LANL HSWA IV

RESPONSE TO NOD FOR THE CLASS 3 PERMIT MODIFICATION FOR EXPEDITED CLEANUPS DATED APRIL 21, 1995

August 3, 1995

GENERAL COMMENTS:

Comment No. 1: *All upper tolerance limits (UTLs) based on LANL's Assessment Council position paper "Interim Guidance for Evaluating PAHs in Soil" have been rejected by EPA in a letter dated May 19, 1995. The UTL values for polycyclic aromatic hydrocarbons (PAHs) are inappropriate, and should not be used as a basis for determining if remediation is required at a site for the elimination of certain PAHs from consideration in cleanup values.*

Response:

LANL prepared and submitted the Expedited Cleanup (EC) Plans included in the April 21, 1995 permit modification prior to receipt of notice on May 19, 1995, that EPA Region 6 had rejected the LANL position paper entitled "Interim Guidance for Evaluating PAHs in Soil." The ER Project has decided to discontinue use of the Bradley (northeast urban) data set for use as a surrogate for PAH background distribution at the Laboratory. We are currently in the process of evaluating the available PAH analytical data collected for the Laboratory in FIMAD. There are approximately 1800 data points currently in the database. Of these points, approximately 90% are non-detects, with detection limits varying, but on the order of 0.7 mg/kg. Therefore, any statistic (i.e., mean, UCL, UTL) created to represent the distribution of PAH background at the Laboratory will likely be less than 1 mg/kg. As a result, the ER Project will be dealing with decisions relative to PAH similar to that of the other organic contaminants. The ER Project will, however, remain aggressive on the stance that it is not appropriate to cleanup residual PAH in soil if a release has not occurred and a contamination scenario is not present (e.g., when the site is located next to an asphalt road or a storm drain associated with an asphalt parking lot).

Proposed Changes to Text: None required.

Comment No. 2: *LANL should present risk values starting with 1E-06 independent of which future land used scenario is determined. EPA may use a cleanup level for an excess cancer risk of 1E-06 as a target level, whether or not final cleanup levels will have to meet that risk level is a risk management decision to be made by EPA after the appropriate risk assessment procedures have been followed. Therefore, LANL should present the appropriate risk numbers. In addition, all numbers used in calculations should be included in the expedited cleanup plan including calculations for those constituents with a noncarcinogenic hazard index of one or less.*

Response:

LANL agrees with EPA that cleanup level concentrations starting with an acceptable level of risk of 1E-06 should be presented. Cleanup levels for RCRA-regulated substances were developed using the approach presented in *Risk Assessment*

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Guidance for Superfund, Volume 1 - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals) (EPA 1991).

Current and future land use determination is a critical step in the process of defining the set of assumptions used to calculate cleanup levels. Because it is projected that the Laboratory will be continuing operations for at least several decades in the future, an industrial exposure scenario has been adopted for those sites "behind the fence" under Laboratory control. For sites that pose a moderate to low risk, the industrial scenario will evaluate the "generic" worker with the default set of assumptions presented in RAGS Part B. The generic worker scenario evaluates a healthy adult working male. Residential and recreational exposure scenarios are also considered for sites where appropriate.

Site-specific information is also factored in to the derivation of cleanup levels. Information such as the size of the site, accessibility, the presence of multiple constituents, etc. are considered.

Proposed Changes to Text: See SWMU 48-002 (a) and (b) response No. 3 for specific changes to EC Plan text.

Comment No. 3: *For determining the number of verification samples to be collected LANL should be using the following guidance:* ***Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals) (EPA 1991)*** *rather than Methods for Evaluating the Attainment of Cleanup Standard, Volume I, Solid Media (EPA 1988). LANL should recalculate verification sampling based on this document for all Expedited Cleanups.*

Response:

The *Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (RAGS)* Part B does not provide specific guidance for calculating verification sampling requirements. However, RAGS Part A does generically discuss the strategy for sample collection, and Section 4.6.1 addresses the determination of the number of samples. Unfortunately, specific methods and equations are not provided. This Section does refer the reader to the EPA methods document ***Statistical Methods for Evaluating the Attainment of Superfund Cleanup Standards: Vol. 1, Soils and Solid Media (EPA 1988)*** LANL used to determine the number of samples (Rags Part A, page 4-17).

Proposed Changes to Text: None required.

<u>SWMU 48-002(a) and 48-002(b)</u>

Comment No. 3: LANL should provide the information as indicated in deficiency #2 for mercury and benzopyrene.

Response:

The derivation of human health risk-based cleanup levels for SWMU 48-002(a) and 48-002(b) is based on an occupational exposure scenario (continued laboratory operations) using the standard EPA default exposure parameters for a generic worker (RAGS Part B). Exposure pathways considered include ingestion and inhalation of contaminated soil. This approach is considered very conservative in that very few workers are expected to come in contact with remediated soils as modeled by this exposure scenario (i.e., 250 days/year on-site with an ingestion rate of 50 mg/day of soil).

