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Date: September 25, 1998
Refer to: EM/ER:98-386

Dr. Robert Dinwiddie
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87505-2100

SUBJECT: ECOLOGICAL RISK ASSESSMENTS FOR PRSs 3-010(a), 32-001, 32-002(a, b), 32-003, and 32-004 (FORMER OU 1114, FU 1) and Former OU 1079, FU 1)

Dear Dr. Dinwiddie:

This letter is in response to your request for ecological risk assessments for Potential Release Sites (PRSs) 3-010(a), 32-001, 32-002(a, b), 32-003, and 32-004. This request was made in 1997 and extensions were requested (EM/ER:97-072, EM/ER:97-374) until the end of this Fiscal Year (1998).

Los Alamos National Laboratory has been working in partnership with Hazardous and Radioactive Materials Bureau (HRMB) staff to develop approaches for both ecological screening assessment and ecological risk assessments. This transmittal is intended to start the problem formulation discussions that are needed for a successful ecological risk assessment. It is assumed that the purpose of the ecological risk assessments is to evaluate impacts from residual contamination to determine if the sites can be recommended for no further action (NFA) or need additional assessment and/or remediation.

The Laboratory follows the Environmental Protection Agency (EPA) Comprehensive Environmental Response, Compensation, and Liability Act guidance for performing ecological risk assessments. The first step of the EPA ecological risk assessment guidance is problem formulation. In order to make sure that regulatory concerns are fully addressed, the problem formulation is completed in coordination with HRMB. Two enclosures to this letter, Problem Formulation for PRS 3-010(a) (Enclosure 1) and Problem Formulation for PRSs 32-001, 32-002(a, b), 32-003, and 32-004 (Enclosure 2) include the results of the screening level ecological risk assessments for these PRSs. These narratives are meant to provide background information to HRMB managers and technical advisors to facilitate completion of the problem formulation step. It is anticipated HRMB personnel will work with Laboratory Environmental Restoration Project personnel to identify any immediate concerns and to complete the risk assessments for these sites.

All of these PRSs have been previously proposed for NFA in either the Resource Conservation and Recovery Act facility investigation reports or Voluntary Corrective Action completion reports. The proposal for NFA was based primarily on human health risk information, and copies of the appropriate reports and responses to notices of deficiency.

If you have any questions, please contact Dave McInroy at (505) 667-0819 or Joe Mose at (505) 667-5808.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/WN/rfr

Enclosures: (1) Problem Formulation for PRS 3-010(a) (Former OU 1114, FU 1)
(2) Problem Formulation for PRSs 32-001, 32-002(a, b), 32-003, and 32-004 (Former OU 1114, FU 1)

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Problem Formulation for
Ecological Risk Assessment of the TA-32 PRS Aggregate
[PRSs 32-001, 32-002(a,b), 32-003, 32-004]

The Laboratory follows the EPA CERCLA Guidance for performing ecological risk assessments (EPA 1997, 59370). The first two steps of the EPA ecological risk assessment guidance are ecological screening steps, and include screening-level problem formulation and screening-level exposure calculations. The purpose of these ecological screening steps are to focus the risk assessment and to provide risk management information to site decision-makers. In order to make sure that regulatory concerns are addressed, problem formulation for ecological risk assessment is completed in coordination with the administrative authority (AA). Thus, this narrative and supporting calculations are provided as the first step in ecological risk problem formulation for PRS aggregate 32-002(a), 32-002(b) and 32-003 and individual PRSs 32-001 and 32-004. No ecotoxicological screening assessment was provided in the "Phase II and Voluntary Corrective Action Report for Potential Release Sites at TA-32" (LANL 1996, ER ID 59178). This narrative will follow the current RFI report format to be consistent with other ecological risk information provided by the Laboratory to the AA.

There are two phases of the ecological screening assessment as presented in Kelly et al. (1998, 57916) and followed in this narrative: the scoping evaluation and the screening evaluation. The scoping evaluation includes (1) the data assessment step, which identifies the list of contaminants of potential concem (COPCs) for the PRS or PRS aggregate; (2) the problem formulation step for the specific PRS or PRS aggregate under investigation; and (3) the bioaccumulation evaluation step, which evaluates the level of concern for persistent bioaccumulation and/or biomagnification from contaminants at the PRSs. The basis for the PRS-specific problem formulation is found in the Ecological Scoping Checklist provided in Attachment 1. The scoping checklist is a useful tool for organizing existing ecological information and focusing the site visit on the information needed to develop the conceptual site model. The scoping checklist also provides the basis for evaluating the adequacy of the data for ecological risk screening.

The screening evaluation includes the calculation of hazard quotients (HQs) and hazard indices (HIs) for all COPCs and all appropriate screening receptors. The HQ can be thought of as the ratio of the calculated exposure dose to the receptor (based on contaminant levels at the PRS) to a dose that has been determined to be acceptable (based on toxicity studies for the receptor). An HI is a sum of HQs, across contaminants with like effects, for a given screening receptor. An HQ or HI greater than 1 is considered an indicator of potential adverse impacts, and the chemical constituents resulting in an HQ or HI greater than 1 are identified as contaminants of potential ecological concern (COPECs). HQ calculations require toxicity, bioconcentration, and bioaccumulation information for all chemicals for all receptors. This narrative will not include a quantitative aquatic screening evaluation because the required toxicity, bioconcentration, and bioaccumulation information are not available for aquatic receptors. To provide some information for a qualitative uncertainty analysis, ratios of maximum COPC concentrations with the ecological screening level were calculated for the most sensitive terrestrial receptors.

An uncertainty analysis follows the COPEC identification, which describes the key sources of uncertainty in the screening assessment. The uncertainty analysis can result in adding chemical constituents to or removing them from the list of COPECs. This narrative contains a qualitative uncertainty analysis to help understand issues relevant to evaluating ecological risk for this PRS.

The last part of the problem formulation is to make recommendations on the appropriate spatial scale and relevant ecological values to be assessed in the ecological risk assessment. An evaluation will also be made of the need for interim corrective measures to mitigate potential risk before the PRS-specific ecological risk assessment is completed.

1 Scoping

1.1 Data Assessment

Data assessment for the PRS aggregate and individual PRS evaluated in this narrative relies on information obtained from the "Phase I RFI report for Potential Release Sites 32-001, 32-002(a), 32-002(b), 32-003, and 32-004", (LANL 1995, ER ID 48944) and the "Phase II and Voluntary Corrective Action Report for Potential Release Sites at TA-32" (LANL 1996, ER ID 59178). These RFI Reports summarize the initial characterization of the PRSs, the corrective actions taken at the PRSs to remove metals, organics, and radionuclides, and the subsequent characterization of the residual concentrations of COPCs. The data used in this assessment will only include samples from environmental media that remain after the VCA phase was completed. For the readers convenience, referenced data tables or figures from Phase I or Phase II reports have been reproduced and included with this report in Attachment 2.

1.2 Problem Formulation

The purpose of the screening-level ecological risk problem formulation for TA-32 is to provide information to (1) determine if ecological receptors can be affected by a release; (2) determine how the PRSs should be aggregated spatially for screening and to establish the functional/operational boundaries of the assessment; and (3) gather information to develop the conceptual site model (e.g., what are the contaminant sources, dominant transport pathways and exposure routes, and potential receptors).

