESSMENT (CADD SUPPORT)	WBS: 104010213030101
TAP: CONTAMINATED WASTE SITES	LOCATION: TTR

TYPE OF ESTIMATE	TYPE OF WORK
☐ ORDER OF MAGNITUDE ☒ PLANNING/STUDY ☐ CONCEPTUAL/BUDGET ☐ TITLE I / PRELIMINARY	☐ RI / FS ☒ REMEDIATION ☒ CONSTRUCTION ☐ OTHER
☐ PRELIMINARY TITLE II ☐ WORK ORDER ☐ COMPARATIVE ☐ OTHER	

BN REMEDIATION PROJECT	WORK TO BE PERFORMED BY
ESTIMATOR: Bruce Wilcox 702-295-4629	☒ DOE PRIME CONTRACTOR ☐ NATIONAL LAB
TASK MGR: Dave Madsen 702-295-7211	☐ NTS GENERAL ☐ SUBCONTRACT
PROGRAM MGR: Dave Cowser 702-295-1632	☐ NTS MAINTENANCE ☐ OTHER

STATEMENT OF WORK:

This estimate has been prepared at the request of DOE/NV to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 424, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 424 is specifically described as the Area 3 Landfills located at the Tonopah Test Range (TTR). The project consists of eight landfills which will require one of the following closure options; No Further Action: Administrative Controls, Cover Repair, and Maintenance: Partial Excavation, Backfill, and Recontouring. This estimate will be used to identify the most cost effective option for each site while being protective of human health and the environment. Total Estimated Costs are intended for comparative analysis of remedial field work only. Estimates do not include costs for Project Management, project support, report preparation, or other overhead functions.

SCOPE - A3-1:

- NO FURTHER ACTION: No field activities will be required for this alternative.
- ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:
 - a. Landmarks will be installed at/near the edges of the landfill cells.
 - b. Survey and engineering support will be required for as-built drawing preparation. Site inspection is not anticipated for engineering techs.
 - c. Minor fill activities will be conducted in the surface depressions (approx. 1200 cy).
- PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:

Field work consists of excavation, segregation, transportation, and disposal of the impacted landfill cell contents and backfill of the excavated trench area for the cell containing COC's exceeding Action Levels.

 - a. Approximately 1,000 cy is to be disposed of as a hazardous waste (includes 30% expansion factor).
 - b. Approximately 2,000 cy of fill is required to be compacted in the excavation area.
 - c. Land marks will be installed at/near the edges of the landfill cells.
 - d. Survey and engineering support will be required for as-built drawing preparation.

See following page/s for continuation and cost summary

Review / Concurrence:

Estimator

12/16/1997
Date

Checked By

12/16/97
Date

EST: 424-A3-1.XLS

BN ENVIRONMENTAL RESTORATION

COST ESTIMATE SUMMARY

DATE: 12/16/97

BASIS OF ESTIMATE - A3-1:

- Five landfill cells are present at the site. All cells contain debris.
- Analytical results indicate TPH action levels were exceeded at sample point BHI-13 at the sample depths of 7, 10, and 21.5 ft.
- A surface depression is located at landfill cell A3-1a. The depression contains no debris.
- The construction debris at the eastern cell will remain in place and will require an approx. 1.5 ft. compacted soil cover.

GENERAL ASSUMPTIONS:

- Estimated costs are for comparative analysis only. Assume costs for activities other than field work (Project Management, project support, report preparation, etc.) will be similar for each remedial alternative and are not included in this estimate.
- Costs are the result of a BN review of summarized characterization data only (from the 1997 characterization activities).
- Site inspections were not conducted as part of this estimate, therefore some costs may not be included based upon site specific conditions/characteristics (utilities, adjacent structures/facilities, etc.).
- Equipment and personnel are to be mobed/demobed to the TTR from the Nevada Test Site. One move/demove activity is estimated for the CAU closure (8 sites). The move/demove cost has been divided between each CAS and remedial alternative requiring equipment and labor support in the field depending on size and complexity of the site.
- Lodging and meals are available for personnel at the TTR USAF facilities.
- TPH impacted materials will be transported to and disposed at the NTS Area 6 Hydrocarbon Landfill.
- Hazardous waste will be transported to and disposed of at a licensed and approved TSDF.
- No radioactive waste or unexploded ordnance is present at the sites. No RCT support will be required.
- Non-hazardous and sanitary excavated wastes will be disposed at the Nye County Landfill located near Tonopah.
- Construction water can be obtained from a well within 7 miles of the site.
- Any soil used for site grading, backfill, or cap construction activities can be obtained from a borrow pit approximately 1 mile from the site.
- All landfill cells currently have a minimum soil cover of 1.5 feet. Cover soils will be segregated, set aside, and reused for final cover on sites requiring excavation. The eastern cell is not covered.

