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Ecotoxicological Screen of Potential Release Site 50-006(D) of Operable Unit 1147 of Mortandad Canyon and Relationship to the Radioactive Liquid Waste Treatment Facilities Project

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ACRONYMS

BDAT	Best demonstrated available technology
crql	Contractor-required quantitation limit
DCG	Derived concentration guideline
DI	Data inadequate
EPS	U. S. Environmental Protection Agency
ESAL	Ecotoxicological screening action level
FIMAD	Facility for Information Management, Analysis, and Display
HEAST	Health Effects Assessment Summary Tables
IRIS	Integrated Risk Information System
LANL	Los Alamos National Laboratory
M&O	Management and operation
Max. SC	Maximum soil concentration
MCL	Maximum contaminent level
NFA	No further action
NOAEL	No Observed Adverse Effect Level
NPDES	National Pollution Discharge Elimination System
PCOC	Potential contaminant of concern
PRS	Potential release site
RLWTF	Radioactive Liquid Waste Treatment Facility
SAL	Screening action level (human risk)
SWMU	Solid waste management unit
UTL	Upper tolerance limit

ECOTOXICOLOGICAL SCREEN OF POTENTIAL RELEASE SITE 50-006(D) OF OPERABLE UNIT 1147 OF MORTANDAD CANYON AND RELATIONSHIP TO THE RADIOACTIVE LIQUID WASTE TREATMENT FACILITIES PROJECT

by

G. J. Gonzales and P. G. Newell

ABSTRACT

Potential ecological risk associated with soil contaminants in Potential Release Site (PRS) 50-006(d) of Mortandad Canyon at the Los Alamos National Laboratory was assessed by performing an ecotoxicological risk screen. The PRS surrounds Outfall 051, which discharges treated effluent from the Radioactive Liquid Waste Treatment Facility. Discharge at the outfall is permitted under the Clean Water Act National Pollution Discharge Elimination System. Radionuclide discharge is regulated by US Department of Energy (DOE) Order 5400.5.

Ecotoxicological Screening Action Levels (ESALs) were computed for nonradionuclide constituents in the soil, and human risk SALs for radionuclides were used as ESALs. Within the PRS and beginning at Outfall 051, soil was sampled at three points along each of nine linear transects at 100-ft intervals. Soil samples from 3 depths for each sampling point were analyzed for the concentration of a total of 121 constituents. Only the results of the surface sampling are reported in this report.

The spatial change in radionuclide concentrations from the outfall to the downcanyon sample locations was statistically insignificant. The average concentration (19.7 pCi/g) of alpha-emitting radionuclides was higher than values reported in a different study for all 15 onsite locations for the period 1976–1981 and is 242% of the mean gross alpha concentration measured in the same area between 1975 and 1977 (Purtymun et al., 1980). The variation within transect means in this study was high (avg. std. dev., alpha = 3.1 pCi/g). Although the results of subsurface sampling are not reported here, a cursory review of the data revealed that the concentrations of several of the Potential Contaminants of Concern (PCOCs) are highest at the intermediate sampling depth, 1.5–2.5 ft. Of 121 screened soil constituents, 42 met the criteria for PCOCs. However, 25 of the 42 PCOCs were constituents for which the maximum soil concentration was equal to or less than the lowest required analytical limit, which is known as the "contractor-required quantitation limits" (crql's). Excluding the crql-related PCOCs, there were no semi-volatile PCOCs, 1 volatile PCOC, 5 inorganic PCOCs, and 11 radionuclide PCOCs. The inorganic PCOCs are heavy metals and are of concern because of their susceptibility to biomagnification. There were inadequate data to make a determination on 20 constituents. Animal guild sensitivities in descending order were small herbivore, small omnivore, small carnivore, and large herbivore. In general, PRS 50-006(d) as a whole cannot be proposed for No Further Action at this time from the perspective of potential ecological impact. The results may be compliance issues related to the National Resource Damage Assessment, the Clean Water Act, and/or the Comprehensive Environmental Response, Compensation, and Liability Act. At least 17 PCOCs require further investigation in an Ecological Risk Assessment.

Planned discharge of "supercleaned" waste water from a new plant will add to the complexity of PRS consideration. The authors theorize that radionuclides could be remobilized, making them available for vertical and horizontal transport and for biotic uptake.

1.0. INTRODUCTION

An ecotoxicological screening, hereafter referred to as "the Screen," was conducted in a small portion of Mortandad Canyon at the Los Alamos National Laboratory (LANL), which is located in north central New Mexico (Fig. 1). The purpose of the Screen was to assess the need for an Ecological Risk Assessment of Potential Release Site (PRS) 50-006(d) (Fig. 2). A risk assessment, if needed, would begin to assess the potential past ecological impact of the Radioactive Liquid Waste Treatment Facility (RLWTF), which discharges treated effluent in a Mortandad Canyon inlet. The Screen focussed on examining soil contaminant data for an area including Outfall 051 (Fig. 2), which releases treated effluent from the RLWTF. The sampled area extends 800 ft down canyon from Outfall 051. A secondary purpose of the Screen was to provide screening results that can be used to validate the Probabilistic Risk and Hazard Analysis Group's environmental hazard analysis (EHA) methodology. Validating the EHA methodology provides a link between ecotoxicological impact screening and traditional hazard analysis (HA) such that a simple EHA can be applied to facilities concurrently with the conduct of HAs.

2.0. BACKGROUND

The methodology used in this report is based on the more detailed methodology of Ecological Risk Assessments. Ecological Risk Assessments are currently based on three principles: Problem Formulation, Analysis, and Risk Characterization (EPA, 1992). In the Screen methodology, the Ecological Risk Assessment principles have been broken down into five working components.

- Site Characterization
- Endpoint Selection
- Hazard Identification
- Exposure/Dose-Response Estimation
- Risk Characterization

These components serve as input to a decision tree for the use of ecotoxicological screening action levels (ESALs) at environmental restoration sites (Ebinger et al., 1995).

2.1. Site Characterization

Section 2.1.1 describes the types of operations that have been and continue to be conducted at the RLWTF and associated structures. Section 2.1.2 describes the environmental topography, climate, geology and stratigraphy, hydrology, and ecology associated with PRS 50-006(d).

2.1.1. Discharge Regulation

2.1.1.1. Waste Generation and Discharge. LANL was established during World War II to design the first nuclear weapon and continued to operate to advance nuclear technology after the war. Technical Area 50 (TA-50) was built in response to the growing need for treatment and disposal of Laboratory wastes. The RLWTF, which is within Solid Waste Management Unit (SWMU) 50-001(a) (Fig. 3), began operation in 1963 and continues to operate. This facility treats and removes radioactive elements from liquid waste produced by 75 to 100 waste generators from throughout the Laboratory. The liquid waste is received by a drainline system, SWMU 50-001(b), which is shown in Fig. 4. The facility is designed to treat 250 gal./min of contaminated liquids by neutralization, flocculation/clarification, pH control, ion exchange, and filtration (LANL, 1992).

Of concern to this study is the operational release from SWMU 50-006(d) into Mortandad Canyon through Outfall 051 (Figs. 4, 5, and 2). This release is a permitted outfall release under the National Pollutant Discharge Elimination System (NPDES), Permit No. NM0028355. SWMU 50-006(d) is the treated liquid waste discharge line (No. 64) from the RLWTF [50-001(a)] to the stream channel outfall in Mortandad Canyon. In 1983, this 6-in.-diam iron discharge pipe's route into

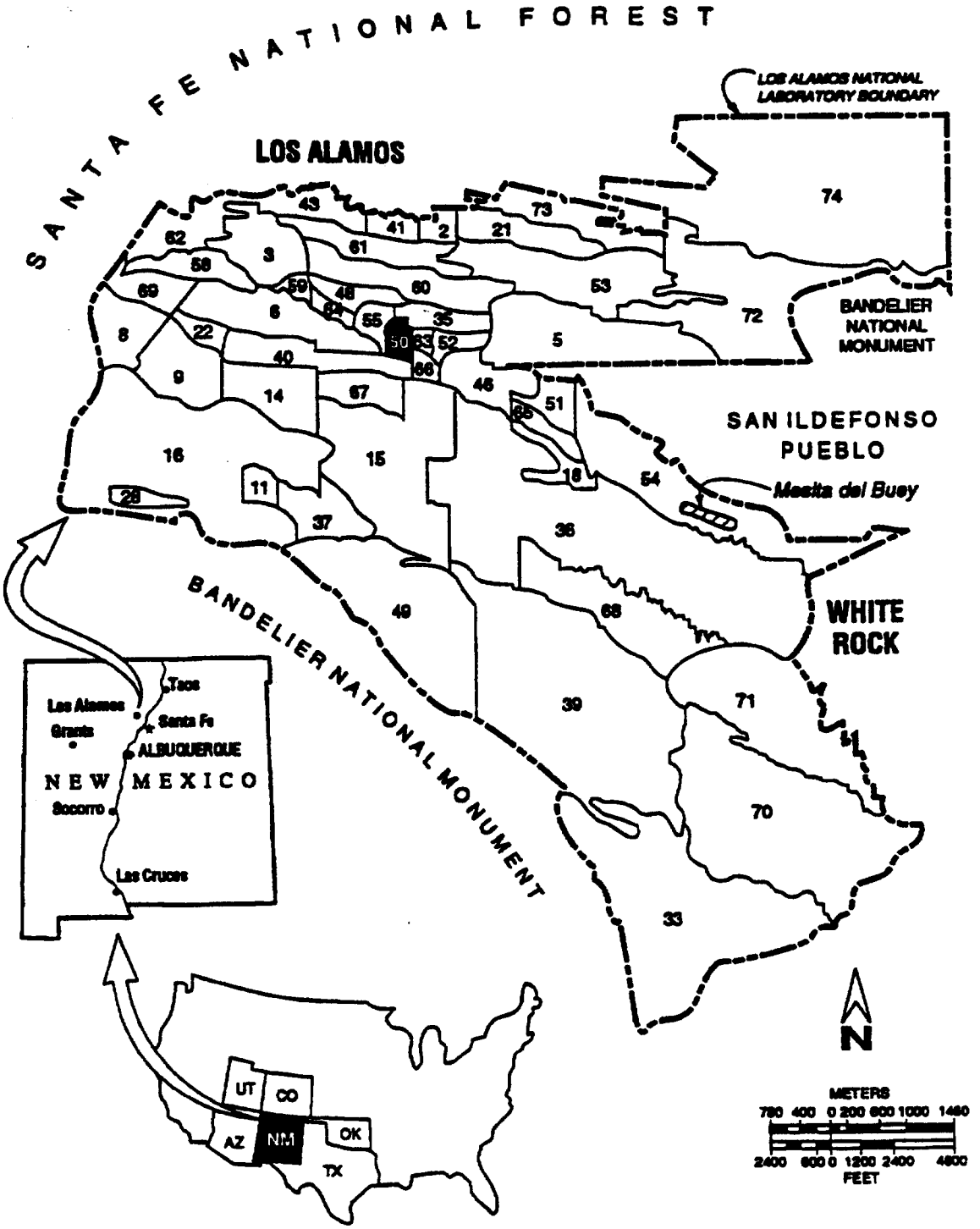

Fig. 1. Location of the Los Alamos National Laboratory.

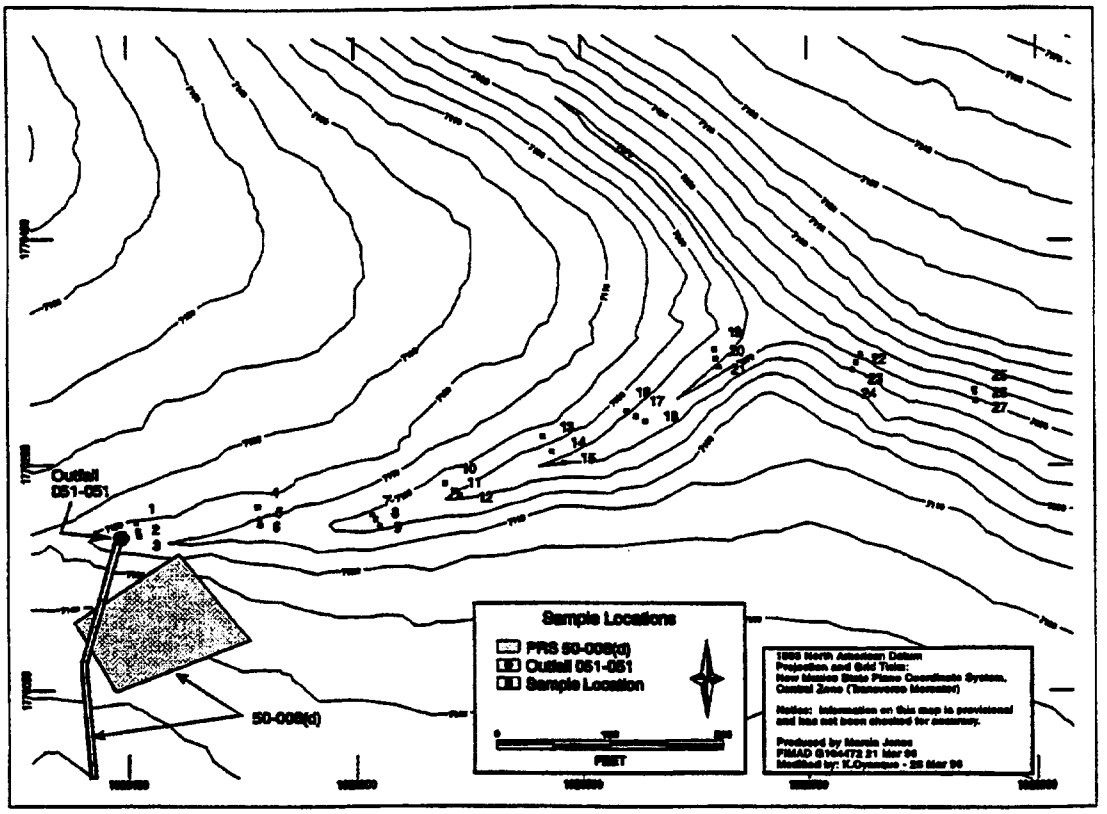

Fig. 2. Approximate location of Outfall 051-051, PRS 50-006(d) and sampling for the ecotoxicological screen. (Note: Samples 1, 2, 3 = "Transect #1"; samples 4, 5, 6 = "Transect #2"; and so on.

Mortandad Canyon was adjusted to accommodate the building of the Target Fabrication Facility (TA-35-213). A US Environmental Protection Agency (EPA) Region VI administrative order was issued to the US Department of Energy (DOE) on February 3, 1985, requiring modification of the outfall to alleviate stream bank erosion caused by the outfall pipe ending 25 ft short of the stream channel. In response to the administrative order, the pipe was extended into the stream channel, and the administrative order was closed on October 15, 1986.

2.1.1.2. Clean Water Act/National Pollution Discharge Elimination System. Although all treated effluent has been and continues to be sampled and screened before release, the treated effluent release into the canyon that began in 1963 has resulted in an accumulation of heavy metals and radionuclides in the stream channel sediments, bank soils, and underlying tuff (LANL, 1992). This outfall is recorded having 13 NPDES outfall permit violations for iron and copper (LANL, 1992).

2.1.1.3. Radiation Protection of the Public and the Environment (DOE 5400.5.) DOE Order 5400.5, "Radiation Protection of the Public and the Environment," regulates the discharge of radionuclides from Outfall 051 (DOE, 1990). In addition to limiting dose to members of the public (onsite and offsite), controls on the release of liquid wastes were adopted to reduce the potential for radiological contamination of natural resources such as land, ground, and ecosystems. Derived Concentration Guideline (DCG) values in the Order for liquid effluent discharges have the objective of minimizing contamination in the environment to the extent practicable.

