TA-21

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Date: March 26, 2003
Refer to: RRES-WQH: 03-068

RECEIVED
MAR 2003
NMED Hazardous Waste Bureau

Mr. Mark V. Coffman
Environmental Scientist
New Mexico Environment Department
DOE Oversight Bureau, MS J993
Los Alamos, New Mexico 87544

SUBJECT: TA-21-57 ABOVEGROUND STORAGE TANK DIESEL RELEASE, TIER 1 EVALUATION

Dear Mr. Coffman:

On February 21, 2002, the Laboratory notified the U.S. Environmental Protection Agency (EPA), the New Mexico Environmental Department (NMED), and the National Response Center (NRC) of a potential release of approximately 48,000 gallons of diesel fuel from an above-ground storage tank (AST) at Technical Area (TA) -21-57 into the environment. Seven-day and fifteen-day notifications were provided to NMED pursuant to Section 1203 of the New Mexico Water Quality Control Commission (NMWQCC) Regulations on February 27, 2002, and March 7, 2002, respectively.

On April 19, 2002, the Statement of Work (SOW) for remediation of the diesel release was submitted to the NMED Hazardous Waste Bureau. The SOW included using Underground Storage Tank Regulations, as guidance, for potential remedial actions per NMED's recommendation. Soil removal and sampling were performed in accordance with Laboratory and regulatory requirements to determine the presence and extent of the leak from the underground fuel-oil supply and return lines from the AST. The results of this assessment were included in a report entitled "*TA-21-57 Aboveground Storage Tank Diesel Fuel Oil Environmental Assessment Characterization*" which was submitted to your office on September 19, 2002.

As a follow up to this initial assessment, the Laboratory has prepared the enclosed report entitled *"Tier 1 Evaluation, TA-21-57 Aboveground Storage Tank Diesel Fuel Oil Release"* (Enclosure 1). This report was completed in accordance with NMED Regulations (20 NMAC 5) and guidelines for subsurface diesel releases.

For the drinking water pathway, the maximum concentrations of contaminants of concern were below Tier 1 soil Risk Based Screening Levels (RBSLs) protective of groundwater. Using the Tier 1 RBSL lookup tables, contaminants within the contaminated zone are not likely to reach groundwater within 40 years. As an exercise, the Tier 1 comparison was repeated using a DAF_{unsat} of 1, which conservatively assumes that the contamination has already made contact with groundwater. Under this worst-case assumption, the soil contaminant concentrations also were below the Tier 1 RBSLs.

For onsite commercial workers, observed soil concentrations were below the Tier 1 soils RBSLs protective of indoor air, with the exception of benzene. As a result of this, indoor air sampling was conducted for BTEX within the Steam Plant. Subsequent indoor and outdoor air sample results showed non-detectable concentrations of contaminants of concern for benzene, toluene, ethylbenzene, and xylene.

For the onsite construction worker, the detected soil concentrations were below the Tier 1 RBSLs for all analyzed compounds.

Based on the findings of this report, the site of the TA-21-57 diesel release was found to meet Tier 1 Risk Based Screening Levels (RBSLs) requirements.

We would appreciate the opportunity to meet with you and other NMED representatives to discuss this report at your convenience. Please contact me at 665-6085 if you have any questions or need additional information for your review.

Sincerely,

Mike Saladen
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MS/yg

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TIER 1 EVALUATION
TA-21-57
ABOVEGROUND STORAGE TANK
DIESEL FUEL OIL RELEASE

February 2003

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ACRONYMS

AST	aboveground storage tank
BGL	below ground level
BTEX	benzene, toluene, ethylbenzene, and xylenes
DAF	Dilution attenuation factor
DOE	U.S. Department of Energy
DRO	diesel-range organics
EPA	U.S. Environmental Protection Agency
FWO-SWO	Facility Waste Operations–Solid Waste Operations
JCNNM	Johnson Controls Northern New Mexico
LANL	Los Alamos National Laboratory
NMED	New Mexico Environment Department
PAH	polynuclear aromatic hydrocarbon
RBCA	risk based corrective action
RBSLs	risk based screening levels
TA	Technical Area
UST	underground storage tank
VOC	volatile organic compound

1.0 INTRODUCTION

1.1 Background

A Risk Based Corrective Action (RBCA) Tier 1 evaluation was conducted for a diesel fuel release involving the above ground storage tank (AST) Technical Area (TA)-21-57 located north of the TA-21 Steam Plant, building TA-21-357 at the Los Alamos National Laboratory (LANL) (Figure 1). This report was prepared in accordance with the New Mexico Environment Department's (NMED) "New Mexico Underground Storage Tank Regulations, 20 NMAC 5, Revised February 2, 2000" and the NMED's "New Mexico Underground Storage Tanks Bureau Guidelines for Correction Action, March 13, 2000" (NMED, 2000).

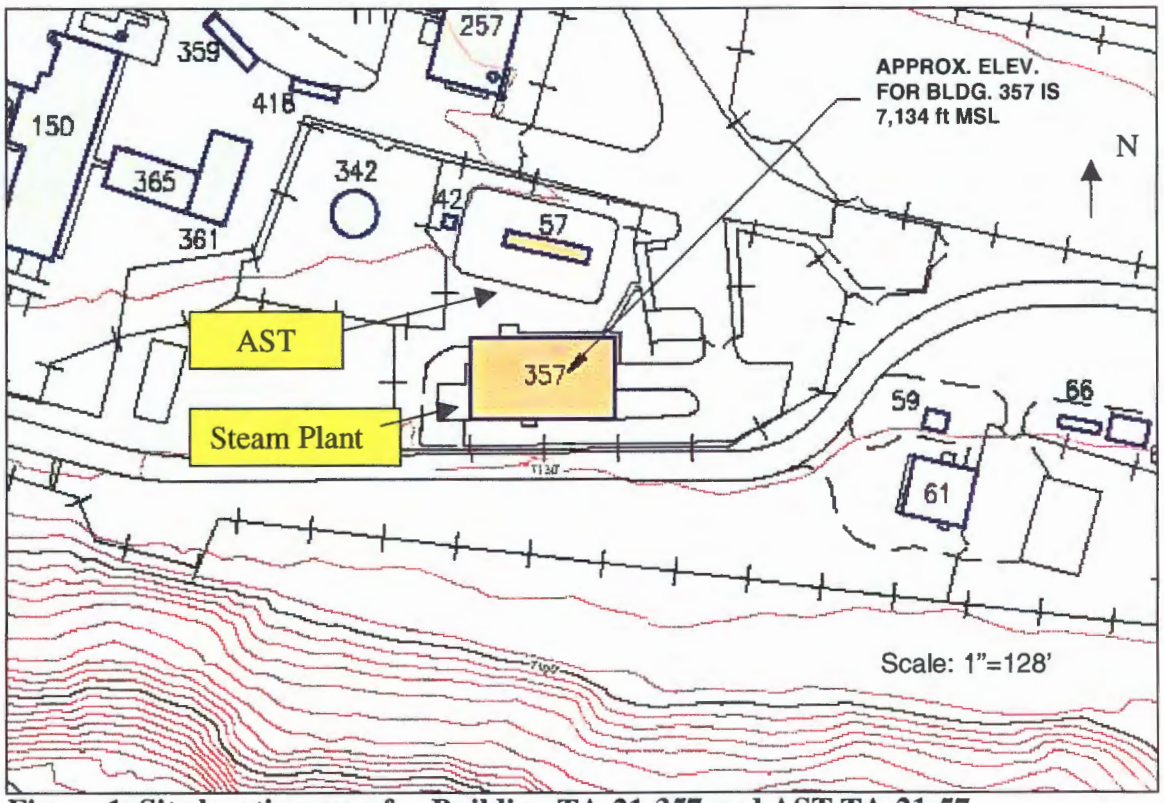

Figure 1. Site location map for Building TA-21-357 and AST TA-21-57

In January 2002, up to 50,000 gallons of No. 2 fuel oil (diesel fuel) were discovered to have been released from the AST adjacent to the Steam Plant. The source of the release was traced to a leaky fuel line running from the AST to the Steam Plant. The AST and associated piping have been out of service since February, 2002.

A preliminary site assessment was conducted (BEC, 2002) that involved the collection of subsurface samples from trenches, geoprobe borings, soil borings and angled borings. Samples were analyzed for diesel range organics (DRO) by EPA method 8015, metals by EPA method 6010, volatile organic compounds (VOCs) by EPA method 8260 and polynuclear aromatic hydrocarbon (PAH) compounds by EPA methods 8270 and 8310. Calculations based on the residual saturation of diesel and the investigation data indicate that the diesel fuel is present in the native Bandelier Tuff within a volume encompassing

approximately 22 ft by 22 ft by 145 ft in depth (BEC, 2002). Rock samples from borings did not show evidence of contaminant saturated soil or tuff, as defined in 20 NMAC 5.1.

According to the preliminary assessment report, depth to groundwater at the site is approximately 1,100 feet below ground level (bgl), and is located chiefly within sediments of the Puye and Tesuque Formations. The aquifer is generally believed to flow easterly toward the Rio Grande. The City of Los Alamos and LANL derives their drinking water from a municipal well field on the east side of the Pajarito Plateau. The nearest production well is Otowi 4 located more than 4,400 ft southeast of the site. Figure 2 depicts Otowi 4 and the TA-21 Steam Plant.

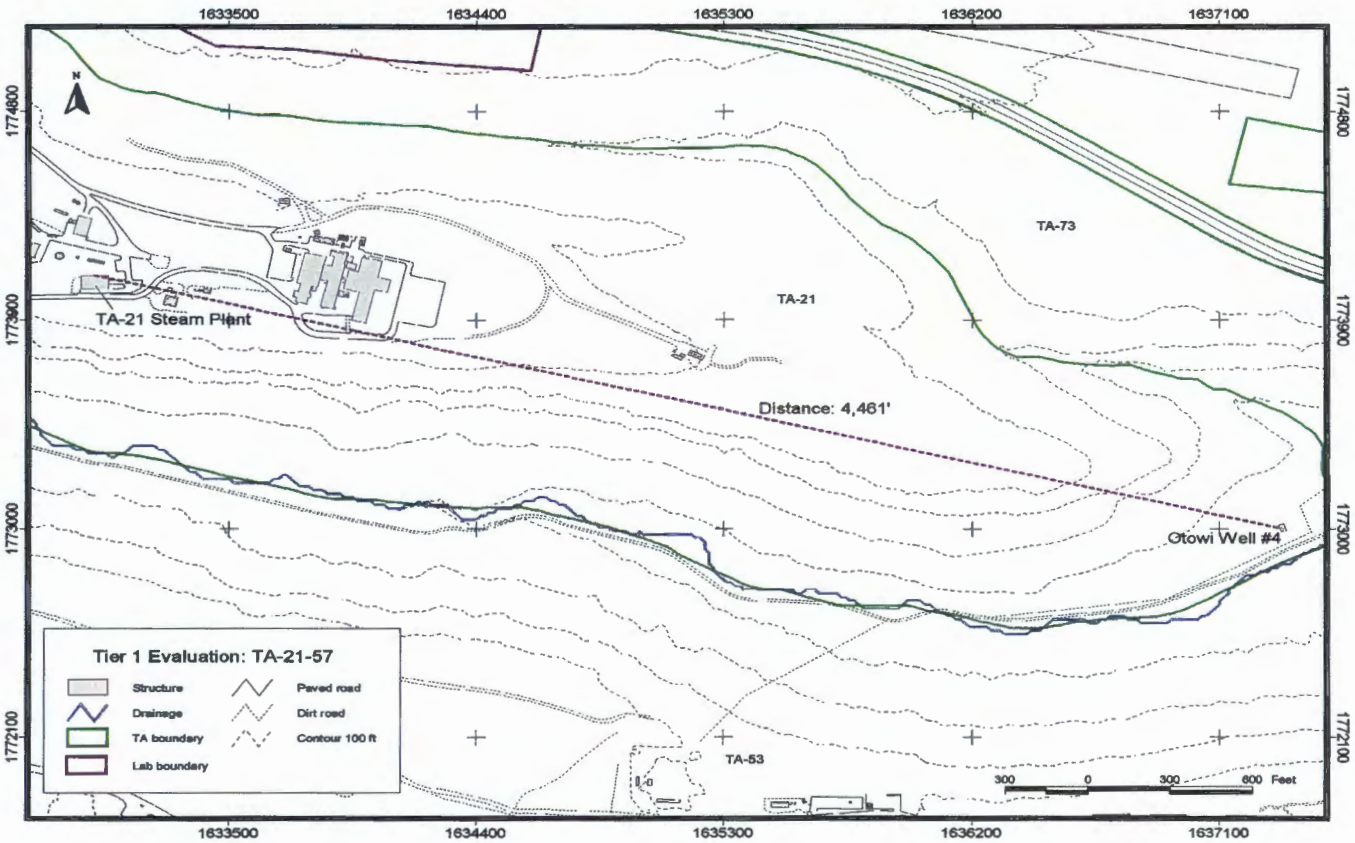

Figure 2. Relationship between TA-21 and nearest water production well, Otowi #4

1.2 Site Regulatory Status

As of June 30, 2002, ASTs are regulated by the NMED's Petroleum Storage Tank Bureau, formerly the Underground Storage Tank Bureau. This Tier 1 evaluation was performed in accordance with applicable regulations and guidance documents.