CONTINGENCY:

Contingency costs are not included in this estimate. All costs are in FY98 dollars.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE - A3-1:

• NO FURTHER ACTION:	0
• ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:	\$ 27,500
• PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:	\$ 408,500

EST: 424-A3-2.XLS	BN ENVIRONMENTAL RESTORATION COST ESTIMATE SUMMARY	DATE: 12/16/97
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TO: DAVE MADSEN - Environmental Restoration Task Manager	FROM: BRUCE WILCOX - ER Project Controls
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SITE: TTR LANDFILL A3-2	TEC: (see totals below)
WORK PKGE: CAU 424 - A-3 LANDFILL TTR ASSESSMENT (CADD SUPPORT)	WBS: 104010213030101
TAP: CONTAMINATED WASTE SITES	LOCATION: TTR

TYPE OF ESTIMATE	TYPE OF WORK
☐ ORDER OF MAGNITUDE ☒ PLANNING/STUDY ☐ CONCEPTUAL/BUDGET ☐ TITLE I / PRELIMINARY	☐ RI / FS ☒ REMEDIATION ☒ CONSTRUCTION ☐ OTHER

BN REMEDIATION PROJECT	WORK TO BE PERFORMED BY
ESTIMATOR: Bruce Wilcox 702-295-4629 TASK MGR: Dave Madsen 702-295-7211 PROGRAM MGR: Dave Cowser 702-295-1632	☒ DOE PRIME CONTRACTOR ☐ NTS GENERAL ☐ NTS MAINTENANCE ☐ NATIONAL LAB ☐ SUBCONTRACT ☐ OTHER

STATEMENT OF WORK:

This estimate has been prepared at the request of DOE/NV to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 424, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 424 is specifically described as the Area 3 Landfills located at the Tonopah Test Range (TTR). The project consists of eight landfills which will require one of the following closure options; No Further Action: Administrative Controls, Cover Repair, and Maintenance: Partial Excavation, Backfill, and Recontouring. This estimate will be used to identify the most cost effective option for each site while being protective of human health and the environment. Total Estimated Costs are intended for comparative analysis of remedial field work only. Estimates do not include costs for Project Management, project support, report preparation, or other overhead functions.

SCOPE - A3-2:

- NO FURTHER ACTION: No field activities will be required for this alternative.
- ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:
 - a. Land marks will be installed at/near the edges of the landfill cells.
 - b. Survey and engineering support will be required for as-built drawing preparation. Site inspection is not anticipated for engineering techs.
 - c. Minor fill activities will be conducted in the surface depressions (approx. 60 cy).
- PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:

Field work consists of excavation, segregation, transportation, and disposal of the impacted landfill cell contents and backfill of the excavated trench area.

 - a. Approximately 40 cubic yards [includes 30% expansion factor for soils] of soil is anticipated to be disposed of as non-hazardous petroleum impacted soil.
 - b. Additional material will be required to be excavated and disposed of since metal and other potentially large debris was observed that would affect the size of the excavation. The additional material is anticipated to consist of 20 cy hydrocarbon impacted debris and 20 cy of construction debris sanitary waste.
 - c. Land marks will be installed at/near the edges of the landfill cells.
 - d. Survey and engineering support will be required for as-built drawing preparation.

See following page/s for continuation and cost summary

Review / Concurrence:
Estimator	12/16/1997 Date	Checked By	12/16/97 Date

EST: 424-A3-2.XLS

BN ENVIRONMENTAL RESTORATION

COST ESTIMATE SUMMARY

DATE: 12/16/97

BASIS OF ESTIMATE - A3-2:

- Two landfill cells are present at the site. One cell contain debris.
- Analytical results indicate the TPH action level was exceeded at sample point BH2-3 at a depth of 10 feet.
- No other COC's above action levels were detected.
- No COC's above action levels were detected in samples from the adjacent boring locations.
- The impacted area is assumed to be approximately 8 feet in diameter X 15 feet in depth.