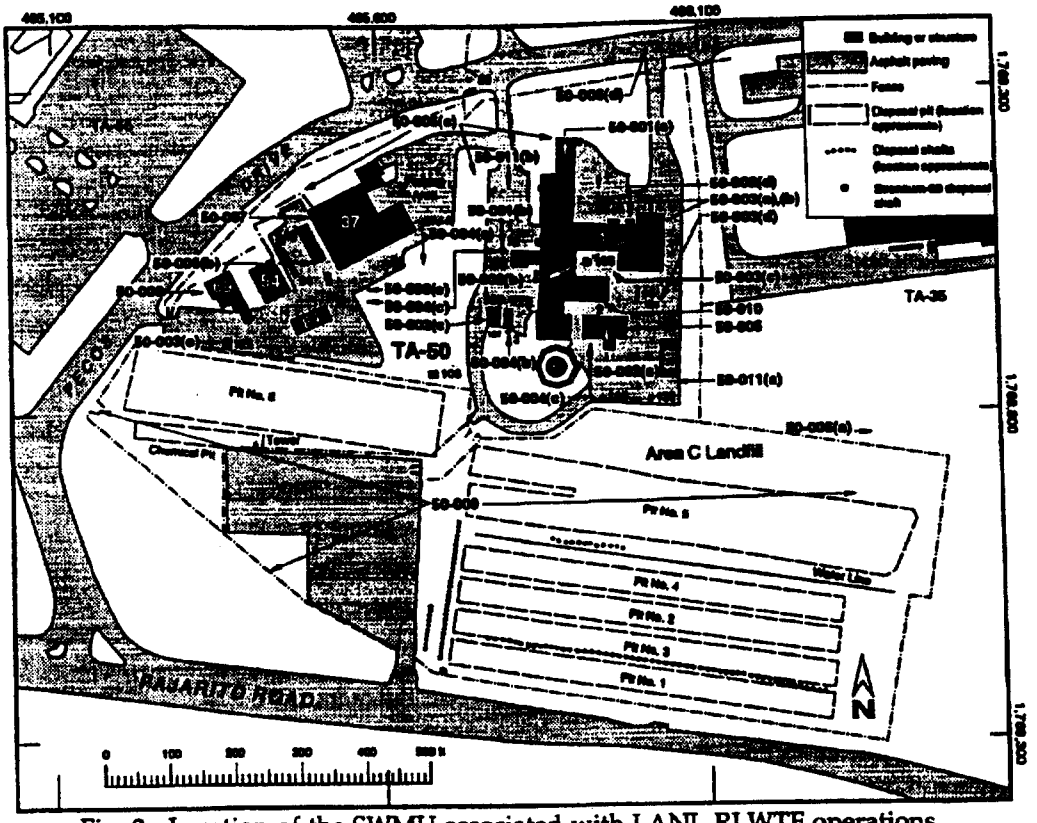

Fig. 3. Location of the SWMU associated with LANL RLWTF operations.

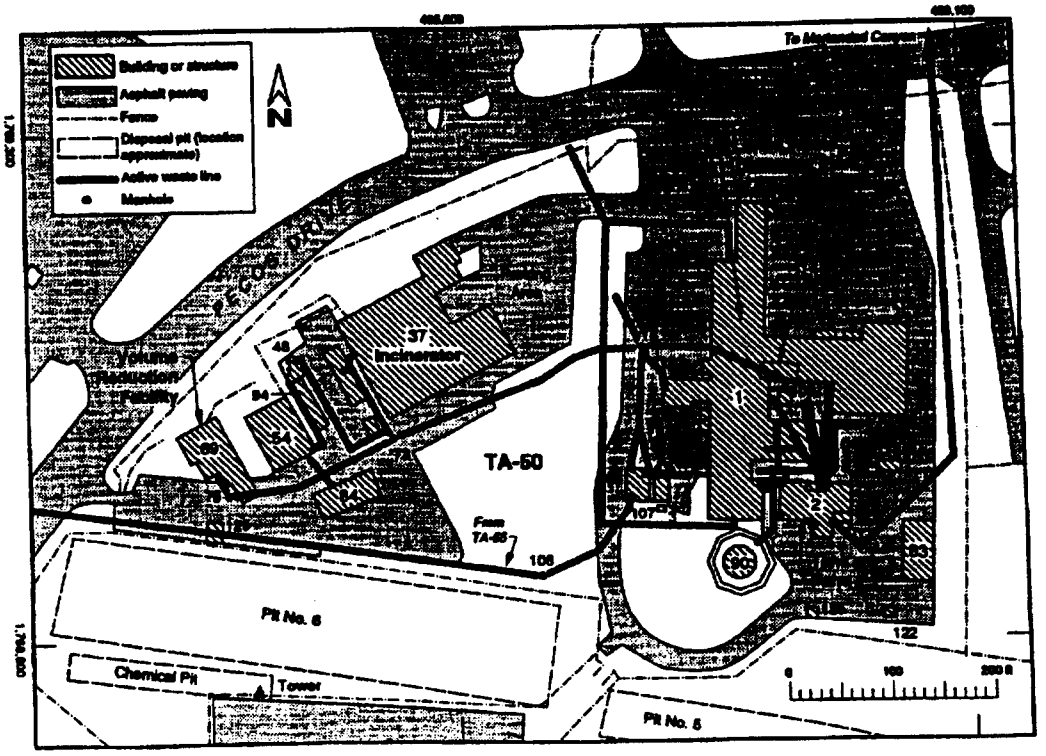

Fig. 4. Schematic of drainline systems for RLWTF influent and effluent.

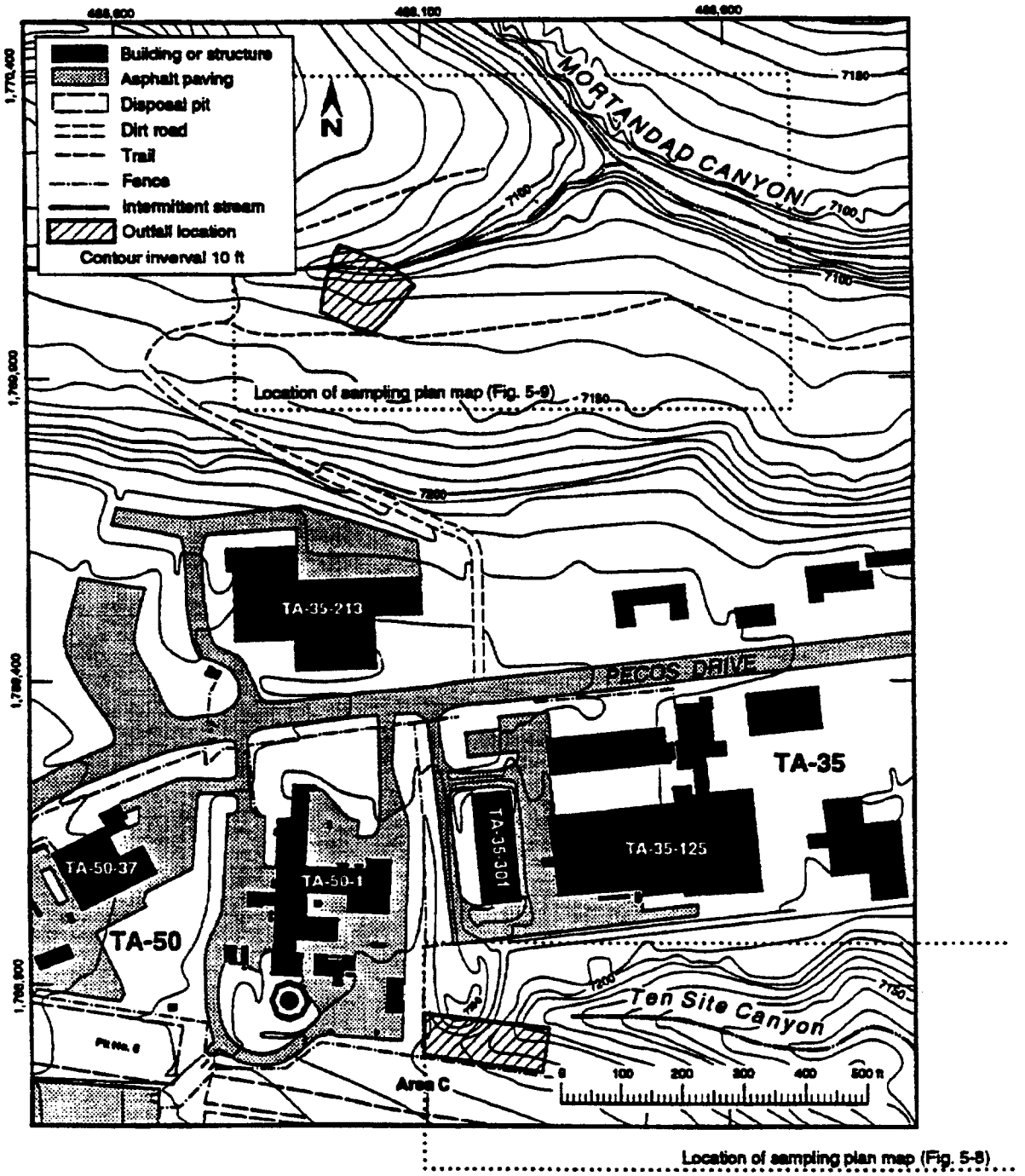

Fig. 5. Map showing the location of the LANL RLWTF discharge into Mortandad Canyon through Outfall 051.

Table 1 is a comparison of arithmetic mean concentrations of radionuclides in the RLWTF process effluent for calendar year 1991 with the DCGs (Bond and Gonzales, 1995). The DCGs were exceeded for four radionuclides (^{90}Sr, ^{137}Cs, ^{239}Pu, and ^{241}Am), and the sum of the normalized radionuclide concentrations (measured concentration divided by DCG) exceeds 1.0. The DCGs are liquid radionuclide discharge screening levels that, if exceeded, require the completion of a Best Available Technology (BAT) study, ultimate consideration of implementing the BAT, and the performance of a risk assessment.

A Best Demonstrated Available Technology (BDAT) study has been completed (RTG, 1995), and the selected technology is a hybrid of reverse osmosis and evaporation as the main treatment processes. The BDAT has resulted in conceptual design of a proposed new RLWTF. The DOE has the expectation that any BDAT implemented by its management and operation (M&O) contractors protect

TABLE 1

AVERAGE RADIONUCLIDE CONTENT AND COMPARISON WITH DCG VALUES OF PROCESS EFFLUENT LANL RLWTF

Radionuclide	Concentration (nCi/L)	DCG[a] (nCi/L)	Ratio Conc./DCG
^{3}H	484.0	2,000.0	0.24
^{57}Co	0.04	100.0	0.0004
^{75}Se	0.27	20.0	0.01
^{83}Rb	1.9	20.0	0.1
^{84}Rb	0.11	10.0	0.01
^{85}Sr	1.7	70.0	0.02
^{88}Y	0.03	30.0	0.001
^{89}Sr	0.24	20.0	0.012
^{90}Sr	3.7	1.0	3.7
^{137}Cs	3.1	3.0	1.03
^{234}U	0.003	0.5	0.006
^{238}Pu	0.01	0.04	0.25
^{239}Pu	0.04	0.03	1.3
^{241}Am	0.05	0.03	1.7
Gross alpha	0.11	-	-
Gross beta	10.8	-	-

[a]DCG - Derived Concentration Guideline defined by DOE Order 5400.5 as the concentration of a radionuclide in drinking water that would result in a limiting 100-mrem committed dose by the ingestion pathway over a 1-yr period.

groundwater and prevent radionuclide buildup in the soil (DOE, 1990). For any constituents that exceed ESALs, an Ecological Risk Assessment should examine the relationship between the ESALs and DCGs. This is important to providing critical feedback on whether compliance limits protect human and ecological health adequately.

As a result of the BDAT, a proposed new RLWTF has been designed to the 95% stage. The predicted effluent characteristics are such that the modeled discharge water would be essentially void of ions. This essentially distilled water is planned for discharge to the same PRS in Mortandad Canyon that currently is being used. Although it is a complex process requiring study, the "supercleaned" water could serve as an "ion seeker" that will attract radionuclides that are now bonded to soil colloids (Welch, 1980). This may, in essence, remobilize the radionuclides, making them available for vertical and horizontal transport and for biotic uptake. The distance from the PRS to offsite areas is large; remobilized radionuclides may be transported further down canyon, but equilibrium likely will occur well before the offsite boundary. Nevertheless, hydrologic transport of radionuclides is a complex process requiring site-specific investigation.

The remobilization concept may present a unique opportunity to remediate the PRS-affected area. Based on a preliminary review of the scientific literature, there are strong indications that concentrations of both radionuclides and nonradionuclides can be lowered to below SALs and ESALs using *in situ* phytoextraction. Phytoextraction is the term given to the new technology of using large-biomass plants to translocate soil constituents to easily harvested, above-ground, plant parts. This potential remediation opportunity needs further study.

2.1.1.4. Discussion. With codification of DOE 5400.5 in the Code of Federal Regulations (10 CFR 834), the DCGs are legally available to the EPA for adoption as maximum contaminant levels (MCLs) with which LANL must comply under statutory enforcement (Hanson, 1994). Because of the BDAT study, current plans to replace or upgrade the RLWTF will result in a much cleaner effluent, essentially consisting of distilled water (RTG, 1995a). This water will possess such a void of ions that its discharge is considered "Discharge of Other Liquids," in DOE 5400.5. In this case, a new discharge location is permitted under the NPDES because "liquid discharges, even though uncontaminated, are prohibited in inactive release areas to prevent the further spread of radionuclides previously deposited" (DOE, 1990).

2.1.2. Environmental Setting

2.1.2.1. Topography. LANL is located in north central New Mexico. The Laboratory lies 100 km (62 mi) north-northeast of Albuquerque, New Mexico, and 40 km (25 mi) northwest of Santa Fe, New Mexico. LANL and the adjacent communities of Los Alamos and White Rock occupy 111 km^2 (43 mi^2) of the Pajarito Plateau, which consists of a series of finger-like mesas separated by deep canyons (Fig. 5). The orientation of the mesa top/canyon system is east-west to northwest-northeast. Mesa tops on the west have a maximum elevation of 2400 m (7870 ft) and intersect with the eastern flank of the Jemez Mountains. At the east end of the plateau, the mesa tops have a maximum elevation of 1800 m (5900 ft) as they intersect the Espanola Valley and White Rock Canyon. All other mesa tops are at elevations between the west and east extremes (LANL, May 1992).

TA- 50 (Fig. 1) and the RLWTF are located on the north central half of LANL on the Mesita del Buey. TA-50 is bordered by Mortandad Canyon, Ten Site Canyon, Two Mile Canyon, and Canada del Buey. The mesa top elevations in this area range from 2194–2218 m (7200–7280 ft) (LANL, 1992).

2.1.2.2. Climate. Los Alamos is located in an area with a semi-arid, temperate mountain climate. The predominant wind direction is north to northeast with wind speeds generally less than 5.5 mph (40% of the time), but winds do increase to speeds greater than 11 mph (20% of the time). The strongest winds occur in the spring (LANL, May 1992).

On the Pajarito Plateau, average precipitation is 18 in., with one-third of that resulting from snow. Most rainfall (40%) is the result of intense thunderstorms in July and August that can create large volumes of surface run-off. The winter brings an average accumulation of 130 cm (51 in.) of snow, which also adds to run-off in the warmer months (LANL, May 1992).

2.1.2.3. Geology and Stratigraphy. Two zones are important to site characterization and remediation: (1) the Vadose Zone and (2) the Upper Saturated Zone. TA- 50 is underlain by Miocene and Pleistocene volcanic and sedimentary rocks. As shown in Fig. 6, the following geologic units underlie TA-50 (listed from above surface to below ground).

- Tshirege (upper) Member of the Bandelier Tuff
- Otowi (lower) Member of the Bandelier Tuff (including Guaje Pumice)
- Guaje Member
- Puye Formation
- Santa Fe Group

The Puye Formation consists of (in descending order)

- the first Puye Conglomerate,
- basaltic lava flows of Chino Mesa, and
- a second Puye Conglomerate.

The soils of the mesa tops surrounding TA-50 are mainly shallow, well-drained, sandy loams. The soils at PRS 50-006(d) belong to the TOCAL Series (Nyhan et al., 1978).