1.3 Overview of the Tier 1 Process

The NMED has determined that a risk-based decision making program is appropriate for managing subsurface releases of petroleum from storage tanks. A Tier 1 evaluation compares site-specific concentrations of contaminants of concern with risk-based screening levels (RBSLs) promulgated by the NMED (NMED 2000). The Tier 1 process involves the

following steps: development of a site conceptual model including the determination of current and most likely future land use, identification of potential receptors, identification of pathways and routes of exposure, selection of site analytical data, and comparison of site analytical data with Tier 1 RBSLs.

2.0 EXTENT AND NATURE OF RELEASE

2.1 Extent of Subsurface Release

In the preliminary assessment (BEC, 2002), soil analytical DRO results were used to determine the vertical and horizontal extent of the subsurface diesel plume within the tuff. Tuff samples were obtained by digging trenches along the fuel line, advancement of shallow borings completed by Geoprobe, and deeper vertical and angled borings completed using hollow stem auger drilling. A three-dimensional depiction of the DRO analytical results is shown in Figure 3.

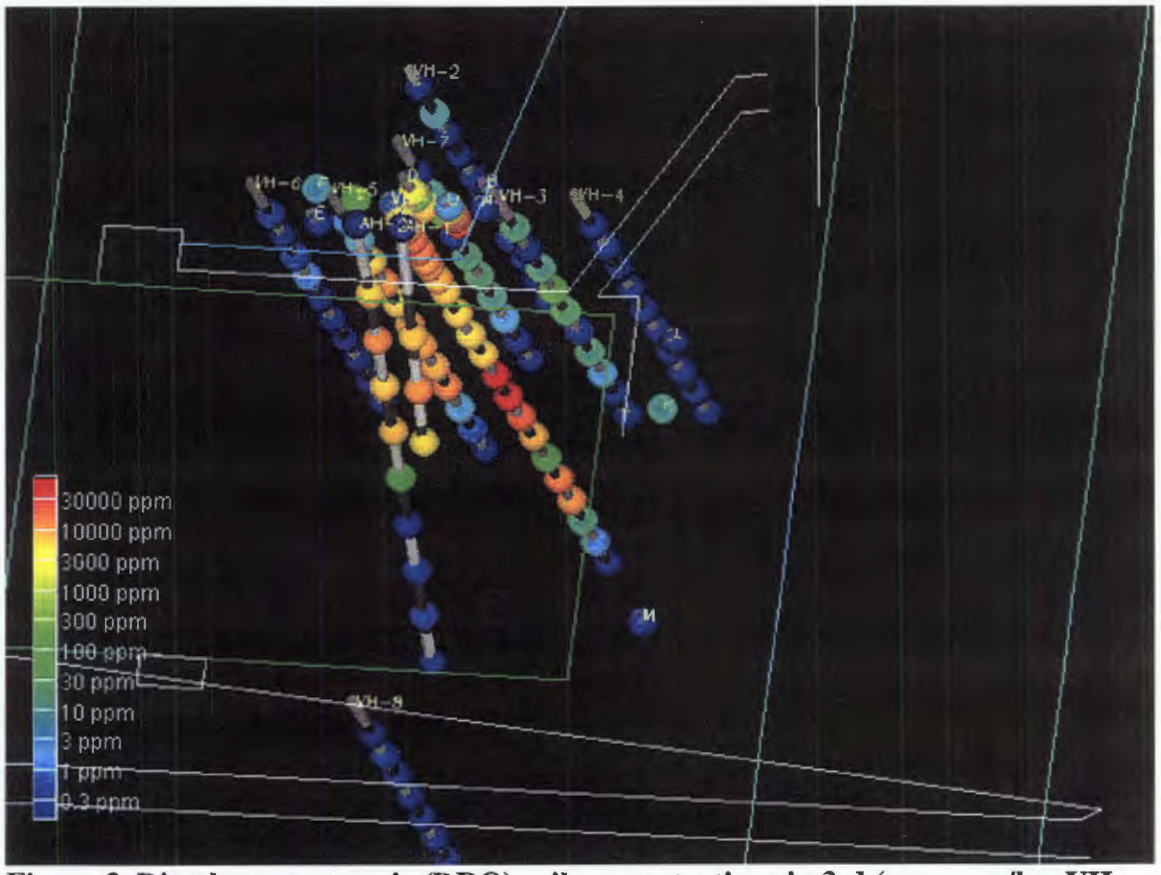

Figure 3. Diesel range organic (DRO) soil concentrations in 3-d (ppm=mg/kg, VH-vertical borings, AH- angled borings)

2.2 Contaminants of Concern

The contaminants of concern at this site consist of VOCs and PAH compounds normally associated with diesel fuel. The VOC compounds include benzene, toluene, ethylbenzene, and xylene (BTEX); the PAH compounds include napthalene and pyrenes. Diesel range organic compounds include the contaminants of concern. Table 1 presents a list of the site

contaminants of concern, their maximum detected concentrations, and the number of soil samples and laboratory analyses. Samples were collected for BTEX analysis more frequently than for PAH analysis in order to support waste management decisions for the soils excavated from the trench surrounding the line connecting the AST and building TA-21-357.

Table 1
Site Contaminants of Concern, Maximum Soil Concentrations or Detection Limit, and Number of Samples for the TA-21 Diesel Release

Benzene	0.311	30
Toluene	5.67	30
Ethyl benzene	7.57	30
Xylenes (total)	24.5	30
Acenaphthene	5.85	13
Anthracene	1.92	13
Benzo(a)anthracene	<1.620	13
Benzo(a)pyrene	<1.620	13
Benzo(b)fluoranthene	<1.620	13
Benzo(k)fluoranthene	<1.620	13
Chrysene	<1.620	13
Dibenzo(a,h)anthracene	<1.620	13
Fluoranthene	0.594J+	13
Fluorene	8.45	13
Naphthalene	25.4	13
Phenanthrene	13.2	13
Pyrene	1.4	13

Notes:
1. <1.620 mg/kg maximum detection limit
2. J+ indicates compound was detected with high bias

2.3 Environmental Fate and Transport

The environmental fate and transport of the contaminants is dependent on their chemical and physical properties and the physical, geochemical, and hydrological properties of the site. The petroleum or petroleum constituent contaminants of concern can be transported to potential receptors via several transport mechanisms. In the unsaturated tuff above groundwater, these mechanisms include petroleum flow under the influence of gravity and subsurface capillary pressure, leaching of water-soluble constituents by infiltrating surface water, and volatilization and molecular diffusion of the volatile constituents. If petroleum or petroleum constituents reach groundwater, water-soluble petroleum constituents may be carried by flowing groundwater to a drinking water well. With the exception of gravity and capillary flow of petroleum, the NMED's Tier 1 process incorporates these transport mechanisms into the NMED transport models used to develop the RBSLs. These transport mechanisms are illustrated in Figure 4.

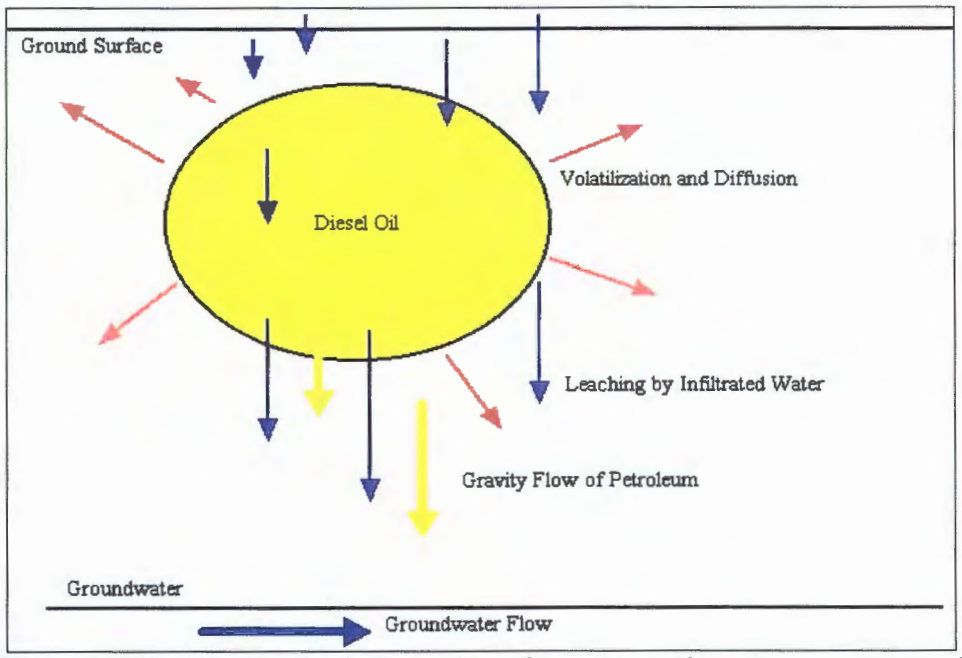

Figure 4. Illustration depicting subsurface contaminant transport mechanisms

Groundwater lies approximately 1,100 feet bgl at the site (BEC, 2002). Transport by gravity of diesel in the tuff falls within the unsaturated flow regime, with petroleum conductivities and migration rates dependent on the degree of saturation. Given the volume of the release, retention capacity of the tuff, and depth to groundwater, a bounding calculation presented by JCNNM in "TA-21-57, Aboveground Storage Tank Diesel Fuel Oil Environmental Assessment and Characterization, LAUR-02-4007, Revision 0, August 2002" indicates that the diesel fuel within the tuff will not likely reach groundwater (BEC, 2002) by the gravity flow transport mechanism. Moreover, the preliminary site assessment did not observe the presence of contaminated saturated soil, as defined by NMED 20 NMAC 5.1.

The leaching transport mechanism involves rainwater infiltration into the subsurface and dissolution or leaching of water-soluble diesel constituents and subsequent transport by gravity of the infiltrated water to groundwater. At this site, the depth to groundwater, small site area, low rainfall, properties of tuff, and high evapotranspiration rate, all diminish the likelihood of this pathway.

The VOC constituents of diesel, primarily BTEX compounds, will volatilize, creating a vapor "plume" of volatile constituents surrounding the diesel fuel. This vapor plume will be transported by vapor-phase molecular diffusion, and may intercept the foundations of occupied buildings, creating a potential human exposure pathway and potential building hazard. Vapor-phase diffusion may also carry these volatile constituents to groundwater, where dissolution into groundwater may occur.

If contaminants of concern reach the groundwater through the unsaturated zone, the groundwater will carry the contaminants in the direction of groundwater flow. Drinking water wells in the area may potentially intercept these contaminants. As discussed above, the closest municipal drinking water well lies approximately 4,400 ft to the east of the site.

In addition to the transport mechanisms cited above, diesel fuel and associated constituents may also attenuate by natural biodegradation in the subsurface, provided subsurface conditions (pH, moisture, nutrients, and microbial population) are favorable.