Due to the small size of this SWMU and the absence of a multiple constituent problem, LANL recommends a soil cleanup level for mercury at 545 mg/kg. This level will result in an estimated noncarcinogenic hazard index of one or less. Because the maximum observed concentration of PAH (approximately 20 mg/kg) was observed in the first foot of soil, it is anticipated that PAH contamination will be removed with the mercury-contaminated-soil. Due to the absence of a multiple constituent problem at this SWMU and the small size with limited access to the area, LANL recommends a cleanup level for carcinogenic PAH of 78 mg/kg. A summary of the cleanup levels calculated for this EC is presented in the following table:

Cleanup Levels for Occupational Scenario mg/kg					
	Carcinogenic			Noncarcinogenic	
Chemical	1.00E-04	1.00E-05	1.00E-06	HI = 1	HI = 0.1
Mercury				545	54
Benzo[a]pyrene	78	7.8	0.78		

The following equation and input parameters were used to derive cleanup levels for **carcinogenic** compounds in commercial/industrial soil:

$$C\ (mg/kg) = \frac{TR \times BW \times AT \times 365\,d/yr}{EF \times ED \times \left[\left(SF_o \times 10^{-6}\ kg/mg \times IR_{soil}\right) + \left(SF_i \times IR_{air} \times (1/Y)\right)\right]}$$

Where:

Parameter	Definition	Units	Default
C	cleanup level - chemical concentration in soil	mg/kg	---
TR	target excess individual lifetime cancer risk	unitless	10^{-4} to 10^{-6}
BW	adult body weight	kg	70
AT	carcinogenic averaging time	yr	70
EF	exposure frequency	days/yr	250
ED	exposure duration	yr	25
SF_o	oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	chemical-specific
IR_{soil}	soil ingestion rate	mg/day	50
SF_i	inhalation cancer slope factor	$(mg/kg\text{-}day)^{-1}$	chemical-specific
IR_{air}	workday inhalation rate	m^3/day	20
Y	volatilization factor (VF) for volatiles particulate emission factor (PEF) for non-volatiles	m^3/kg m^3/kg	chemical-specific 1.11×10^7

The following equation and input parameters were used to derive cleanup levels for **noncarcinogenic** contaminants in commercial/industrial soil:

$$Action\,Level(mg/kg) = \frac{THI \times BW \times AT \times 365\,d/yr}{EF \times ED \times \left[\left(\left(1/RfD_o\right) \times 10^{-6}\,kg/mg \times IR_{soil}\right) + \left(\left(1/RfD_i\right) \times IR_{air} \times 1/Y\right)\right]}$$

Where:

Parameter	Definition	Units	Default
THI	target hazard index	unitless	1 or 0.1
BW	adult body weight	kg	70
AT	noncarcinogenic averaging time	yr	25 (always equal to ED)
EF	exposure frequency	days/yr	250
ED	exposure duration	yr	25
RfD_o	oral chronic reference dose	mg/kg-day	chemical-specific
IR_{soil}	soil ingestion rate	mg/day	50
SF_i	inhalation chronic reference dose	mg/kg-day	chemical-specific
IR_{air}	workday inhalation rate	m^3/day	20
Y	volatilization factor (VF) for volatiles	m^3/kg	chemical-specific
	particulate emission factor (PEF) for non-volatiles	m^3/kg	1.11×10^7 (LANL)

Toxicity criteria available in IRIS and HEAST for mercury and carcinogenic PAH (benzo(a)pyrene) are as follows:

	TOXICITY CRITERIA			
	Carcinogenic Slope Factor (kg-day/mg)		Chronic RfD (mg/kg-day)	
Chemical	Oral	Inhalation	Oral	Inhalation
mercury	ND	ND	3E-04	8.6E-05
benzo(a)pyrene	7.3	ND		

ND = no data available

	Toxicity Criteria				
	Carcinogenic Slope Factors (kg-day/mg)		Chronic RfDs (mg/kg-day)		VF
Chemical	Oral	Inhalation	Oral	Inhalation	m^3/kg
Arsenic	1.75	15	0.0003		
Barium			0.07	0.00014	
Cadmium		6.3	0.001	-	
Chromium III			1		
Chromium VI		42	0.005		
Copper			0.037		
Manganese			0.14	0.000014	
Mercury			0.0003	0.000086	
Nickel			0.02		
Silver			0.005		
Thallium			0.00008		
Vanadium			0.007		
Zinc			0.3		
Benzene	0.029	0.029			5700
cis-1,2-Dichloroethene			0.01		4600
Methylene Chloride	0.0075	0.0016	0.06	0.86	2900
Tetrachloroethene	0.052	0.002	0.01		6000
1,1,1-Trichloroethane			0.09	0.29	5100
Trichloroethane	0.011	0.006			5800
Benzo[a]pyrene	7.3				
PCBs	7.7				
2,4-DNT	0.68		0.002		
2,6-DNT	0.68		0.001		
HMX			0.05		
PETN			0.02		
RDX	0.11		0.003		
TNT	0.03		0.0005		

Proposed Changes to Text: Include revised tables and equations (shown above) for risk calculations.

Comment No. 4: *Section 2.2.3 Summary and Evaluation of Results, P. 7 - Bullet #1 indicates that highest concentration of mercury in soil was 62 ppm; however, XRF data in Annex 6.9 indicates mercury was found at 50110 ppm at sampling location 48-2060.*

Response:

The XRF analyses on soil samples from these SWMUs were conducted for preliminary screening purposes only and were not used in the decision making process. Each of the soil samples undergoing XRF analysis was also submitted to a fixed laboratory for mercury analysis. Since there was little correlation between the XRF and the fixed laboratory results, the XRF results were not discussed in the EC Plan. Additionally due to the presence of elemental mercury in the soils at this site, there is a possibility that a bead of mercury was present in the sample exhibiting the 50110 ppm value. It should be noted that an uncertainty of 5011 ppm was reported for this result. For the purpose

of this EC, the XRF will be used for screening and all verification sampling will be performed off-site by a fixed laboratory.

Proposed Changes to Text: None required.