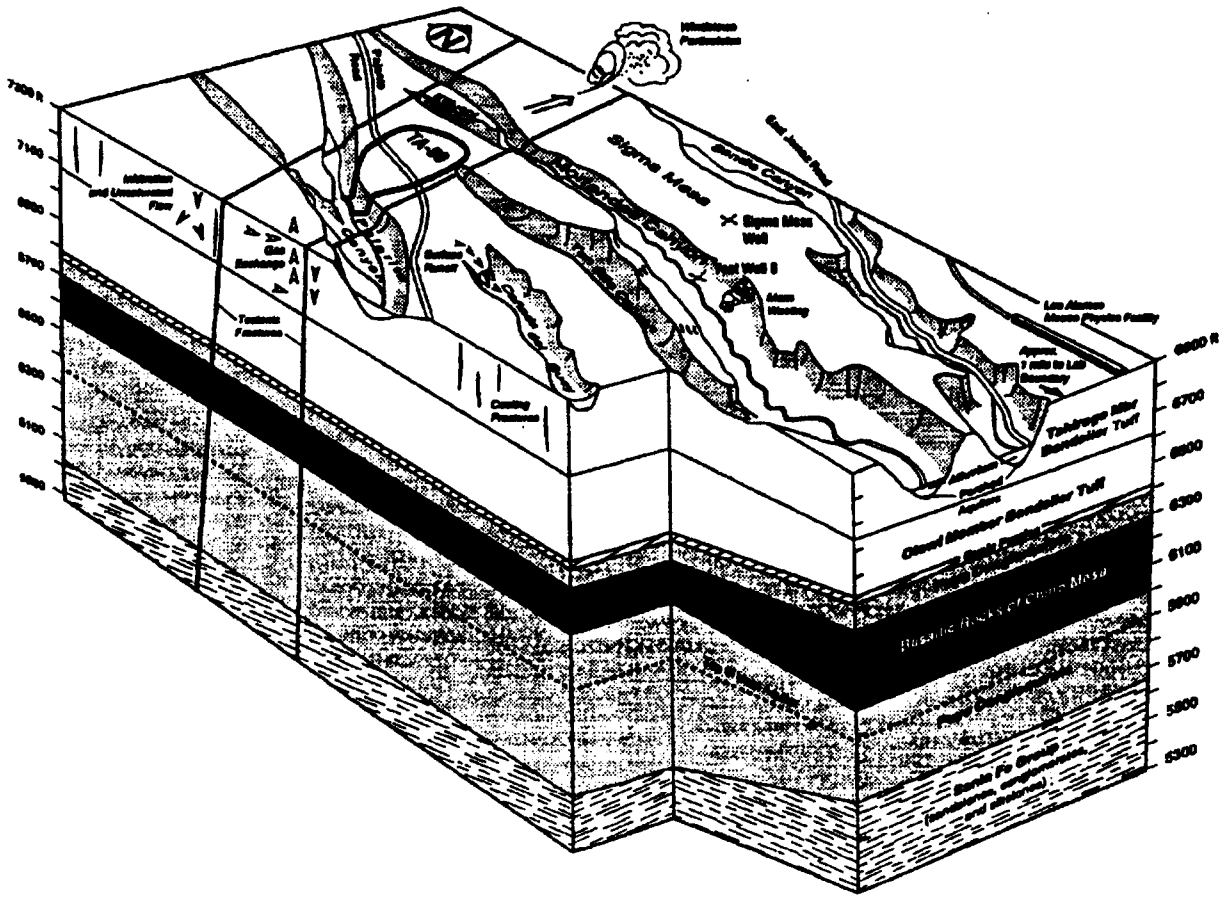

Fig. 6. Schematic block diagram of the geology and stratigraphy of the area surrounding LANL TA-50.

2.1.2.4. **Hydrology.** The surface water hydrology is characterized by ephemeral streams. Runoff from heavy thunderstorms or snows can cause flows that reach the Rio Grande (LANL 1992). Effluent releases from sewage treatment plants, industrial plants, and cooling towers also contribute to limited segment flows in the canyons. Any flow with a high discharge rate (thunderstorm runoff or effluent release) tends to suspend and move large masses of sediment down the canyon, sometimes all the way to the Rio Grande (LANL May 1992).

The groundwater hydrology generally is characterized by three types of systems: (1) shallow alluvium, which is quite permeable; (2) perched water; and/or (3) the main aquifer.

2.1.2.5. **Ecology.** The primary target groups of the ecotoxicological screen were the mammals that use Mortandad Canyon partially or totally for their foraging needs. Table 2 lists each mammal known to be found in Mortandad Canyon along with information on the ecological niche(s) occupied and the animal exposure guild (foraging mode).

3.0. METHODOLOGY

3.1. Endpoint Selection

Application of the screening methodology to PRS 50-006(d), also called SWMU 50-006(d), resulted in the selection of endpoints that focused on community effects on four key animal exposure guilds known to have access to the area known as Mortandad Canyon. The key animal exposure guilds are (1) small herbivore mammal, (2) large herbivore mammal, (3) small carnivore mammal, and (4) small omnivore mammal. In this study, a guild is defined as species that use similar resources in similar ways (Root 1967). The community effect endpoint for each guild is based on calculated ESALs discussed in Sec. 3.4.

3.2. Hazard Identification and Potential Contaminants of Concern

Hazard identification includes listing the constituents selected as candidates for Potential Contaminants of Concern (PCOCs). The basis for generating the list of 121 candidates was knowledge of chemicals processed during historical site activities; i.e., discharge into Mortandad Canyon. Section 3.3 summarizes the sampling and analysis plan used to acquire and measure the amounts of these candidate PCOCs and sample locations are identified in Fig. 2. Candidate PCOCs are listed in Table 3.

3.3. Sampling and Analysis

In June 1993, a four-phase sampling and analysis scheme was employed at PRS 50-006(d)/ Mortandad Canyon sampling area, per RFI Work Plan LA-UR-92-969 (LANL 1992). The four phases were (1) field survey, (2) field screening, (3) field sampling, and (4) laboratory analysis. Every third sample was subjected to the following analyses.

- Gamma spectrometry
- Tritium
- Total Uranium
- Isotopic Uranium
- Isotopic Plutonium
- Strontium-90
- Volatile Organic Aromatics (SW 8246)
- Semi-Volatile Organic Aromatics (SW 8270)
- Metals (SW 6016)
- Polychlorinated biphenyls (SW 8080)

TABLE 2

SPECIES LIST FOR MAMMALS IDENTIFIED WITHIN MORTANDAD CANYON (FROM TA-52 TO SAN ILDEFONSO SACRED AREA)[a,b]

Common Name[a]	Species Name[a]	Niche(s) Occupied[b]	Animal Exposure Guild[b]
Deer mouse	*Peromyscus maniculatus*	Primary consumer/herbivore • Juniper/grassland upland climax • Pinyon/juniper woodland upland climax and early succession • Ponderosa pine upland climax, early succession and riparian • Mixed-conifer forest upland climax and early succession • Spruce/fir upland climax	Small herbivore mammal
Brush mouse	*Peromyscus boylii*	Primary consumer/herbivore • Pinyon/juniper woodland upland climax • Spruce/Fir upland climax	Small herbivore mammal
Pocket gopher	*Thomomys bottae*	Primary consumer/ground-roots • Ponderosa pine forest upland climax	Small herbivore mammal
Long-tailed vole	*Microtus longicaudus*	Primary consumer/ground-grazer • Ponderosa pine forest early succession • Mixed-conifer forest early succession • Spruce/fir upland climax	Small herbivore mammal
Colorado chipmunk	*Eutamias minimus*	Primary consumer/herbivore • Pinyon/juniper woodland upland climax foliage-seed • Ponderosa pine forest upland climax and early succession • Mixed-conifer forest upland climax	Small herbivore mammal
Silky pocket mouse	*Perognathus flavus*	Primary consumer/ground-seed • Ponderosa pine forest upland climax	Small herbivore mammal
Rocky Mountain elk	*Cervus claphus nelsoni*	Primary consumer/ground grazer herbivore • Juniper/grassland upland climax • Pinyon/juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax • Spruce/fir upland climax	Large herbivore mammal
Mule deer	*Odocoileus hemionus*	Primary consumer/ground browser herbivore • Juniper/grassland upland climax • Pinyon/juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax • Spruce/fir upland climax	Large herbivore mammal
Black bear	*Ursus americanus*	Omnivore • Juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax scavenger and omnivore • Spruce/fir upland climax	Large omnivore mammal
Coyote	*Canis latrans*	Secondary consumer/predator/carnivore • Juniper/grassland upland climax • juniper woodland upland climax • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax • Spruce/fir upland climax	Medium carnivore mammal[c]
Porcupine	*Erethizon dorsatum*	Primary consumer/foliage-cambrium • Ponderosa pine forest upland climax • Mixed-conifer forest upland climax	Small herbivore mammal

[a] LANL 1992
[b] Ebinger, et al., 1995
[c] Note: Medium mammal is not a listed animal exposure guild body size. However, for the purposes of this report, a small mammal exposure guild is considered to be protective of the medium mammal.

TABLE 3

CANDIDATE POTENTIAL CONTAMINANTS OF CONCERN AT PRS 50-006(D)

MORTANDAD CANYON

Semi-volatiles	Semi-volatiles (cont)	Volatiles	Inorganics	Radionuclides
Acenapthene	Fluoranthene	Acetone	Antimony	Americium-241
Acenapthylene	Fluorene	Benzene	Arsenic	Barium-133
Anthracene	Hexachlorobenzene	Benzoic acid	Barium	Cesium-134
Aroclor[Mixed-]	Hexachlorobutadiene	Bromodichloromethane	Beryllium	Cesium-137
Benzo[a]anthracene	Hexachlorocyclopentadiene	Bromoform	Cadmium	Cobalt-57
Benzo[a]pyrene	Hexachloroethane	Bromomethane	Cr (III)	Cobalt-60
Benzo[b]fluoranthene	Indeno[1,2,3-cd]pyrene	Butanone[2-]	Cr (IV)	Europium-152
Benzo[g,h,i]perylene	Isophorone	Carbon disulfide	Lead	Plutonium-238
Benzo[k]fluoranthene	2-Methylnapthalene	Carbon tetrachloride	Mercury	Plutonium-239
Bis(2-chloretnoxy)methane	Methylphenol[2-]	Chlorobenzene	Nickel	Potassium-40
Bis(2-chloroethyl)ether	Methylphenol[4-]	Chloroethane	Selenium	Radium-226
Bis(2-chloroisopropyl)ether	Napthalene	Chloroform	Silver	Strontium-90
Bis-(2-ethylhexyl)phthalate	Nitroaniline[2-]	Chloromethane	Thallium	Thorium-232
Bromodiphenyl ether[4-]	Nitroaniline[3-]	Dichlorethane[1,1-]		Tritium
Butyl benzyl phthalate	Nitroaniline[4-]	Dichloroethane[1,2-]		Uranium-234
Chloro-3-methylphenol[4-]	Nitrobenzene	Dichlorethene[1,1-]		Uranium-235
Chloroaniline[4-]	Nitrophenol[2-]	Dichlorethylene[trans-1,2-]		Uranium-238
o-Chlorophenol	Nitrophenol[4-]	Dichlorethylene[cis-1,2-]		
Chrysene	Nitrosodi-n-ropylamine[N-]	Dichloropropane[1,2-]		
Dibenzo[a,h]anthracene	Nitrosodiphenylamine[N-]	Dichloropropene[cis-1,3-]		
Dibenzofuran	Pentachlorophenol	Dichloropropene[trans-1,3-]		
Di-n-butyl phthalate	Phenanthrene	Ethyl benzene		
Di-n-octyl phthalate	Phenol	Hexanone[2-]		
Dichlorbenzene[o-]	Pyrene	Methylene chloride		
Dichlorbenzene[m-]	Trichlorobenzene[1,2,4-]	Styrene		
Dichlorbenzene[p-]	Trichlorophenol[2,4,5-]	Tetrachloroethane[1,1,1,2-]		
Dichlorobenzidiene[3,3'-]	Trichlorophenol[2,4,6-]	Tetrachloroethane[1,1,2,2-]		
Dichlorphenol[2,4-]		Trichloroethane[1,1,1-]		
Diethyl phthalate		Trichloroethane[1,1,2-]		
Dimethyl phthalate		Trichloroethene		
Dimethylphenol[2,4-]		Vinyl chloride		
Dinitrophenol[2,4-]		Xylene[mixed-]		

Shallow boreholes (3 ft deep) were made in groups of three along nine linear transects (Fig. 2) that were perpendicular to the stream channel. The first transect was in line with Outfall 051, and the additional eight transects were located at 100-ft intervals extended along the line of drainage, for a total horizontal distance of 800 ft. Each borehole served as a sample point; thus, there were three sample points per transect. Of the three samples, one was positioned in the channel bottom, one was on the north-facing slope, and one was on the south-facing slope. Sample depths within a borehole included 0–0.5 ft ("surface level"), 1.5–2.5 ft, and 3–4 ft. A total of 27 samples was taken from the sampling area at each depth. Beyond reviewing the data for all depths for selecting the maximum soil concentration for comparison against the ESALs and/or background levels, only surface-level radionuclide data are analyzed and presented. Data for all PCOCs for all depths will be analyzed and presented in a subsequent risk assessment report.

3.4. Radionuclide Data Analysis

Surface sample data were reduced and plotted for six radionuclides. Assuming that the samples within a transect constitute replications, data for the six radionuclides were subjected to analysis of variance and ^{241}Am and ^{90}Sr data were subjected to the Duncan's new multiple-range test to evaluate the statistical significance of the spatial changes in radionuclide concentration. The spatial variation (error) is important to understanding the relationship, if any, of discharge from Outfall 051 with the soil contaminant data. Assuming that samples within a transect are replications to statistically analyze spatial changes using least squares analyses is plausible because slope aspect is held constant for each transect; i.e., each transect has a north-facing, a south-facing, and a channel bottom sample.

3.5. Exposure/Dose-Response Estimation

The exposure/dose-response estimation was based on the calculation of the ESAL developed by Ebinger et al. (1994). The ESAL is a screening-level tool used as a benchmark to determine the potential adverse ecological effects at a PRS that may lead to a decision of No Further Action (NFA) or an Ecological Risk Assessment. The ESAL is built on foraging mode, behaviors, types of food consumed, the amount consumed, and the No Observed Adverse Effect Levels (NOAELs) from the EPA's Integrated Risk Information System (IRIS) database (EPA 1992) or Health Effects Assessment Summary Tables (HEAST) (EPA 1993). ESALs were developed for three taxa: mammals, birds, and reptiles. Species within each taxa were grouped into categories having similar exposure profiles because of a common foraging mode. Exposure guilds were developed for carnivores, insectivores, herbivores, grainivores, nectivores, and omnivores. Carnivores primarily consume other vertebrates, insectivores consume arthropods, herbivores feed primarily on the stems and leaves of vegetation, grainivores eat seeds, nectivores consume nectar, and omnivores consume a variety of all these food types. Total ingestion rates and soil ingestion rates for any bird, mammal, or reptile were based on the empirical relationship between body size and metabolic rate (Ebinger et al., 1994).

3.6. Ingestion Estimation

For the preliminary ecotoxicological screening of PRS 50-006(d), the selected animal exposure guilds of concern are within the mammal taxa. The equations in Appendix A were used by Ebinger et. al. (1994) to estimate food and soil ingestion rates for key mammal guilds potentially affected by PRS 50-006(d).

Tables B-1 through B-3 in Appendix B list the parameters used to calculate the intake rates for the key animal exposure guilds in this screening. Table B-4 lists the soil, water, and intake rate for the key animal exposure guilds considered in this report (Ebinger et al., 1994).

3.7. ESAL for Nonradionuclides

The equations for calculating ESALs for systemic nonvolatile inorganic and organic contaminants and nonvolatile carcinogenic contaminants are presented in Appendix C as defined in Ebinger et al. (1994).

3.8. ESAL for Radionuclides

Because radionuclide ESALs have not been developed yet, the radionuclide ESALs used in the Screen are based on the conservative assumptions used to calculate human health Screening Action Levels (SALs) (Ebinger et al., 1995). It is assumed that using SALs that are protective of an individual also will protect an ecological community. Using SALs as ESALs may be conservative; however, the main purpose of the screen is to focus risk assessors and risk managers on PCOCs that need evaluation in a risk assessment, which is the appropriate tool for considering factors that promote or disfavor conservatism. Using SALs as ESALs may not be conservative in all cases. For example, small herbivores, one of the animal guilds targeted in this screen, are present in the contaminated area 100% of the time in some cases. The estimated human SALs for ingestion of radionuclide contaminants in soil at LANL were determined by using the RESRAD computer code (Gilbert et al., 1989). The estimate takes into account all pathways, including external exposure from gamma emitters, inhalation of contaminated dust particles and/or radioactive gases, ingestion of contaminated soil and plants, and consumption of contaminated water. Two assumptions were made.

1. The radiation dose limit for an individual is 10 mrem/yr.
2. The consumption rate of contaminated soil is 200 mg/day.

Refer to LANL (1993) for more detail.

Results based on ESALs or SALs generally are sufficiently conservative to be protective of other ecological components such as plants and microbes.

3.9. Risk Characterization/Ecotoxicological Screening Procedure

A potential ecological risk screening was carried out for each PCOC candidate using the following steps.

(1) **Upper Tolerance Limit (UTL) Comparison**
When data are available, compare the maximum soil concentration with the UTL for the background concentration data at LANL, which is available in the Environmental Restoration Program's "Facility for Information Management, Analysis, and Display" (FIMAD) database (LANL, 1993). Record comparison as "yes" or "no" based on whether the soil concentration is greater than or equal to the UTL (Meyers and Ferenbaugh, 1995).

(2) **Habitat Screening Model (Meyers and Ferenbaugh, 1995)**
Determine if the PRS and adjacent canyon require a complete ESAL screening (continue with step 3) or whether the site can be proposed for NFA based on the habitat exposure model.

(3) **ESAL Comparison**
Nonradionuclides: Compare the maximum soil concentration with the ESAL developed by Ebinger et al. (1994). Record comparison as "yes" or "no" based on whether the soil concentration is greater than or equal to the ESAL.
Radionuclides: Compare the maximum soil concentration with the human health SAL developed by LANL's Environmental Restoration Program and available in FIMAD.

(4) **Risk Ratio Calculation**
A risk ratio is calculated using the following equation (Ebinger et al., 1994):

Risk Ratio (RR) = Soil Concentration/ESAL Value,

where RR = or > 1 establishes a chemical as a PCOC, potentially posing unacceptable risk to the ecology of the area.