Five PRSs are addressed in this Ecological Risk Assessment for TA-32 and identified in Figure 1.

PRS 32-001 is the former location of an incinerator, which received combustible wastes from the medical research facility. Ash was disposed of off-site. PRS 32-001 is currently located beneath asphalt in the active working area of the Los Alamos County Public Works Department, Pavement Management Division. The phase II RFI of PRS 32-001 identified copper, manganese, mercury, sodium, zinc, trichloroethene and Aroclor 1260 as COPCs. All COPCs were reported at low levels relative to BV or detection limits (table 2.1.3-1 and 2.1.3-2, Attachment 2). Aroclor-1260 in particular was not reported above 1 mg/kg in any of the 18 samples collected during Phase II (Table 2.1.2-1, Attachment 2). As presented in the Ecological Scoping Checklist for PRS 32-001, due to the location and current use of the site, no ecological receptors are present and no offsite transport pathways exist. Therefore, no further ecological assessment of PRS 32-001 is required or proposed.

PRSs 32-002(a,b) were septic systems that include the influent drainlines, the sites of two previously removed septic tanks, the remaining effluent drainline and outfall area into the Los Alamos Canyon. For the purpose of this screening assessment, Phase II RFI data from the effluent drainline removal was not considered due to the fact that the sample media are currently located beneath 1-2 ft of clean fill and asphalt following the VCA. No ecological assessment is required for these removed drainlines, because there are no receptors on-site and no offsite transport pathways for COPCs. This ecological risk assessment will consider COPCs reported in surface and subsurface soils collected south of the paved area within the footprint of the previous septic tank structure and

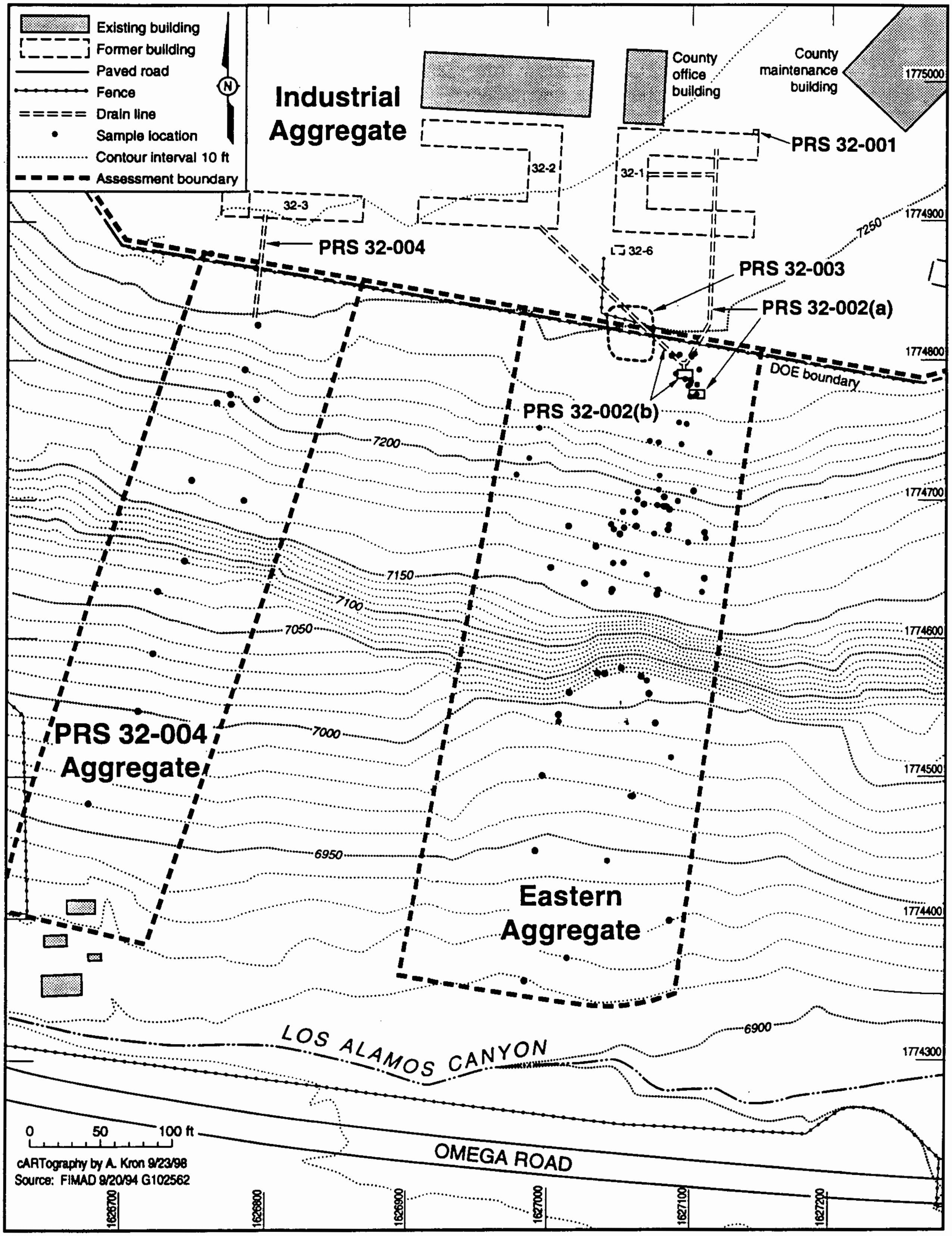


Figure 1. Locations of TA-32 PRSs and assessment boundaries.

continuing down the outfall areas to the edge of the canyon bottom. COPCs associated with the PRSs 32-002 (a,b) include inorganic chemicals, volatile organic chemicals, semivolatile organic chemicals, and radionuclides.

PRS 32-003 was a transformer station consisting of three transformers on a wooden platform elevated 19.5 feet above the ground. A wooden debris pile and several sawed-off poles were found at the site and are believed to be the remains of the transformer platform. As discussed in Section 4.1.3 of the Phase II and VCA report, PCBs were present in the soil at levels up to 4700 mg/kg and the extent of contamination was determined to include an area approximately 38 feet x 30 feet x 2-5 feet deep (Fig. 4.1.3-1, Attachment 2). Data used for the Ecological Risk Assessment of PRS 32-003 are limited to VCA confirmation data for Aroclor 1260, the only COPC identified at the PRS (Table 4.1.4-1, Attachment 2). All reported PCB concentrations are subsurface, below 2-5 feet of clean fill. No exposure pathways are currently complete, and due to its proximity to PRSs 32-002 (a,b), these three PRSs will be screened as a single unit. COPCs identified in Phase I (LANL 1995, ER ID 48944) and Phase II investigation (ER ID 59178), associated with PRS 32-003 included lead, Aroclor 1260, and three PAHs (benzo(b)fluoranthene, fluoranthene, and pyrene).