3.0 SITE CONCEPTUAL EXPOSURE SCENARIO

3.1 Current and Future Site Usage

The area encompassing the site is currently owned by the Department of Energy (DOE) and operated by LANL. It is expected to remain DOE property for the foreseeable future. Current and future usage of the site is industrial. Figure 5 is an aerial photograph of the site and surrounding area and clearly illustrates the industrial development of the site.

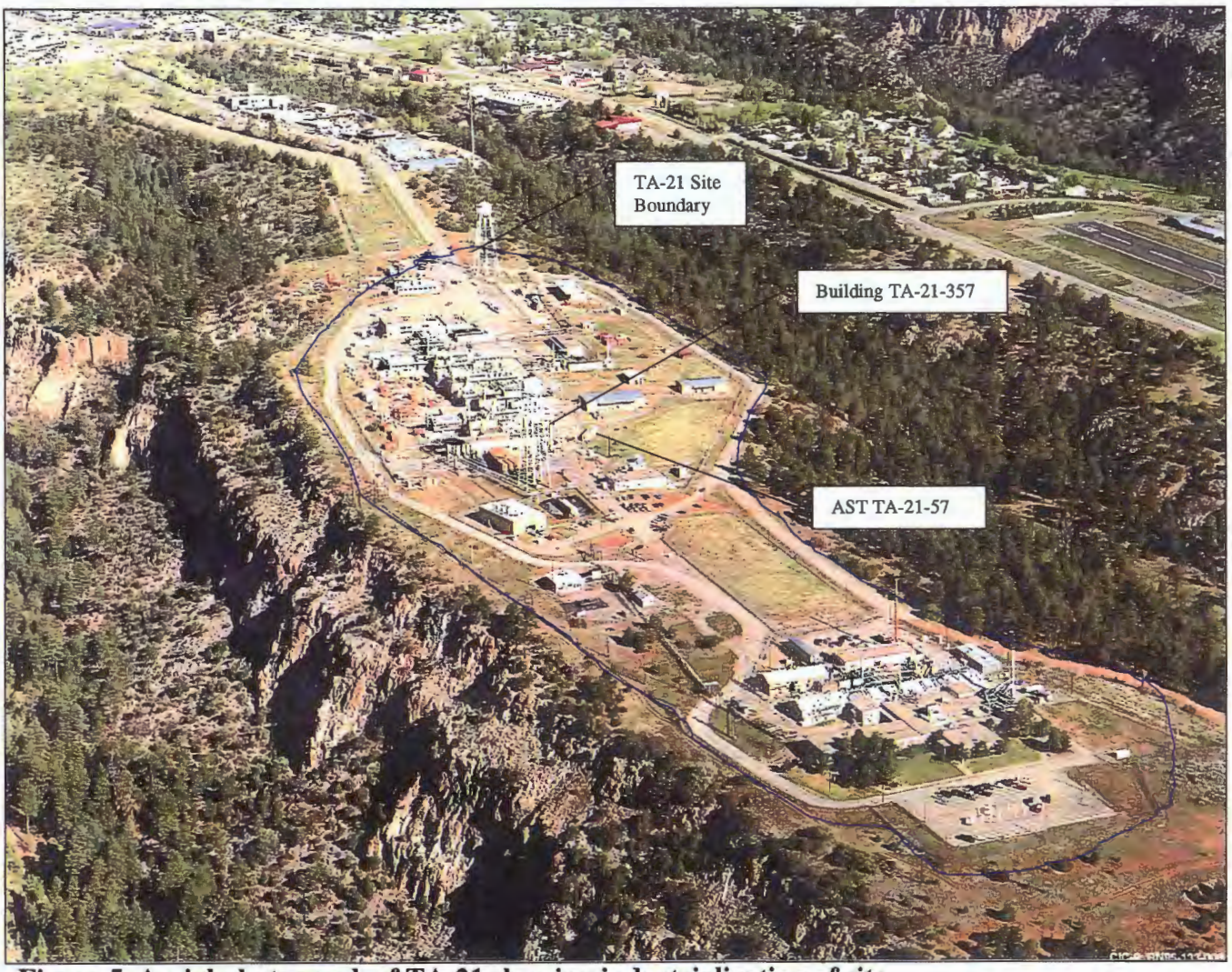

Figure 5. Aerial photograph of TA-21 showing industrialization of site

3.2 Potential Human Receptors and Pathways

The NMED requires identification of all potential human receptor groups, potential pathways, and potential exposure routes. Human receptor groups are classified as commercial worker, construction worker, or residential (either adult or child). At this site,

the commercial worker group represents onsite LANL employees present at the site during a normal 8-9 hour workday. The construction worker group represents onsite construction workers involved in subsurface excavation work, such as the installation of foundations and utilities, potentially exposed to site soil contamination in the course of daily work. The third group, residential receptors, represents offsite home and apartment occupants who could be exposed to a contaminated municipal water supply resulting from the migration of site soil contaminants to the municipal well field. All of these receptor groups are recognized to be potential receptors for the Tier 1 evaluation of this site and are considered further.

Potentially contaminated media at the site include atmospheric air, surficial soils, subsurface soils, and groundwater. For atmospheric air, the potential exposure route at the site is inhalation of VOCs in indoor air by commercial worker occupants of the Steam Plant. For surficial outdoor soils (soils less than 1 foot bgl), the potential exposure routes would consist of dermal contact, ingestion, and inhalation of contaminated soil by commercial workers. Based on field reports, there is no indication of a surface spill and the piping suspected of causing the release was located greater than 1 foot bgl, precluding surficial soil contamination and any potential surficial soil exposure to commercial workers. Therefore, surficial soils are not included as a contaminated medium requiring further consideration for the Tier 1 evaluation of this site.

For subsurface tuff and/or soils (located between 1 and 15 ft bgl), the potential exposure routes consist of indoor inhalation of vapors by commercial workers via vapor migration through a foundation, and dermal contact, soil ingestion, and vapor inhalation by subsurface construction workers who may make contact with site soils within 1 to 15 ft bgl, the so-called construction zone.

For groundwater, the potential exposure route consists of the consumption of contaminated groundwater by users of the municipal water supply. This scenario is unlikely given the nature of site contaminants, the depth to site groundwater, and the distance from the site to the nearest municipal well, but is considered further in the Tier 1 evaluation of this site as a highly conservative exposure scenario. Surface exposure to vapors derived from diesel fuel transported by the regional groundwater system is precluded due to the great distance from the surface of the regional aquifer to the ground surface. Figure 6 presents a graphical summary of the potential pathways and receptors that were evaluated for this site.

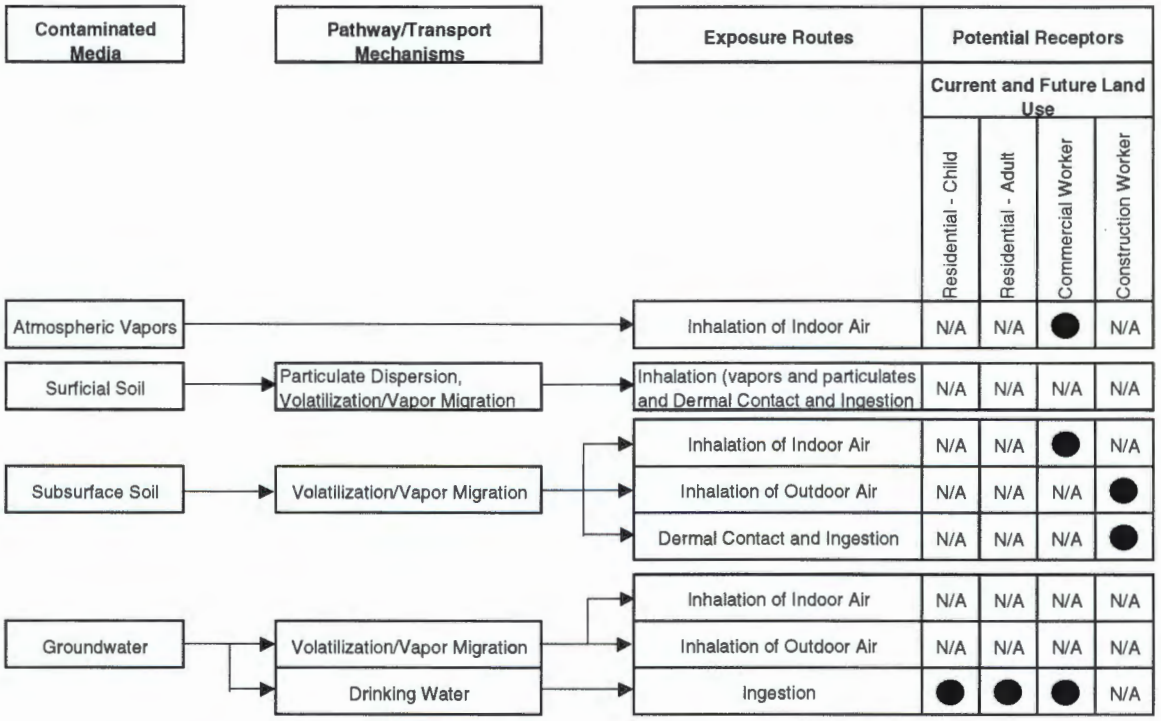

Figure 6. Site conceptual exposure scenarios

3.3 Environmental Receptors

Environmental receptors consist of natural biota, other than humans, that may be adversely affected by the presence of site contaminants of concern. At this site, there is no viable pathway for such exposure because the contaminants are limited to the subsurface, precluding direct contaminant contact by biota. In addition, there are no plants, such as trees, present with deep root systems in contact with contaminated soil. Burrowing animals are also not present at the site.

4.0 TIER 1 EVALUATION

4.1 Selection of Site Analytical Data

Complete site analytical soil data from the preliminary assessment report are presented in tables of Appendix A. These tables show the sample name, depth, analytical method and analytical result. Contaminant concentrations from Appendix A tables were selected for comparison with the Tier 1 RBSLs promulgated by the NMED (NMED, 2000).

4.2 Comparison with Soil RBSLs Protective of Groundwater

The NMED's Tier 1 model for assessing the risks posed by site soil contaminants to groundwater assumes that leaching and petroleum vapor diffusion to groundwater, and groundwater flow are potential contaminant transport mechanisms. Using these transport mechanisms in their screening models, the NMED has developed RBSLs for soil that are protective of groundwater for various site configurations. These configurations incorporate the depth of contamination, thickness of the contaminated zone, depth from the contaminated zone to groundwater, and the distance that contaminated groundwater must be transported to

encounter a potential receptor. The latter two values are used to assign a dilution attenuation factor (DAF), DAF_{unsat} and DAF_{sat}, respectively.

Under the Tier 1 evaluation process, the choices for assignment of the site-specific configurations on which the RBSLs are based are restricted to a prescribed set of values. Generally, the Tier 1 RBSLs are developed using a range of standard, conservative values for these unsaturated zone soil configuration parameters.

Figure 7 shows the actual site values for this configuration and the values assigned as model inputs during the Tier 1 evaluation. As shown by this figure, the actual contaminant thickness and depth to groundwater exceed the assigned values available in a Tier 1 evaluation. Using the NMED's Tier 1 tables, the assigned values correspond to a configuration ID number of 56.