(5) **Proposed Status**

PCOC(1): Potential Contaminant of Concern, Category 1. Decision based on comparison of maximum soil concentration (Max. SC) with the UTL and ESAL. Result: UTL < Max. SC >ESAL.

PCOC(2): Potential Contaminant of Concern, Category 2. Decision based on comparison of Max. SC with the ESAL only because of unavailability of UTL. Result: Max. SC > ESAL.

PCOC(3): Potential Contaminant of Concern, Category 3. Decision based on comparison of Max. SC with the UTL only because of unavailability of ESAL. Result: Max. SC > UTL

PCOC(4): Potential Contaminant of Concern, Category 4. Decision based on comparison of Max. SC with the UTL and ESAL. Result: UTL < Max. SC < ESAL.

DI: Data inadequate. Decision based on unavailability of both UTL or ESAL values

NFA(1): No Further Action, Category 1. Decision based on comparison Max. SC with the UTL and ESAL. Result: UTL > Max. SC < ESAL.

A status from the list below is proposed for each analyzed soil constituent.

NFA(2): No Further Action, Category 2. Decision based on comparison Max. SC with the ESAL only because of the unavailability of UTL. Result: Max. SC < ESAL.

NFA(3): No Further Action, Category 3. Decision based on comparison Max. SC with the UTL only because of the unavailability of ESAL. Result: Max. SC < UTL.

NFA(4): No Further Action, Category 4. Decision based on comparison Max. SC with the UTL and ESAL. Result: UTL > Max. SC > ESAL.

(6) **Statistical Analysis**

Analyses of variance were applied to the six selected radionuclide data sets to generally test for significant differences between transect means within any given radionuclide data set. Duncan's new multiple range test was performed on the ^{242}Am and ^{90}Sr data sets to identify whether significant ($\alpha = 0.01$) differences existed between any two specific transect means.

4.0. RESULTS AND DISCUSSION

4.1. Habitat Screening

The habitat screening results are presented in Table 4. At PRS 50-006(d), the landscape condition would categorize as 2, and the accessibility of the PRS to ecological receptors would categorize as a 2–3. The result indicates an ESAL screening should be completed for this site because exposure is likely.

- **Landscape Condition (land use)**

  1 Heavy Industrial/Residential Development
  2 Light/Moderate Disturbance
  3 Little or No Disturbance, Special Habitats (e.g., wetlands, endangered species habitat).

- **Accessibility of PRS to Ecological Receptors**

  0 No access
  1 Low
  2 Moderate
  3 High

TABLE 4

HABITAT SCREENING MODEL RESULTS AT PRS 50-006(D)/MORTANDAD CANYON

(MEYERS AND FERENBAUGH, 1995)

Receptor Access	Landscape Condition		
	1	2	3
0	NFA		
1			
2			
3			

4.2. Sampling Results

Table 5 lists the analytical results for six radionuclides sampled in the 0–6 in. soil depth in PRS 50-006 (d). Transect locations and sampling points were shown in Fig. 2. Each group of three samples (Fig. 2) will be referred to by transect number as follows: Transect #1 = samples 1, 2, 3; Transect #2 = samples 4, 5, 6; and so on. Figure 7 shows the concentration of the radionuclides averaged within each transect. Analysis of variance generated F values that were not significant, at $\alpha = 0.01$ and 8/18 df, for all six radionuclides. F values were 1.7, 1.5, 0.6, 0.7, 1.7, and 1.3 for ^{241}Am, ^{238}Pu, ^{239}Pu, ^{232}Th, ^{90}Sr, and ^{137}Cs, respectively. This indicates that there generally is no real difference between the transect means. For the nuclides with the highest calculated F, ^{241}Am and ^{90}Sr, Duncan's test was used to identify whether significant differences between any two specific transect means existed. No significant differences were detected.

Radionuclide and total alpha concentrations followed the general pattern; that is, concentrations were generally higher at transects 7, 8, and 9 than at the up-canyon transects that are closer to the Outfall. For example, total alpha averaged 26.9 pCi/g at Transect #8 compared to 10.0 pCi/g at Transect #2. It is likely that high erosion at the upper end of the channel washes radionuclides to the lower end of the channel, where a human-made sediment trap then retains the wash-down. There is visual evidence of severe erosion at Transect #2, and summer thunderstorms do occur at intensities that are capable of eroding surface soil (Gonzales et al., 1995). The sediment trap is located approximately at Transect #8. The standard deviation averaged across all transects for four alpha-emitting radionuclides was 3.1 pCi/g.

The nine-transect mean alpha concentration averaged for four radionuclides was 19.7 pCi/g. This is higher than the upper 95% confidence limit values reported in a different study for all 15 onsite locations for the period 1976–1981 (Fresquez et al., 1995) and is 242% of the mean gross alpha concentration measured in the same area between 1975 and 1977 (Purtymun et al., 1980). Both of these previous studies sampled 0–2 in. soils. The mean 0–6 in. ^{137}Cs concentration in this study averaged across the 800-ft sampling distance, 18.0 pCi/g, compares to a 0–5 in. ^{137}Cs concentration of 1004 pCi/g for a 525-ft distance and 1152 pCi/g for a 1050-ft distance for the period 1972–1973 (Hakonson et al., 1973). Six of nine transects in this study had a higher gross alpha concentration than all 15 onsite locations in the study by Fresquez et al. (1995).

The results of subsurface sampling by LANL are not reported here.

4.3. Ecotoxicological Screen Results

A summary of the screen results is presented in Table 6. Detailed screen results are presented in Appendix D, Tables D-1 (Small Herbivore Mammal), D-2 (Large Herbivore Mammal), D-3 (Small Carnivore Mammal), and D-4 (Small Omnivore Mammal). Of 121 constituents (59 semi-volatile organics, 32 volatile organics, 13 inorganics, and 17 radionuclides) suspected (based on site history) to be present at PRS 50-006(d), 42 of these met the criteria of one of the PCOC categories [PCOC(1), PCOC(2), PCOC(3), or PCOC(4)], and there were inadequate data ("DI") to make a determination on 20 constituents. The breakdown included 6 PCOC(1) chemicals, 27 PCOC(2) chemicals, 2 PCOC(3) chemicals, and

TABLE 5

SUMMARY OF THE RADIONUCLIDE SAMPLING RESULTS FOR THE 0–6 IN. SOIL DEPTH IN PRS 50-006(D)/MORTANDAD CANYON AREA, LANL (ALL VALUES ARE PCI/G)*

	TRANSECT NUMBER								
Replication No.	1	2	3	4	5	6	7	8	9
Am-241									
1	7.22	8.18	16.53	10.50	6.00	9.03	19.08	18.22	6.13
2	14.33	7.66	9.24	8.37	24.20	6.64	5.21	5.73	7.68
3	6.54	5.58	4.09	6.65	6.88	5.28	2.98	9.23	9.01
Mean	9.36[a]	7.14[a]	9.95[a]	8.51[a]	12.36[a]	6.98[a]	11.94[a]	11.06[a]	7.61[a]
s	4.31	1.38	6.25	1.93	10.26	1.90	9.13	6.44	1.44
Pu-238	1.96	0.08	3.08	0.24	0.67	0.44	4.19	5.91	1.30
	4.41	0.01	2.86	4.09	3.67	2.73	0.03	1.11	3.56
	1.91	0.01	0.60	0.87	0.00	0.05	0.01	7.37	4.18
Mean	2.76	0.03	2.18	1.73	1.45	1.07	1.41	4.80	3.15
s	1.43	0.04	1.37	2.07	1.95	1.45	2.40	3.28	1.27
Pu-239	4.80	0.44	13.23	0.93	1.38	1.25	16.13	17.56	5.70
	11.68	0.03	11.01	10.43	19.73	5.11	0.16	2.97	7.88
	3.97	0.01	0.80	1.52	0.03	0.31	0.15	4.89	13.21
Mean	6.82	0.16	8.35	4.29	7.04	2.22	5.48	8.47	8.68
s	4.23	0.24	6.63	5.32	11.01	2.54	9.23	7.93	3.19
Th-232	2.08	3.23	2.49	3.89	2.24	3.21	1.86	2.53	2.62
	2.56	2.80	2.46	2.53	2.36	2.03	3.01	2.06	3.16
	2.55	1.86	2.68	2.25	2.84	3.22	3.50	3.06	4.38
Mean	2.40	2.63	2.54	2.89	2.48	2.82	2.73	2.55	3.39
s	0.27	0.70	0.12	0.88	0.32	0.68	0.70	0.50	0.90
Sr-90	0.54	0.51	1.05	0.97	0.05	5.14	1.71	3.01	0.54
	0.33	0.59	0.43	1.49	1.17	1.03	0.89	0.93	1.48
	1.83	0.37	1.38	1.39	0.00	1.48	1.37	2.75	1.48
Mean	0.90[a]	0.49[a]	0.95[a]	1.28[a]	0.39[a]	2.55[a]	1.32[a]	2.23[a]	1.17[a]
s	0.81	0.11	0.48	0.28	0.68	2.25	0.41	1.13	0.54
Cs-137	3.48	2.96	19.13	4.76	6.71	7.58	31.56	67.69	6.05
	5.71	0.34	13.25	77.90	42.90	28.30	1.054	14.26	43.53
	5.44	0.44	3.56	11.70	0.50	2.89	1.16	50.15	32.95
Mean	4.88	1.25	11.98	31.45	16.70	12.92	11.26	44.03	27.51
s	1.22	1.49	7.86	40.37	22.90	13.52	17.58	27.23	19.32
Alpha	21.34	9.96	23.02	17.42	23.33	13.10	18.77	26.87	22.94

[a] Means with different letters are significantly different at $\alpha = 0.01$.

* Values in Tables 6 and D-1 through D-4 are not necessarily found in this table — values in Tables 6 and D-1–D-4 are maximums selected from any of the three depths, whereas values in Table 5 present only surface soil samples

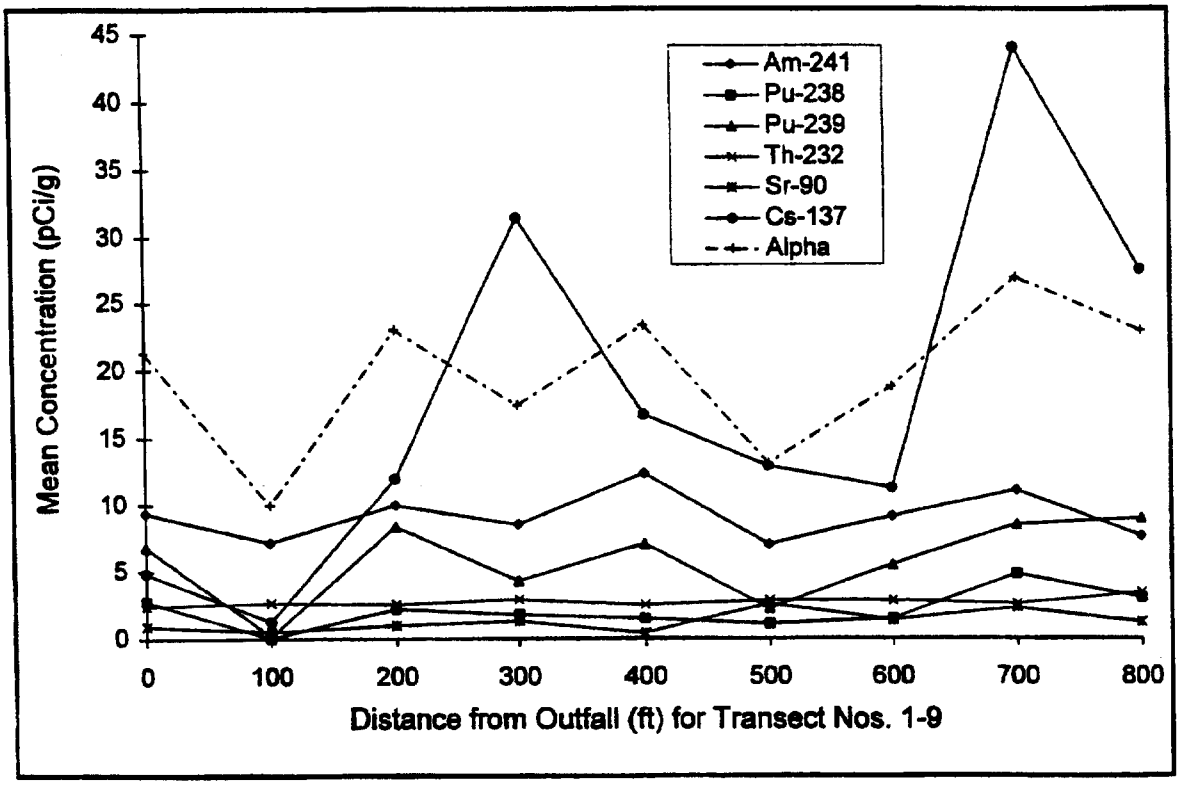

Fig. 7. Mean concentration of radioactive isotopes at 0–6 in. soil depth in PRS 50-006(d), Operable Unit 1147, Mortandad Canyon, LANL.

7 PCOC(4) chemicals. The PCOC list includes 22 semi-volatile organics, 3 volatile organics, 6 inorganics, and 11 radionuclides.

4.4. Discussion of Results

A PCOC result does not necessarily imply that a constituent cannot be proposed for NFA after further evaluation. A PCOC listing only focuses risk assessors and risk managers on the constituents that need to be studied further in a risk assessment.

The nonradionuclide results are based on the conservative assumptions used in the calculation of the ESAL; furthermore, the results are based on the most conservative ESAL or most sensitive animal exposure guild within a taxa. In this screen, the primary sensitive animal exposure guild was the small herbivore mammal. However, in five instances (Indeno[1,2,3-cd]pyrene, N-Nitrosodiphenylamine, N-nitrosodi-n-propylamine, Pentachlorophenol, and Benzoic acid), the small omnivore mammal was the most sensitive animal exposure guild.

The general order of the least to most sensitive mammal exposure guild is large herbivore, small carnivore, small omnivore, and small herbivore. This is somewhat contrary to the general tendency but has the potential for greater impact as follows. Generally, the guilds at the top of a food chain (carnivores) are more affected because of their greater susceptibility to biomagnification. The reason that the potential exists for greater ecological impact when the small herbivore is most sensitive is that lower trophic levels feed higher trophic levels; therefore, impact on lower trophic levels

TABLE 6

POTENTIAL CONTAMINANTS OF CONCERN AT PRS 50-006(D)/MORTANDAD CANYON AREA

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (mg/kg)		UTL (mg/kg)	ESAL[a] (mg/kg)		Risk Ratio	Proposed Status
Aroclor[Mixed-]	Small carnivore mammal				4.89E-02			
	Large herbivore mammal				2.62E-01			
	Small omnivore mammal	1.10E-01	max.		1.05E-02			
	Small hebivore mammal	1.00E+00	crql	---	7.70E-03		1.30E+02	PCOC(2)
Benzo[a]pyrene	Small carnivore mammal				1.02E-02	ca		
	Large herbivore mammal				7.29E-01	ca		
	Small omnivore mammal				8.55E-04	ca		
	Small hebivore mammal	6.60E-01	crql	---	6.29E-04	ca	1.05E+03	PCOC(2)
Benzo[b]fluoranthene	Small carnivore mammal				6.77E-02	ca		
	Large herbivore mammal				4.80E+00	ca		
	Small omnivore mammal				5.70E-03	ca		
	Small hebivore mammal	6.60E-01	crql	---	4.20E-03	ca	1.57E+02	PCOC(2)
Benzo[g,h,i]perylene	Small carnivore mammal				4.66E-01	ca		
	Large herbivore mammal				3.32E+01	ca		
	Small omnivore mammal				3.90E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	2.87E-02	ca	2.30E+01	PCOC(2)
Benzo[k]fluoranthene	Small carnivore mammal				1.55E-01	ca		
	Large herbivore mammal				1.11E+01	ca		
	Small omnivore mammal				1.30E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	9.60E-03	ca	6.88E+01	PCOC(2)
Bis(2-chloroethyl)ether	Small carnivore mammal				6.77E-02	ca		
	Large herbivore mammal				4.80E+00	ca		
	Small omnivore mammal				5.70E-03	ca		
	Small hebivore mammal	6.60E-01	crql	---	4.20E-03	ca	1.57E+02	PCOC(2)
Bis(2-chloroisopropyl)ether	Small carnivore mammal				1.10E+00	ca		
	Large herbivore mammal				7.60E+01	ca		
	Small omnivore mammal				8.91E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	6.56E-02	ca	1.01E+01	PCOC(2)
Bis(2-ethylhexyl)phthalate	Small carnivore mammal				5.30E+00	ca		
	Large herbivore mammal				3.80E+02	ca		
	Small omnivore mammal	3.90E-01	max.		4.46E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	3.28E-03	ca	2.01E+02	PCOC(2)
Chrysene	Small carnivore mammal				2.30E+00	ca		
	Large herbivore mammal				1.66E+02	ca		
	Small omnivore mammal				1.95E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	1.43E-03	ca	4.62E+02	PCOC(2)
Dibenzo[a,h]anthracene	Small carnivore mammal				9.20E-03	ca		
	Large herbivore mammal				6.57E-01	ca		
	Small omnivore mammal				7.70E-04	ca		
	Small hebivore mammal	6.60E-01	crql	---	5.67E-04	ca	1.16E+03	
Dichlorobenzene[p-]	Small carnivore mammal				2.30E+03	ca		
	Large herbivore mammal				2.22E+02	ca		
	Small omnivore mammal				2.60E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	1.91E-03	ca	3.46E+02	PCOC(2)
Dichlorobenzidiene[3,3']	Small carnivore mammal				1.66E-01	ca		
	Large herbivore mammal				1.18E+01	ca		
	Small omnivore mammal				1.39E-02	ca		
	Small hebivore mammal	1.30E+00	crql	---	1.02E-02	ca	1.27E+02	PCOC(2)
Dichlorophenol[2,4-]	Small carnivore mammal				2.10E+00			
	Large herbivore mammal				1.12E+01			
	Small omnivore mammal				4.50E-01			
	Small hebivore mammal	6.60E-01	crql	---	3.32E-01		1.99E+00	PCOC(2)