GENERAL ASSUMPTIONS:

- Estimated costs are for comparative analysis only. Assume costs for activities other than field work (Project Management, project support, report preparation, etc.) will be similar for each remedial alternative and are not included in this estimate.
- Costs are the result of a BN review of summarized characterization data only (from the 1997 characterization activities).
- Site inspections were not conducted as part of this estimate, therefore some costs may not be included based upon site specific conditions/characteristics (utilities, adjacent structures/facilities, etc.).
- Equipment and personnel are to be mobed/demobed to the TTR from the Nevada Test Site. One move/demove activity is estimated for the CAU closure (8 sites). The move/demove cost has been divided between each CAS and remedial alternative requiring equipment and labor support in the field depending on size and complexity of the site.
- Lodging and meals are available for personnel at the TTR USAF facilities.
- TPH impacted materials will be transported to and disposed at the NTS Area 6 Hydrocarbon Landfill.
- Hazardous waste will be transported to and disposed at a licensed and approved TSDF.
- No radioactive waste or unexploded ordnance is present at the sites. No RCT support will be required.
- Non-hazardous and sanitary excavated wastes will be disposed at the Nye County Landfill located near Tonopah.
- Construction water can be obtained from a well within 7 miles of the site.
- Any soil used for site grading, backfill, or cap construction activities can be obtained from a borrow pit approximately 1 mile from the site.
- All landfill cells currently have a minimum soil cover of 1.5 feet. Cover soils will be segregated, set aside, and reused for final cover on sites requiring excavation.

CONTINGENCY:

Contingency costs are not included in this estimate. All costs are in FY98 dollars.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE - A3-2:

• NO FURTHER ACTION:	0
• ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:	\$ 15,250
• PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:	\$ 56,000

See MPM print out for official detailed estimated costs.

EST: 424-A3-3.XLS	BN ENVIRONMENTAL RESTORATION COST ESTIMATE SUMMARY	DATE: 12/16/97
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TO: DAVE MADSEN - Environmental Restoration Task Manager	FROM: BRUCE WILCOX - ER Project Controls
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SITE: TTR LANDFILL A3-3	TEC: (see totals below)
WORK PKGE: CAU 424 - A-3 LANDFILL TTR ASSESSMENT (CADD SUPPORT)	WBS: 104010213030101
TAP: CONTAMINATED WASTE SITES	LOCATION: TTR

TYPE OF ESTIMATE	TYPE OF WORK
☐ ORDER OF MAGNITUDE ☒ PLANNING/STUDY ☐ CONCEPTUAL/BUDGET ☐ TITLE I / PRELIMINARY	☐ PRELIMINARY TITLE II ☐ WORK ORDER ☐ COMPARATIVE ☐ OTHER
☐ RI / FS ☒ REMEDIATION ☒ CONSTRUCTION ☐ OTHER	

BN REMEDIATION PROJECT	WORK TO BE PERFORMED BY
ESTIMATOR: Bruce Wilcox 702-295-4629	☒ DOE PRIME CONTRACTOR
TASK MGR: Dave Madsen 702-295-7211	☐ NATIONAL LAB
PROGRM MGR: Dave Cowser 702-295-1632	☐ NTS GENERAL
	☐ NTS MAINTENANCE
	☐ SUBCONTRACT
	☐ OTHER

STATEMENT OF WORK :

This estimate has been prepared at the request of DOE/NV to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 424, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 424 is specifically described as the Area 3 Landfills located at the Tonopah Test Range (TTR). The project consists of eight landfills which will require one of the following closure options; No Further Action: Administrative Controls, Cover Repair, and Maintenance: Partial Excavation, Backfill, and Recontouring. This estimate will be used to identify the most cost effective option for each site while being protective of human health and the environment. Total Estimated Costs are intended for comparative analysis of remedial field work only. Estimates do not include costs for Project Management, project support, report preparation, or other overhead functions.

SCOPE - A3-3:

- NO FURTHER ACTION: No field activities will be required for this alternative.
- ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:
 - a. Land marks will be installed at/near the edges of the landfill cells.
 - b. Survey and engineering support will be required for as-built drawing preparation. Site inspection is not anticipated for engineering techs.
 - c. Minor fill activities will be conducted in the surface depressions (approx. 60 cy).
- PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:

No COCs' above action levels have been detected in the samples from the trenches at this site. Therefore, this option is not an alternative closure method for this site.

See following page/s for continuation and cost summary

Review / Concurrence:

B. Wilcox
Estimator

12/16/1997
Date

Al
Checked By

12/16/97

Date

EST: 424-A3-3.XLS

BN ENVIRONMENTAL RESTORATION
COST ESTIMATE SUMMARY

DATE: 12/16/97

BASIS OF ESTIMATE - A3-3:

- Four landfill cells are present at the site. Three of the four cells contain debris.
- Analytical results indicate no COCs above action levels were detected.