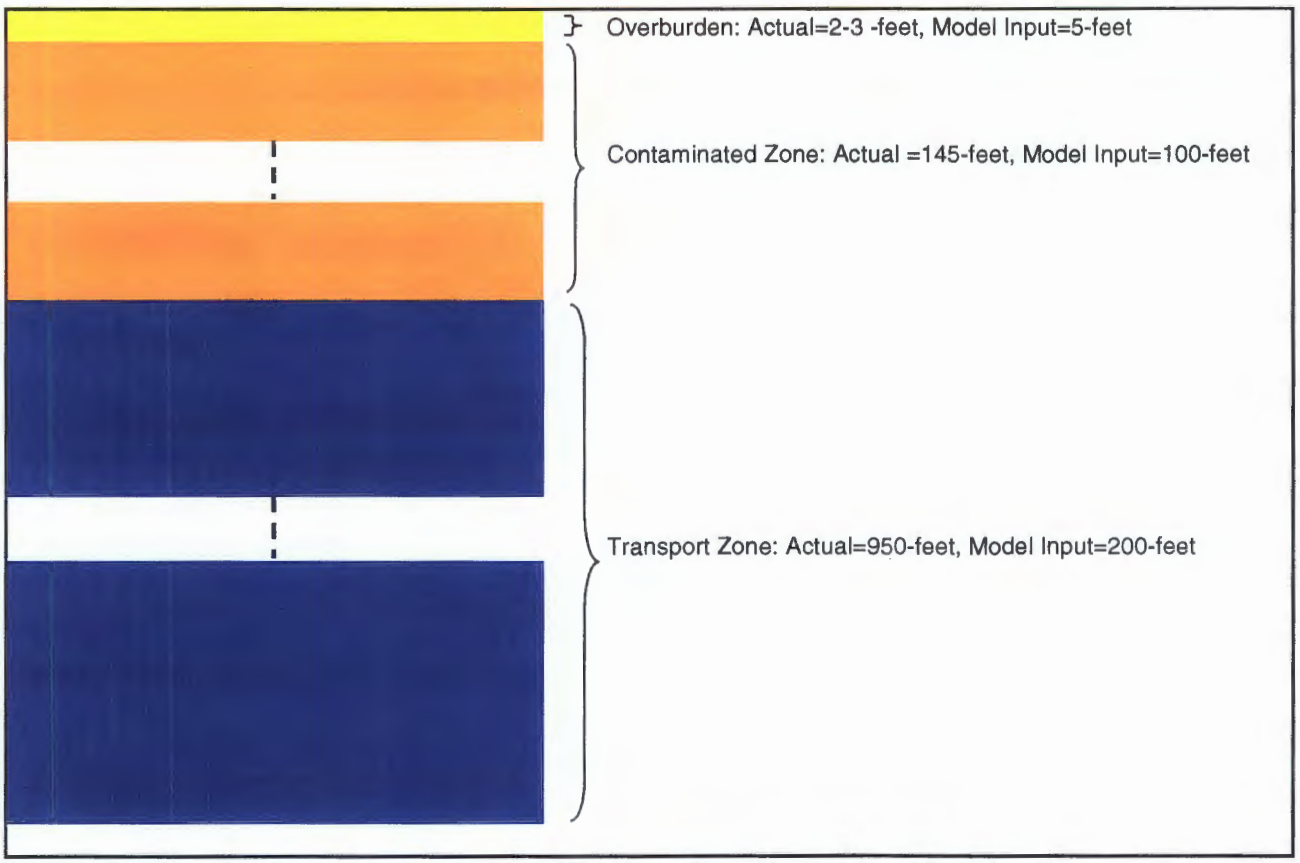

Figure 7: Actual and modeled unsaturated zone soil configurations for Tier 1

In the Tier 1 process, the maximum available value for DAF_{sat} is 163, corresponding to a groundwater transport distance of 1000 feet. The distance from the site to the municipal well field is greater than 4000 feet, so that use of this value for DAF_{sat} is conservative. The value of DAF_{sat} is used as a multiplication factor to increase the RBSL to reflect dilution that will occur over the transport distance.

The maximum detected soil contamination analytical data were selected for comparison with the Tier 1 RBSLs for the groundwater pathway. Table 2 presents the comparison between these data and the Tier 1 RBSLs. Using the NMED Tier 1 lookup tables, the PAH compounds shown in Table 2 are immobile with respect to vapor diffusion and leaching. For BTEX compounds, the NMED Tier 1 lookup tables specify that for the assigned configuration ID number, BTEX contaminants will not reach groundwater within 40 years (NMED 2000).

Table 2
Comparison of Detected Soil Contaminants and Tier 1 RBSLs for the Drinking Water Pathway

Contaminant of Concern	Config. 56 RBSLs, mg/kg	DAF_{sat}	DAF_{sat} Modified RBSLs, mg/kg	Maximum Detected Soil Concentration, mg/kg	Pass/Fail
Organics					
Benzene	-	163	-	0.311	Pass
Toluene	-	163	-	5.67	Pass
Ethyl benzene	-	163	-	7.57	Pass
Xylenes (total)	-	163	-	24.5	Pass
Acenaphthene	Immobile				
Anthracene	Immobile				
Benzo(a)anthracene	Immobile				
Benzo(a)pyrene	Immobile				
Benzo(b)fluoranthene	Immobile				
Benzo(k)fluoranthene	Immobile				
Chrysene	Immobile				
Dibenzo(a,h)anthracene	Immobile				
Fluoranthene	Immobile				
Fluorene	Immobile				
Naphthalene	Immobile				
Phenanthrene	Immobile				
Pyrene	Immobile				

"-" Per the NMED (NMED, 2000), contaminant does not reach groundwater in 40 years
"immobile" Per the NMED (NMED, 2000), target levels were not developed for these contaminants because they are not mobile

Diesel fuel transport by gravity to the groundwater is not expected because of the release volume and the 950-foot depth to groundwater. As a highly conservative evaluation, however, comparison to RBSLs was conducted assuming that DAF_{unsat}=1. As shown by Table 3, the soil concentrations also pass the Tier 1 RBSLs.

Table 3
Comparison to Tier 1 RBSLs Protective of Groundwater Assuming DAF_{unsat} =1

Contaminant of Concern	RBSLs for DAF_{unsat}=1, mg/kg	DAF_{sat}	DAF_{sat} Modified RBSLs, mg/kg	Maximum Detected Soil Concentration, mg/kg	Pass/Fail
Organics					
Benzene	0.02	163	3.26	0.311	Pass
Toluene	2.09	163	340.67	5.67	Pass
Ethyl benzene	17.23	163	2808.49	7.57	Pass
Xylene	2.91	163	474.33	24.5	Pass
Acenaphthene	Immobile				
Anthracene	Immobile				
Benzo(a)anthracene	Immobile				
Benzo(a)pyrene	Immobile				
Benzo(b)fluoranthene	Immobile				
Benzo(k)fluoranthene	Immobile				
Chrysene	Immobile				
Dibenzo(a,h)anthracene	Immobile				
Fluoranthene	Immobile				
Fluorene	Immobile				
Naphthalene	Immobile				
Phenanthrene	Immobile				
Pyrene	Immobile				

"immobile" Per the NMED (NMED, 2000), target levels were not developed for these contaminants because they are not mobile

4.3 Comparison with Other Tier 1 Soil RBSLs

Other potential receptors include commercial workers and site construction workers. The Tier 1 evaluation requires soil data from specific soil depths for comparison against the Tier 1 soil RBSLs for these groups. For example, the comparison against Tier 1 RBSLs for subsurface construction workers requires soil data from the 0 to 15 ft bgl interval. Similarly, for commercial workers potentially exposed to contaminated indoor air, soil samples from 0 to 15 ft bgl beneath the occupied structure foundation (the Steam Plant) are required.

For the commercial worker potentially exposed to contaminated indoor air, Table 4 presents the results of the comparison of both the maximum site-wide soil concentrations and the required 0-15-ft bgl soil concentrations with RBSLs protective of indoor air.

Table 4
Comparison of Tier 1 Soil RBSLs Protective of Commercial Workers with Maximum Detected and Steam Plant 0-15 -ft Soil Concentrations

Contaminant of Concern	Maximum Sitewide Soil Concentration, mg/kg	0-15' BG (Boring AH-1) Soil Concentration, mg/kg	Tier 1 Subsurface Soil RBSLs, mg/kg	Pass/Fail
Organics				
Benzene	0.311	0.311	0.128	Fail
Toluene	5.67	<5.65	20.5	Pass
Ethylbenzene	7.57	6.41	402	Pass
Xylenes (total)	24.5	24.4	28.2	Pass
Acenaphthene	5.85	5.85	28,100	Pass
Anthracene	1.92	<1.620	2,080,000	Pass
Benzo(a)anthracene	<1.620	<1.620	60,000	Pass
Benzo(a)pyrene	<1.620	<1.620	7,330,000	Pass
Benzo(b)fluoranthene	<1.620	<1.620	14,000	Pass
Benzo(k)fluoranthene	<1.620	<1.620	1,870,000	Pass
Chrysene	<1.620	<1.620	484,000	Pass
Dibenzo(a,h)anthracene	<1.620	<1.620	27,200,000	Pass
Fluoranthene	<1.620	<1.620	2,510,000	Pass
Fluorene	8.45	8.45	83,100	Pass
Naphthalene	25.4	11.6	376	Pass
Phenanthrene	13.2	13.2	50,400	Pass
Pyrene	1.4	1.4	4,240,000	Pass

For benzene, the maximum concentration in the 0-15 ft interval was observed in the sample collected from boring AH-1 at a depth of approximately 15 feet below the concrete slab of the Steam Plant. As shown in Table 4, this result exceeds the RBSL for benzene. Based on these results for the Tier 1 evaluation for the commercial worker, Tier 1 indoor air sampling of the TA-21 Steam Plant was also conducted, as discussed below.

Table 5 presents a comparison of the maximum soil contaminant concentrations from the 0 to 15 ft bgl interval to Tier 1 RBSLs for a subsurface construction worker. Within this interval, 24 soil samples were collected and analyzed for BTEX and PAH compounds. The compounds of concern passed the Tier 1 standard.

Table 5
Comparison of Tier 1 Soil RBSLs for Construction Workers with Detected Soil Contaminants

Contaminant of Concern	Construction Zone Maximum Detected Soil Concentration, mg/kg	Tier 1 Construction Zone RBSLs, mg/kg	Pass/Fail
Organics			
Benzene	0.269	167	Pass
Toluene	6.2	6310	Pass
Ethylbenzene	7.57	5980	Pass
Xylenes (total)	32.2	8000	Pass
Acenaphthene	2.72	11,160	Pass
Anthracene	1.92	99,600	Pass
Benzo(a)anthracene	<0.36	419	Pass
Benzo(a)pyrene	<0.36	43	Pass
Benzo(b)fluoranthene	<0.36	410	NA
Benzo(k)fluoranthene	<0.36	427	NA
Chrysene	<0.36	39,900	Pass
Dibenzo(a,h)anthracene	<0.36	43	Pass
Fluoranthene	<0.36	16,000	Pass
Fluorene	4.58	11,000	Pass
Naphthalene	13	3,230	Pass
Phenanthrene	9.37	7,900	Pass
Pyrene	0.712	12,400	Pass

Notes:

1. NA - Not Analyzed
2. The sample count was 24 for the interval 0-15 bgl, outside of the slab

4.4 Comparison with Tier 1 Indoor Air RBSLs

The detected benzene soil concentration within 0 to 15 ft bgl beneath the Steam Plant concrete slab exceeded the Tier 1 RBSL protective of indoor air for commercial workers. If the detected soil concentrations exceed the RBSLs, the Tier 1 process permits the direct sampling of indoor air within the Steam Plant to determine compliance with Tier 1 RBSLs for indoor air. Three air samples were collected indoors and one was collected outdoors by sorption on carbon sample tubes. The results and the comparison with Tier 1 RBSLs are shown in Table 6. Contaminants were not detected above their detection limits, which in turn are less than the RBSLs.

Table 6
Comparison of Tier 1 Indoor Air RBSLs to Contaminant Indoor Air Concentrations

	Benzene	Toluene	Ethylbenzene	Xylene
Tier 1 RBSLs	6.58	749	1980	586
Indoor Sample 1	<4.0	<3.4	<2.9	<2.9
Indoor Sample 2	<4.4	<3.7	<3.2	<3.2
Indoor Sample 3	<4.4	<3.8	<3.3	<3.3
Outdoor Sample 4	<4.4	<3.7	<3.2	<3.2

Note: All results in micrograms/m^3

5.0 CONCLUSION

A Tier 1 analysis was conducted in accordance with NMED regulations (20 NMAC 5) and guidelines for the subsurface diesel release located at LANL TA-21, Building 357. Summary tables of the Tier 1 evaluation are presented in Appendix C. Potential receptors and potentially contaminated media included onsite commercial workers (indoor air), onsite construction workers (subsurface soils), and offsite residents (drinking water). Contaminants of concern at the site included organic compounds normally associated with diesel petroleum, including benzene, toluene, ethylbenzene, xylenes and PAH compounds, such as napthalene.