Comment No. 5: *Section 2.4.1.1 SWMUs in Place, p. 8 - Bullet # 1 indicates that mercury vapor screening results showed elevated concentrations of mercury at the soil immediately adjacent to the wall and on the wall. This information should be provided in the reports.*

Response:

The mercury vapor screening data collected at these SWMUs was used to specify adequate personal protective equipment (PPE) as part of the health and safety planning prior to initiation of site characterization activities. These screening results were not used in any way to determine sampling locations or other site contaminant characterization decisions.

In July 1993, a Jerome (Model 431-X) mercury vapor sniffer was used to monitor the worker breathing zone and soil core during site characterization activities. As per your request, the data collected from soil cores are presented in the table below.

Sample Location	Sample Depth	Mercury mg/m^3
2006	0 - 6 in	.88
2006	6 in - 1.5 ft	ND
2006	1.5 - 3 ft	.22
2006	3 - 4 ft	.04
2006	4 - 5 ft	.08
2006	5 - 6 ft	.212
2006	6 -7 ft	.02
2006	7 - 8 ft	.009
2006	8 ft	.123
2061	0 - 6 in	.001
2060	0 - 6 in	off scale (Hg beads)

These data indicate low concentrations of mercury vapor in air adjacent to the soil cores during site characterization, with the exception of one location where the instrument was placed in the direct vicinity of elemental mercury visible in the soil.

Proposed Changes to Text: None required.

Comment No. 6: *Section 2.3 - There should be a discussion of the proposed disposition of all the waste.*

Response:

In addition to Section 2.3, Section 3.4.2 of the EC Plan also addresses this issue. The contaminated soil will be disposed at an approved, permitted waste disposal facility.

Since the contaminated soil is classified as hazardous waste, LANL will send it to a permitted hazardous waste disposal facility.

The final report will include a discussion on the final disposition of all waste generated.

Proposed Changes to Text: None required.

SWMU 18-001(b)

Comment No. 7: Section 2.2.3 Evaluation of Results, p.5. - *Were the water samples from the manholes taken as filtered or non-filtered for metals analysis.*

Response:

All water samples collected from the manholes were non-filtered for all analyses, including the metals. The Laboratory has received guidance from the EPA indicating that groundwater samples should be non-filtered. However, the screening action level (SAL) values for groundwater used by the ER Project are numerically equivalent to the New Mexico State Groundwater Quality standards, when a standard exists for a particular constituent. We have been provided with written guidance from the New Mexico State Groundwater Protection Bureau that comparison of water quality with these standards must be based on analysis of filtered samples. The issue of filtered versus non-filtered samples must be resolved between NMED and EPA, as well as between the Hazardous and Radioactive Materials Bureau and the Groundwater Protection Bureau at NMED. The plan for future groundwater sampling at this SWMU is to use non-filtered methods.

Proposed Changes in Text:

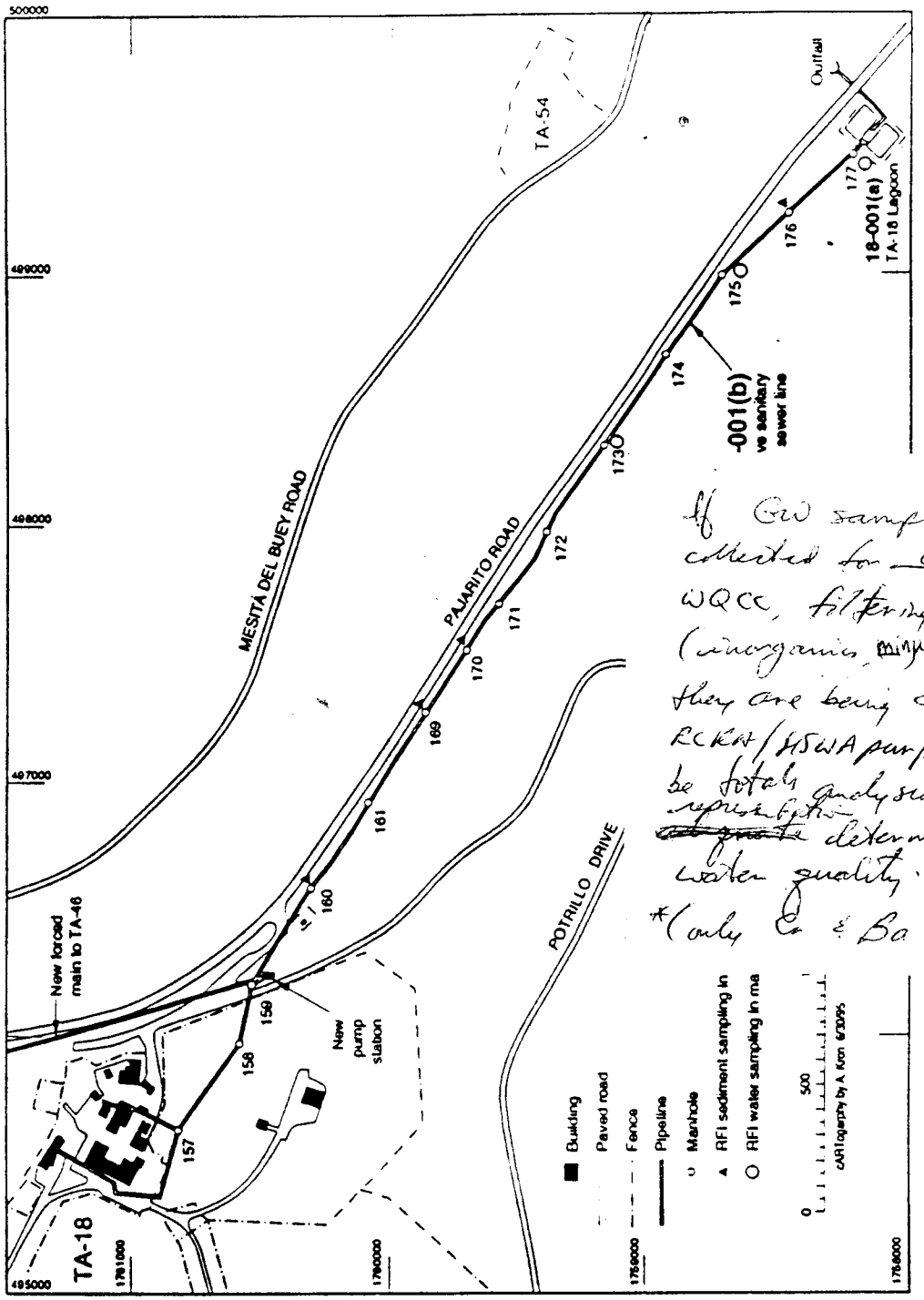
Page 5, Section 2.2.2 Resource Conservation and Recovery Act facility investigation (RFI), third paragraph.