PRS 32-004 was a former radiation source vault location, drainline, and outfall area (see Figure 1.1-1, Attachment 2). Phase II investigation of the vault did not identify the presence of radioactive contamination (Section 5.1.3, ER ID 59178). Phase II investigation of the drainline (Section 5.2.3, ER ID 59178) reported that "Visual inspection, field screening results, and fixed laboratory analysis results indicated that no release had occurred from the drainline". Although no release was indicated, the PRS 32-004 drainline located on Los Alamos County Property was removed. Approximately 50 feet of drainline remains on DOE property leading to the outfall. As a best management practice the remaining line was grouted. Data for the screening assessment of PRS 32-004 included surface and subsurface samples collected in the outfall area (Figure 5.1.2-1, Attachment 2). COPCs from Phase II included inorganic chemicals (lead, mercury and silver), phthalates and PAHs. The investigation of the outfall area provides the only data applicable to ecological assessment. The locations of the former vault and drainline are under asphalt pavement with no receptors currently present nor complete exposure pathways.

Three spatial aggregates of PRS were identified during the scoping process. These aggregates include:

The industrial PRS aggregate, which includes portions of TA-32 that are located under asphalt pavement within an active industrial area. Therefore, there are currently no ecological receptors and exposure pathways associated with these portions of the PRSs. This includes all of PRS 32-001, and portions of PRSs 32-002(a,b) and 32-004. Due to the lack of receptors and exposure pathways no further ecological assessment is needed for this aggregate.

The eastern PRS aggregate, which includes portions of PRSs 32-002(a,b), and the entire PRS 32-003. This PRS aggregate is characterized by vegetation typical of south-facing slopes, and dominant plants on the mesa edge and canyon walls or benches include: pinon pine, juniper, shrub oak, yucca, forbs, and grasses. No aquatic receptors were noted in the vicinity of this PRS aggregate, which is assumed to terminate at the colluvial slope in Los Alamos Canyon.

PRS 32-004, which is considered separately from the eastern PRS aggregate due the distance between the outfall areas and the type of contamination detected in each area. The vegetation is the same as that noted for the eastem PRS aggregate.

Threatened and endangered (T&E) species are potential receptors for contaminant releases associated with the eastem PRS aggregate and PRS 32-004. Specifically, the Mexican spotted owl and the peregrine falcon are expected to roost or forage in the vicinity (LANL 1998, 59369). Thus, T&E species concerns are relevant to ecological risk assessment at these sites.

The eastem PRS aggregate and PRS 32-004 share a common contaminant release mechanism, i.e., liquids release of contaminants to surface soils. The primary impacted media are 1) surface soil; 2) subsurface soil and tuft, and 3) storm waste runoff. The most important transport mechanism for contaminants in surface soil is erosion of through surface water runoff, particularly in storm events. Uncontaminated surface water could become contaminated by suspension or dissolution of contaminated soil or sediment. Another transport mechanism is the suspension of dry particulates by eolian processes, which makes air a secondary contaminated media.

The ecological conceptual site models for the eastern PRS aggregate and PRS 32-004 are presented graphically in Figures 2 and 3 respectively. The ecological conceptual site model identifies which exposure pathways represent major, minor, unlikely, or no pathway to ecological receptors. Exposure pathways to terrestrial receptors can occur through air (inhalation or deposition of particulates); surface soil (root uptake and rain splash on plants' food web transport to plants and animals, incidental ingestion of soil, dermal contact with contaminated soil, and external radiation); and surface water or active channel sediments (root uptake and rain splash on plants, food web transport to animals, incidental ingestion of water and sediment, dermal contact with contaminated water or sediment, and external radiation from sediment). The major soil-related exposure pathways are expected to be food web transport and incidental ingestion of contaminated soil. The major sediment/surface water -related exposure pathways are expected to be food web transport and incidental ingestion of contaminated sediment/water. However, the importance of the water/sediment pathways are questionable because of the limited extent of active channel sediments and surface water in the outfall area. A comprehensive evaluation of aquatic pathways will be performed through the ongoing Canyon Reach evaluations. Exposure to vapors is not a complete pathway because of the general absence of volatile contaminants. Exposure to airborne particulates is expected to be a minor pathway because of the limited amount of contamination on the ground surface. Lastly, the remaining pathways that are related to exposure to surface soil (root uptake/rain splash and dermal contact) and surface water/sediment (dermal contact) are expected to be minor or unlikely because of the limited amount of contamination expressed at the ground surface.

Figure 2: Conceptual site model for ecological receptors at the eastern PRS aggregate.