TABLE 6 (CONT)

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (mg/kg)		UTL (mg/kg)	ESAL[a] (mg/kg)		Risk Ratio	Proposed Status
Dinitrophenol [2,4-]	Small carnivore mammal				1.40E+00			
	Large herbivore mammal				7.50E+00			
	Small omnivore mammal				3.01E-01			
	Small hebivore mammal	1.30E+00	crql	---	2.21E-01		5.88E+00	PCOC(2)
Hexachlorobenzene	Small carnivore mammal				5.59E-01			
	Large herbivore mammal				3.00E+00			
	Small omnivore mammal				1.20E-01			
	Small hebivore mammal	6.60E-01	crql	---	8.85E-02		7.46E+00	PCOC(2)
Hexachlorobutadiene	Small carnivore mammal				9.55E-01	ca		
	Large herbivore mammal				6.82E+01	ca		
	Small omnivore mammal				8.00E-02	ca		
	Small hebivore mammal	6.60E-01	crql	---	5.88E-02	ca	1.12E+01	PCOC(2)
Indeno[1,2,3-cd]pyrene	Small carnivore mammal				4.38E-02	ca		
	Large herbivore mammal				3.10E+00	ca		
	Small omnivore mammal	6.60E-01	crql	---	7.81E-04	ca	8.45E+02	PCOC(2)
	Small hebivore mammal				2.70E-03	ca		
Nitrosodiphenlyamine[N-]	Small carnivore mammal				1.52E+01	ca		
	Large herbivore mammal				1.10E+03	ca		
	Small omnivore mammal	6.60E-01	crql	---	2.70E-05	ca	2.44E+04	PCOC(2)
	Small hebivore mammal				9.37E+02	ca		
Nitrosodi-n-propylamine[N-]	Small carnivore mammal				1.06E-02	ca		
	Large herbivore mammal				7.60E-01	ca		
	Small omnivore mammal	6.60E-01	crql	---	1.90E-04	ca	3.47E+03	PCOC(2)
	Small hebivore mammal				6.56E-04	ca		
Nitrobenzene	Small carnivore mammal				3.20E+00			
	Large herbivore mammal				1.72E+01			
	Small omnivore mammal				6.92E-01			
	Small hebivore mammal	6.60E-01	crql	---	5.09E-01		1.30E+00	PCOC(2)
Pentachlorophenol	Small carnivore mammal				2.09E+01			
	Large herbivore mammal				1.13E+02			
	Small omnivore mammal	3.30E+00	crql	---	1.30E+00		2.54E+00	PCOC(2)
	Small hebivore mammal				3.30E+00			
Trichlorophenol[2,4,6-]	Small carnivore mammal				6.80E+00	ca		
	Large herbivore mammal				4.84E+02	ca		
	Small omnivore mammal				5.67E-01	ca		
	Small hebivore mammal	6.60E-01	crql	---	4.17E-01	ca	1.58E+00	PCOC(2)
PCOC Volatile	**Animal Exposure Guild**	**Max. SC (mg/kg)**		**UTL (mg/kg)**	**ESAL[a] (mg/kg)**		**Risk Ratio**	**Proposed Status**
Benzene	Small carnivore mammal				2.60E+00	ca		
	Large herbivore mammal				1.83E-02	ca		
	Small omnivore mammal				2.15E-01	ca		
	Small hebivore mammal	5.00E-03	crql	---	1.58E-03	ca	3.16E+00	PCOC(2)
Benzoic acid	Small carnivore mammal				3.11E+01			
	Large herbivore mammal				1.67E+02			
	Small omnivore mammal	5.70E+00		---	1.90E+00		3.00E+00	PCOC(2)
	Small hebivore mammal				4.90E+00			
Vinyl chloride	Small carnivore mammal				3.92E-02	ca		
	Large herbivore mammal				2.80E+00	ca		
	Small omnivore mammal				3.30E-03	ca		
	Small hebivore mammal	1.00E-02	crql	---	2.40E-03	ca	4.17E+00	PCOC(2)
PCOC Inorganic	**Animal Exposure Guild**	**Max. SC (mg/kg)**		**UTL (mg/kg)**	**ESAL[a] (mg/kg)**		**Risk Ratio**	**Proposed Status**
Chromium (III)	Small carnivore mammal				7.12E+02			
	Large herbivore mammal				5.50E+03			
	Small omnivore mammal				2.21E+02			
	Small hebivore mammal	5.60E+01		3.42E+01	1.62E+02		3.46E-01	PCOC(4)

TABLE 6 (CONT)

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (mg/kg)		UTL (mg/kg)	ESAL[a] (mg/kg)		Risk Ratio	Proposed Status
Chromium (IV)	Small carnivore mammal				1.68E+01			
	Large herbivore mammal				9.00E+01			
	Small omnivore mammal				3.60E+00			
	Small hebivore mammal	5.60E+01		3.42E+01	2.70E+00		2.07E+01	PCOC(1)
Lead	Small carnivore mammal				6.30E+00			
	Large herbivore mammal				3.37E+01			
	Small omnivore mammal				1.40E+00			
	Small hebivore mammal	7.00E+01		3.90E+01	9.96E-01		7.03E+01	PCOC(1)
Mercury	Small carnivore mammal				2.20E+00			
	Large herbivore mammal				1.20E+01			
	Small omnivore mammal				4.81E-01			
	Small hebivore mammal	2.00E-01		1.00E-01	3.54E-01		5.65E-01	PCOC(4)
Nickel	Small carnivore mammal				3.49E+01			
	Large herbivore mammal				1.87E+02			
	Small omnivore mammal				7.50E+00			
	Small hebivore mammal	4.80E+01		2.67E+01	5.50E+00		8.73E+00	PCOC(1)
Thallium	Small carnivore mammal				---			
	Large herbivore mammal				---			
	Small omnivore mammal	3.40E-01	max.		---			
	Small hebivore mammal	1.20E+00	crql	9.00E-01	---		---	PCOC(3)
PCOC Radionuclide	**Animal Exposure Guild**	**Max. SC (pCi/g)**		**UTL (pCi/g)**	**SAL (pCi/g)**		**Risk Ratio**	**Proposed Status**
Americium-241	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	7.10E+01		---	1.70E+01		4.18E+00	PCOC(2)
Cesium-137	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	3.73E+02		1.40E+00	4.00E+00		9.33E+01	PCOC(1)
Cobalt-60	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	5.22E+00		---	9.00E-01		5.80E+00	PCOC(2)
Plutonium-238	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	1.38E+01		1.40E-02	2.00E+01		6.90E-01	PCOC(4)
Plutonium-239	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	4.78E+01		5.20E-02	1.80E+01		2.66E+00	PCOC(1)
Potassium-40	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	4.78E+01		3.61E+01	---		---	PCOC(3)
Strontium-90	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	1.83E+01		1.00E+00	5.90E+00		3.10E+00	PCOC(1)
Thorium-232	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	4.38E+00		2.68E+00	5.00E+00		8.76E-01	PCOC(4)

TABLE 6 (CONT)

PCOC Semi-volatile	Animal Exposure Guild	Max. SC (pCi/g)		UTL (pCi/g)	SAL (pCi/g)		Risk Ratio	Proposed Status
Uranium-234	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	5.61E+00		2.03E+00	**8.60E+01**		6.52E-02	PCOC(4)
Uranium-235	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	3.58E+00		8.80E-02	**1.80E+01**		1.99E-01	PCOC(4)
Uranium-238	Small carnivore mammal							
	Large herbivore mammal							
	Small omnivore mammal							
	Small hebivore mammal	3.44E+01		1.90E+00	**5.90E+01**		5.83E-01	PCOC(4)

Acryonyms, Definitions, and Footnotes
PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
Max. SC = maximum chemical soil concentration from PRS 50-006(d) analysis results
UTL = Upper Tolerance Limit for LANL's Background Chemical Concentrations in soil
ESAL = Ecotoxicological Screening Action Level
SAL = Human Health Screening Action Level
crql = Contractor Required Quantitation Limit
ca = soil carcinogenic ESAL used when soil systemic ESAL is unavailable
*Bold Type indicates the lowest ESAL used to screen for potential ecological risk

also can impact higher trophic levels through consumption. Regardless of which guild was found to be the most sensitive, the lowest, or most conservative, ESAL was used to screen the chemicals for potential ecological risk based on the assumption that using the most conservative ESAL and the most sensitive animal exposure guild will bound the other less conservative ESALs and be somewhat protective of less sensitive animal exposure guilds.

The radionuclide results are based on the conservative assumptions used to calculate human health SALs (Ebinger et al., 1995). Until radionuclide ESALs are developed, it is assumed that using SALs that are protective of an individual also will be somewhat protective of a community. In other words, a community-level endpoint allows for the death of some individuals of that community while still allowing the community to remain reproductively intact. Therefore, using an individual-level endpoint, such as the SAL, that does not allow the death of any individual in the community prevents an unacceptable degree of decline in community reproductive capacity. One exception to this is that the reproductive capacity of a community can be affected without deaths of individuals occurring in that community. This issue needs further study with regard to the specific PCOCs and specific ecology of PRS 006(d).

The results of the screen indicate a number of areas of uncertainty that require further investigation to confirm a specific chemical at the PRS as having a PCOC or NFA status in order to assess the status of the entire PRS.

(1) **Proposed Status PCOC(1)**
This status is somewhat driven by the statistical value of the data used, but because all the information required for the screen was available, the certainty of the status is high. Of special concern are the PCOCs Cr(IV), Pb, and Ni because of their potential to bioconcentrate, bioaccumulate, and/or biomagnify.

(2) **Proposed Status PCOC(2)**
This status is driven by the statistical value of data used and by the amount that the soil concentration exceeded the existing ESAL or SAL. If the soil concentration is much greater than the ESAL or SAL, establishing a UTL for that chemical is necessary to assess whether the high concentration is a result of background levels instead of contamination caused by sampling and/or analysis. Otherwise, the chemical is listed as a PCOC and recommended for further investigation into probable exposure scenarios.

(3) **Proposed Status PCOC(3)**
This status is dependent on the statistical value of the data used and on the extent that the maximum soil concentration exceeded the UTL. In the interest of saving time and money on remediation, establishing an ESAL for this chemical may eliminate the need for remediation if the ESAL is greater than both the maximum soil concentration and UTL for that chemical. Otherwise, the chemical must be listed as a PCOC for further evaluation.

(4) **Proposed Status PCOC(4)**
This status will be based on statistical value, process knowledge of the site, and stakeholder input. The issue here is that the maximum soil concentration is greater than the UTL but less than the ESAL. Because the soil concentration is less than the ESAL, LANL may not be required to remediate the contaminant even though it is above background. The assumption is that a maximum soil concentration below an ESAL will cause no observable adverse effects. The relative certainty of the status is low compared with that of PCOC(1).

(5) **Proposed Status DI**
This status requires further investigation and establishment of both a UTL and a ESAL value to completely assess the site.

(6) **Proposed Status NFA(1)**
This status will be based somewhat on the statistical value of the data used, but because all the information required for the screen was available, the relative certainty of the status is high.

(7) **Proposed Status NFA(2)**
This status is somewhat based on the statistical value of the data used and generally can be assumed to stand as a decision because the ESALs are conservative and can be assumed to protect ecological receptors, so UTL establishment may not be a priority.

(8) **Proposed Status NFA(3)**
This status will be based on the statistical value of the data used and may stand as a decision because LANL is not required to remediate beyond background levels. The maximum soil concentration reflects a less than background concentration and thus can be eliminated from the PCOC list.

(9) **Proposed Status NFA(4)**
This status will be based on the statistical value of data used and may stand as a decision even though the maximum soil concentration is greater than the ESAL. Because the UTL is greater than the ESAL and LANL may not be required to remediate beyond chemical background concentration levels, exceeding the ESAL may not be an issue. However, stakeholder input will be key to the decision as to what is best for the environmental health of the site.

Other issues to consider when using the screen results to propose a constituent as NFA or as a PCOC include the following.

1. Evaluating risk ratios on the basis of the actual area of contamination and the actual home range of the animal exposure guilds.

2. Acknowledging the possible underestimation of risk ratios for some carnivores because although their primary foraging mode is as a carnivore, they do get some of their nourishment from fruit or other edible parts of plants.

3. Other foraging modes within bird and reptile taxa may need to be considered at some point in order to eliminate the chance that these other exposure guilds could be the most sensitive, and in overlooking them, the ecological impact is overlooked as well.

4. Evaluating the usefulness of crql's that do not actually give a soil concentration but report a minimum value, which only means the actual maximum soil concentration was equal to or less than the crql.

5. Consideration of multiple PCOC impacts.

6. Consideration of potential impact to plants and microbes.

7. Collection/calculation of additional information on the 20 constituents for which the conclusion at this time is "data inadequate (DI)."

Regarding 4 above, two values are reported for some constituents because two chemical analyses are performed for each constituent, each analysis from a different laboratory. One value is the crql reported by a contracted laboratory and the other is a maximum value that was derived from analysis at LANL, possibly with a different instrument or technique. This result is triggered when, in FIMAD, the maximum value reported is below the crql. Analytical laboratories outside of LANL that process LANL samples are not required to report values below the crql, whereas LANL will report values less than the crql. This issue is the reason that FIMAD reports both a maximum value below the crql and the crql. In general, the crql does not provide an adequate measure of some constituents. When a crql value is greater than background (UTL) and greater than the ESAL or SAL, a constituent must be listed as a PCOC, and further assessment is recommended. The crql's used in this screen included the following.

- Semi-volatiles: 59 crql's out of 62 analytical results with 3 chemicals having both a crql and a maximum value

- Volatiles: 30 crql's out of 32 analytical results

- Inorganics: 2 crql's out of 15 analytical results with 2 chemicals having both a crql and a maximum value

- Radionuclides: 0 crql's out of 17 analytical results.

As is apparent from these results, the crql validity in the screening process will be very influential in evaluating semi-volatile and volatile organic chemicals and, to a lesser extent, a few inorganic chemicals. Also, out of the 42 proposed PCOCs as determined by this screen, 25 of the total proposed PCOCs are based on a reported crql value. All 22 semi-volatile PCOCs are crql-based with 1 chemical having both a crql and a maximum. Two out of three volatile PCOCs and one out of six inorganic PCOCs are crql-based. None out of the eleven radionuclide PCOCs are crql-based.

Regarding 6 above, although plants and microbes are generally less sensitive than animals, significant impact to the plant or microbe trophic level can result in greater impact to the ecology of an area than would impact higher levels of a food chain because plants and microbes play more of a supporting role. Plants do not possess the ability to conjugate contaminants like higher animals. Potential impact to the plant and microbe trophic levels in the area of Mortandad Canyon that includes PRS 006(d) should be considered at least minimally in a risk assessment.

Future analysis of the screening results may include the comparison of risk ratios with ESAL uncertainty. This uncertainty analysis may involve the uncertainty factors and modifying factors developed by EPA to account for variance in toxicological information used for developing ESALs. The comparison would be a "yes" or "no" answer based on whether the ratio is greater than the uncertainty. If the risk ratio is greater than the uncertainty of ESALs, then the PCOC might be considered a candidate for a Voluntary Corrective Action. If the ratio is less than the uncertainty of the ESAL, then the conclusion usually is "no remedial action at this time/retain for analysis over ecologically defined exposure unit" (Ebinger et al., 1995). In an Ecological Risk Assessment, statistical analysis of the data set in relation to both field and analytical error also might be performed to assess the validity of the conclusions drawn from this study.

5.0. CONCLUSIONS

The study resulted in several conclusions.

- It was expected that radionuclide concentration would decrease with distance from the outfall. This did not occur. Because the four-nuclide alpha concentration was 242% of the gross alpha concentration for the period 1975-1977, it is important that sampling at points below the 9th transect be conducted so that the trend in concentration as the LANL boundary is approached can be established.