Either sediments or **non-filtered** water samples were collected from. . .

Comment No. 8: *Additional groundwater sampling was indicated in the RFI work plan dated May 1993. If this sampling was conducted the analytical information should be provided. If sampling was not conducted a rationale should be provided.*

Response:

The RFI work plan proposed that water samples be collected at five locations, representative of five segments of the sanitary sewer line. These water samples were to be taken from the manholes, if water was present, or by direct sampling of groundwater outside the line if water was not present. Water samples could only be collected at three of these five locations from the manholes, because insufficient water was present in the remainder of the line to allow sampling. Figure 2-1, attached, has been revised to indicate the sampling actually performed. The water flowing in the line, and accumulating in the eastern-most manhole (Manhole 177) is derived from groundwater which infiltrates the line throughout its length, and the Laboratory asserts



If GW samples are being collected for compliance w/ WQCC, filtering is appropriate (inorganics, minus Hg); if they are being collected for RCRA/HSWA purpose, they should be total analysis to ensure representative determinations of water quality.
*(only Co & Ba are impacted)

Figure 2-1. SWMUs 18-001(a) and 18-001(b) location map.

Figure 2-1. SWMUs 18-001(a) and 18-001(b) location map.

that analysis of that water is a conservative measure of water quality adjacent to the line. However, the Laboratory acknowledges the benefit of sampling the groundwater beneath portions of the line where groundwater was not infiltrating at the time of the 1993 sampling. There is also benefit in sampling the groundwater in a portion of the line where groundwater is infiltrating to provide support for the assertion that water in the line is representative of groundwater outside the line. The groundwater table is higher at present than when the original sampling was performed, and water can be collected from Manhole 171, which was dry at the time of the previous sampling. Sampling of groundwater at the downgradient -end of the lagoons [PRS 18-001(a)] will provide data on the combined effects of the sewer line and lagoons on groundwater quality.

Proposed changes in text:

3.5 Verification Plan

~~Verification sampling of this EC effort is not proposed. Based on sample results obtained during the RFI, the detected concentrations of hazardous or radioactive constituents are very low. Furthermore, it is believed that the water samples collected from the manholes, which represent groundwater infiltration, indicate that no significant releases have occurred to the surrounding media. Therefore, further sampling of the groundwater and adjacent soils is not warranted.~~

The RFI Work Plan for Operable Unit (OU) 1093 (LANL 1993, 1085) proposed the collection of water samples within or adjacent to five segments of the line to characterize groundwater. The Laboratory asserts that because water in the inactive sewer line is derived from infiltration of groundwater, samples collected within the line are conservatively representative of groundwater adjacent to the line. As noted in Section 2.2.2, water was only present in sufficient quantities to collect samples from three manholes. Through an oversight, groundwater samples were not collected adjacent to the two western segments of the line. Although the water samples that were collected did not indicate the presence of contaminants in groundwater above SALs, the Laboratory acknowledges the benefit of collecting representative samples of groundwater adjacent to the entire length of the inactive sewer line.

Verification sampling of the groundwater will be conducted before any action is taken to decommission the manholes or sewer line. A temporary monitoring well will be constructed in the shallow aquifer, adjacent to the sewer line, at the location indicated in Figure 2-2. In addition, water samples will be collected from Manhole 171 adjacent to this, as indicated in Figure 2-2. A second well will be constructed southeast of the lagoons, as indicated in Figure 2-2. All water samples will be analyzed for VOCs, semi-VOCs, total metals, total uranium, isotopic plutonium, nitrates, and chlorides. The wells will provide data to verify that groundwater beneath the line does not contain potential contaminants above New Mexico State Water Quality Standards (See Section 2.4.3 for a discussion of clean-up standards). The eastern-most