GENERAL ASSUMPTIONS:

- Estimated costs are for comparative analysis only. Assume costs for activities other than field work (Project Management, project support, report preparation, etc.) will be similar for each remedial alternative and are not included in this estimate.
- Costs are the result of a BN review of summarized characterization data only (from the 1997 characterization activities).
- Site inspections were not conducted as part of this estimate, therefore some costs may not be included based upon site specific conditions/characteristics (utilities, adjacent structures/facilities, etc.).
- Equipment and personnel are to be moved/demoved to the TTR from the Nevada Test Site. One move/demove activity is estimated for the CAU closure (8 sites). The move/demove cost has been divided between each CAS and remedial alternative requiring equipment and labor support in the field depending on size and complexity of the site.
- Lodging and meals are available for personnel at the TTR USAF facilities.
- TPH impacted materials will be transported to and disposed at the NTS Area 6 Hydrocarbon Landfill.
- Hazardous waste will be transported to and disposed of at a licensed and approved TSDF.
- No radioactive waste or unexploded ordnance is present at the sites. No RCT support will be required.
- Non-hazardous and sanitary excavated wastes will be disposed at the Nye County Landfill located near Tonopah.
- Construction water can be obtained from a well within 7 miles of the site.
- Any soil used for site grading, backfill, or cap construction activities can be obtained from a borrow pit approximately 1 mile from the site.
- All landfill cells currently have a minimum soil cover of 1.5 feet. Cover soils will be segregated, set aside, and reused for final cover on sites requiring excavation.

CONTINGENCY:

Contingency costs are not included in this estimate. All costs are in FY98 dollars.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE - A3-3:

• NO FURTHER ACTION:	0
• ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:	\$ 15,200
• PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:	0

EST: 424-A3-4.XLS	BN ENVIRONMENTAL RESTORATION COST ESTIMATE SUMMARY	DATE: 12/16/97
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TO: DAVE MADSEN - Environmental Restoration Task Manager	FROM: BRUCE WILCOX - ER Project Controls
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SITE: TTR LANDFILL A3-4	TEC: (see totals below)
WORK PKGE: CAU 424 - A-3 LANDFILL TTR ASSESSMENT (CADD SUPPORT)	WBS: 104010213030101
TAP: CONTAMINATED WASTE SITES	LOCATION: TTR

TYPE OF ESTIMATE ORDER OF MAGNITUDE ☒ PLANNING/STUDY CONCEPTUAL/BUDGET TITLE I / PRELIMINARY	PRELIMINARY TITLE II WORK ORDER COMPARATIVE OTHER	TYPE OF WORK RI / FS ☒ REMEDIATION ☒ CONSTRUCTION OTHER
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BN REMEDIATION PROJECT ESTIMATOR: Bruce Wilcox 702-295-4629 TASK MGR: Dave Madsen 702-295-7211 PROGRAM MGR: Dave Cowser 702-295-1632	WORK TO BE PERFORMED BY ☒ DOE PRIME CONTRACTOR NTS GENERAL NTS MAINTENANCE	NATIONAL LAB SUBCONTRACT OTHER
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STATEMENT OF WORK:

This estimate has been prepared at the request of DOE/NV to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 424, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 424 is specifically described as the Area 3 Landfills located at the Tonopah Test Range (TTR). The project consists of eight landfills which will require one of the following closure options; No Further Action: Administrative Controls, Cover Repair, and Maintenance: Partial Excavation, Backfill, and Recontouring. This estimate will be used to identify the most cost effective option for each site while being protective of human health and the environment. Total Estimated Costs are intended for comparative analysis of remedial field work only. Estimates do not include costs for Project Management, project support, report preparation, or other overhead functions.

SCOPE - A3-4:

- NO FURTHER ACTION: No field activities will be required for this alternative.
- ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:
 - a. Land marks will be installed at/near the edges of the landfill cells.
 - b. Survey and engineering support will be required for as-built drawing preparation. Site inspection is not anticipated for engineering techs.
 - c. Minor fill activities will be conducted in the surface depressions (approx. 160 cy).
- PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:

No COCs' above action levels have been detected in the samples from the trenches at this site. Therefore, this option is not an alternative closure method for this site.

See following page/s for continuation and cost summary

Review / Concurrence:

12/16/1997
Estimator Date

12/16/97
Checked By Date

EST: 424-A3-4.XLS

BN ENVIRONMENTAL RESTORATION

COST ESTIMATE SUMMARY

DATE: 12/16/97

BASIS OF ESTIMATE - A3-4:

- Three landfill cells are present at the site. Two of the three cells contain debris.
- Analytical results indicate no COCs above action levels were detected.