- Soil erosion in the stream channel likely caused the condition whereby the spatial change in radionuclide concentration was not statistically significant. It is important to maintain vegetative cover to minimize the erosion of soil-adhered radionuclides.

- PRS 50-006(d) as a whole cannot be proposed for NFA at this time from the perspective of potential ecological impact.

- A Phase I Ecological Risk Assessment must be conducted for at least 17 PCOCs.

- Further consideration should be made of, and additional information collected for, 25 crql-based PCOCs and 20 constituents for which there was inadequate data (DI).

- Discharging "superclean" waste water through Outfall 051 may remobilize contaminants, potentially making them available for movement or biotic uptake but possibly creating an opportunity for *in situ* remediation.

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LITERATURE CITED

Bond, A. J. and G. J. Gonzales. 1995. "Safety Analysis Report of the Radioactive Liquid Waste Treatment Facility at TA-50," Los Alamos National Laboratory report LW-CST-13-AP13, R0, Volume III (November 1995).

DOE (U.S. Department of Energy). 1990. Order DOE 5400.5, "Radiation Protection of the Public and the Environment" (June 5, 1990).

Ebinger, M. H. et al. 1995. "Decision Tree for Use of Ecotoxicological Screening Action Levels at Environmental Restoration Sites," Los Alamos National Laboratory document LA-UR-95-439 (1995), Draft.

Ebinger, M. H., R. W. Ferenbaugh, A. F. Gallegos, W. R. Hansen, O. B. Myers, and W. J. Wenzel. 1994. "Preliminary Ecological Screening Assessment for Operable Unit 1147," Los Alamos National Laboratory document LA-UR-94-3894 (October 1, 1994).

EPA (U.S. Environmental Protection Agency). 1992. "Integrated Risk Information System (IRIS)," Office of Research and Development; Office of Health and Environmental Assessment database (February 1992).

EPA (U.S. Environmental Protection Agency). 1993. "Health Effects Assessment Summary Tables (HEAST), FY 93 Annual," Office of Research and Development, Office of Emergency and Remedial Response; report EPA 540-R-93-058; PB93-921199 (March 1993).

EPA (U.S. Environmental Protection Agency). 1992. "Framework for Ecological Risk Assessment," U.S. EPA report EPA/630/R-92/001 (February 1992).

Fresquez, P. R., M. A. Mullen, and J. K. Ferenbaugh. 1995. "Radionuclides and Radioactivity in Soils within and around Los Alamos National Laboratory: 1974 to 1994," Los Alamos National Laboratory document LA-UR-95-3671 (1995).

Gilbert, T. L., et al., "A Manual for Implementing Residual Radioactive Material Guidelines," Argonne National Laboratory report ANL/ES-160, DOE/CH/8901 (June 1989).

Gonzales, G. J., M. T. Saladen, and T. E. Hakonson. 1995. "Effects of Pocket Gopher Burrowing on Cesium-133 Distribution in Engineered Test Plots," J. Environ. Qual. **24**, 1056-1062 (November/December 1995).

Hakonson, T. E., Nyhan, J. W., Johnson, L. J., and Bostick, K. V. 1973. "Ecological Investigation of Radioactive Materials in Waste Discharge Areas at Los Alamos for the Period July 1, 1992, through March 31, 1973." Los Alamos National Laboratory report, LA-UR-5282, UC-70, May 1973. Los Alamos, NM.

Hanson, S. W. 1994. Personal communication S. W. Hanson (LANL, CST-13, Waste Management) to G. J. Gonzales (LANL, ESH-3, Facility Risk Management) "Codification of DOE Orders" (August 17, 1994).

LANL 1995. Environmental Restoration Project, "Facility for Information Management, Analysis, and Display" (FIMAD), Los Alamos National Laboratory database (1995).

LANL 1993. "Los Alamos National Laboratory (LANL) Installation Workplan for Environmental Restoration," Volume 1, Revision 3, 1993 (tracked document 86).

LANL 1992. "RFI Work Plan for Operable Unit 1147 (Anonymous) for the Environmental Restoration Program, A DOE Environmental Cleanup Program," Los Alamos National Laboratory document LA-UR-92-969 (May 1992).

Meyers, O., and R. Ferenbaugh. 1995. "Screening Methodology for Ecotoxicological Risk Assessment," Los Alamos National Laboratory document LA-UR-95-3272 (1995).

Nagy, K. A. 1987. "Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds," Ecological Monographs 57, 111-128 (1987).

Nyhan, J. W., L. W. Hacker, T. E. Calhoun, and D. L. Young, 1978. "Soil Survey of Los Alamos County, New Mexico," Los Alamos National Laboratory report LA-6779-MS (1978).

Purtymun, W. D., R. J. Peters, and A. K. Stoker, 1980. "Radioactivity in Soils and Sediments in and Adjacent to the Los Alamos Area, 1974-1977," Los Alamos National Laboratory report LA-8234-MS, UC-11 (February 1980).

Robbins, C. T. 1983. *Wildlife Feeding and Nutrition* (Academic Press, New York, 1983).

Root, R. B. 1967. "The Niche Exploitation Pattern of the Blue Gray Gnatcatcher," Ecological Monographs 37, 317-350 (1967).

RTG (Resource Technologies Group, Inc.). 1995a. "Conceptual Design Report; 60% DOE Review Submittal; Radioactive Liquid Waste Treatment Facility," (October 25, 1995).

RTG (Resource Technologies Group, Inc.). 1995b. "Influent Design Basis, Los Alamos National Laboratory Radioactive Liquid Waste Treatment Facility," Conceptual Design Best Demonstrated Available Technology Evaluation #940185.007 (March 15, 1995).

Welch, E. B. 1980. *Ecological Effects of Waste Water* (Cambridge Univ. Press, New York, 1980).

APPENDIX A
MISCELLANEOUS APPLICABLE EQUATIONS

Food Intake estimation (Source: Ebinger et al., 1994)

$$DMI = FMR95/ME$$

where

DMI	=	dry matter intake (g/d)
FMR95	=	upper values of a simultaneous 95% prediction band for the average field metabolic rate (Nagy, 1987)
$\log_{10}(FMR95)$	=	$[a + b(\log_{10} x)] + c[d + e(\log_{10} x - \log_{10} x)^2]^{0.5}$
ME	=	metabolizable energy content of food (kJ/g dry matter) consumed by a specific guild.

The average ME values from Nagy (1987) and Robbins (1983) were used.

Soil Ingestion (Source: Ebinger et al., 1994)

$$SOIL = (DMI) * (f_s) * (1000)$$

where

SOIL	=	daily soil ingestion rate (mg/d)
f_s	=	fraction of daily dry matter intake that is soil. A median estimate of
f_s	=	0.05 for soil ingestion by wildlife was used for all foraging modes.

Water Intake (Source: Ebinger et al., 1994)

$$WATER = FMR95 \times \text{Scaling factor}$$

where

WATER	=	intake rate of water (L/d)
FMR95	=	upper values of a simultaneous 95% prediction band for the average field metabolic rate (Nagy, 1987)
$\log_{10}(FMR95)$	=	$[a + b(\log_{10} x)] + c[d + e(\log_{10} x - \log_{10} x)^2]^{0.5}$
Scaling factor	=	scales FMR95 to water turnover

Air Intake (Source: Ebinger et al., 1994)

AIR	=	FMR95 x Scaling factor
AIR	=	intake rate of air (m^3/d)
FMR95	=	upper values of a simultaneous 95% prediction band for the average field metabolic rate (Nagy, 1987)
$\log_{10}(FMR95)$	=	$[a + b(\log_{10} x)] + c[d + e(\log_{10} x - \log_{10} x)^2]^{0.5}$
Scaling factor	=	scales FMR95 to inhalation

APPENDIX B

VALUES FOR USE IN VARIOUS EQUATIONS

TABLE B-1

PARAMETERS FOR CALCULATING FOOD AND SOIL INGESTION RATES FOR KEY MAMMAL GUILDS POTENTIALLY AFFECTED BY PRS 50-006(D) (SOURCE: EBINGER ET AL., 1994)

MAMMAL EXPOSURE GUILD	BODY MASS	METABOLIZABLE ENERGY
Herbivore	5 g–200 kg	10.3
Carnivore	85 g–35 kg	7.5
Omnivore	5 g–40 kg	14

TABLE B-2

VALUES USED TO CALCULATE FMR95 (SOURCE: EBINGER ET AL., 1994)

Taxa	a	b	$\overline{\log_{10} x}$	x	c	d	e
Mammal	0.525	0.813	2.196	2.311	0.559	1.022	0.015

TABLE B-3

FACTORS USED TO SCALE WATER INTAKE AND INHALATION VOLUMES FROM METABOLIC RATES (FMR95) BY MULTIPLICATION WITH BODY MASS IN KG (W) (SOURCE: EBINGER ET AL., 1994)

	Inhalation Scaling Factor (m^3/kJ)	Water Scaling Factor (L/kJ)
Taxa		
Mammal	$1.30E\text{-}04W^{0.027}$	$6.01E\text{-}04W^{-0.013}$

TABLE B-4

ESTIMATES OF SOIL, AIR, AND WATER INTAKES FOR MAMMALS WITH DIFFERENT FORAGING MODES (SOURCE: EBINGER ET AL., 1994)

Taxa	Foraging Mode	Body Size	Body Mass (kg)	Intake Rates		
				Soil (mg/d)	Water (L/d)	Air (m^3/d)
Mammal	Herbivore	Small	0.005	226	0.01	0.03
	Herbivore	Large	200	1333769	41.26	154.03
	Carnivore	Small	0.085	3043	0.06	0.28
	Omnivore	Small	0.005	166	0.01	0.03

APPENDIX C

ESAL EQUATIONS

Systemic Non-Volatile Inorganic and Organic ESAL (Source: Ebinger et al., 1994)

$$ESAL = (RfD * BW * CF) / (I * FS)$$

where

ESAL = Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
RfD = chronic reference intake dose for toxic effects (mg/kgfwt-animal/day from soil
BW = body weight for animal guild (kgfwt)
CF = conversion factor: soil (1.00E+06 mg/kg)
I = food intake for animal guild (mg/day)
FS = fraction of dietary intake estimated as soil (0.05)

Non-volatile Carcinogenic ESAL (Source: Ebinger et al., 1994)

$$ESAL = (R * BW * CF * SFA) / (SF * I * FS)$$

where

ESAL = Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
R = target risk or cancer incidence for all classes of cancer (assumed to be 0.01)
BW = body weight for animal guild (kgfwt)
CF = conversion factor: soil (1.00E+06 mg/kg)
SFA = cancer slope conversion factor for specific animal or group:
SFA = $BW^{1/3}/70^{1/3}$, where
BW = animal guild body weight (kg)
70 = weight of standard man in the U.S.A.
SF = slope factor for humans, 1.0/(mg/kg/day)
I = food intake for animal guild (mg/day)
FS = fraction of dietary intake estimated as soil (0.05), and the exposure duration for a given animal guild is assumed to be equal to the mean life-span of that guild.

Systemic Volatile Organic and Inorganic ESAL (Source: Ebinger et al., 1994)

$$ESAL = BW/ (INGF + INHF)$$

where

ESAL = Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
BW = body weight for animal guild (kgfwt)
INGF = ingestion factor
INGF = ING * FS/(RfDo * CF)
INHF = inhalation factor
INHF = [1/RfDi * INH * (1/ VF + 1/PEF)]
ING = ingestion rate (mg/day)
RfDo = chronic oral reference dose (mg/kgfwt-animal/day)
FS = fraction of dietary intake estimated as soil (0.05)
CF = conversion factor: soil (1.00E+06 mg/kg)

INH = inhalation rate (m^3/day)
RfDi = chronic inhalation reference dose (mg/kgfwt-animal/day)
VF = soil-to-air volatilization factor (m^3/kg), specific for each contaminant
PEF = particulate emission constant (4.63 E+09 m^3/kg)

Volatile Carcinogenic organic and inorganic ESAL

ESAL = BW * R * SFA/ (INGF + INHF)

where

ESAL = Ecotoxicological Screening Action Level concentrations for soils (mg/kg)
BW = body weight for animal guild (kgfwt)
R = target risk or cancer incidence for all classes of cancer (assumed to be 0.01)
SFA = cancer slope conversion factor for specific animal or group:
SFA = $BW^{1/3}/70^{1/3}$, where
BW = animal guild body weight (kg)
70 = weight of standard man in the U.S.A.
INGF = ingestion factor
INGH = ING * FS * SFo/CF
INHF = inhalation factor
INHF = [SFi * INH * (1/VF + 1/PEF)]
ING = ingestion rate (mg/day)
FS = fraction of dietary intake estimated as soil (0.05)
SFo = oral human slope factor (1/mg/kg/day)
CF = conversion factor: soil (1.00E+06 mg/kg)
SFi = inhalation human slope factor (1/mg/kg/day)
INH = inhalation rate (m^3/day)
VF = soil-to-air volatilization factor (m^3/kg), specific for each contaminant
PEF = particulate emission constant (4.63 E+09 m^3/kg)

APPENDIX D

DETAILED RESULTS OF ECOTOXICOLOGICAL RISK SCREEN

TABLE D-1

PRELIMINARY ECOTOXICOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR A SMALL HERBIVORE MAMMAL IN PRS 50-006(D)/MORTANDAD AREA

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	1.97E+02		n			3.35E-03	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	1.11E+02		n			5.95E-03	NFA(2)
Aroclor[Mixed-]	1.10E-01		---	---	7.70E-03		y			1.43E+01	PCOC(2)
	1.00E+00	crql			7.70E-03		y			1.30E+02	
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	6.29E-04	ca	y			1.05E+03	PCOC(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	4.20E-03	ca	y			1.57E+02	PCOC(2)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	2.87E-02	ca	y			2.30E+01	PCOC(2)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	9.60E-03	ca	y			6.88E+01	PCOC(2)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	4.20E-03	ca	y			1.57E+02	PCOC(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	6.56E-02	ca	y			1.01E+01	PCOC(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01		---	---	3.28E-03	ca	y			1.19E+02	PCOC(2)
	6.60E-01	crql			3.28E-03		y			2.01E+02	
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	1.76E+02		n			3.75E-03	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	1.40E+00		n			9.29E-01	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	5.50E+00		n			1.20E-01	NFA(2)
Chrysene	6.60E-01	crql	---	---	1.43E-03	ca	y			4.62E+02	PCOC(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	5.67E-04	ca	y			1.16E+03	NFA(4)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01		---	---	---		---				DI
	6.60E-01	crql									
Di-n-octyl phthalate	6.60E-01	crql	---	---	1.94E+01		n			3.40E-02	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	9.48E+01		n			6.96E-03	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---	---		---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	1.91E-03	ca	y			3.46E+02	PCOC(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.02E-02	ca	y			1.27E+02	PCOC(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	3.32E-01		y			1.99E+00	PCOC(2)
Diethyl phthalate	6.60E-01	crql	---	---	8.30E+02		n			7.95E-04	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	1.10E+03		n			6.00E-04	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	5.53E+01		n			1.19E-02	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	2.21E-01		y			5.88E+00	PCOC(2)
Fluoranthene	6.60E-01	crql	---	---	1.38E+02		n			4.78E-03	NFA(2)
Fluorene	6.60E-01	crql	---	---	1.38E+02		n			4.78E-03	NFA(1)
Hexachlorobenzene	6.60E-01	crql	---	---	8.85E-02		y			7.46E+00	PCOC(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	5.88E-02	ca	y			1.12E+01	PCOC(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	7.70E+00		n			8.57E-02	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	1.10E+00		n			6.00E-01	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	2.70E-03	ca	y			2.44E+02	PCOC(2)
Isophorone	6.60E-01	crql	---	---	1.66E+02		n			3.98E-03	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	5.53E+01		n			1.19E-02	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	5.50E+01		n			1.20E-02	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	5.09E-01		y			1.30E+00	PCOC(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	6.56E-04	ca	y			1.01E+03	PCOC(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	9.37E+02	ca	n			7.04E-04	NFA(2)
Pentachlorophenol	3.30E+00	crql	---	---	3.30E+00		y			1.00E+00	PCOC(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	6.64E+01		n			9.94E-03	NFA(2)
Pyrene	6.60E-01	crql	---	---	8.30E+01		n			7.95E-03	NFA(2)
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	1.64E+01		n			4.02E-02	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	1.11E+02		n			5.95E-03	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	4.17E-01	ca	y			1.58E+00	PCOC(2)
Volatiles											
Acetone	2.70E-02		---	---	1.11E+02		n			2.43E-04	NFA(2)
Benzene	5.00E-03	crql	---	---	1.58E-03	ca	y			3.16E+00	PCOC(2)
Benzoic acid	5.70E+00		---	---	4.90E+00		y			1.16E+00	PCOC(2)
Bromodichloromethane	5.00E-03	crql	---	---	1.98E+01		n			2.53E-04	NFA(2)
Bromoform	5.00E-03	crql	---	---	1.98E+01		n			2.53E-04	NFA(2)
Bromomethane	1.00E-02	crql	---	---	1.50E+00		n			6.67E-03	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	2.00E+03		n			1.00E-05	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	1.22E+01		n			4.10E-04	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	7.85E-01		n			6.37E-03	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	2.10E+01		n			2.38E-04	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.12E-02	ca	n			8.93E-01	NFA(2)
Chloroform	5.00E-03	crql	---	---	1.40E+00		n			3.57E-03	NFA(2)
Chloromethane	1.00E-02	crql	---	---	3.53E-01	ca	n			2.83E-02	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				NFA(2)
Dichloroethane[1,2-]	5.00E-03	crql	---	---	5.04E-02	ca	n			9.92E-02	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	9.96E-01		n			5.02E-03	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	1.88E+01		n			2.66E-04	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				DI
Dichloropropane[1,2-]	5.00E-03	crql	---	---	6.75E-02	ca	n			7.41E-02	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	2.55E-02	ca	n			1.96E-01	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	2.55E-02	ca	n			1.96E-01	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	1.07E+02		n			4.67E-05	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	6.50E+00		n			7.69E-04	NFA(2)
Styrene	5.00E-03	crql	---	---	2.21E+02		n			2.26E-05	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	9.90E+00		n			5.05E-04	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	2.29E-02	ca	n			2.18E-01	NFA(2)
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				DI
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	4.40E+00		n			1.14E-03	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	4.17E-01	ca	n			1.20E-02	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	2.40E-03	ca	y			4.17E+00	PCOC(2)
Xylene[mixed-]	5.00E-03	crql	---	---	1.98E+02		n			2.53E-05	NFA(2)
Inorganics											
Antimony	1.50E-01		2.50E+01	n/n	3.87E-02		y			3.88E+00	NFA(4)
	1.20E+00	crql			3.87E-02		y			3.10E+01	NFA(4)
Arsenic	5.80E+00	crql	1.16E+02	n	8.85E-04		y			6.55E+03	NFA(4)
Barium	1.60E+02	crql	1.14E+04	n	2.32E-01		y			6.90E+02	NFA(4)
Beryllium	2.00E+00	crql	3.31E+01	n	5.97E-01		y			3.35E+00	NFA(4)
Cadmium	1.20E+00	crql	2.70E+01	n	5.50E-03		y			2.18E+02	NFA(4)
Chromium (Total)	5.60E+01		3.4E+02	y	---						
Cr (III)	5.60E+01		3.42E+02	y	1.62E+02		n			3.46E-01	PCOC(4)
Cr (IV)	5.60E+01		3.42E+02	y	2.70E+00		y			2.07E+01	PCOC(1)
Lead	7.00E+01		3.90E+02	y	9.96E-01		y			7.03E+01	PCOC(1)
Mercury	2.00E-01		1.00E-00	y	3.54E-01		n			5.65E-01	PCOC(4)