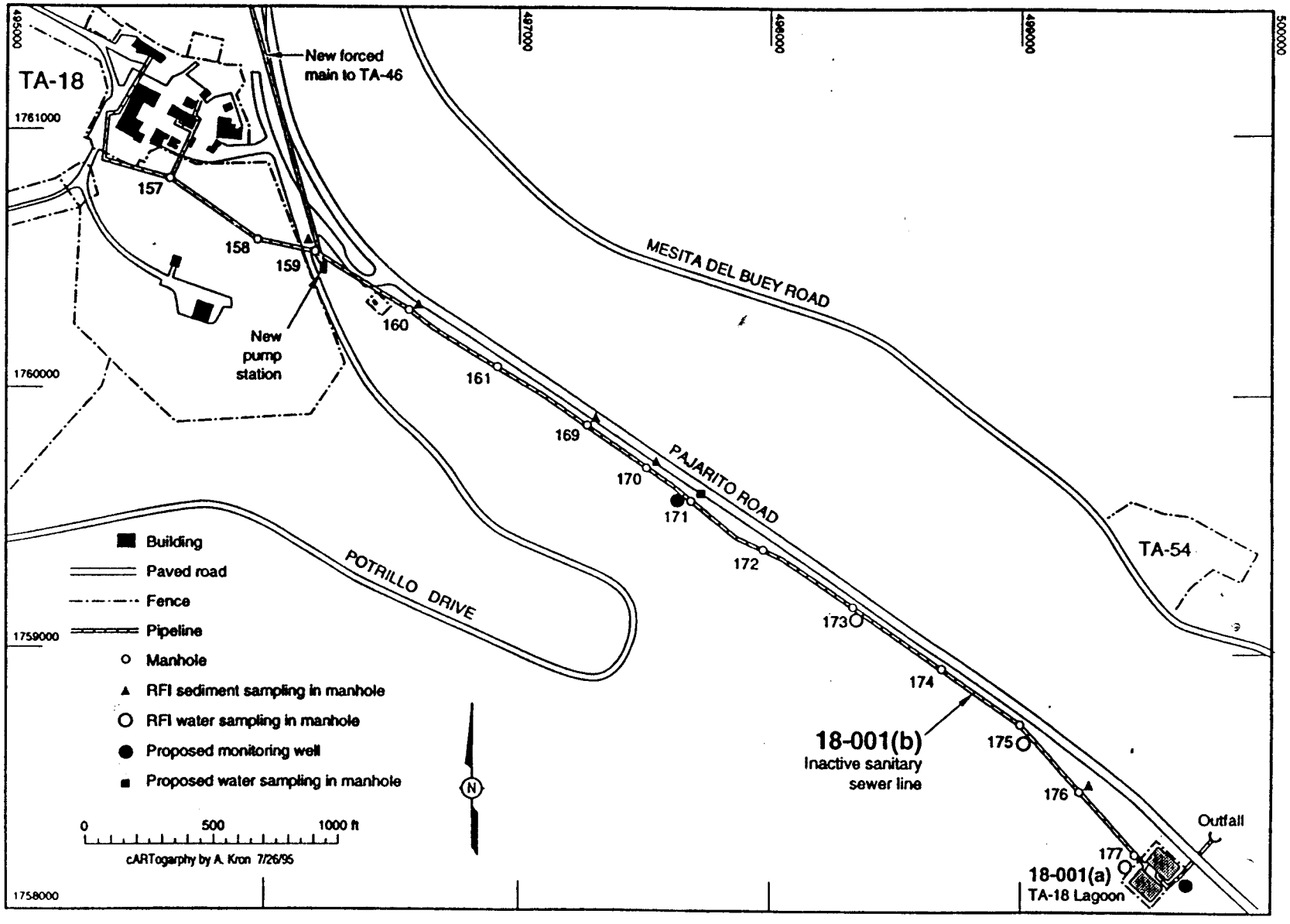


Figure 2-2. Proposed verification sampling at SWMU 18-001(b).

well, near Manhole 171, and the water sample from within the line will evaluate the similarity between groundwater adjacent to the line and that collected from the manholes.

The results of this water sampling will be submitted to EPA for review, and further actions at SWMU 18-001(b) will not proceed without approval from EPA.

Comment No. 9: *Are contaminated sediments restricted to the manholes? Although this plan states that the manholes act as catchments for sediments and fluids, low points/areas along the sewer line may contain sediments as well. Breaks in the line may have created a mixing area between contaminants and the surrounding soil and groundwater.*

Response:

It is entirely reasonable to believe that the portions of the line between manholes may contain sediments. The sampling of sediments present in the manholes was intended to be representative of material present elsewhere in the line. The EC Plan, as submitted, did not present cleanup levels for this site. Proposed modifications to the plan, as presented below, develop cleanup levels for the site, based on a present and future industrial land use. However, the Laboratory believes that this approach is only appropriate for evaluation of the consequences of exposure to the sediments by a possible future excavation. Cleanup standards for groundwater should be coincident, where practicable, with New Mexico State Water Quality Standards or Federal MCLs, whichever is more conservative. A reasonable effort to sample the groundwater, as ~~presented in the RFI Work Plan~~, is therefore appropriate. See also response to Comment Nos. 8 and 10.

Proposed Changes in Text:

Revise Section 2.4.3, beginning with the second paragraph, as follows:

As discussed in Section 2.2.**3**, analytical results from the RFI sampling effort indicate that concentrations of potential contaminants of concern for the SWMU ~~was~~ were generally below the SALs, with the exception of the sediment samples obtained from the manholes. **Multiple constituent analysis revealed no additional chemicals of concern (COCs).** As described above, the SALs for hazardous and radioactive constituents are calculated values, based on a conservative residential scenario, that represent a concentration at which exposure would produce a risk of 10^{-6} to human health. Since the future land use for this site is industrial, these are conservative criteria. ~~The risk posed by the sediments in the manholes at SWMU 18-001(b) is in the range of 10^{-5} to 10^{-6} (LANL 1995) using these criteria. Based on the RFI sampling effort, the volume of remaining sediments is small, and the risk will be further reduced following the proposed EC activities (Section 3.3).~~

Results of sampling conducted at MH-176, MH-170, MH-169, and MH-160 indicated that some metals and some semivolatiles failed the screening assessment (comparison to background concentrations and SALs) and have been identified as COCs at their respective manholes. Site-specific risk-based cleanup goals were calculated for SWMU 18-

001, using Subpart S equations and RFI analytical results for MH-176, MH-170, MH-169, and MH-160.