For the drinking water pathway, the maximum concentrations of contaminants of concern were below Tier 1 soil RBSLs protective of groundwater. Using the Tier 1 RBSL lookup tables, contaminants within the contaminated zone are not likely to reach groundwater within 40 years. As an exercise, the Tier 1 comparison was repeated using a DAF_{unsat} of 1, which conservatively assumes that the contamination has already made contact with groundwater. Under this worst-case assumption, the soil contaminant concentrations also were below the Tier 1 RBSLs.

For onsite commercial workers, observed soil concentrations were below the Tier 1 soils RBSLs protective of indoor air, with the exception of benzene. As a result of this, indoor air sampling was conducted for BTEX within the Steam Plant. Subsequent indoor and outdoor air sample results showed non-detectable concentrations of contaminants of concern for benzene, toluene, ethylbenzene, and xylene.

For the onsite construction worker, the detected soil concentrations were below the Tier 1 RBSLs for all analyzed compounds.

These results indicate the site has met the applicable Tier 1 RBSLs, and no further remedial action is required according to NMED regulations.

6.0 REFERENCES

NMED, "New Mexico Underground Storage Tanks Bureau Guidelines for Correction Action, March 13, 2000", New Mexico Environment Department, March 2000 **(NMED, 2000)**

BEC, "TA-21-57, Aboveground Storage Tank Diesel Fuel Oil Environmental Assessment and Characterization, LAUR-02-4007, Revision 0, August 2002" Benchmark Environmental Corporation **(BEC, 2002)**

APPENDIX A

TABLES OF SOIL ANALYTICAL RESULTS

COCs and Concentrations, mg/kg, Between 0-15 feet BGL **Subsurface Soils, 0-15 Feet**

Sample	Benzene	Ethylbenzene	0-Xylene	p/m-Xylenes	Toluene	Total Xylene	Acenaphthene	Anthracene	Benzo (a) anthreacene	Benzo (a) pyrene	Chrysene	Dibenz(a,h)anthracene	Flouranthene	Flourene	Napthalene	Phenanthrene	Pyrene
TSA-1	ND	0.31	0.24	0.61	ND	0.85	0.31	ND	ND	ND	ND	ND	ND	ND	ND	0.47	0.13
TSA-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TSA-3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TSA-4	ND	0.012	0.012	0.018	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TSA-5	ND	0.012	0.013	0.017	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TSA-6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TSA-7	ND	0.085	0.16	0.25	0.025	0.41	0.7	ND	ND	ND	ND	ND	ND	ND	0.2	ND	0.21
TSA-8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
S/R-01	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-02	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-03	ND	4.6	5.2	11	1.6	16.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-04	ND	0.024	0.018	0.075	0.011	0.093	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-05	ND	6	9.2	23	6.2	32.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-06	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-07	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-08	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-09	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-10	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-11	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-12	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
S/R-13	ND	ND	ND	ND	ND	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
VH-1	0.269	7.57	NA	NA	5.67	24.5	2.72	1.92	ND	ND	ND	ND	ND	4.58	13	9.37	0.712
BSA-1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
BSA-2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum	**0.269**	**7.57**	**9.2**	**23**	**6.2**	**32.2**	**2.72**	**1.92**	**ND**	**ND**	**ND**	**ND**	**ND**	**4.58**	**13**	**9.37**	**0.712**

S/R Boring Soil Analytical Data			
Location	**Depth**	**Analyte**	**Result (mg/Kg)**
S/R-01	4.5-5.0 ft	Benzene	ND
S/R-01	4.5-5.0 ft	Ethylbenzene	ND
S/R-01	4.5-5.0 ft	o-Xylene	ND
S/R-01	4.5-5.0 ft	p/m-Xylenes	ND
S/R-01	4.5-5.0 ft	Tolunene	ND
S/R-01	4.5-5.0 ft	DRO	ND
S/R-02	4.5-5.0 ft	Benzene	ND
S/R-02	4.5-5.0 ft	Ethylbenzene	ND
S/R-02	4.5-5.0 ft	o-Xylene	ND
S/R-02	4.5-5.0 ft	p/m-Xylenes	ND
S/R-02	4.5-5.0 ft	Tolunene	ND
S/R-02	4.5-5.0 ft	DRO	ND
S/R-03	4.5-5.0 ft	Benzene	ND
S/R-03	4.5-5.0 ft	Ethylbenzene	4.6
S/R-03	4.5-5.0 ft	o-Xylene	5.2
S/R-03	4.5-5.0 ft	p/m-Xylenes	11
S/R-03	4.5-5.0 ft	Tolunene	1.6
S/R-03	4.5-5.0 ft	DRO	10000
S/R-04	4.5-5.0 ft	Benzene	ND
S/R-04	4.5-5.0 ft	Ethylbenzene	0.024
S/R-04	4.5-5.0 ft	o-Xylene	0.018
S/R-04	4.5-5.0 ft	p/m-Xylenes	0.075
S/R-04	4.5-5.0 ft	Tolunene	0.011
S/R-04	4.5-5.0 ft	DRO	730
S/R-05	4.5-5.0 ft	Benzene	ND
S/R-05	4.5-5.0 ft	Ethylbenzene	6
S/R-05	4.5-5.0 ft	o-Xylene	9.2
S/R-05	4.5-5.0 ft	p/m-Xylenes	23
S/R-05	4.5-5.0 ft	Tolunene	6.2
S/R-05	4.5-5.0 ft	DRO	25000
S/R-06	4.5-5.0 ft	Benzene	ND
S/R-06	4.5-5.0 ft	Ethylbenzene	ND
S/R-06	4.5-5.0 ft	o-Xylene	ND
S/R-06	4.5-5.0 ft	p/m-Xylenes	ND
S/R-06	4.5-5.0 ft	Tolunene	ND
S/R-06	4.5-5.0 ft	DRO	78
S/R-07	4.5-5.0 ft	Benzene	ND
S/R-07	4.5-5.0 ft	Ethylbenzene	ND
S/R-07	4.5-5.0 ft	o-Xylene	ND
S/R-07	4.5-5.0 ft	p/m-Xylenes	ND
S/R-07	4.5-5.0 ft	Tolunene	ND

S/R-07	4.5-5.0 ft	DRO	210
TVP-1/ Valve Pit	4.5-5.0 ft	Benzene	ND
TVP-1/ Valve Pit	4.5-5.0 ft	Ethylbenzene	ND
TVP-1/ Valve Pit	4.5-5.0 ft	o-Xylene	ND
TVP-1/ Valve Pit	4.5-5.0 ft	p/m-Xylenes	ND
TVP-1/ Valve Pit	4.5-5.0 ft	Tolunene	ND
TVP-1/ Valve Pit	4.5-5.0 ft	DRO	ND
S/R-08	4.5-5.0 ft	Benzene	ND
S/R-08	4.5-5.0 ft	Ethylbenzene	ND
S/R-08	4.5-5.0 ft	o-Xylene	ND
S/R-08	4.5-5.0 ft	p/m-Xylenes	ND
S/R-08	4.5-5.0 ft	Tolunene	ND
S/R-08	4.5-5.0 ft	DRO	250
S/R-9	4.5-5.0 ft	Benzene	ND
S/R-9	4.5-5.0 ft	Ethylbenzene	ND
S/R-9	4.5-5.0 ft	o-Xylene	ND
S/R-9	4.5-5.0 ft	p/m-Xylenes	ND
S/R-9	4.5-5.0 ft	Tolunene	ND
S/R-9	4.5-5.0 ft	DRO	1100
S/R-10	4.5-5.0 ft	Benzene	ND
S/R-10	4.5-5.0 ft	Ethylbenzene	ND
S/R-10	4.5-5.0 ft	o-Xylene	ND
S/R-10	4.5-5.0 ft	p/m-Xylenes	ND
S/R-10	4.5-5.0 ft	Tolunene	ND
S/R-10	4.5-5.0 ft	DRO	29
S/R-11	4.5-5.0 ft	Benzene	ND
S/R-11	4.5-5.0 ft	Ethylbenzene	ND
S/R-11	4.5-5.0 ft	o-Xylene	ND
S/R-11	4.5-5.0 ft	p/m-Xylenes	ND
S/R-11	4.5-5.0 ft	Tolunene	ND
S/R-11	4.5-5.0 ft	DRO	ND
S/R-12	4.5-5.0 ft	Benzene	ND
S/R-12	4.5-5.0 ft	Ethylbenzene	ND
S/R-12	4.5-5.0 ft	o-Xylene	ND
S/R-12	4.5-5.0 ft	p/m-Xylenes	ND
S/R-12	4.5-5.0 ft	Tolunene	ND
S/R-12	4.5-5.0 ft	DRO	ND
S/R-13	4.5-5.0 ft	Benzene	ND
S/R-13	4.5-5.0 ft	Ethylbenzene	ND
S/R-13	4.5-5.0 ft	o-Xylene	ND
S/R-13	4.5-5.0 ft	p/m-Xylenes	ND
S/R-13	4.5-5.0 ft	Tolunene	ND

S/R-13	4.5-5.0 ft	DRO	ND
S/R-15 (S/R-3)	4.5-5.0 ft	Benzene	ND
S/R-15 (S/R-3)	4.5-5.0 ft	Ethylbenzene	20
S/R-15 (S/R-3)	4.5-5.0 ft	o-Xylene	22
S/R-15 (S/R-3)	4.5-5.0 ft	p/m-Xylenes	55
S/R-15 (S/R-3)	4.5-5.0 ft	Tolunene	7.8
S/R-15 (S/R-3)	4.5-5.0 ft	DRO	20000
S/R-16 (S/R-4)	4.5-5.0 ft	Benzene	ND
S/R-16 (S/R-4)	4.5-5.0 ft	Ethylbenzene	0.014
S/R-16 (S/R-4)	4.5-5.0 ft	o-Xylene	0.013
S/R-16 (S/R-4)	4.5-5.0 ft	p/m-Xylenes	0.046
S/R-16 (S/R-4)	4.5-5.0 ft	Tolunene	ND
S/R-16 (S/R-4)	4.5-5.0 ft	DRO	1800

APPENDIX B

INDOOR AIR ANALYTICAL RESULTS

Sample Number	Analyte Name	Mass of Analyte ug	Air Volume of Sample L	Analyte Concentration mg/m^3
1(Indoor)	Benzene	< 1	78.97	< 4.0
1(Indoor)	Toluene	< 1.1	78.97	< 3.4
1(Indoor)	Ethylbenzene	< 1	78.97	< 2.9
1(Indoor)	Xylene	< 1.1	78.97	< 2.9
2(Indoor)	Benzene	< 1	71.96	< 4.4
2(Indoor)	Toluene	< 1.1	71.96	< 3.7
2(Indoor)	Ethylbenzene	< 1	71.96	< 3.2
2(Indoor)	Xylene	< 1.1	71.96	< 3.2
3(Indoor)	Benzene	< 1	70.85	< 4.4
3(Indoor)	Toluene	< 1.1	70.85	< 3.8
3(Indoor)	Ethylbenzene	< 1	70.85	< 3.3
3(Indoor)	Xylene	< 1.1	70.85	< 3.3
4(outdoor)	Benzene	< 1	71.96	< 4.4
4(outdoor)	Toluene	< 1.1	71.96	< 3.7
4(outdoor)	Ethylbenzene	< 1	71.96	< 3.2
4(outdoor)	Xylene	< 1.1	71.96	< 3.2

APPENDIX C

TIER 1 REPORT FORMS

Tier 1 Report Forms

Risk-Based Decision Making For Petroleum Releases At Underground Storage Tank Sites In New Mexico

SITE NAME:	*AST- TA- 21-57 & TA-21-357*
SITE LOCATION:	*Los Alamos, New Mexico*
SITE ID:	*Los Alamos National Laboratory (LANL)*
FACILITY ID:	*TA-21*
SUBMITTAL DATE:	*October 11, 2002*
PREPARED BY:	*Shaw Environmental & Infrastructure, Inc.*
REVIEWED BY:	

TABLE OF CONTENTS *(Page 1 of 3)*

☐ *Check the box against the item, if the item is included.*

TIER 1 REPORT FORMS

Form No.	Description	
1.	Executive summary.	☑
2.	Site conceptual exposure scenario.	☑
3.	Justification for pathways complete and incomplete.	
	Residential (child and adult).	☑
	Commercial worker.	☑
	Construction worker.	☑
4.	Comparison of Tier 1 RBSLs with representative site concentrations.	
	On-site receptors.	
	Resident (child and adult).	☐
	Commercial worker.	☑
	Construction worker.	☑
	Off-site receptors.	
	Resident (child and adult).	☑
	Commercial worker.	☐
	Construction worker.	☐
5.	Tier 1 groundwater protection - no petition for variance to WQCC standards required.	☐
6.	Tier 1 groundwater protection - petition for variance to WQCC standards required.	☐
7.	Tier 1 applicable target levels for various media.	☑
8.	Tier 1 conclusions and recommendations.	☑
9.	References and protocol.	☐

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All maps submitted to NMED must include a bar scale, legend, north arrow, location of all known soil borings and monitoring wells, and date of map, where appropriate.