Definitions:

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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
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NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-1 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	5.50E+00		y			8.73E+00	PCOC(1)
Selenium	4.10E-01		1.70E+00	n	1.66E-02		y			2.47E+01	NFA(4)
Silver	8.00E+00		1.80E+03	n	1.50E-03		y			5.33E+03	NFA(4)
Thallium	3.40E-01 1.20E+00	 crql	9.00E-01	n/y	---		---				NFA(1) PCOC(3)
Radionuclides	(pCi/g)		(pCi/g)					(pCi/g)			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
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NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as crql - the Contract Required Quantitaton Limit for that chemical.

[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).

[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.

[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94).

TABLE D-2

PRELIMINARY ECOTOXOCOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR LARGE HERBIVORE ANIMALS IN PRS 50-006(D)/MORTANDAD CANYON

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	6.60E+03		n			1.00E-04	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	9.33E+02		n			7.07E-04	NFA(2)
Aroclor[Mixed-]	1.10E-01 1.00E+00	 crql	---	---	2.62E-01 2.62E-01		n y			4.20E-01 3.82E+00	NFA(2) PCOC(2)
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	7.29E-01	ca	n			9.05E-01	NFA(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	4.80E+00	ca	n			1.38E-01	NFA(2)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	3.32E+01	ca	n			1.99E-02	NFA(2)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	1.11E+01	ca	n			5.95E-02	NFA(2)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	4.80E+00	ca	n			1.38E-01	NFA(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	7.60E+01	ca	n			8.68E-03	NFA(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01 6.60E-01	 crql	---	---	3.80E+02 3.80E+02	ca	n n			1.03E-03 1.74E-03	NFA(2)
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	6.00E+03		n			1.10E-04	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	4.69E+01		n			2.77E-02	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	1.87E+02		n			3.53E-03	NFA(2)
Chrysene	6.60E-01	crql	---	---	1.66E+02	ca	n			3.98E-03	NFA(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	6.57E-01	ca	y			1.00E+00	PCOC(2)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01 6.60E-01	 crql	---	---	---		---				DI
Di-n-octyl phthalate	6.60E-01	crql	---	---	6.56E+02		n			1.01E-03	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL

PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL

NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	3.20E+03		n			2.06E-04	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---	---		---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	2.22E+02	ca	n			2.97E-03	NFA(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.18E+01	ca	n			1.10E-01	NFA(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	1.12E+01		n			5.89E-02	NFA(2)
Diethyl phthalate	6.60E-01	crql	---	---	2.81E+04		n			2.35E-05	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	3.75E+04		n			1.76E-05	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	1.90E+03		n			3.47E-04	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	7.50E+00		n			1.73E-01	NFA(2)
Fluoranthene	6.60E-01	crql	---	---	4.73E+00		n			1.40E-01	NFA(2)
Fluorene	6.60E-01	crql	---	---	4.73E+00		n			1.40E-01	NFA(2)
Hexachlorobenzene	6.60E-01	crql	---	---	3.00E+00		n			2.20E-01	NFA(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	6.82E+01	ca	n			9.68E-03	NFA(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	2.62E+02		n			2.52E-03	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	3.75E+01		n			1.76E-02	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	3.10E+00	ca	n			2.13E-01	NFA(2)
Isophorone	6.60E-01	crql	---	---	5.60E+03		n			1.18E-04	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	1.90E+03		n			3.47E-04	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	1.87E+02		n			3.53E-03	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	1.72E+01		n			3.84E-02	NFA(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	7.60E-01	ca	n			8.68E-01	NFA(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	1.10E+03	ca	n			6.00E-04	NFA(2)
Pentachlorophenol	3.30E+00	crql	---	---	1.13E+02		n			2.92E-02	NFA(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	2.20E+03		n			3.00E-04	NFA(2)
Pyrene	6.60E-01	crql	---	---	2.80E+03		n			2.36E-04	DI
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	5.55E+02		n			1.19E-03	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	3.70E+03		n			1.78E-04	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	4.84E+02	ca	n			1.36E-03	NFA(2)
Volatiles											
Acetone	2.70E-02		---	---	3.70E+03		n			7.30E-06	NFA(2)
Benzene	5.00E-03	crql	---	---	1.83E-02	ca	n			2.73E-01	NFA(2)
Benzoic acid	5.70E+00		---	---	1.67E+02		n			3.41E-02	NFA(2)
Bromodichloromethane	5.00E-03	crql	---	---	6.71E+02		n			7.45E-06	NFA(2)
Bromoform	5.00E-03	crql	---	---	6.71E+02		n			7.45E-06	NFA(2)
Bromomethane	1.00E-02	crql	---	---	5.25E+01		n			1.90E-04	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	6.64E+04		n			3.01E-07	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	4.12E+02		n			1.21E-05	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	2.66E+01		n			1.88E-04	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	7.12E+02		n			7.02E-06	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.30E+01	ca	n			7.69E-04	NFA(2)
Chloroform	5.00E-03	crql	---	---	4.84E+01		n			1.03E-04	NFA(2)
Chloromethane	1.00E-02	crql	---	---	4.09E+02	ca	n			2.44E-05	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				DI
Dichloroethane[1,2-]	5.00E-03	crql	---	---	5.85E-01	ca	n			8.55E-03	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	3.37E+01		n			1.48E-04	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	6.37E+02		n			7.85E-06	NFA(2)

Definitions:

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PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				DI
Dichloropropane[1,2-]	5.00E-03	crql	---	---	7.82E-01	ca	n			6.39E-03	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	2.96E+01	ca	n			1.69E-04	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	2.96E+01	ca	n			1.69E-04	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	3.60E+03		n			1.39E-06	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	2.19E+02		n			2.28E-05	NFA(2)
Styrene	5.00E-03	crql	---	---	7.50E+03		n			6.67E-07	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	3.35E+02		n			1.49E-05	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	2.66E-01	ca	---			1.88E-02	DI
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	1.46E+02		n			3.42E-05	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	4.84E+02	ca	n			1.03E-05	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	1.30E+03	ca	n			7.69E-06	NFA(2)
Xylene[mixed-]	5.00E-03	crql	---	---	6.70E+03		n			7.46E-07	NFA(2)
Inorganics											
Antimony	1.50E-01		2.50E+00	n/ n	1.30E+00		n			1.15E-01	NFA(1)
	1.20E+00	crql			1.30E+00		n			9.23E-01	
Arsenic	5.80E+00	crql	1.16E+01	n	3.00E-02		y			1.93E+02	NFA(4)
Barium	1.60E+02	crql	1.14E+03	n	7.90E+00		y			2.03E+01	NFA(4)
Beryllium	2.00E+00	crql	3.31E+00	n	2.02E+01		n			9.90E-02	NFA(1)
Cadmium	1.20E+00	crql	2.70E+00	n	1.87E-01		y			6.42E+00	NFA(4)
Chromium (Total)	5.60E+01		3.42E+01	y	---						
Cr (III)	5.60E+01		3.42E+01	y	5.50E+03		n			1.02E-02	PCOC(4)
Cr (IV)	5.60E+01		3.42E+01	y	9.00E+01		n			6.22E-01	PCOC(4)
Lead	7.00E+01		3.90E+01	y	3.37E+01		y			2.08E+00	PCOC(1)
Mercury	2.00E-01		1.00E-01	y	1.20E+01		n			1.67E-02	PCOC(4)

Definitions:

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PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-2 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	1.87E+02		n			2.57E-01	PCOC(4)
Selenium	4.10E-01		1.70E+00	n	5.62E-01		n			7.30E-01	NFA(1)
Silver	8.00E+00		1.80E+03	n	5.25E-02		y			1.52E+02	NFA(4)
Thallium	3.40E-01 1.20E+00	 crql	9.00E-01	n/ y	---		---				NFA(3) PCOC(3)
Radionuclides	(pCi/g)		(pCi/g)					(pCi/g)			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

Definitions:

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PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as crql—the Contract Required Quantitaton Limit for that chemical.
[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).
[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR-95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.
[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94).

TABLE D-3
PRELIMINARY ECOTOXOCOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR SMALL CARNIVORE ANIMALS IN PRS 50-006(D)/MORTANDAD CANYON

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	1.20E+03		n			5.50E-04	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	6.98E+02		n			9.45E-04	NFA(2)
Aroclor[Mixed-]	1.10E-01 1.00E+00	crql	---	---	4.89E-02 4.89E-02		y/y			2.25E+00 2.04E+01	PCOC(2)
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	1.02E-02	ca	y			6.47E+01	PCOC(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	6.77E-02	ca	y			9.75E+00	PCOC(2)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	4.66E-01	ca	y			1.42E+00	PCOC(2)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	1.55E-01	ca	y			4.26E+00	PCOC(2)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	6.77E-02	ca	y			9.75E+00	PCOC(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	1.10E+00	ca	n			6.00E-01	NFA(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01 6.60E-01	crql	---	---	5.30E+00 5.30E+00	ca	n/n			7.36E-02 1.25E-01	NFA(2) NFA(2)
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	1.10E+03		n			6.00E-04	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	8.70E+00		n			1.49E-01	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	3.49E+01		n			1.89E-02	NFA(2)
Chrysene	6.60E-01	crql	---	---	2.30E+00	ca	n			2.87E-01	NFA(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	9.20E-03	ca	y			7.17E+01	PCOC(2)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01 6.60E-01	crql	---	---	---		---				DI
Di-n-octyl phthalate	6.60E-01	crql	---	---	1.22E+02		n			5.40E-03	NFA(2)

Definitions:
PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	5.98E+02		n			1.10E-03	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---	---		---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	2.30E+03	ca	n			2.87E-04	NFA(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.66E-01	ca	y			7.83E+00	PCOC(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	2.10E+00		n			3.14E-01	NFA(2)
Diethyl phthalate	6.60E-01	crql	---	---	5.20E+03		n			1.27E-04	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	7.00E+03		n			9.43E-05	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	3.49E+02		n			1.89E-03	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	1.40E+00		n			9.29E-01	NFA(2)
Fluoranthene	6.60E-01	crql	---	---	8.73E+02		n			7.56E-04	NFA(2)
Fluorene	6.60E-01	crql	---	---	8.73E+02		n			7.56E-04	NFA(2)
Hexachlorobenzene	6.60E-01	crql	---	---	5.59E-01		y			1.18E+00	PCOC(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	9.55E-01	ca	n			6.91E-01	NFA(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	4.89E+01		n			1.35E-02	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	7.00E+00		n			9.43E-02	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	4.38E-02	ca	y			1.51E+01	PCOC(2)
Isophorone	6.60E-01	crql	---	---	1.00E+03		n			6.60E-04	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	3.49E+02		n			1.89E-03	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	3.49E+01		n			1.89E-02	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	3.20E+00		n			2.06E-01	NFA(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	1.06E-02	ca	y			6.23E+01	PCOC(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	1.52E+01	ca	n			4.34E-02	NFA(2)
Pentachlorophenol	3.30E+00	crql	---	---	2.09E+01		n			1.58E-01	NFA(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	4.19E+02		n			1.58E-03	NFA(2)
Pyrene	6.60E-01	crql	---	---	5.24E+02		n			1.26E-03	NFA(2)
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	1.03E+02		n			6.39E-03	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	6.98E+02		n			9.45E-04	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	6.80E+00	ca	n			9.71E-02	NFA(2)
Volatiles											
Acetone	2.70E-02		---	---	6.98E+02		n			3.87E-05	NFA(2)
Benzene	5.00E-03	crql	---	---	2.60E+00	ca	n			1.92E-03	NFA(2)
Benzoic acid	5.70E+00		---	---	3.11E+01		n			1.83E-01	NFA(2)
Bromodichloromethane	5.00E-03	crql	---	---	1.25E+02		n			4.00E-05	NFA(2)
Bromoform	5.00E-03	crql	---	---	1.25E+02		n			4.00E-05	NFA(2)
Bromomethane	1.00E-02	crql	---	---	9.80E+00		n			1.02E-03	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	8.60E+03		n			2.33E-06	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	7.68E+01		n			6.51E-05	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	5.00E+00		n			1.00E-03	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	1.33E+02		n			3.77E-05	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.82E-01	ca	n			5.49E-02	NFA(2)
Chloroform	5.00E-03	crql	---	---	9.00E+00		n			5.56E-04	NFA(2)
Chloromethane	1.00E-02	crql	---	---	5.70E+00	ca	n			1.75E-03	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				DI
Dichlorethane[1,2-]	5.00E-03	crql	---	---	6.00E-01	ca	n			8.33E-03	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	4.40E+00		n			1.14E-03	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	1.19E+02		n			4.21E-05	NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				DI
Dichloropropane[1,2-]	5.00E-03	crql	---	---	8.03E-01	ca	n			6.23E-03	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	4.14E-01	ca	n			1.21E-02	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	4.14E-01	ca	n			1.21E-02	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	6.78E+02		n			7.37E-06	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	4.08E+01		n			1.23E-04	NFA(2)
Styrene	5.00E-03	crql	---	---	1.40E+03		n			3.57E-06	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	6.24E+01		n			8.01E-05	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	2.73E-01	ca	n			1.83E-02	NFA(2)
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				DI
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	1.89E+01		n			2.65E-04	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	6.80E+00	ca	n			7.35E-04	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	3.92E-02	ca	n			2.55E-01	NFA(2)
Xylene[mixed-]	5.00E-03	crql	---	---	1.20E+03		n			4.17E-06	NFA(2)
Inorganics											
Antimony	1.50E-01		2.50E+00	n/ n	2.44E-01		n/y			6.14E-01	NFA(1)
	1.20E+00	crql			2.44E-01					4.91E+00	NFA(4)
Arsenic	5.80E+00	crql	1.16E+01	n	5.60E-03		y			1.04E+03	NFA(4)
Barium	1.60E+02	crql	1.14E+03	n	1.50E+00		y			1.07E+02	NFA(4)
Beryllium	2.00E+00	crql	3.31E+00	n	2.60E+00		n			7.69E-01	NFA(1)
Cadmium	1.20E+00	crql	2.70E+00	n	2.42E-02		y			4.96E+01	NFA(4)
Chromium (Total)	5.60E+01		3.42E+01	y	---		---				NFA(3)
Cr (III)	5.60E+01		3.42E+01	y	7.12E+02		n			7.87E-02	PCOC(4)
Cr (IV)	5.60E+01		3.42E+01	y	1.68E+01		y			3.33E+00	PCOC(1)
Lead	7.00E+01		3.90E+01	y	6.30E+00		y			1.11E+01	PCOC(1)
Mercury	2.00E-01		1.00E-01	y	2.20E+00		n			9.09E-02	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
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NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-3 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	3.49E+01		y			1.38E+00	PCOC(1)
Selenium	4.10E-01		1.70E+00	n	1.05E-01		y			3.92E+00	NFA(4)
Silver	8.00E+00		1.80E+03	n	9.80E-03		y			8.16E+02	NFA(4)
Thallium	3.40E-01 1.20E+00	crql	9.00E-01	n/ y	---		---				NFA(3) PCOC(3)
Radionuclides	(pCi/g)		(pCi/g)					(pCi/g)			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESAL
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as (crql)— the Contract Required Quantitaton Limit for that chemical.
[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).
[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR-95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.
[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94)