GENERAL ASSUMPTIONS:

- Estimated costs are for comparative analysis only. Assume costs for activities other than field work (Project Management, project support, report preparation, etc.) will be similar for each remedial alternative and are not included in this estimate.
- Costs are the result of a BN review of summarized characterization data only (from the 1997 characterization activities).
- Site inspections were not conducted as part of this estimate, therefore some costs may not be included based upon site specific conditions/characteristics (utilities, adjacent structures/facilities, etc.).
- Equipment and personnel are to be moved/demoved to the TTR from the Nevada Test Site. One move/demove activity is estimated for the CAU closure (8 sites). The move/demove cost has been divided between each CAS and remedial alternative requiring equipment and labor support in the field depending on size and complexity of the site.
- Lodging and meals are available for personnel at the TTR USAF facilities.
- TPH impacted materials will be transported to and disposed at the NTS Area 6 Hydrocarbon Landfill.
- Hazardous waste will be transported to and disposed of at a licensed and approved TSDF.
- No radioactive waste or unexploded ordnance is present at the sites. No RCT support will be required.
- Non-hazardous and sanitary excavated wastes will be disposed at the Nye County Landfill located near Tonopah.
- Construction water can be obtained from a well within 7 miles of the site.
- Any soil used for site grading, backfill, or cap construction activities can be obtained from a borrow pit approximately 1 mile from the site.
- All landfill cells currently have a minimum soil cover of 1.5 feet. Cover soils will be segregated, set aside, and reused for final cover on sites requiring excavation.

CONTINGENCY:

Contingency costs are not included in this estimate. All costs are in FY98 dollars.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE - A3-4:

• NO FURTHER ACTION:	0
• ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:	\$ 17,250
• PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:	0

EST: 424-A3-5.XLS	BN ENVIRONMENTAL RESTORATION COST ESTIMATE SUMMARY	DATE: 12/16/97
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TO: DAVE MADSEN - Environmental Restoration Task Manager

FROM: BRUCE WILCOX - ER Project Controls

SITE: TTR LANDFILL A3-5	TEC: (see totals below)
WORK PKGE: CAU 424 - A-3 LANDFILL TTR ASSESSMENT (CADD SUPPORT)	WBS: 104010213030101
TAP: CONTAMINATED WASTE SITES	LOCATION: TTR

TYPE OF ESTIMATE	TYPE OF WORK
☐ ORDER OF MAGNITUDE ☒ PLANNING/STUDY ☐ CONCEPTUAL/BUDGET ☐ TITLE I / PRELIMINARY	☐ RI / FS ☒ REMEDIATION ☒ CONSTRUCTION ☐ OTHER

BN REMEDIATION PROJECT	WORK TO BE PERFORMED BY
ESTIMATOR: Bruce Wilcox 702-295-4629 TASK MGR: Dave Madsen 702-295-7211 PROGRAM MGR: Dave Cowser 702-295-1632	☒ DOE PRIME CONTRACTOR ☐ NTS GENERAL ☐ NTS MAINTENANCE ☐ NATIONAL LAB ☐ SUBCONTRACT ☐ OTHER

STATEMENT OF WORK:

This estimate has been prepared at the request of DOE/NV to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 424, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 424 is specifically described as the Area 3 Landfills located at the Tonopah Test Range (TTR). The project consists of eight landfills which will require one of the following closure options: No Further Action; Administrative Controls, Cover Repair, and Maintenance; Partial Excavation, Backfill, and Recontouring. This estimate will be used to identify the most cost effective option for each site while being protective of human health and the environment. Total Estimated Costs are intended for comparative analysis of remedial field work only. Estimates do not include costs for Project Management, project support, report preparation, or other overhead functions.

SCOPE - A3-5:

- NO FURTHER ACTION: No field activities will be required for this alternative.
- ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:
 - a. Land marks will be installed at/near the edges of the landfill cells.
 - b. Survey and engineering support will be required for as-built drawing preparation. Site inspection is not anticipated for engineering techs.
 - c. Minor fill activities will be conducted in the surface depressions (approx. 60 cy).
- PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:
 No COCs' above action levels have been detected in the samples from the trenches at this site. Therefore, this option is not an alternative closure method for this site.

See following page/s for continuation and cost summary

Review / Concurrence:			
Estimator		Date	12/16/1997
Checked By		Date	12/16/97

EST: 424-A3-5.XLS

BN ENVIRONMENTAL RESTORATION

COST ESTIMATE SUMMARY

DATE: 12/16/97

BASIS OF ESTIMATE - A3-5:

- One landfill cell is present at the site. The cell contain debris.