KEY
0 - No Pathway
1 - Unlikely Pathway
2 - Minor Pathway
3 - Major Pathway

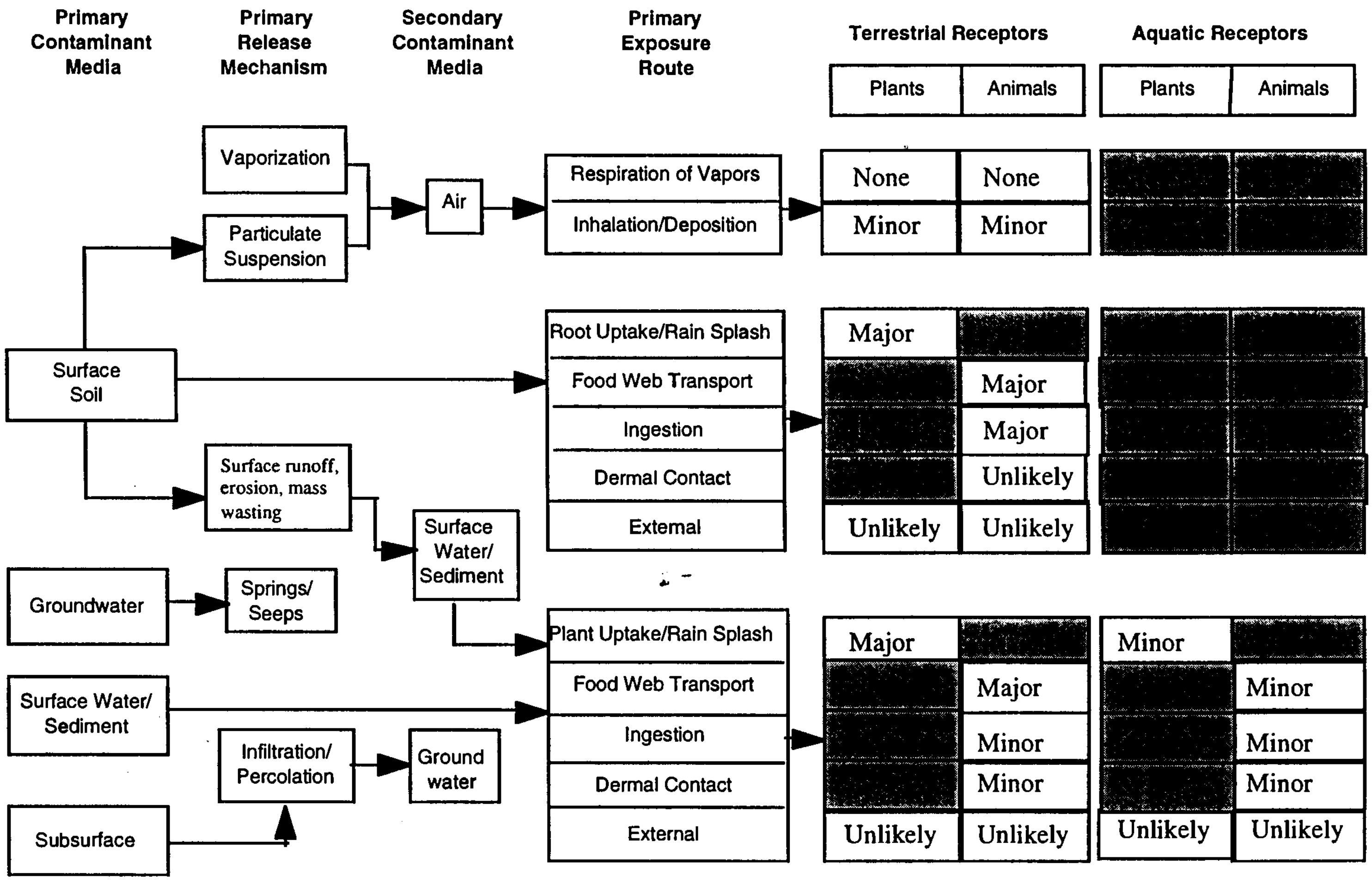
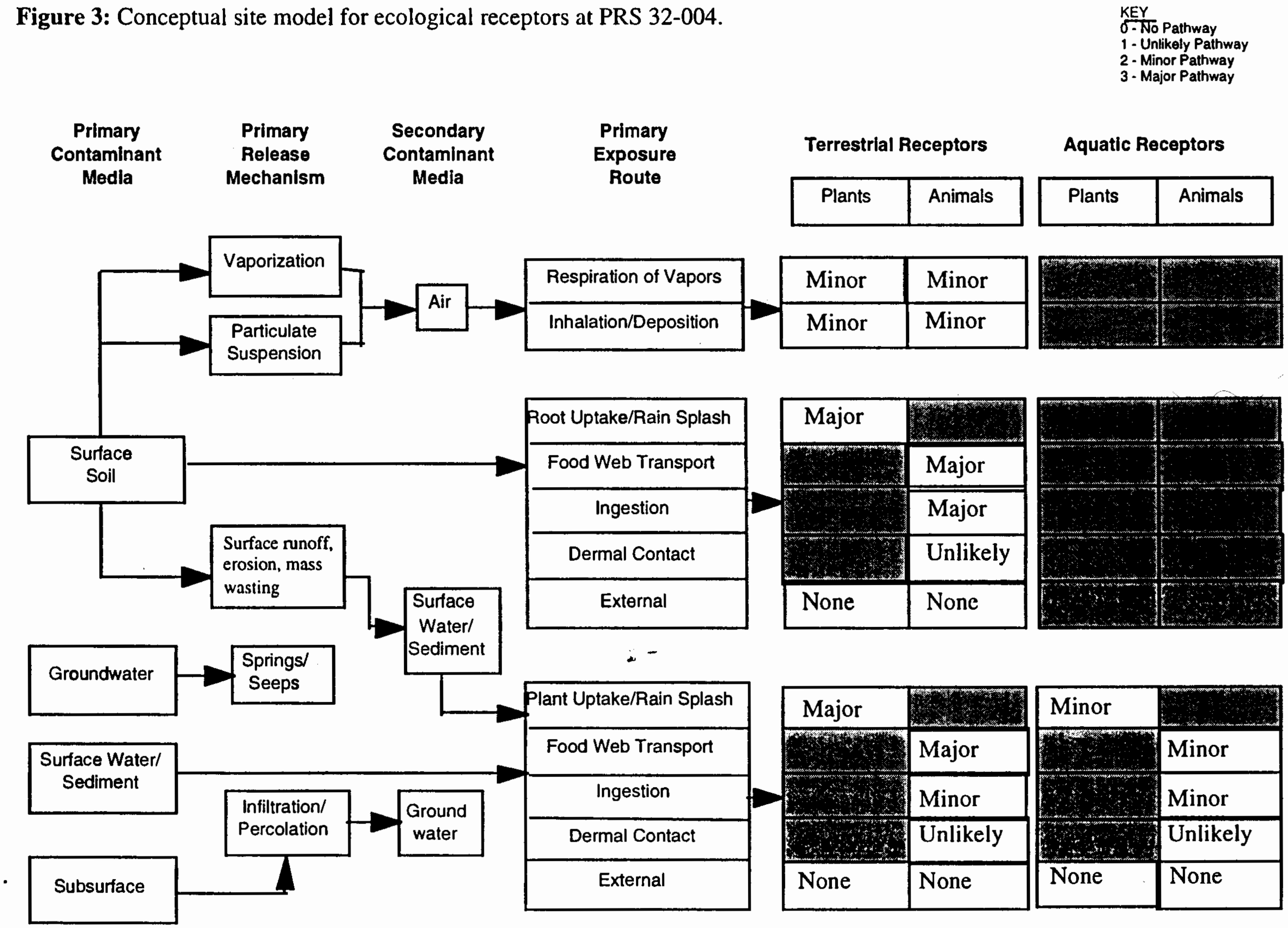


Figure 3: Conceptual site model for ecological receptors at PRS 32-004.



1.3 Bioaccumulator Evaluation

Several analytes detected above background values in PRSs 32-002(a,b), 32-003, and 32-004 are potentially persistent bioaccumulators. Potential bioaccumulating COPCs at PRS aggregate 32-002 (a,b) and 32-003 are identified in Table 1. Potential bioaccumulating COPCs at PRS 32-004 are identified in Table 2. Bioaccumulation is defined based on the potential for bioaccumulation in aquatic environments. Because aquatic pathways are not relevant for this ecological risk assessment, none of these potentially bioaccumulating chemicals warrant any specialized bioaccumulation evaluation. The potential for food web uptake and dietary exposure will be modeled to terrestrial screening receptors

TABLE 1

COPCS FOR THE ECOLOGICAL SCREENING EVALUATION AT EASTERN PRS AGGREGATE

Analyte Group	Analytes
Inorganic Chemicals	Antimony, cadmium*, chromium, copper*, lead*, mercury*, silver, thallium, zinc
Volatile Organics	Acetone, methylene chloride
Semivolatile Organics	Bis(2-ethylhexyl)phthalate*, di-n-butyl phthalate*, benzo(a)pyrene*, benzo(b)fluoranthene*, benzo(g,h,i)perylene*, benzo(k)fluoranthene*, chrysene*, pyrene*, fluoranthene*, indeno(1,2,3-cd)pyrene*,
PCBs	Aroclor 1260*
Radionuclides	Americium-241*, cesium-137*; plutonium-238*; plutonium-239*, uranium-234*, uranium-238*

*Potential persistent bioaccumulator as defined by the New Mexico Environment Department

TABLE 2

COPCS FOR THE ECOLOGICAL SCREENING EVALUATION AT PRS 32-004

Analyte Group	Analytes
Inorganic Chemicals	Lead*, mercury*, silver
Semivolatile Organics	Bis(2-ethylhexyl)phthalate*, butyl benzyl phthalate*, acenapthene*, anthracene*, benzo(a)anthracene*, benzo(a)pyrene*, benzo(b)fluoranthene*, benzo(g,h,i)perylene*, benzo(k)fluoranthene*, chrysene*, pyrene*, fluoranthene*, indeno(1,2,3-cd)pyrene*, naphthalene, phenanthrene*

*Potential persistent bioaccumulator as defined by the New Mexico Environment Department

2 Screening Evaluation

The ecological risk screenings for the eastern PRS aggregate and PRS 32-004, will be based on exposure to terrestrial receptors by ecologically available contamination. That is, contamination which occurs in undeveloped areas and within 5 feet of the soil surface. It is important to remember that the purpose of the screening evaluation is to identify COPECs, and not to calculate risk. The HQ analysis is used as an indicator of potential risk and this analysis is intended to be conservative to minimize the chance of missing an analyte that potentially poses an ecological risk. The results of the screening evaluations for the eastern PRS aggregate and PRS 32-004 are presented in Tables 3 and 4 respectively.