With the exception of lead, site-specific cleanup goals were calculated using the equations presented in Annex 6.10. The COCs are present in a small volume of sediments located at the bottom of four manholes. There are no complete exposure pathways under the nonintrusive industrial soil exposure scenario. Thus, site-specific cleanup goals were calculated for carcinogenic and non-carcinogenic contaminants using the intrusive industrial soil exposure scenario. The toxicity values used in these equations were obtained from IRIS and HEAST (updated through March 1995). The methodologies are consistent with U.S. EPA Risk Assessment Guidance for Superfund, Part B using Laboratory-specific exposure scenario parameters. The methodology calculates a soil concentration for carcinogens from a target cancer risk range of 10^{-4} to 10^{-6} and for non-carcinogens from a target hazard quotient of 1. The equations for cleanup levels under the intrusive soil exposure scenario combine across exposure pathways to include ingestion, dermal, and inhalation exposures.

As described in Annex 6.10, lead soil cleanup levels are calculated not to exceed a target blood level of 10 μg/dl at the 95th percentile concentration (EPA 1994). Sources of lead exposure include drinking water, grocery store food products, soil (incidental soil ingestion and dermal contact), and the air.

Cleanup goals and maximum chemical concentrations for COCs in each of the manholes are presented in Table 2-1. Maximum concentrations of COCs in each of the manholes are at least a factor of 3 less than the lowest cleanup goal based on an intrusive industrial exposure scenario. Therefore, no further removal of sediments in the manholes is required.

TABLE 2-1

CLEANUP GOALS FOR SWMU 18-001(b)

	Intrusive Cleanup Goals (mg/kg) based on Hazard Index of 1 or Cancer Risk of			Maximum Concentration of Chemical of Concern (mg/kg)			
Chemical of Concern	1×10^{-4}	1×10^{-5}	1×10^{-6}	MH-176	MH-170	MH-169	MH-160
Barium	32,300	32,300	32,300	NA	NA	9,400	NA
Lead	1,000	1,000	1,000	480	NA	NA	NA
Benzo(a)pyrene	500	50	5	0.43	NA	NA	0.35
Benzo(b)fluoranthene	5,000	500	50	0.75	NA	NA	NA
bis(2-Ethylhexyl)phthalate	10,300	10,300	2,580	NA	34	NA	NA

Comment No. 10: 3.5 Verification Plan. *The Laboratory makes the assumption that water samples collected in the manholes are indicative of the surrounding media. Breaks and cracks in the sewer line should be located either by tracer test and/or video log before the proposed cleanup plan is initiated. Following location of cracks, characterization of the surrounding soil may be required.*

Response:

As indicated in the discussion of Comment No. 8, the Laboratory does assert that water in the line is conservatively representative of the groundwater outside the line; groundwater is the source of the water in the line. It is reasonable to assume that every joint in the line, as well as cracks that may have developed after the line was installed, could be a pathway for infiltration/exfiltration of water. Available information indicates that the pipe used to construct the line has joints every two to three feet. The Laboratory believes that it is not cost-effective to sample every such location. Comparison of the concentrations in the sediments with cleanup levels, as derived in the modified Section 2.4.3 indicate that no removal of sediments from the sewer line is required. The sampling of groundwater within and outside the line, as detailed in the response to Comment No. 8, will provide verification that no significant groundwater contamination has occurred.

Proposed Changes in Text:

See response to Comment No. 8.

SWMU 8-003(a)

Comment No. 11: *The expedited cleanup plan should indicate which facilities are being considered for disposal of the material.*

Response:

In addition to Section 2.3, Section 3.4.2 of the EC Plan also addresses this issue. The contaminated soil will be disposed at an approved, permitted waste disposal facility. Since the contaminated soil is classified as hazardous waste, LANL will send it to a permitted hazardous waste disposal facility.

The final report will include a discussion on the final disposition of all waste generated.

Proposed Changes to Text: None required.

ANNEX 6.10

Methodologies for Developing Site-Specific Cleanup Goals to Demonstrate Clean Closure

Methodologies for Developing Site-Specific Cleanup Goals to Demonstrate Clean Closure

1.0 APPROACH

Site-specific risk-based cleanup goals were calculated for Solid Waste Management Unit (SWMU) 18-001, Manhole-176 (MH-176), MH-170, MH-169, and MH-160. Results of sampling conducted at MH-176, MH-170, MH-169, and MH-160 indicated that some metals and some semivolatiles failed the screening assessment [comparison to background concentrations and screening action levels (SALs)] and have been identified as chemicals of concern (COCs) at their respective MHs. Chemicals of concern for these MHs are presented in Table I.