GENERAL ASSUMPTIONS:

- Estimated costs are for comparative analysis only. Assume costs for activities other than field work (Project Management, project support, report preparation, etc.) will be similar for each remedial alternative and are not included in this estimate.
- Costs are the result of a BN review of summarized characterization data only (from the 1997 characterization activities).
- Site inspections were not conducted as part of this estimate, therefore some costs may not be included based upon site specific conditions/characteristics (utilities, adjacent structures/facilities, etc.).
- Equipment and personnel are to be mobed/demobed to the TTR from the Nevada Test Site. One mobe/demobe activity is estimated for the CAU closure (8 sites). The mobe/demobe cost has been divided between each CAS and remedial alternative requiring equipment and labor support in the field depending on size and complexity of the site.
- Lodging and meals are available for personnel at the TTR USAF facilities.
- TPH impacted materials will be transported to and disposed at the NTS Area 6 Hydrocarbon Landfill.
- Hazardous waste will be transported to and disposed of at a licensed and approved TSDF.
- No radioactive waste or unexploded ordnance is present at the sites. No RCT support will be required.
- Non-hazardous and sanitary excavated wastes will be disposed at the Nye County Landfill located near Tonopah.
- Construction water can be obtained from a well within 7 miles of the site.
- Any soil used for site grading, backfill, or cap construction activities can be obtained from a borrow pit approximately 1 mile from the site.
- All landfill cells currently have a minimum soil cover of 1.5 feet. Cover soils will be segregated, set aside, and reused for final cover on sites requiring excavation.

CONTINGENCY:

Contingency costs are not included in this estimate. All costs are in FY98 dollars.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE - A3-5:

• NO FURTHER ACTION:	0
• ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:	\$ 15,250
• PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:	0

EST: 424-A3-6.XLS	BN ENVIRONMENTAL RESTORATION COST ESTIMATE SUMMARY	DATE: 12/16/97
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TO: DAVE MADSEN - Environmental Restoration Task Manager FROM: BRUCE WILCOX - ER Project Controls

SITE: TTR LANDFILL A3-6	TEC: (see totals below)
WORK PKGE: CAU 424 - A-3 LANDFILL TTR ASSESSMENT (CADD SUPPORT)	WBS: 104010213030101
TAP: CONTAMINATED WASTE SITES	LOCATION: TTR

TYPE OF ESTIMATE	TYPE OF WORK
☐ ORDER OF MAGNITUDE ☒ PLANNING/STUDY ☐ CONCEPTUAL/BUDGET ☐ TITLE I / PRELIMINARY	☐ RI / FS ☒ REMEDIATION ☒ CONSTRUCTION ☐ OTHER

BN REMEDIATION PROJECT	WORK TO BE PERFORMED BY
ESTIMATOR: Bruce Wilcox 702-295-4629 TASK MGR: Dave Madsen 702-295-7211 PROGRAM MGR: Dave Cowser 702-295-1632	☒ DOE PRIME CONTRACTOR ☐ NTS GENERAL ☐ NTS MAINTENANCE ☐ NATIONAL LAB ☐ SUBCONTRACT ☐ OTHER

STATEMENT OF WORK:

This estimate has been prepared at the request of DOE/NV to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 424, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 424 is specifically described as the Area 3 Landfills located at the Tonopah Test Range (TTR). The project consists of eight landfills which will require one of the following closure options: No Further Action: Administrative Controls, Cover Repair, and Maintenance: Partial Excavation, Backfill, and Recontouring. This estimate will be used to identify the most cost effective option for each site while being protective of human health and the environment. Total Estimated Costs are intended for comparative analysis of remedial field work only. Estimates do not include costs for Project Management, project support, report preparation, or other overhead functions.

SCOPE - A3-6:

- NO FURTHER ACTION: No field activities will be required for this alternative.
- ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:
 - a. Land marks will be installed at/near the edges of the landfill cells.
 - b. Survey and engineering support will be required for as-built drawing preparation. Site inspection is not anticipated for engineering techs.
 - c. Minor fill activities will be conducted in the surface depressions (approx. 60 cy).
- PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:
 No COCs' above action levels have been detected in the samples from the trenches at this site. Therefore, this option is not an alternative this site.

See following page/s for continuation and cost summary

Review / Concurrence:

 Estimator 12/16/1997 Date

 Checked By 12/16/97 Date

BN ENVIRONMENTAL RESTORATION

EST: 424-A3-6.XLS

COST ESTIMATE SUMMARY

DATE: 12/16/97

BASIS OF ESTIMATE - A3-6:

- Two landfill cell are present at the site. Both cells contain debris.
- Analytical results indicate no COCs above action levels were detected.