The HQ analysis is based on the maximum sample result or detection limit for each analyte identified as a COPC in Phase I, Phase II or VCA Confirmation sampling. Samples collected from the bottom of excavations were included in the ecological screening assessment. The HQ is calculated by dividing the maximum analyte concentration by the soil ESL for nine screening ecological risk receptors. Tables 3 and 4 show the maximum concentration of each analyte, the minimum ESL, the HQ for the minimum ESL, and the receptor with the minimum ESL. Attachment 3 presents the details of the screening calculations for all terrestrial receptors.

The screening evaluation of the eastern PRS aggregate is summarized in Table 3 below. Based on the information presented in this table, it is clear that mercury and chromium are the major COPCs driving any potential ecological risk with non-radiological effect HQs of 2.5E+04 and 1.1E+03 respectively. Additional analytes identified at the aggregate with HQs greater than 1.0 include, silver (75), thallium (35), Aroclor 1260 (32), lead (32), di-n-butyl phthalate (28), bis (2-ethylhexyl) phthalate (23), antimony (12), zinc (6.4), copper (3.2), and cadmium (1.9). Uranium-234 and uranium-238 may be associated with potential radiological effects based on their respective HQs of 12 and 9.2. These fourteen analytes would be identified as COPECs for any future site investigation or assessment activities. All other analytes presented in Table 3 with HQs less than 1.0 do not present a potential unacceptable risk and are eliminated as COPECs in future assessment activities at the aggregate.

The screening evaluation of PRS 32-004 is summarized in Table 4 below. Based on the information presented in this table, it is clear that any potential ecological risk at the PRS is driven by three inorganic chemicals, mercury (17), lead (1.8), silver (1.7), and bis(2-ethylhexyl)phthalate (3.6). These four analytes would be identified as COPECs for any future site investigation or assessment activities. All other analytes presented in Table 4 with HQs less than 1.0 do not present a potential unacceptable risk and are eliminated as COPECs in future assessment activities at PRS 32-004.

TABLE 3
Maximum Detected Soil Concentrations
and Ecological Screening Levels for the Eastern PRS Aggregate

Analyte	**Maximum Sample Result**	**Minimum ESL**	**HQ**	**Screening Receptor with Minimum ESL[a]**
Non-Radiological Effects	(mg/kg)	(mg/kg)		
Antimony	12 (U)	1.02E+00	1.2E+01	Mouse
Cadmium	5.6	3.00E+00	1.9E+00	Plant
Chromium VI	440	4.00E-01	1.1E+03	Invert
Copper	170	5.00E+01	3.4E+00	Invert
Lead	1600	5.00E+01	3.2E+01	Plant
Mercury (methyl)	303 (J)	1.23E-02	2.5E+04	Robin
Silver	150	2.00E+00	7.5E+01	Plant
Thallium	2.4	6.78E-02	3.5E+01	Shrew
Zinc	320	5.00E+01	6.4E+00	Plant
Acetone	0.033 (U)	1.85E+00	1.8E-02	Mouse
Bis(2-ethylhexyl)phthalate	5.5	2.42E-01	2.3E+01	Kestrel (falcon)
Di-n-butylphthalate	2.9	1.03E-01	2.8E+01	Robin
Methylene chloride	0.008	6.68E+00	1.2E-03	Mouse
Benzo(a)pyrene	0.35	3.77E+00	9.3E-02	Shrew
Benzo(b)fluoranthene	0.51	3.74E+00	1.4E-01	Shrew
Benzo(g,h,i)perylene	1.2	2.17E+00	5.5E-01	Fox
Benzo(k)fluoranthene	0.28	3.74E+00	7.5E-02	Shrew
Chrysene	0.34	3.95E+00	8.6E-02	Shrew
Pyrene	0.8	3.16E+01	2.5E-02	Shrew
Aroclor-1260	4.83	1.51E-01	3.2E+01	Shrew
Fluoranthene	0.53	5.26E+01	1.0E-02	Shrew
Indeno(1,2,3-cd)pyrene	0.64	2.46E+00	2.6E-01	Fox
		Total	2.59E+04	
Radiological Effects	pCi/g			
Americium-241	1.07 (J)	4.66E+01	2.3E-02	Robin
Cesium-137 + Barium-137	2.56	4.24E+01	6.0E-02	Robin
Plutonium-238	0.079	3.07E+01	2.6E-03	Robin
Plutonium-239/240	5 (U)	3.28E+01	1.5E-01	Robin
Uranium-234	3.55	2.92E-01	1.2E+01	Robin
Uranium-238	3.04	3.32E-01	9.2E+00	Robin
		Total	2.15E+01	

a. ESLs are calculated based on the methodology presented in Kelly et al. (1998, 57916).

TABLE 4
Maximum Detected Soil Concentrations and Ecological Screening Levels for PRS 32-004

Analyte	Maximum Sample Result	Minimum ESL	HQ	Screening Receptor with Minimum ESL
Non-Radiological Effects	(mg/kg)	(mg/kg)		
Lead	89	5.00E+01	1.8E+00	Plant
Mercury (methyl)	0.137	1.23E-02	1.1E+01	Robin
Silver	3.3	2.00E+00	1.7E+00	Plant
Bis(2-ethylhexyl)phthalate	0.88	2.42E-01	3.6E+00	Kestrel (falcon)
Butyl benzyl phthalate	3.1	6.90E+02	4.5E-03	Shrew
Acenaphthene **(U)**	0.53	4.49E+00	1.2E-01	Mouse
Anthracene **(U)**	0.53	4.43E+02	1.2E-03	Mouse
Benzo(a)anthracene	1.7	3.95E+00	4.3E-01	Shrew
Benzo(a)pyrene	1.9	3.77E+00	5.0E-01	Shrew
Benzo(b)fluoranthene	2.2	3.74E+00	5.9E-01	Shrew
Benzo(g,h,i)perylene	1.4	2.17E+00	6.4E-01	Fox
Benzo(k)fluoranthene	1.7	3.74E+00	4.6E-01	Shrew
Chrysene	3.5	3.95E+00	8.9E-01	Shrew
Fluoranthene	4.8	5.26E+01	9.1E-02	Shrew
Indeno(1,2,3-cd)pyrene	1.3	2.46E+00	5.3E-01	Fox
Naphthalene **(U)**	0.53	2.14E+01	2.5E-02	Mouse
Phenanthrene	2.2	4.43E+00	5.0E-01	Mouse
Pyrene	3.8	3.16E+01	1.2E-01	Shrew
		Total	2.3E+01	

a. ESLs are calculated based on the methodology presented in Kelly et al. (1998, 57916).

2.1 Uncertainty Analysis

This section presents separate qualitative uncertainty analyses for the eastern PRS aggregate and for PRS 32-004.