☐ *Check the box against the item, if the item is included.*

Map No.	Description	MAPS

Maps 1-6 are part of 14 Day Report and maps 7-10 are part of Investigation Report. Update and resubmit as appropriate.

Note: Maps may be combined, as appropriate. ☐

1. Topographic map.
2. Site map with UST system location(s), including tank ID number(s). ☐
3. Site map with utility locations. ☐
4. Land use map (radius of 1,000 feet). ☐
5. Receptor survey map: with detailed land use in the vicinity of the site (at least 1,000 feet in the downgradient direction and one property deep on all other sides including across the street). ☐
6. Area map with water use well locations: within one mile radius of the site (the wells on the map must be labeled). Maps must also indicate the location of surface water drains including but not limited to streams, lakes and well head protection areas, within a 500 foot radius of the site. ☐
7. NAPL thickness contour map. ☐
8. Area geologic map. ☐
9. Groundwater gradient map: contoured map with the predominant flow direction from the most recent gauging event (add additional maps if the flow direction fluctuates). ☐
10. Soil and groundwater concentration contour maps showing boring and well locations and concentrations in each: for benzene, MTBE, total BTEX, and Total PAHs from the most recent sampling event. ☐
11. Map identifying the location of data points used to calculate representative soil concentrations protective of groundwater. ☐
12. Map Identifying POE(s) and POC(s): for both current and future conditions. ☐

ADDITIONAL MAPS:

_____

_____

_____

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☐ *Check the box against the item, if the item is included.*

Attachment No. Description **ATTACHMENTS**

Aattachments 1and 2 are part of 14 Day Report and attchments 3-7 are part of Investigation Report. Update and resubmit as appropriate.

1. Most recent UST system test results. ☐
2. Vapor screening results for utilities. ☐
3. Estimation of NAPL present: Estimated thickness vs measured thickness of NAPL. Include calculation brief for estimated thickness. ☐
4. Monitoring well construction diagram. ☐
5. Representative soil boring logs: cross-section(s) showing the stratigraphy of the site and the extent of contamination. ☐
6. Historical groundwater monitoring data for all the monitoring wells. Include any data collected from temporary wells or borings. ☐
7. Contaminant concentration and depth to groundwater vs. time graphs for wells with four or more sampling events. ☐
8. Description of the logic used in the selection of data for calculation of representative site concentrations, for on-site and off-site media. Provide raw data selected and representative concentrations. ☐
9. Justification for the selection of POE(s), POC(s), and groundwater standards (MCLs vs. WQCC standards). ☐

ADDITIONAL ATTACHMENTS:

Laboratory analytical report(s) not previously submitted to the department.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 1

SITE ID: Los Alamos National Laboratory (LANL)	**FACILITY ID: TA-21**
SUBMITTAL DATE: 11-Oct-02	**PREPARED BY: Shaw Environmental & Infrastructure, Inc**

EXECUTIVE SUMMARY

Facility name:	*Technical Area (TA) 21*
Facility address:	*Los Alamos National Laboratory* *Los Alamos, New Mexico 87545*
Status of UST system:	☐ Active ☑ Inactive
Ground surface condition:	
Estimated volume and type of product(s) released:	*48,000 gallons no.2 fuel oil (diesel fuel)*
Has any vapor impacts been identified?	☐ No ☑ On-site ☐ Off-site
If yes (check all that apply):	☐ Utility corridor ☐ Subsurface structures ☑ Above surface structures
Is soil contaminated?	☐ No ☑ On-site ☐ Off-site
Is there any contaminant-saturated soil?	☑ No ☐ On-site ☐ Off-site
Is groundwater contaminated?	☑ No ☐ On-site ☐ Off-site
Has the source of release been identified?	☑ Yes ☐ No
Has NAPL ever been detected?	☑ Yes ☐ No
Was NAPL removed?	☐ Yes ☑ No
Was NAPL detected in the most recent sampling event?	☑ Yes ☐ No
Has surface water been contaminated by the release?	☐ Yes ☑ No ☐ Uknown ☐ Suspected
Shallowest depth to groundwater (ft bgs.):	*1100 ft bgs*
Average depth to groundwater (ft bgs.):	*1100 ft bgs*
Has a drinking water supply well been contaminated by this release?	☐ Yes ☐ No ☑ Unknown ☐ Suspected
If yes	☐ Drinking ☐ Irrigation ☐ Other

RECOMMENDATIONS

- ☑ No further action under tier 1
- ☐ Compliance monitoring
- ☐ Remediate to tier 1 RBSLs and WQCC standards to achieve no further action
- ☐ Perform interim remedial action and then re-evaluate
- ☐ Perform tier 2 evaluation
- ☐ Petition WQCC for approval of alternative groundwater standards

ADDITIONAL NOTES

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 2 - SCES
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

SITE CONCEPTUAL EXPOSURE SCENARIO

CONTAMINATED MEDIA	PATHWAYS/TRANSPORT MECHANISMS	EXPOSURE ROUTES	POTENTIAL RECEPTORS: CURRENT LAND USE, ON-SITE: Residents-Child	Residents - Adult	Commercial Workers	Construction Workers	CURRENT LAND USE, OFF-SITE: Residents-Child	Residents - Adult	Commercial Workers	Construction Workers	FUTURE LAND USE, ON-SITE: Residents-Child	Residents - Adult	Commercial Workers	Construction Workers	FUTURE LAND USE, OFF-SITE: Residents-Child	Residents - Adult	Commercial Workers	Construction Workers
Air Vapors		Inhalation (Indoors)	NA	NA	C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Inhalation (Outdoors)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Surficial Soil	Wind Erosion/Dispersion/ Volatilization/Vapor Migration	Inhalation (vapors & particulates) and Dermal Contact and Ingestion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Subsurface Soils	Volatilization/Vapor Migration	Inhalation (Indoors)	NA	NA	C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Inhalation (Outdoors)	NA	NA	NA	C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Dermal Contact and Ingestion	NA	NA	NA	C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Groundwater	Volatilization/Vapor Migration	Inhalation (Indoors)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Inhalation (Outdoors)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Drinking Water	Ingestion	NA	NA	C	NA	C	C	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

	YES	NO
Contaminant-saturated soil present?	☐	☑
Nonaqueous phase liquid present?	☑	☐
Utilities Threatened ?	☐	☑
Surface Waters within a 500 foot radius?	☐	☑
Ecological Receptors?	☐	☑
Leaching to groundwater?	☑	☐

C Indicates potentially completed pathways

NA Not applicable as per the NMED policy

For construction worker, no distinction is made between the surficial and subsurface soils.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 3 - RESIDENT
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

JUSTIFICATION OF PATHWAYS - ON-SITE RESIDENT (CHILD AND ADULT)

ROUTES OF EXPOSURE	CURRENT CONDITIONS		FUTURE CONDITIONS	
	C/ NC*	JUSTIFICATION	C/ NC*	JUSTIFICATION
SURFICIAL SOIL				
Ingestion, outdoor inhalation of vapors and particulate matter, and dermal contact	*NA*		*NA*	
SUBSURFACE SOIL				
Indoor inhalation of vapors (only when depth to contamination is less than 15 ft bgs)	*NA*		*NA*	
GROUNDWATER				
Indoor inhalation of vapors (only when depth to groundwater is less than 15 ft bgs)	*NA*		*NA*	
Ingestion (only when groundwater is used, from an impacted on-site well, for drinking)	*NA*		*NA*	

JUSTIFICATION OF PATHWAYS - OFF-SITE RESIDENT (CHILD AND ADULT)

SURFICIAL SOIL				
Ingestion, Outdoor Inhalation of Vapors and Particulate Matter, and Dermal Contact	*NA*		*NA*	
SUBSURFACE SOIL				
Indoor inhalation of vapors (only when depth to contamination is less than 15 ft bgs)	*NA*		*NA*	
GROUNDWATER				
Indoor inhalation of vapors (only when depth to groundwater is less than 15 ft bgs)	*NA*		*NA*	
Ingestion (only when groundwater is used, from an impacted off-site well, for drinking)	*C*	*This pathway is considered in the Tier 1 evaluation as a conservative exposure scenario. Currently, there is no indication diesel fuel has migrated beyond 145 ft bgs.*	*NA*	

NOTE:

* **C** : Complete Pathway, **NC** : Not Complete

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 3 - COMMERCIAL WORKER
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

JUSTIFICATION OF PATHWAYS - ON-SITE COMMERCIAL WORKER

ROUTES OF EXPOSURE	CURRENT CONDITIONS		FUTURE CONDITIONS	
	C/ NC*	JUSTIFICATION	C/ NC*	JUSTIFICATION
SURFICIAL SOIL				
Ingestion, outdoor inhalation of vapors and particulate matter, and dermal contact	*NA*		*NA*	
SUBSURFACE SOIL				
Indoor inhalation of vapors (only when depth to contamination is less than 15 ft bgs)	*C*	*Indoor air by commercial worker at steam plant*	*NA*	
GROUNDWATER				
Indoor inhalation of vapors (only when depth to groundwater is less than 15 ft bgs)	*NA*		*NA*	
Ingestion (only when groundwater is used, from an impacted on-site well, for drinking)	*C*	*This pathway is considered in the Tier 1 evaluation as a conservative exposure scenario. Currently, there is no indication diesel fuel has migrated beyond 145 ft bgs.*	*NA*	

JUSTIFICATION OF PATHWAYS - OFF-SITE COMMERCIAL WORKER

SURFICIAL SOIL				
Ingestion, Outdoor Inhalation of Vapors and Particulate Matter, and Dermal Contact	*NA*		*NA*	
SUBSURFACE SOIL				
Indoor inhalation of vapors (only when depth to contamination is less than 15 ft bgs)	*NA*		*NA*	
GROUNDWATER				
Indoor inhalation of vapors (only when depth to groundwater is less than 15 ft bgs)	*NA*		*NA*	
Ingestion (only when groundwater is used, from an impacted off-site well, for drinking)	*NA*		*NA*	

NOTE:

* **C** : Complete Pathway, **NC** : Not Complete

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 3-CONSTRUCTION WORKER
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

JUSTIFICATION OF PATHWAYS - ON-SITE CONSTRUCTION WORKER

ROUTES OF EXPOSURE	CURRENT CONDITIONS		FUTURE CONDITIONS	
	C/ NC*	JUSTIFICATION	C/ NC*	JUSTIFICATION
SOIL WITHIN THE TYPICAL CONSTRUCTION DEPTH				
Ingestion, outdoor inhalation of vapors and particulate matter, and dermal contact	*C*	*This pathway is considered in the Tier 1 evaluation as a conservative exposure scenario. Currently, there is no indication diesel fuel has migrated beyond 145 ft bgs.*	*NA*	
GROUNDWATER				
Outdoor inhalation of vapors	*NA*		*NA*	

JUSTIFICATION OF PATHWAYS - OFF-SITE CONSTRUCTION WORKER

SOIL WITHIN THE TYPICAL CONSTRUCTION DEPTH				
Ingestion, Outdoor Inhalation of Vapors and Particulate Matter, and Dermal Contact	*NA*		*NA*	
GROUNDWATER				
Outdoor inhalation of vapors	*NA*		*NA*	

NOTE:

* **C** : Complete Pathway, **NC** : Not Complete

No distinction is made between surficial soil and subsurface soil for a construction worker within the zone of construction since subsurface soil may be brought to the surface during construction/excavation activities.