GENERAL ASSUMPTIONS:

- Estimated costs are for comparative analysis only. Assume costs for activities other than field work (Project Management, project support, report preparation, etc.) will be similar for each remedial alternative and are not included in this estimate.
- Costs are the result of a BN review of summarized characterization data only (from the 1997 characterization activities).
- Site inspections were not conducted as part of this estimate, therefore some costs may not be included based upon site specific conditions/characteristics (utilities, adjacent structures/facilities, etc.).
- Equipment and personnel are to be mobed/demobed to the TTR from the Nevada Test Site. One move/demove activity is estimated for the CAU closure (8 sites). The move/demove cost has been divided between each CAS and remedial alternative requiring equipment and labor support in the field depending on size and complexity of the site.
- Lodging and meals are available for personnel at the TTR USAF facilities.
- TPH impacted materials will be transported to and disposed at the NTS Area 6 Hydrocarbon Landfill.
- Hazardous waste will be transported to and disposed of at a licensed and approved TSDF.
- No radioactive waste or unexploded ordnance is present at the sites. No RCT support will be required.
- Non-hazardous and sanitary excavated wastes will be disposed at the Nye County Landfill located near Tonopah.
- Construction water can be obtained from a well within 7 miles of the site.
- Any soil used for site grading, backfill, or cap construction activities can be obtained from a borrow pit approximately 1 mile from the site.
- All landfill cells currently have a minimum soil cover of 1.5 feet. Cover soils will be segregated, set aside, and reused for final cover on sites requiring excavation.

CONTINGENCY:

Contingency costs are not included in this estimate. All costs are in FY98 dollars.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE - A3-6:

• NO FURTHER ACTION:	0
• ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:	\$ 15,250
• PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:	0

EST: 424-A3-8.XLS	BN ENVIRONMENTAL RESTORATION COST ESTIMATE SUMMARY	DATE: 12/16/97
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TO: DAVE MADSEN - Environmental Restoration Task Manager	FROM: BRUCE WILCOX - ER Project Controls
--	--

SITE: TTR LANDFILL A3-8	TEC: (see totals below)
WORK PKGE: CAU 424 - A-3 LANDFILL TTR ASSESSMENT (CADD SUPPORT)	WBS: 104010213030101
TAP: CONTAMINATED WASTE SITES	LOCATION: TTR

TYPE OF ESTIMATE	TYPE OF WORK
☐ ORDER OF MAGNITUDE ☒ PLANNING/STUDY ☐ CONCEPTUAL/BUDGET ☐ TITLE I / PRELIMINARY	☐ RI / FS ☒ REMEDIATION ☒ CONSTRUCTION ☐ OTHER
☐ PRELIMINARY TITLE II ☐ WORK ORDER ☐ COMPARATIVE ☐ OTHER	

BN REMEDIATION PROJECT	WORK TO BE PERFORMED BY
ESTIMATOR: Bruce Wilcox 702-295-4629	☒ DOE PRIME CONTRACTOR ☐ NATIONAL LAB
TASK MGR: Dave Madsen 702-295-7211	☐ NTS GENERAL ☐ SUBCONTRACT
PROGRAM MGR: Dave Cowser 702-295-1632	☐ NTS MAINTENANCE ☐ OTHER

STATEMENT OF WORK:

This estimate has been prepared at the request of DOE/NV to provide remedial alternative costs for the closure of Corrective Action Unit (CAU) 424, an environmental restoration site listed in the Federal Facilities and Consent Order (FFACO). CAU 424 is specifically described as the Area 3 Landfills located at the Tonopah Test Range (TTR). The project consists of eight landfills which will require one of the following closure options: No Further Action; Administrative Controls, Cover Repair, and Maintenance; Partial Excavation, Backfill, and Recontouring. This estimate will be used to identify the most cost effective option for each site while being protective of human health and the environment. Total Estimated Costs are intended for comparative analysis of remedial field work only. Estimates do not include costs for Project Management, project support, report preparation, or other overhead functions.

SCOPE - A3-8:

- NO FURTHER ACTION: No field activities will be required for this alternative.
- ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:
 - a. Land marks will be installed at/near the edges of the landfill cells.
 - b. Survey and engineering support will be required for as-built drawing preparation. Site inspection is not anticipated for engineering techs.
 - c. Minor fill activities will be conducted in the surface depressions (approx. 200 cy).
- PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:
No COCs' above action levels have been detected in the samples from the trenches at this site. Therefore, this option is not an alternative closure method for this site.

See following page/s for continuation and cost summary

Review / Concurrence:

Estimator

12/16/1997
Date

Checked By

12/16/97
Date

EST: 424-A3-8.XLS

BN ENVIRONMENTAL RESTORATION

COST ESTIMATE SUMMARY

DATE: 12/16/97

BASIS OF ESTIMATE - A3-8:

- Four landfill cells are present at the site. Two of the cells contain debris.
- Analytical results indicate no COCs above action levels were detected.