TABLE 1

CHEMICALS OF CONCERN FOR MH-176, MH-170, MH-169, AND MH-160

Manhole	Chemical of Concern
MH-176	Lead
	Benzo(a)pyrene
	Benzo(b)fluoranthene
MH-170	bis(2-ethylhexyl)phthalate
MH-169	Barium
MH-160	Benzo(a)pyrene

2.0 CLEANUP GOALS

2.1 Chemicals Other Than Lead

Site-specific cleanup goals were calculated using modified Environmental Protection Agency (EPA) equations and site-specific input parameters. Because of the location of these sites, cleanup goals are based on a reasonable maximum exposed individual (a healthy working adult) under a continued laboratory operations land use scenario.

Under the industrial land use scenario, risk from exposure to chemicals in the manholes is assumed to be a result of incidental ingestion, inhalation of particulates from the soil, and dermal exposure during excavation (i.e., intrusive work). Under this scenario it is assumed that heavy equipment may be used. Thus, there is a greater potential for soils to be disturbed and produce particulate emissions than in most industrial, residential, and recreational land use scenarios. EPA default parameters are based on intrusive work and the physical properties of the COCs.

Calculations of cleanup goals are consistent with Risk Assessment Guidance for

Calculations of cleanup goals are consistent with Risk Assessment Guidance for Superfund (RAGS) Part B (EPA 1991a) and RAGs Supplemental Guidance (EPA 1991b) and consider updates to the RAGs Part B equations (EPA 1994a). The cleanup goals were developed using the most current sources of EPA-approved toxicity criteria found in the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Table (HEAST). Equations 1 and 2 were used to calculate cleanup goals for carcinogenic and noncarcinogenic chemicals, respectively. The methodology calculates a soil cleanup range for carcinogens from a target cancer risk range of 10^{-4} (i.e., 1 in 10,000) to 10^{-6} (i.e., 1 in a million) and a soil cleanup level for non-carcinogens from a target hazard quotient of 1. The equations for soil combine across pathways for direct exposure (i.e., ingestion, skin contact, and inhalation). When a chemical has toxicity criteria for both cancer and noncancer health effects, the most conservative calculated cleanup goal (i.e., cleanup goal based on carcinogenic risk or noncancer health hazard) is identified as the target cleanup level.

The cancer slope factor (CSF) and reference dose (RfD) for dermal exposure are calculated in Equations 3 and 4, respectively. Table 2, Spreadsheet for Calculating Cleanup Goals for Industrial Soil Exposure (Intrusive Work), provides chemical-specific input parameters. Table 3, Site-Specific Cleanup Goals (Intrusive Work) provides calculated site-specific cleanup goals for the chemicals of concern.

2.2 Lead

Since the anticipated future use of the Laboratory site is industrial, the residential exposure scenario is not relevant for this site. Under the industrial exposure scenario, a reasonable maximum exposed individual is a healthy adult worker.

An industrial soil lead cleanup level of 1,000 ppm has been adopted for the SWMUs described in this Permit Modification based on recommendations and discussions with EPA Region VI. The lead soil cleanup level is based on an industrial exposure scenario and considers fetal effects when a pregnant worker is exposed.

Equation 1: Direct Exposures to Carcinogenic Constituents in Industrial Soil (Intrusive Work)

$$C(mg/kg) = \frac{TR \times BW_a \times AT_c \times 365 d/y}{EF_o \times ED_o [\frac{IRS_o \times CSF_o}{10^6\ mg/kg} + \frac{SA_a \times CSF_d \times AF \times ABS}{10^6\ mg/kg} + IRA_a \times CSF_i \times (\frac{1}{VF_s} + \frac{1}{PEF})]}$$

Where:

C(mg/kg)	=	Cleanup goal for soil based on exposure to carcinogenic constituents (mg/kg)
TR	=	Target cancer risk (unitless) Considered to range from 1×10^{-4} to 1×10^{-6}
BW_a	=	Body weight, adult (kg) Considered to be 70 kg (EPA 1991b)
AT_c	=	Averaging Time - cancer (years) Considered to be 70 years (EPA 1991b)
EF_o	=	Exposure Frequency - occupational (d/y) Considered to be 90 d/y (LANL 1993)
ED_o	=	Exposure duration - occupational (years) Considered to be 1 year (LANL 1993)
IRS_o	=	Soil ingestion - occupational (mg/day) Considered to be 480 mg/day (LANL 1993)
CSF_o	=	Cancer slope factor-oral $(mg/kg\text{-}d)^{-1}$ (IRIS, HEAST, or ECAO)
SA_a	=	Surface area, adult (cm^2) Considered to be 3200 cm^2
CSF_d	=	Cancer slope factor-dermal $(mg/kg\text{-}d)^{-1}$ (See Equation 3)
AF	=	Adherence factor (mg/cm^2) Considered to be 0.2 mg/cm^2 (EPA 1992)
ABS	=	Skin absorption Considered to be 0.1 for organics (EPA 1994) Considered to be 0.01 for inorganics (EPA 1994)
IRA_a	=	Inhalation rate - adult (m^3/day) Considered to be 20 m^3/day (EPA 1991b)
CSF_i	=	Cancer slope factor-inhalation $(mg/kg\text{-}d)^{-1}$ (IRIS, HEAST, or ECAO)
$1/VF_s$	=	Volatilization factor for soil (m^3/kg) Considered to be zero for all chemicals with a molecular weight > 200 g/mole and Henry's Law Constant $<1 \times 10^{-5}$ atm-m^3/mole
PEF	=	Particulate emission factor (m^3/kg) Considered to be $1.32 \times 10^{+9}$ (m^3/kg) (EPA 1994)