NEW MEXICO RBDM	TIER 1 REPORT	FORM 4 - RESIDENT
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

COMPARISON OF TIER 1 RBSLs WITH REPRESENTATIVE CONCENTRATIONS - ON-SITE RESIDENT (CHILD AND ADULT)

CONTAMINANTS OF CONCERN	SURFICIAL SOIL			SUB-SURFACE SOIL			GROUNDWATER					
	Ingestion, inhalation,and dermal contact		NA	Indoor inhalation of vapors		NA	Indoor inhalation of vapors		NA	Ingestion		NA
	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [µg/L]	RBSLs [µg/L]	E/Exceeds or NE/Not Exceeds	Concentration at the tap [µg/L]	MCL [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS *												
Benzene												
Toluene												
Ethylbenzene												
Xylenes (Total)												
Ethylene Dibromide (EDB)												
1,2-Dichloroethane (EDC)												
MTBE												
POLYCYCLIC AROMATIC HYDROCARBONS												
Acenaphthene												
Anthracene												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(k)fluoranthene												
Chrysene												
Dibenz(a-h)anthracene												
Fluoranthene												
Fluorene												
Total Naphthalenes												
Phenanthrene												
Pyrene												
METALS												
Lead												

NOTE:

Enter the representative concentration and indicate.

N/A: Not applicable

>RES: Calculated RBSLs exceeded residual soil saturation level.

>SOL: Calculated RBSLs exceeded pure component water solubility.

This comparative evaluation is performed automatically after the user has completed Report Form No.3 and entered the representative concentration on this form for complete pathways.

Representative concentration is:

Soil:

Groundwater:

NEW MEXICO RBDM	TIER 1 REPORT	FORM 4 - RESIDENT
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

COMPARISON OF TIER 1 RBSLs WITH REPRESENTATIVE CONCENTRATIONS - OFF-SITE RESIDENT (CHILD AND ADULT)

CONTAMINANTS OF CONCERN	SURFICIAL SOIL			SUB-SURFACE SOIL			GROUNDWATER					
	Ingestion, inhalation,and dermal contact		NA	Indoor inhalation of vapors		NA	Indoor inhalation of vapors		NA	Ingestion		C
	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [µg/L]	RBSLs [µg/L]	E/Exceeds or NE/Not Exceeds	Concentration at the tap [µg/L]	MCL [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS												
Benzene										NA	5.00E+00	
Toluene										NA	1.00E+03	
Ethylbenzene										NA	7.00E+02	
Xylenes (Total)										NA	1.00E+04	
Ethylene Dibromide (EDB)										NA	5.00E-02	
1,2-Dichloroethane (EDC)										NA	5.00E+00	
MTBE										NA	1.00E+02	
POLYCYCLIC AROMATIC HYDROCARBONS												
Acenaphthene										NA	2.19E+03	
Anthracene										NA	4.34E+01	
Benzo(a)anthracene										NA	1.17E+00	
Benzo(a)pyrene										NA	2.00E-01	
Benzo(b)fluoranthene										NA	1.17E+00	
Benzo(k)fluoranthene										NA	8.00E-01	
Chrysene										NA	1.60E+00	
Dibenz(a-h)anthracene										NA	1.17E-01	
Fluoranthene										NA	2.06E+02	
Fluorene										NA	1.46E+03	
Total Naphthalenes										NA	3.00E+01	
Phenanthrene										NA	1.10E+03	
Pyrene										NA	1.10E+03	
METALS												
Lead										NA	1.50E+01	

NOTE:

Enter the representative concentration and indicate.

Representative concentration is:

Soil:

Groundwater: *Currently there is no evidence plume will reach groundwater.*

N/A: Not applicable

>RES: Calculated RBSLs exceeded residual soil saturation level.

>SOL: Calculated RBSLs exceeded pure component water solubility.

This comparative evaluation is performed automatically after the user has completed Report Form No.3 and entered the representative concentration on this form for complete pathways.

NEW MEXICO RBDM	TIER 1 REPORT	FORM 4 - COMMERCIAL WORKER
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

COMPARISON OF TIER 1 RBSLs WITH REPRESENTATIVE CONCENTRATIONS - ON-SITE COMMERCIAL WORKER

CONTAMINANTS OF CONCERN	SURFICIAL SOIL			SUB-SURFACE SOIL			GROUNDWATER					
	Ingestion, Inhalation,and Dermal Contact		NA	Indoor inhalation of vapors		C	Indoor inhalation of vapors		NA	Ingestion		C
	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [µg/L]	RBSLs [µg/L]	E/Exceeds or NE/Not Exceeds	Concentration at the tap [µg/L]	MCL [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS												
Benzene				0.311	1.28E-01	E				NA	5.00E+00	
Toluene				5.65	2.05E+01	NE				NA	1.00E+03	
Ethylbenzene				6.41	4.02E+02 >RES	NE				NA	7.00E+02	
Xylenes (Total)				24.4	2.82E+01	NE				NA	1.00E+04	
Ethylene Dibromide (EDB)										NA	5.00E-02	
1,2-Dichloroethane (EDC)										NA	5.00E+00	
MTBE										NA	1.00E+02	
POLYCYCLIC AROMATIC HYDROCARBONS												
Acenaphthene				5.85	2.81E+04 >RES	NE				NA	2.19E+03	
Anthracene				1.62	2.08E+06 >RES	NE				NA	4.34E+01	
Benzo(a)anthracene				1.62	6.00E+04 >RES	NE				NA	1.17E+00	
Benzo(a)pyrene				1.62	7.33E+06 >RES	NE				NA	2.00E-01	
Benzo(b)fluoranthene				1.62	1.40E+04 >RES	NE				NA	1.17E+00	
Benzo(k)fluoranthene				1.62	1.87E+06 >RES	NE				NA	8.00E-01	
Chrysene				1.62	4.84E+05 >RES	NE				NA	1.60E+00	
Dibenz(a-h)anthracene				1.62	2.72E+07 >RES	NE				NA	1.17E-01	
Fluoranthene				1.62	2.51E+06 >RES	NE				NA	2.06E+02	
Fluorene				8.45	8.31E+04 >RES	NE				NA	1.46E+03	
Total Naphthalenes				11.6	3.76E+02 >RES	NE				NA	3.00E+01	
Phenanthrene				13.2	5.04E+04 >RES	NE				NA	1.10E+03	
Pyrene				1.4	4.24E+06 >RES	NE				NA	1.10E+03	
METALS												
Lead										NA	1.50E+01	

NOTE:

Enter the representative concentration and indicate.

Representative concentration is:

Soil:

Groundwater: *Currently there is no evidence plume will reach groundwater.*

N/A: Not applicable

>RES: Calculated RBSLs exceeded residual soil saturation level.

>SOL: Calculated RBSLs exceeded pure component water solubility.

This comparative evaluation is performed automatically after the user has completed Report Form No.3 and entered the representative concentration on this form for complete pathways.

NEW MEXICO RBDM	TIER 1 REPORT	FORM 4 - COMMERCIAL WORKER
SITE ID: Los Alamos National Laboratory (LANL)		FACILITY ID: TA-21
SUBMITTAL DATE: 11-Oct-02		PREPARED BY: Shaw Environmental & Infrastructure, Inc.

COMPARISON OF TIER 1 RBSLs WITH REPRESENTATIVE CONCENTRATIONS - OFF-SITE COMMERCIAL WORKER

CONTAMINANTS OF CONCERN	SURFICIAL SOIL			SUB-SURFACE SOIL			GROUNDWATER					
	Ingestion, inhalation, and dermal contact		NA	Indoor inhalation of vapors		NA	Indoor inhalation of vapors		NA	Ingestion		NA
	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [µg/L]	RBSLs [µg/L]	E/Exceeds or NE/Not Exceeds	Concentration at the tap [µg/L]	MCL [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS												
Benzene												
Toluene												
Ethylbenzene												
Xylenes (Total)												
Ethylene Dibromide (EDB)												
1,2-Dichloroethane (EDC)												
MTBE												
POLYCYCLIC AROMATIC HYDROCARBONS												
Acenaphthene												
Anthracene												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(k)fluoranthene												
Chrysene												
Dibenz(a-h)anthracene												
Fluoranthene												
Fluorene												
Total Naphthalenes												
Phenanthrene												
Pyrene												
METALS												
Lead												

NOTE:

Enter the representative concentration and indicate.

Representative concentration is:

Soil:

Groundwater:

N/A: Not applicable

>RES: Calculated RBSLs exceeded residual soil saturation level.

>SOL: Calculated RBSLs exceeded pure component water solubility.

This comparative evaluation is performed automatically after the user has completed Report Form No.3 and entered the representative concentration on this form for complete pathways.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 4 - CONSTRUCTION WORKER
SITE ID: Los Alamos National Laboratory (LANL)		FACILITY ID: TA-21
SUBMITTAL DATE: 11-Oct-02		PREPARED BY: Shaw Environmental & Infrastructure, Inc.

COMPARISON OF TIER 1 RBSLs WITH REPRESENTATIVE CONCENTRATIONS - ON-SITE CONSTRUCTION WORKER

CONTAMINANTS OF CONCERN	SOIL WITHIN THE TYPICAL CONSTRUCTION ZONE				GROUNDWATER		
	Ingestion, inhalation,and dermal contact			C	Outdoor inhalation of vapors		NA
	Representative concentration [mg/kg]	RBSLs [mg/kg]		E/Exceeds or NE/Not Exceeds	Representative concentration [µg/L]	RBSLs [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS							
Benzene	0.27	1.67E+02		NE			
Toluene	6.20	6.31E+03	>RES	NE			
Ethylbenzene	7.57	5.98E+03	>RES	NE			
Xylenes (Total)	32.20	8.00E+03	>RES	NE			
Ethylene Dibromide (EDB)							
1,2-Dichloroethane (EDC)							
MTBE							
POLYCYCLIC AROMATIC HYDROCARBONS							
Acenaphthene	2.72	1.16E+04	>RES	NE			
Anthracene	1.92	9.96E+04	>RES	NE			
Benzo(a)anthracene	0.36	4.19E+02	>RES	NE			
Benzo(a)pyrene	0.36	4.28E+01	>RES	NE			
Benzo(b)fluoranthene	NA	4.10E+02	>RES				
Benzo(k)fluoranthene	NA	4.27E+02	>RES				
Chrysene	0.36	3.99E+04	>RES	NE			
Dibenz(a-h)anthracene	0.36	4.32E+01	>RES	NE			
Fluoranthene	0.36	1.60E+04	>RES	NE			
Fluorene	4.58	1.10E+04	>RES	NE			
Total Naphthalenes	13	3.23E+03	>RES	NE			
Phenanthrene	9.37	7.90E+03	>RES	NE			
Pyrene	0.712	1.24E+04	>RES	NE			
METALS							
Lead							

NOTE:

Enter the representative concentration and indicate.

Representative concentration is:

Soil:

Groundwater:

Page 5 of _____

N/A: Not applicable

>RES: Calculated RBSLs exceeded residual soil saturation level.

>SOL: Calculated RBSLs exceeded pure component water solubility.

This comparative evaluation is performed automatically after the user has completed Report Form No.3 and entered the representative concentration on this form for complete pathways.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 4 - CONSTRUCTION WORKER
SITE ID: Los Alamos National Laboratory (LANL)		FACILITY ID: TA-21
SUBMITTAL DATE: 11-Oct-02		PREPARED BY: Shaw Environmental & Infrastructure, Inc.