GENERAL ASSUMPTIONS:

- Estimated costs are for comparative analysis only. Assume costs for activities other than field work (Project Management, project support, report preparation, etc.) will be similar for each remedial alternative and are not included in this estimate.
- Costs are the result of a BN review of summarized characterization data only (from the 1997 characterization activities).
- Site inspections were not conducted as part of this estimate, therefore some costs may not be included based upon site specific conditions/characteristics (utilities, adjacent structures/facilities, etc.).
- Equipment and personnel are to be mobed/demobed to the TTR from the Nevada Test Site. One mobe/demobe activity is estimated for the CAU closure (8 sites). The mobe/demobe cost has been divided between each CAS and remedial alternative requiring equipment and labor support in the field depending on size and complexity of the site.
- Lodging and meals are available for personnel at the TTR USAF facilities.
- TPH impacted materials will be transported to and disposed at the NTS Area 6 Hydrocarbon Landfill.
- Hazardous waste will be transported to and disposed of at a licensed and approved TSDF.
- No radioactive waste or unexploded ordnance is present at the sites. No RCT support will be required.
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- Construction water can be obtained from a well within 7 miles of the site.
- Any soil used for site grading, backfill, or cap construction activities can be obtained from a borrow pit approximately 1 mile from the site.
- All landfill cells currently have a minimum soil cover of 1.5 feet. Cover soils will be segregated, set aside, and reused for final cover on sites requiring excavation.

CONTINGENCY:

Contingency costs are not included in this estimate. All costs are in FY98 dollars.

COST SUMMARY - TOTAL ESTIMATED COST PER REMEDIAL ALTERNATIVE - A3-8:

• NO FURTHER ACTION:	0
• ADMINISTRATIVE CONTROLS, COVER REPAIR, and MAINTENANCE:	\$ 17,250
• PARTIAL EXCAVATION, BACKFILL, and RECONTOURING:	0

Appendix C

Nevada Environmental Restoration Project Document Review Sheet

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

1. Document Title/Number <u>Corrective Action Decision Document for the Area 3 Landfill Complex, TTR, Nevada, CAU 424</u>			2. Document Date <u>December 1997</u>	
3. Revision Number <u>Draft Rev. 0</u>			4. Originator/Organization <u>IT Corporation</u>	
5. Responsible DOE/NV ERP Subproject Mgr. <u>J. Appenzeller-Wing</u>			6. Date Comments Due	
7. Review Criteria				
8. Reviewer/Organization/Phone No. <u>NDEP</u>			9. Reviewer's Signature	
10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
1. Page 28		For the A3-1 Landfill, "TPH were detected in a few samples at levels below 1,000 ppm." An A-K evaluation specific to this landfill needs to be provided to evaluate and justify leaving in place TPH contaminants above 100 ppm as required in NAC 445A.227.	The (a) - (k) analysis for this site is presented in Appendix A, Section A.1.3.	
2. General		Various places in the document discuss cover repair and compaction of the cells in the landfill. The Corrective Action Decision Document (CADD) needs to state what the level of density of the compacted material will be and the permeability requirements proposed for capping.	<p>To allow flexibility in design, the actual specifications will be presented in the Corrective Action Plan to be developed after the CADD is approved. The text will, however, be modified as follows to indicate the relative level of compaction for the capping:</p> <p>Page 17, second paragraph - add the following text after the second sentence: "Native or native-like materials will be used for backfilling. They will be compacted to approximate native soil conditions."</p> <p>Page 18, fourth paragraph, 1st sentence - modify as follows: "...voids left by excavation, then compacted as stated in Section 3.3.2 and graded..."</p>	

^aComment Types: M = Mandatory, S = Suggested.
Return Document Review Sheets to DOE/NV Environmental Restoration Division, Attn: QAC, M/S 505.

Plate

Area 10

Nellis
Air Force
Range

TTR EH-1 WW
1,510.6'
TTR EH-1
1,571.2'

Area 3 Compound

LEGEND

- Borehole location based on handheld global positioning unit (accuracy to within 3 to 10 m)
- Interpreted landfill cell
- Interpreted geophysical anomaly - no debris encountered or not investigated
- Original geophysical grid
- Paved road
- Dirt road
- Fence
- Well
- Contingency borehole location - not drilled
- Surface mound
- Surface depression

005	12/23/97	SITE LAYOUT	SHYFACE	BS/CR			
REV. #	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY	
PROJECT MANAGER: K. BEACH			DRAWN BY: L.SHYFACE				
PLATE A-1 AREA 3 LANDFILL COMPLEX AND BOREHOLE LOCATIONS, TONOPAH TEST RANGE							
LAYER(S)		DATE INITIATED		DRAWING NUMBER			
		02-20-97		4703002			

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