The uncertainty analysis for the eastern PRS aggregate will consider 14 COPECs identified in the screening evaluation section. These COPECs include nine inorganic chemicals of which cadmium, copper, lead and mercury are also considered to be potentially persistent bioaccumulators; three semi-volatile organic chemicals, bis(2-ethylhexyl)phthalate, di-n-butyl phthalate, and Aroclor-260 which are also considered to be potentially persistent bioaccumulators; and two radionuclides, uranium-234 and uranium-238 which are also considered to be potentially persistent bioaccumulators. Each of these COPECs is briefly discussed below.

Mercury. The highest mercury sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum mercury value is associated with a HQ of 25000, which suggests that mercury in surface soil represents the greatest potential ecological effects. Generally, mercury contamination in samples collected on the mesa edge and hillside is much lower than the maximum reported value of 303(J) mg/kg, with the average hillside concentration approximately an order of magnitude lower at 33.5 mg/kg. This suggests that there is a reasonable expectation that the maximum value was obtained. A relevant factor in evaluating the potential ecological hazard posed by mercury is whether it exists as organic mercury (methyl mercury). Methyl mercury is readily absorbed by animals, and it is more toxicologically potent in this form. Environmental fate and process knowledge of the mercury source suggests that it would persist at the site as elemental or inorganic mercury. Thus, ecological risk may be more accurately assessed by using toxicity data for inorganic mercury. Ecological risk would also be more accurately estimated by calculating the representative concentration for mercury over the home range of the receptor. Application of these last two modifying factors would dramatically reduce the estimated mercury HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Chromium. The highest chromium sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum chromium value is associated with a HQ of 1100, which suggests that chromium in surface soil represents the second greatest potential for ecological effects. Generally, chromium contamination in samples collected on the mesa edge and hillside is much lower than the maximum reported value of 440 mg/kg, with the average hillside concentration approximately an order of magnitude lower at 54.7 mg/kg. This suggests that there is a reasonable expectation that the maximum value was obtained. A relevant factor in evaluating the potential ecological hazard posed by chromium is whether it exists as chromium VI or chromium III. Chromium VI is the more potent toxicological form of this metal however, environmental fate and geochemical processes suggest that it would persist at the site as chromium III. Thus, ecological risk may be more accurately assessed by using toxicity data for chromium III. Ecological risk would also be more accurately estimated by calculating the representative concentration for chromium over the home range of the receptor. Application of these last two modifying factors would dramatically reduce the estimated chromium HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Silver. The highest silver sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum silver value is associated with a HQ of 75, which suggests that silver in surface soil represents a substantially lower potential ecological risk than mercury or chromium discussed above. Generally, silver contamination in samples collected on the mesa edge and hillside is much lower than the maximum reported value of 150 mg/kg, with the average hillside concentration approximately an order of magnitude lower at 16.5 mg/kg. This suggests that there is a reasonable expectation that the maximum value was obtained. Ecological risk presented by silver would also be more accurately estimated by calculating the representative concentration for silver across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would reduce the estimated silver HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Thallium. The highest thallium sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum thallium value is associated with a HQ of 35, which suggests that thallium in surface soil represents a substantially lower potential ecological risk than mercury or chromium discussed above. Generally, thallium was undetected in hillside samples with 11 of 16 results qualified (U). Substitution of one half the detection limit in the calculation of the average thallium concentration for hillside samples results in a value 0.86 mg/kg. The elevated detection limit for thallium in RFI samples provides uncertainty in the determining whether the maximum value was obtained. Furthermore, ecological risk presented by thallium would also be more accurately estimated by determining the representative concentration for thallium across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would reduce the estimated thallium HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Lead. The highest lead sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum lead value is associated with a HQ of 32, which suggests that lead in surface soil represents a substantially lower potential ecological risk than mercury or chromium discussed above. Lead contamination in samples collected on the mesa edge and hillside is much lower than the maximum reported value of 1600 mg/kg, with the average hillside concentration approximately an order of magnitude lower at 198 mg/kg. The ecological risk presented by lead would also be more accurately estimated by determining the representative concentration for lead across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would reduce the estimated lead HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Aroclor-1260. The highest Aroclor-1260 sample result was collected at location 32-06458 during the confirmation sampling of the VCA for PRS 32-003. This maximum Aroclor-1260 value is associated with a HQ of 32. However, this maximum concentration as well as all other Aroclor-1260 results for the PRS aggregate represent subsurface tuff media which is currently lying below a minimum of 2 feet of clean fill on the mesa edge. Therefore the potential for ecological receptor exposure to this COPEC is extremely limited.

Di-n-butyl phthalate. The highest di-n-butyl phthalate sample result was collected at location 32-1019 on the hillside below the PRS 32-002(a,b) outfall. This maximum di-n-butyl phthalate value is associated with a HQ of 28. This contaminant is not specifically associated with past operations at TA 32 and as a chemical class, phthalates are considered to be common environmental contaminants in industrialized settings. Despite this, di-n-butyl phthalate was detected in only 4 of 16 hillside samples at relatively low levels. The ecological risk presented by di-n-butyl phthalate would be more accurately estimated by determining the representative concentration for di-n-butyl phthalate across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would further reduce the estimated di-n-butyl phthalate HQ. The amount of reduction in the HQ would naturally be associated with the assessment endpoint selected for the ecological risk assessment.

Bis(2-ethylhexyl)phthalate. The highest bis(2-ethylhexyl)phthalate sample result was collected at location 32-1015 on the hillside below the PRS 32-002(a,b) outfall. This bis(2-ethylhexyl)phthalate value is associated with a HQ of 23. This contaminant is not specifically associated with past operations at TA-32 and as a chemical class, phthalates are considered to be common environmental contaminants in industrialized settings. Despite this, bis(2-ethylhexyl)phthalate was detected in only 1 of 16 hillside samples. The ecological risk presented by bis(2-ethylhexyl)phthalate would be more accurately estimated by determining the representative concentration for bis(2-ethylhexyl)phthalate across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would further reduce the estimated bis(2-ethylhexyl)phthalate HQ. The amount of reduction in the HQ would naturally be associated with the assessment endpoint selected for the ecological risk assessment.

Antimony. The highest antimony sample result was collected at location 32-06374 associated with the confirmational sampling of the PRS 32-002(a) drainline VCA. This maximum antimony value is associated with a HQ of 12, however the actual reported result is qualified as undetected (U) at a detection limit of 12 mg/kg. Antimony was not positively reported in any aggregate samples and all reported results were (U) qualified at levels greater than BV. This contributes to the uncertainty associated with assessing the presence of antimony at the aggregate and further sampling may be required to address this uncertainty.