Equation 2: Direct Exposures to Noncarcinogenic Constituents in Industrial Soil (Intrusive Work)

$$C(mg/kg) = \frac{THQ \times BW_a \times ED_o \times 365\ d/y}{EF_o \times ED_o \left[\frac{1}{RfD_o} \times \frac{IRS_o}{10^6 mg/kg} + \frac{1}{RfD_d} \times \frac{SA_a \times AF \times ABS}{10^6 mg/kg} + \frac{1}{RfD_i} \times \left(\frac{IRA_a}{VF_s} + \frac{IRA_a}{PEF}\right)\right]}$$

Where:

C(mg/kg)	=	Cleanup goal for soil based on exposure to noncarcinogenic constituents (mg/kg)
THQ	=	Target hazard quotient (unitless) Considered to be 1
BW_a	=	Body weight, adult (kg) Considered to be 70 kg (EPA 1991b)
ED_o	=	Exposure duration - occupational (years) Considered to be 1 year (LANL 1993)
EF_o	=	Exposure Frequency - occupational (d/y) Considered to be 90 d/y (LANL 1993)
RfD_o	=	Reference dose-oral (mg/kg-d) (IRIS, HEAST, or ECAO)
IRS_o	=	Soil ingestion - occupational (mg/day) Considered to be 480 mg/day (LANL 1993)
RfD_d	=	Reference dose-dermal (mg/kg-d) (IRIS, HEAST, or ECAO) (See Equation 4)
SA_a	=	Surface area, adult (cm^2) Considered to be 3200 cm^2
AF	=	Adherence factor (mg/cm^2) Considered to be 0.2 mg/cm^2 (EPA 1992)
ABS	=	Skin absorption Considered to be 0.1 for organics (EPA 1994) Considered to be 0.01 for inorganics (EPA 1994)
RfD_i	=	Reference dose inhalation (mg/kg-d) (IRIS, HEAST, or ECAO)
IRA_a	=	Inhalation rate - adult (m^3/day) Considered to be 20 m^3/day (EPA 1991b)
$1/VF_s$	=	Volatilization factor for soil (m^3/kg) Considered to be zero for all chemicals with a molecular weight >200 g/mole and a Henry's Law Constant $<1 \times 10^{-5}$ atm-m^3/mole
PEF	=	Particulate emission factor (m^3/kg) Considered to be $1.32 \times 10^{+9}$ (m^3/kg) (EPA 1994)

Equation 3: Dermal Cancer-Slope Factor (CSFd) Based Upon Absorbed Dose

Cancer slope factors based upon administered doses will be adjusted for absorption to obtain estimates of potential dermal cancer-slope factors (1992). Where absorption factors and oral cancer slope factors are available, dermal cancer-slope factors will be calculated using the following equation:

$$CSF_{absorbed} = \frac{CSF_{administered}}{A_{bs}}$$

Where:

$CSF_{absorbed}$ = cancer-slope factor based on absorbed dose
$CSF_{administered}$ = oral cancer-slope factor
A_{bs} = oral absorption factor

Equation 4: Dermal Reference Dose (RfDd) Based Upon Absorbed Dose

Reference doses based upon administered doses will be adjusted for absorption to obtain estimates of potential dermal reference doses (1992). Where absorption factors and oral reference doses are available, dermal reference doses will be calculated using the following equation:

$$RfD_{absorbed} = RfD_{administered} \times A_{bs}$$

Where:

$RfD_{absorbed}$ = reference dose based on absorbed dose
$RfD_{administered}$ = oral reference dose
A_{bs} = oral absorption factor

Table 2, Spreadsheet for Calculating Cleanup Goals for Industrial Exposure (Intrusive Work)

Chemical	Oral Absorption Factor	Oral Reference Dose (RfDo) (mg/kg/day)	Dermal Reference Dose (RfDd) (mg/kg/day)	Inhalation Reference Dose (RfDi) (mg/kg/day)	Oral Cancer Slope Factor (CSFo) 1/(mg/kg-day)	Dermal Cancer Slope Factor (CSFd) 1/(mg/kg/day)	Inhalation Cancer Slope Factor (CFSi) 1/(mg/kg/day)
Barium	0.05	7.00E-02	3.50E-03	1.43E-04	-	-	-
Lead	See Section 2.2						
Benzo(a)pyrene	1	-	-	-	7.30E+00	7.30E+00	NA
Benzo(b)fluoranthene	1	-	-	-	7.30E-01	7.30E-01	NA
bis (2-Ethylhexyl)phthalate	0.9	2.00E-02	1.80E-02	NA	1.40E-02	1.60E-02	NA

Table 3, Site-Specific Cleanup Goals (Intrusive Work)

Chemical	1 E-04 Risk or Hazard Index of 1			1 E-05 Risk of Hazard Index of 1			1 E-06 Risk of Hazard Index of 1		
	Noncancer Cleanup Goal	Cancer Cleanup Goal	Cleanup Goal (lower of two)	Noncancer Cleanup Goal	Cancer Cleanup Goal	Cleanup Goal (lower of two)	Noncancer Cleanup Goal	Cancer Cleanup Goal	Cleanup Goal (lower of two)
Barium	32,300	-	32,300	32,300	-	32,300	32,300	-	32,300
Lead	1,000	-	1,000	1,000	-	1,000	1,000	-	1,000
Benao(a)pyrene	-	500	500	-	50	50	-	5	5
Benzo(b)fluoranthene	-	5,000	5,000	-	500	500	-	50	50
bis(2-Ethylhexyl)phthalate	10,300	258,000	10,300	10,300	25,800	10,300	10,300	2,580	2,580

Footnote: Lead cleanup goal adopted by Region VI EPA.

References:

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