TABLE D-4
PRELIMINARY ECOTOXOCOLOGICAL SCREENING RESULTS FOR POTENTIAL ECOLOGICAL RISK FOR SMALL OMNIVORE ANIMALS IN PRS 50-006(D)/MORTANDAD CANYON

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Semi-volatiles											
Acenapthene	6.60E-01	crql	---	---	2.63E+02		n			2.51E-03	NFA(2)
Acenapthylene	6.60E-01	crql	---	---	---		---				DI
Anthracene	6.60E-01	crql	---	---	1.50E+02		n			4.39E-03	NFA(2)
Aroclor[Mixed-]	1.10E-01		---	---	1.05E-02		y			1.05E+01	PCOC(2)
	1.00E+00	crql			1.05E-02		y			9.52E+01	PCOC(2)
Benzo[a]anthracene	6.60E-01	crql	---	---	---		---				DI
Benzo[a]pyrene	6.60E-01	crql	---	---	8.55E-04	ca	y			7.72E+02	PCOC(2)
Benzo[b]fluoranthene	6.60E-01	crql	---	---	5.70E-03	ca	y			1.16E+02	NFA(4)
Benzo[g,h,i]perylene	6.60E-01	crql	---	---	3.90E-02	ca	y			1.69E+01	NFA(4)
Benzo[k]fluoranthene	6.60E-01	crql	---	---	1.30E-02	ca	y			5.08E+01	NFA(4)
Bis(2-chlorethoxy)methane	6.60E-01	crql	---	---	---		---				DI
Bis(2-chloroethyl)ether	6.60E-01	crql	---	---	5.70E-03	ca	y			1.16E+02	PCOC(2)
Bis(2-chloroisopropyl)ether	6.60E-01	crql	---	---	8.91E-02	ca	y			7.41E+00	PCOC(2)
Bis-(2-ethylhexyl)phthalate	3.90E-01		---	---	4.46E-01	ca	n			8.75E-01	NFA(2)
	6.60E-01	crql			4.46E-01		y			1.48E+00	PCOC(2)
Bromodiphenyl ether[4-]	6.60E-01	crql	---	---	---		---				DI
Butyl benzyl phthalate	6.60E-01	crql	---	---	2.39E+02		n			2.76E-03	NFA(2)
Chloro-3-methylphenol[4-]	1.30E+00	crql	---	---	---		---				DI
Chloroaniline[4-]	1.30E+00	crql	---	---	1.90E+00		n			6.84E-01	NFA(2)
o-Chlorophenol	6.60E-01	crql	---	---	7.50E+00		n			8.80E-02	NFA(2)
Chrysene	6.60E-01	crql	---	---	1.95E-01	ca	y			3.39E+00	PCOC(2)
Dibenzo[a,h]anthracene	6.60E-01	crql	---	---	7.70E-04	ca	y			8.57E+02	PCOC(2)
Dibenzofuran	6.60E-01	crql	---	---	---		---				DI
Di-n-butyl phthalate	4.50E-01		---	---	---		---				DI
	6.60E-01	crql									
Di-n-octyl phthalate	6.60E-01	crql	---	---	2.63E+01		n				NFA(2)

Definitions:

PCOC(1) = potential contaminant of concern. UTL < Max. SC > ESAL
PCOC(2) = potential contaminant of concern. Soil concentration > ESAL; no UTL
PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESA
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorbenzene[o-]	6.60E-01	crql	---	---	1.29E+02		n			5.12E-03	NFA(2)
Dichlorbenzene[m-]	6.60E-01	crql	---	---			---				DI
Dichlorbenzene[p-]	6.60E-01	crql	---	---	2.60E-01	ca	n			2.54E+00	NFA(2)
Dichlorobenzidiene[3,3'-]	1.30E+00	crql	---	---	1.39E-02	ca	n			9.35E+01	NFA(2)
Dichlorphenol[2,4-]	6.60E-01	crql	---	---	4.51E-01		y			1.46E+00	PCOC(2)
Diethyl phthalate	6.60E-01	crql	---	---	1.10E+03		n			6.00E-04	NFA(2)
Dimethyl phthalate	6.60E-01	crql	---	---	1.50E+03		n			4.40E-04	NFA(2)
Dimethylphenol[2,4-]	6.60E-01	crql	---	---	7.52E+01		n			8.78E-03	NFA(2)
Dinitrophenol[2,4-]	1.30E+00	crql	---	---	3.01E-01		y			4.32E+00	PCOC(2)
Fluoranthene	6.60E-01	crql	---	---	1.88E+02		n			3.51E-03	NFA(2)
Fluorene	6.60E-01	crql	---	---	1.88E+02		n			3.51E-03	NFA(2)
Hexachlorobenzene	6.60E-01	crql	---	---	1.20E-01		y			5.49E+00	PCOC(2)
Hexachlorobutadiene	6.60E-01	crql	---	---	8.00E-02	ca	y			8.25E+00	PCOC(2)
Hexachlorocyclopentadiene	6.60E-01	crql	---	---	1.05E+01		n			6.29E-02	NFA(2)
Hexachloroethane	6.60E-01	crql	---	---	1.50E+00		n			4.40E-01	NFA(2)
Indeno[1,2,3-cd]pyrene	6.60E-01	crql	---	---	7.81E-04	ca	y			8.45E+02	PCOC(2)
Isophorone	6.60E-01	crql	---	---	2.26E+02		n			2.93E-03	NFA(2)
2-Methylnapthalene	6.60E-01	crql	---	---	---		---				DI
Methylphenol[2-]	6.60E-01	crql	---	---	7.52E+01		n			8.78E-03	NFA(2)
Methylphenol[4-]	6.60E-01	crql	---	---	7.50E+00		n			8.80E-02	NFA(2)
Napthalene	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[2-]	6.60E-01	crql	---	---	---		---				DI
Nitroaniline[3-]	3.30E+00	crql	---	---	---		---				DI
Nitroaniline[4-]	3.30E+00	crql	---	---	---		---				DI
Nitrobenzene	6.60E-01	crql	---	---	6.92E-01		n			9.54E-01	NFA(2)
Nitrophenol[2-]	6.60E-01	crql	---	---	---		---				DI
Nitrophenol[4-]	3.30E+00	crql	---	---	---		---				DI

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PCOC(3) = potential contaminant of concern. Soil concentration > UTL; no ESAL
PCOC(4) = potential contaminant of concern. UTL < Max. SC < ESAL
DI = data inadequate; no UTL or ESAL

NFA(1) = no further action. UTL > Max. SC < ESAL
NFA(2) = no further action. Soil concentration < ESAL; no UTL
NFA(3) = no further action. Soil concentration < UTL; no ESA
NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nitrosodi-n-propylamine[N-]	6.60E-01	crql	---	---	1.90E-04	ca	y			3.47E+03	PCOC(2)
Nitrosodiphenylamine[N-]	6.60E-01	crql	---	---	2.70E-05	ca	y			2.44E+04	PCOC(2)
Pentachlorophenol	3.30E+00	crql	---	---	1.30E+00		y			2.54E+00	PCOC(2)
Phenanthrene	6.60E-01	crql	---	---	---		---				DI
Phenol	6.60E-01	crql	---	---	9.02E+01		n			7.32E-03	NFA(2)
Pyrene	6.60E-01	crql	---	---	1.13E+02		n			5.85E-03	DI
Trichlorobenzene[1,2,4-]	6.60E-01	crql	---	---	2.23E+01		n			2.96E-02	NFA(2)
Trichlorophenol[2,4,5-]	6.60E-01	crql	---	---	1.50E+02		n			4.39E-03	NFA(2)
Trichlorophenol[2,4,6-]	6.60E-01	crql	---	---	5.67E-01	ca	y			1.16E+00	PCOC(2)
Volatiles											
Acetone	2.70E-02		---	---	1.50E+02		n			1.80E-04	NFA(2)
Benzene	5.00E-03	crql	---	---	2.15E-01	ca	n			2.32E-02	NFA(2)
Benzoic acid	5.70E+00		---	---	1.90E+00		y			3.00E+00	PCOC(2)
Bromodichloromethane	5.00E-03	crql	---	---	2.69E+01		n			1.86E-04	NFA(2)
Bromoform	5.00E-03	crql	---	---	2.69E+01		n			1.86E-04	NFA(2)
Bromomethane	1.00E-02	crql	---	---	2.10E+00		n			4.76E-03	NFA(2)
Butanone[2-]	2.00E-02	crql	---	---	2.70E+03		n			7.41E-06	NFA(2)
Carbon disulfide	5.00E-03	crql	---	---	1.65E+01		n			3.03E-04	NFA(2)
Carbon tetrachloride	5.00E-03	crql	---	---	1.10E+00		n			4.55E-03	NFA(2)
Chlorobenzene	5.00E-03	crql	---	---	2.86E+01		n			1.75E-04	NFA(2)
Chloroethane	1.00E-02	crql	---	---	1.52E-02	ca	n			6.58E-01	NFA(2)
Chloroform	5.00E-03	crql	---	---	1.90E+00		n			2.63E-03	NFA(2)
Chloromethane	1.00E-02	crql	---	---	4.80E-01	ca	n			2.08E-02	NFA(2)
Dichlorethane[1,1-]	5.00E-03	crql	---	---	---		---				DI
Dichloroethane[1,2-]	5.00E-03	crql	---	---	6.85E-02	ca	n			7.30E-02	NFA(2)
Dichlorethene[1,1-]	5.00E-03	crql	---	---	1.40E+00		n			3.57E-03	NFA(2)
Dichlorethylene[trans-1,2-]	5.00E-03	crql	---	---	---		---				DI

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NFA(4) = no further action. UTL > Max. SC > ESAL
Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Dichlorethylene[cis-1,2-]	5.00E-03	crql	---	---	---		---				NFA(2)
Dichloropropane[1,2-]	5.00E-03	crql	---	---	9.17E-02	ca	n			5.45E-02	NFA(2)
Dichloropropene[cis-1,3-]	5.00E-03	crql	---	---	3.47E-02	ca	n			1.44E-01	NFA(2)
Dichloropropene[trans-1,3-]	5.00E-03	crql	---	---	3.47E-02	ca	n			1.44E-01	NFA(2)
Ethyl benzene	5.00E-03	crql	---	---	1.46E+02		n			3.42E-05	NFA(2)
Hexanone[2-]	2.00E-02	crql	---	---	---		---				DI
Methylene chloride	5.00E-03	crql	---	---	8.80E+00		n			5.68E-04	NFA(2)
Styrene	5.00E-03	crql	---	---	3.01E+02		n			1.66E-05	NFA(2)
Tetrachloroethane[1,1,1,2-]	5.00E-03	crql	---	---	1.34E+01		n			3.73E-04	NFA(2)
Tetrachloroethane[1,1,2,2-]	5.00E-03	crql	---	---	3.12E-02	ca	n			1.60E-01	NFA(2)
Trichloroethane[1,1,1-]	5.00E-03	crql	---	---	---		---				DI
Trichloroethane[1,1,2-]	5.00E-03	crql	---	---	5.90E+00		n			8.47E-04	NFA(2)
Trichloroethene	5.00E-03	crql	---	---	5.67E-01	ca	n			8.82E-03	NFA(2)
Vinyl chloride	1.00E-02	crql	---	---	3.30E-03	ca	y			3.03E+00	PCOC(2)
Xylene[mixed-]	5.00E-03	crql	---	---	7.78E+01		n			6.43E-05	NFA(2)
Inorganics											
Antimony	1.50E-01		2.50E+00	n/n	5.26E-02		y			2.85E+00	NFA(4)
	1.20E+00	crql			5.26E-02		y			2.28E+01	
Arsenic	5.80E+00	crql	1.16E+01	n	1.20E-03		y			4.83E+03	NFA(4)
Barium	1.60E+02	crql	1.14E+03	n	3.16E-01		y			5.07E+02	NFA(4)
Beryllium	2.00E+00	crql	3.31E+00	n	8.12E-01		y			2.46E+00	NFA(4)
Cadmium	1.20E+00	crql	2.70E+00	n	7.50E-03		y			1.60E+02	NFA(4)
Chromium (Total)	5.60E+01		3.42E+01	y							
Cr (III)	5.60E+01		3.42E+01	y	2.21E+02		n			2.54E-01	PCOC(4)
Cr (IV)	5.60E+01		3.42E+01	y	3.60E+00		y			1.56E+01	PCOC(1)
Lead	7.00E+01		3.90E+01	y	1.40E+00		y			5.00E+01	PCOC(1)
Mercury	2.00E-01		1.00E-01	y	4.81E-01		n			4.16E-01	PCOC(4)

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Max. SC = maximum soil concentration

TABLE D-4 (CONT)

Constituent	Max. SC Value (mg/kg)	Type[a]	UTL Value[b] (mg/kg)	≥UTL	ESAL Value[c] (mg/kg)	Type[c]	>ESAL	SAL Value[d] (mg/kg)	>SAL	Risk Ratio [soil]/[ESAL]	Proposed Status
Nickel	4.80E+01		2.67E+01	y	7.50E+00		y			6.40E+00	PCOC(1)
Selenium	4.10E-01		1.70E+00	n	2.26E-02		y			1.81E+01	NFA(4)
Silver	8.00E+00		1.80E+03	n	2.10E-03		y			3.81E+03	NFA(4)
Thallium	3.40E-01 1.20E+00	crql	9.00E-01	n/y	---		---				NFA(3) PCOC(3)
Radionuclides	(pCi/g)		(pCi/g)					(pCi/g)			
Americium-241	7.10E+01		---	---				1.70E+01	y	4.18E+00	PCOC(2)
Barium-133	4.50E-01		---	---				---	---		DI
Cesium-134	3.20E-01		---	---				1.80E+00	n	1.78E-01	NFA(2)
Cesium-137	3.73E+02		1.40E+00	y				4.00E+00	y	9.33E+01	PCOC(1)
Cobalt-57	2.30E+00		---	---				4.00E+01	n	5.75E-02	NFA(2)
Cobalt-60	5.22E+00		---	---				9.00E-01	y	5.80E+00	PCOC(2)
Europium-152	1.90E+00		---	---				---	---		DI
Plutonium-238	1.38E+01		1.40E-02	y				2.00E+01	n	6.90E-01	PCOC(4)
Plutonium-239	4.78E+01		5.20E-02	y				1.80E+01	y	2.66E+00	PCOC(1)
Potassium-40	4.78E+01		3.61E+01	y				---	---		PCOC(3)
Radium-226	4.61E+00		---	---				5.00E+00	n	9.23E-01	NFA(2)
Strontium-90	1.83E+01		1.00E+00	y				5.90E+00	y	3.10E+00	PCOC(1)
Thorium-232	4.38E+00		2.68E+00	y				5.00E+00	n	8.75E-01	PCOC(4)
Tritium	1.05E+02		---	---				8.10E+02	n	1.30E-01	NFA(2)
Uranium-234	5.61E+00		2.03E+00	y				8.60E+01	n	6.52E-02	PCOC(4)
Uranium-235	3.58E+00		8.80E-02	y				1.80E+01	n	1.99E-01	PCOC(4)
Uranium-238	3.44E+01		1.90E+00	y				5.90E+01	n	5.83E-01	PCOC(4)

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FOOTNOTES

[a]All soil sample concentration values for PRS 50-006(d) were taken from FIMAD (6/95). All values are maximums, except where noted as crql—the Contract Required Quantitaton Limit for that chemical.

[b]Upper Tolerance Limits (UTLs) for background chemical concentrations in soil at LANL were taken from FIMAD (6/95).

[c]Ecotoxicological Screening Action Level (ESAL) values were taken from Appendix C of LA-UR-95-439. ESAL values are soil systemic screening action levels, except where noted (ca) for soil carcinogenic screening action level.

[d]Human Health Screening Action Level (SAL) values were taken from FIMAD (revised as of 9/1/94).

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