Zinc. The highest zinc sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum zinc value is associated with a HQ of 6.4, which suggests that zinc in surface soil presents little potential for ecological risk or adverse ecological effects. Generally, zinc contamination in samples collected on the mesa edge and hillside is much lower than the maximum reported value of 320 mg/kg, with the average hillside concentration approximately 88.7 mg/kg. This suggests that there is a reasonable expectation that the maximum value was obtained. Ecological risk presented by zinc would be more accurately estimated by calculating the representative concentration for zinc across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would reduce the estimated zinc HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Copper. The highest copper sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum zinc value is associated with a HQ of 3.4, which suggests that copper in surface soil presents little potential for ecological risk or adverse ecological effects. Generally, copper contamination in samples collected on the mesa edge and hillside is much lower than the maximum reported value of 170 mg/kg, with the average hillside concentration approximately an order of magnitude lower at 21.9 mg/kg. This suggests that there is a reasonable expectation that the maximum value was obtained and the average copper concentration at the aggregate is not substantially different than background. Furthermore, the ecological risk presented by copper would be more accurately estimated by calculating the representative concentration for copper across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would reduce the estimated copper HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Cadmium. The highest cadmium sample result was collected at location 32-1016 on the hillside below the PRS 32-002(a,b) outfall. This maximum cadmium value is associated with a HQ of 1.9, which suggests that cadmium in surface soil presents little potential for ecological risk or adverse ecological effects. Generally, cadmium contamination in samples collected on the mesa edge and hillside is much lower than the maximum reported value of 5.6 mg/kg. Cadmium was undetected (~0.5 mg/kg) in 7 of 16 hillside samples at levels just slightly greater than BV (0.4). This suggests that there is a reasonable expectation that the maximum value was obtained. The ecological risk presented by cadmium would be more accurately estimated by calculating the representative concentration for cadmium across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would further reduce the estimated cadmium HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Uranium-234 and uranium-238. The maximum activities for uranium-234 and uranium-238 were collocated and reported at sample location 32-06313 on the hillside below the PRS 32-002(a,b) outfall. These maximum activities are associated with HQs of 12 and 9.2 respectively. The ecological risk presented by uranium-234 and uranium-238 would be more accurately estimated by calculating the representative concentration for uranium-234 and uranium-238 across the PRS aggregate and relative to the home range of the appropriate receptor. Application of this modifying factor would further reduce the estimated uranium-234 and uranium-238 HQ. The amount of reduction in the HQ would naturally be associated with the assessment endpoint selected for the ecological risk assessment.

The uncertainty analysis for the PRS 32-004 will consider 4 COPECs identified in the screening evaluation section. These COPECs include three inorganic chemicals of which lead and mercury are also considered to be potentially persistent bioaccumulators; and the semi-volatile organic chemical, bis(2-ethylhexyl)phthalate which is also considered to be potentially persistent bioaccumulators.

Mercury. The highest mercury sample result was collected at location 32-06338 on the hillside at the PRS 32-004 outfall. This maximum mercury value is associated with a HQ of 11, which suggests that mercury in surface soil presents a potential for ecological effects. The maximum mercury concentration at PRS 32-004 was 0.137 mg/kg which is just slightly less than the BV. All other positively reported results are essentially the same as the BV in the range of 0.12 to 0.10 mg/kg. A relevant factor in evaluating the potential ecological hazard posed by mercury is whether it exists as organic mercury (methyl mercury). Methyl mercury is readily absorbed by animals, and it is more potent toxicological in this form. Environmental fate and process knowledge of the mercury source suggests that it would persist at the site as elemental or inorganic mercury. Thus, ecological risk may be more accurately assessed by using toxicity data for inorganic mercury. Ecological risk would also be more accurately estimated by calculating the representative concentration for mercury over the home range of the receptor. Application of these last two modifying factors would dramatically reduce the estimated mercury HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment.

Lead. The highest lead sample result was collected at location 32-06338 on the hillside at the PRS 32-004 outfall. This maximum lead value (89 mg/kg) is associated with a HQ of 1.8., which suggests that lead in surface presents a for potential ecological effects. The maximum lead concentration at PRS 32-004 was reported at the outfall and the contamination appears to be bounded both vertically and horizontally as evidenced by a decreasing concentration trend. While the HQ resulting from the maximum reported site value is not substantially greater than 1.0, the ecological risk presented by lead would be more accurately estimated by determining the representative concentration for lead across the PRS aggregate and relative to the home range of the appropriate receptor. In this case a representative concentration across the site would possibly prove to be no different than background. Application of this modifying factor would reduce the estimated lead HQ. The amount of reduction in the HQ would depend on the assessment endpoint selected for the ecological risk assessment..

Silver. The highest silver sample result was collected at location 32-06338 on the hillside at the PRS 32-004 outfall. This maximum silver value is associated with a HQ of 1.7, which suggests that lead in surface presents a for potential ecological effects. The maximum reported value of 3.3 utilized in the HQ calculation is also the only positively detected silver concentration associated with the PRS. All other results were reported as undetected at detection limits ranging from 2.0(U) to 2.4 (U) mg/kg. This suggests that there is a reasonable expectation that the maximum value was obtained, however there is persistent uncertainty due to the elevated detection limits. Based on site history and the limited potential ecological risk associated with the silver HQ there appears to be little justification for further analysis of silver at the PRS.

Bis(2-ethylhexyl)phthalate. The highest bis(2-ethylhexyl)phthalate sample result was collected at location 32-06326 on the hillside at the PRS 32-004 outfall. This bis(2-ethylhexyl)phthalate value of 0.88 mg/kg is associated with a HQ of 3.6. This contaminant is not specifically associated with past operations at TA 32 and as a chemical class, phthalates are considered to be common environmental contaminants in industrialized settings. Generally, bis(2-ethylhexyl)phthalate was detected at low levels in hillside samples and the reported maximum concentration is less than the single maximum concentration reported at sample location 32-06340 intended to characterize run-on to the site from upgradient sources. Based on this observation there appears to little basis for further evaluation of this constituent.

3 Summary

Several COPECs have been identified in the screening assessment of the eastern PRS aggregate and PRS 32-004. Based on existing data, and conservative assumptions made for ecological screening, it is reasonable to propose that no further action for PRS 32-004. The analysis of the eastern PRS aggregate under the worst-case assumptions leads to a conclusion of potential ecological risk. Risk management options should be considered as, mercury, a potentially persistent bioaccumulator, was the COPEC identified as presenting the greatest potential risk. However, the primary function of this narrative is to provide the AA with a sound and technically consistent ecological evaluation to serve as the basis for future problem formulation activities and decision making required for the PRSs reported herein.

If an ecological risk assessment is desired to support risk management decision-making, then this narrative should be used to help focus the scale and scope of this assessment. Ecological risk assessment endpoints should be selected that are both relevant to the key exposure pathways and are representative of the general assessment endpoints currently being developed by the Laboratory in conjunction with the AA.

References

Environmental Protection Agency, June 1997. "Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments," U.S. Environmental Protection Agency, Emergency Response Team, Edison, New Jersey (**EPA 1997, 59370**)

Kelly, E., G. Gonzales, L. Soholt, M. Hooten and R. Ryti, May 1998. "Screening level ecological risk assessment approach for the Environmental Restoration Project at Los Alamos National Laboratory," Los Alamos National Laboratory Report LA-UR-98-1822 (**Kelly et al., 1998, 57916**)

Los Alamos National Laboratory, June 1995. "Phase I RFI report for Potential Release Sites 32-001, 32-002(a), 32-002(b), 32-003, and 32-004," Environmental Restoration Project, Los Alamos National Laboratory, Los Alamos, New Mexico (**LANL 1995, 48944**)

Los Alamos National Laboratory, September 1996. "Phase II and Voluntary Corrective Action Report for Potential Release Sites at TA-32," Environmental Restoration Project, Los Alamos National Laboratory, Los Alamos, New Mexico (**LANL 1996, 59178**).