COMPARISON OF TIER 1 RBSLs WITH REPRESENTATIVE CONCENTRATIONS - OFF-SITE CONSTRUCTION WORKER

CONTAMINANTS OF CONCERN	SOIL WITHIN THE TYPICAL CONSTRUCTION ZONE			GROUNDWATER		
	Ingestion, inhalation,and dermal contact		NA	Outdoor inhalation of vapors		NA
	Representative concentration [mg/kg]	RBSLs [mg/kg]	E/Exceeds or NE/Not Exceeds	Representative concentration [µg/L]	RBSLs [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS						
Benzene						
Toluene						
Ethylbenzene						
Xylenes (Total)						
Ethylene Dibromide (EDB)						
1,2-Dichloroethane (EDC)						
MTBE						
POLYCYCLIC AROMATIC HYDROCARBONS						
Acenaphthene						
Anthracene						
Benzo(a)anthracene						
Benzo(a)pyrene						
Benzo(b)fluoranthene						
Benzo(k)fluoranthene						
Chrysene						
Dibenz(a-h)anthracene						
Fluoranthene						
Fluorene						
Total Naphthalenes						
Phenanthrene						
Pyrene						
METALS						
Lead						

NOTE:

Enter the representative concentration and indicate.

N/A: Not applicable

>RES: Calculated RBSLs exceeded residual soil saturation level.

>SOL: Calculated RBSLs exceeded pure component water solubility.

This comparative evaluation is performed automatically after the user has completed Report Form No.3 and entered the representative concentration on this form for complete pathways.

Representative concentration is:

Soil:

Groundwater:

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 5
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

TIER 1 GROUNDWATER PROTECTION - NO PETITION FOR VARIANCE TO WQCC STANDARDS REQUIRED

	COMPARISON FOR SOURCE SOIL			COMPARISON FOR GROUNDWATER											
				MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-8	MW-9	MW-10		
CONTAMINANTS OF CONCERN	Source rep. conc.* [mg/kg]	RBSLs** [mg/kg]	E/Exceeds or NE/Not Exceeds	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	WQCC std. or RBSL [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS															
Benzene															
Toluene															
Ethylbenzene															
Xylenes (Total)															
Ethylene Dibromide (EDB)															
1,2-Dichloroethane (EDC)															
MTBE															
POLYCYCLIC AROMATIC HYDROCARBONS															
Acenaphthene															
Anthracene															
Benzo(a)anthracene															
Benzo(a)pyrene															
Benzo(b)fluoranthene															
Benzo(k)fluoranthene															
Chrysene															
Dibenz(a-h)anthracene															
Fluoranthene															
Fluorene															
Total Naphthalenes															
Phenanthrene															
Pyrene															
METALS															
Lead															

NOTE:

* Source representative concentration is: _____

** Back-calculated from WQCC groundwater standards for distance to POE=0 (from Table 4-15 of the Guidance Document)

The representative concentrations in each monitoriing well should be the maximum for the most recent 8 consecutive quarters, unless otherwise approved.

N/A: Not applicable

This comparative evaluation is performed automatically after the user has input representative concentrations and target levels for soil and representative concentrations for groundwater.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 5
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

TIER 1 GROUNDWATER PROTECTION - NO PETITION FOR VARIANCE TO WQCC STANDARDS REQUIRED

	COMPARISON FOR GROUNDWATER														
	MW-11	MW-12	MW-13	MW-14	MW-15	MW-16	MW-17	MW-18	MW-19	MW-20	MW-21	MW-22	MW-23		
CONTAMINANTS OF CONCERN	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	Recent# 8 qrtr max. [µg/L]	WQCC std. or RBSL [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS															
Benzene															
Toluene															
Ethylbenzene															
Xylenes (Total)															
Ethylene Dibromide (EDB)															
1,2-Dichloroethane (EDC)															
MTBE															
POLYCYCLIC AROMATIC HYDROCARBONS															
Acenaphthene															
Anthracene															
Benzo(a)anthracene															
Benzo(a)pyrene															
Benzo(b)fluoranthene															
Benzo(k)fluoranthene															
Chrysene															
Dibenz(a-h)anthracene															
Fluoranthene															
Fluorene															
Total Naphthalenes															
Phenanthrene															
Pyrene															
METALS															
Lead															

NOTE:

N/A: Not applicable

The representative concentrations in each monitoriing well should be the maximum for the most recent 8 consecutive quarters, unless otherwise approved.

This comparative evaluation is performed automatically after the user has input the representative concentrations.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 6
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

TIER 1 GROUNDWATER PROTECTION - PETITION FOR VARIANCE TO WQCC STANDARDS REQUIRED

				Distance from source to Point of Exposure (POE) =								
	COMPARISON FOR SOURCE SOIL			COMPARISON FOR COMPLIANCE WELLS								
COMPLIANCE WELL NUMBER	N/A											
DISTANCE FROM SOURCE	N/A											
RECENT TREND	N/A											
CONTAMINANTS OF CONCERN	Source rep. conc.* [mg/kg]	RBSLs** [mg/kg]	E/Exceeds or NE/Not Exceeds	Recent# 8 qrtr max. [µg/L]	RBSLs** [µg/L]	E/Exceeds or NE/Not Exceeds	Recent# 8 qrtr max. [µg/L]	RBSLs** [µg/L]	E/Exceeds or NE/Not Exceeds	Recent# 8 qrtr max. [µg/L]	RBSLs** [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS												
Benzene												
Toluene												
Ethylbenzene												
Xylenes (Total)												
Ethylene Dibromide (EDB)												
1,2-Dichloroethane (EDC)												
MTBE												
POLYCYCLIC AROMATIC HYDROCARBONS												
Acenaphthene												
Anthracene												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(k)fluoranthene												
Chrysene												
Dibenz(a-h)anthracene												
Fluoranthene												
Fluorene												
Total Naphthalenes												
Phenanthrene												
Pyrene												
METALS												
Lead												

NOTE:

* Source representative concentration is: _____

** Back-calculated from WQCC standards using tier 1 default parameters.

The representative concentrations in each compliance well should be the maximum for the most recent 8 consecutive quarters, unless otherwise approved.

N/A: Not applicable

This comparative evaluation is performed automatically after the user has input the representative concentrations and the target levels.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 6
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

TIER 1 GROUNDWATER PROTECTION - PETITION FOR VARIANCE TO WQCC STANDARDS REQUIRED

	Distance to Point of Exposure (POE) =											
	COMPARISON FOR COMPLIANCE WELLS											
COMPLIANCE WELL NUMBER												
DISTANCE FROM SOURCE												
RECENT TREND												
CONTAMINANTS OF CONCERN	Recent# 8 qrtr max. [µg/L]	RBSLs** [µg/L]	E/Exceeds or NE/Not Exceeds	Recent# 8 qrtr max. [µg/L]	RBSLs** [µg/L]	E/Exceeds or NE/Not Exceeds	Recent# 8 qrtr max. [µg/L]	RBSLs** [µg/L]	E/Exceeds or NE/Not Exceeds	Recent# 8 qrtr max. [µg/L]	RBSLs** [µg/L]	E/Exceeds or NE/Not Exceeds
ORGANICS												
Benzene												
Toluene												
Ethylbenzene												
Xylenes (Total)												
Ethylene Dibromide (EDB)												
1,2-Dichloroethane (EDC)												
MTBE												
POLYCYCLIC AROMATIC HYDROCARBONS												
Acenaphthene												
Anthracene												
Benzo(a)anthracene												
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(k)fluoranthene												
Chrysene												
Dibenz(a-h)anthracene												
Fluoranthene												
Fluorene												
Total Naphthalenes												
Phenanthrene												
Pyrene												
METALS												
Lead												

NOTE:

** Back-calculated from WQCC standards using tier 1 default parameters.

The representative concentrations in each compliance well should be the maximum for the most recent 8 consecutive quarters, unless otherwise approved.

N/A: Not applicable

This comparative evaluation is performed automatically after the user has input the representative concentrations and the target levels.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 7
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

TIER 1 APPLICABLE TARGET LEVELS FOR VARIOUS MEDIA

NOTE: The RBSLs listed in this table, for each route of exposure, are the lowest of the RBSLs for all the receptors for that particular route of exposure. The applicable target levels for each medium would be the lowest of the RBSLs listed in this table.

CONTAMINANTS OF CONCERN	SURFICIAL SOIL		SUBSURFACE SOIL		GROUNDWATER						GROUNDWATER PROTECTION	
	Ingestion, inhalation, and dermal contact		Indoor inhalation		Indoor inhalation		Outdoor inhalation		Ingestion	Resource protection	Soil concentrations protective of groundwater - no petition required	Soil concentrations protective of groundwater - petition required
	[mg/kg]		[mg/kg]		[µg/L]		[µg/L]		[µg/L]	[µg/L]	[mg/kg]	[mg/kg]
	ON-SITE	OFF-SITE	ON-SITE	OFF-SITE	ON-SITE	OFF-SITE	ON-SITE	OFF-SITE				
ORGANICS												
Benzene	1.67E+02		1.28E-01						5.00E+00			
Toluene	6.31E+03		2.05E+01						1.00E+03			
Ethylbenzene	5.98E+03		4.02E+02						7.00E+02			
Xylenes (Total)	8.00E+03		2.82E+01						1.00E+04			
Ethylene Dibromide (EDB)									5.00E-02			
1,2-Dichloroethane (EDC)									5.00E+00			
MTBE									1.00E+02			
POLYCYCLIC AROMATIC HYDROCARBONS												
Acenaphthene	1.16E+04		1.16E+04						2.19E+03			
Anthracene	9.96E+04		9.96E+04						4.34E+01			
Benzo(a)anthracene	4.19E+02		4.19E+02						1.17E+00			
Benzo(a)pyrene	4.28E+01		4.28E+01						2.00E-01			
Benzo(b)fluoranthene	4.10E+02		4.10E+02						1.17E+00			
Benzo(k)fluoranthene	4.27E+02		4.27E+02						8.00E-01			
Chrysene	3.99E+04		3.99E+04						1.60E+00			
Dibenz(a-h)anthracene	4.32E+01		4.32E+01						1.17E-01			
Fluoranthene	1.60E+04		1.60E+04						2.06E+02			
Fluorene	1.10E+04		1.10E+04						1.46E+03			
Total Naphthalenes	3.23E+03		3.76E+02						3.00E+01			
Phenanthrene	7.90E+03		7.90E+03						1.10E+03			
Pyrene	1.24E+04		1.24E+04						1.10E+03			
METALS												
Lead									1.50E+01			

N/A: Not applicable

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 8
SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21	
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.	

TIER 1 CONCLUSIONS AND RECOMMENDATIONS

1.	*Has the site been adequately investigated and characterized?*
	Yes
2.	*Has NAPL been removed?*
	No
3.	*Is the groundwater plume stable or shrinking, based on the concentration trend plots?*
	Stable. Calculations of residual diesel suggests that a block of tuff 145 ft deep by 22 ft x 22 ft could contain the diesel plume;groundwater is greater than 900 ft. below the bottom of the plume; therefore contaminants are not expected to reach groundwater.
4.	*Are on-site soil and groundwater concentrations protective of current and reasonable future on-site receptors?*
	Yes, site comtaminants are below levels protective of groundwater (using Tier 1models and Tier 1 RBSLs) for all identified on-site receptors. c
5.	*Are off-site soil and groundwater concentrations protective of current and reasonable future off-site receptors?*
	Yes, site comtaminants are below levels protective of groundwater (using Tier 1models and Tier 1 RBSLs) for all identified on-site receptors.
6.	*Are soil concentrations protective of groundwater?*
	Yes, site comtaminants are below levels protective of groundwater (using Tier 1models and Tier 1 RBSLs) for all identified on-site receptors.
7.	*Are groundwater concentrations below the applicable standards?*
	Yes. Contaminants are not expected to reach the water table.

NEW MEXICO RBDM	TIER 1 REPORT	FORM NO. 8

SITE ID: Los Alamos National Laboratory (LANL)	FACILITY ID: TA-21
SUBMITTAL DATE: 11-Oct-02	PREPARED BY: Shaw Environmental & Infrastructure, Inc.

TIER 1 CONCLUSIONS AND RECOMMENDATIONS

8.	*Is a waiver petition for alternative groundwater protection standards recommended?*
	No
9.	*Is compliance monitoring of groundwater recommended?*
	No
10.	*Is an interim remediation and tier 1 re-evaluation recommended?*
	No
11.	*Is remediation to tier 1 target levels recommended?*
	No
12.	*Is site recommended for NFA status?*
	Yes
13.	*Is a Tier 2 evaluation recommended? If yes, list the receptors, routes of exposure, and the COCs to be evaluated.*
	No
14.	*Other relevant information*