Los Alamos National Laboratory, September 1998. "Review of PRS #3-010(a), 32-001, 32-002(a,b), 32-003, and 32-004 for Threatened and Endangered Species Habitat for the Purpose of Ecological Screening/Risk Assessment," Los Alamos National Laboratory Memorandum to Lance Voss (Neptune and Company) from Gilbert Gonzales (ESH-20), Los Alamos, New Mexico (**LANL 1998, 59369**)

Attachment 1

Ecological Scoping Checklists for TA 32: PRSs 32-001, 32-002(a,b), 32-003, 32-004

Ecological Scoping Checklist for PRS 32-001

Part A: Scoping Meeting Documentation

Site ID	PRS 32-001	
Nature of PRS releases (indicate all that apply)	**Solid** **Liquid** **Gaseous** **Other, explain**	XXXX XXXX XXXX
List of Primary Impacted Media (indicate all that apply)	**Surface soil** **Surface water/sediment** **Subsurface** **Groundwater** **Other, explain**	XXXX XXXX
Vegetation class (based on FIMAD or other available sources, indicate all classes that apply)	**Water** **Bare Ground** **Spruce/fir/aspen/mixed conifer** **Ponderosa pine** **Piñon juniper/juniper woodland** **Grassland/shrubland** **Developed**	 XXXX
Is T&E Habitat Present? List species if applicable. Are there proposed activities that might impact T&E species at the site?	No. The entire area is developed. This PRS is covered by asphalt and provides no T&E or other habitat.	
Provide list and description of Neighboring/ Contiguous/ Upgradient PRSs (consider need to aggregate PRS for screening)	PRSs 32-002(a & b) are former septic tank systems which included influent drainlines, former tank locations, effluent drainlines and outfall area. These PRSs occur approximately 150 feet down-gradient of PRS 32-001. PRS 32-003 is a former transformer site located approximately 150 feet southwest of 32-001. PRS 32-004 is a former radioactive source vault, sink drainline and outfall area located approximately 350 feet west of PRS 32-001. These PRSs are functionally disconnected from 32-001.	
AP 4.5 Part B Information Run-off score (out of 46) Terminal point of surface water transport	PRS 32-001 has an AP 4.5 runoff score of 0. The terminal point of surface water transport from the vicinity of PRS 32-001 is Los Alamos Canyon.	
Other Scoping Meeting Notes	PRS 32-001 is the site of a former incinerator receiving medical waste. Releases would include potential solid and/or liquid spills and ash or gaseous emissions from stack. Primary impacted media during operation was surface and subsurface soil.	

Part B: Site Visit Documentation

Site ID	PRS 32-001
Date of Site Visit	9/9/98, 9/18/98
Site Visit Conducted by	G. McDermott (both visits), L. Voss (9/9/98), T. McFarland (9/18/98)

Receptor Information:

Estimate cover	% vegetated % wetland % structures/asphalt, etc.	 100%
Field notes on the vegetation class	The area is 100% covered by asphalt.	
Field notes on T&E Habitat, if applicable	No T&E habitat present.	
Are ecological receptors present at the PRS? (yes/no/uncertain) Provide explanation	No. The area is entirely covered by asphalt and the general industrial use of the area precludes the presence of ecological receptors.	

Contaminant Transport Information:

Surface water transport Field notes on the terminal point of surface water transport (if applicable)	N/A
Are there any other off-site transport pathways? (yes/no/uncertain). Provide explanation	No. The area is covered by asphalt.

Ecological Effects Information:

Physical Disturbance (provide list of major types of disturbances)	The area is 100% developed.
Are there obvious ecological effects? (yes/no/uncertain). Provide explanation	No. There are no observed ecological effects associated with the PRS. The area is developed and entirely covered with asphalt – no receptors are present.

No Receptor/ No Pathways:

If there are no receptors and no offsite transport pathways the remainder of the checklist should not be completed. Stop here and provide any additional explanation/justification for proposing an ecological No Further Action recommendation (if needed).

No receptors are present. No pathways to receptors are present.

Signatures and certifications:

Checklist completed by (provide name, organization and phone number)

Name (printed):	Greg McDermott
Name (signature):	
Organization:	Neptune and Company, Inc.
Phone number:	505.662.0730, ext 21
Date completed:	9/21/98

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number)

Name (printed):	Lance Voss
Name (signature):	
Organization:	Neptune and Company, Inc.
Phone number:	505.662.0707, ext 23

Ecological Scoping Checklist for PRSs 32-002(a, b), 32-003

Part A: Scoping Meeting Documentation

Site ID	PRSs 32-002(a), 32-002(b), 32-003	
Nature of PRS releases (indicate all that apply)	**Solid** **Liquid** **Gaseous** **Other, explain**	XXXX XXXX
List of Primary Impacted Media (indicate all that apply)	**Surface soil** **Surface water/sediment** **Subsurface** **Groundwater** **Other, explain**	XXXX XXXX
Vegetation class (based on FIMAD or other available sources, indicate all classes that apply)	**Water** **Bare Ground** **Spruce/fir/aspen/mixed conifer** **Ponderosa pine** **Piñon juniper/juniper woodland** **Grassland/shrubland** **Developed**	 XXXX XXXX
Is T&E Habitat Present? List species if applicable. Are there proposed activities that might impact T&E species at the site?	Yes. These PRSs are entirely within nesting habitat for Mexican Spotted Owl, and are within an area in which the Peregrine Falcon and the Mexican Spotted Owl can be conservatively assumed to forage at a relatively high frequency (Gil Gonzales memo to Lance Voss, 16 Sept. 1998).	
Provide list and description of Neighboring/ Contiguous/ Upgradient PRSs (consider need to aggregate PRS for screening)	PRSs 32-002 (a,b) are former septic systems which include influent drainlines, former tank locations, an effluent drainline, and associated outfall. The septic tanks and influent drainlines were removed during VCAs, the effluent drainline remains in place (grouted). Most of the length of the influent drainlines occur under the asphalt parking lot of the Los Alamos County Public Works facility. PRS 32-003 was a transformer site which was contaminated with PCBs. The area of highest PCB contamination was removed and replaced with clean fill. PRS 32-001, a former incinerator location is approximately 150 feet upgradient from these three PRSs and any COPCs from 32-001 occur under the asphalt parking lot of the Public Works facility. PRS 32-004 is a former radioactive source vault, sink drainline and outfall area located approximately 250 feet west of PRS 32-002(a,b). For the purposes of this checklist PRSs 32-002 (a,b) and 32-003 will be aggregated based on geographic proximity and similarity of exposure and transport pathways. Although PRS 32-001 and 32-004 are geographically close to 32-002 (a,b) and 32-003, they does not share similar exposure and transport pathways and will be addressed separately.	
AP 4.5 Part B Information Run-off score (out of 46) Terminal point of surface water transport	An AP 4.5 Evaluation has been conducted for PRSs 32-002(a), -002(b), and -003 with the resulting run-off scores of 0.0, 0.0 and 17.9, respectively. The terminal point of surface water transport from the area is Los Alamos Canyon. BMPs have been installed at 32-003.	
Other Scoping Meeting Notes	Releases include potential leaks and outfall from septic systems and; liquid release of PCB containing transformer oil from electrical equipment. Portions of PRS 32-002(a,b) drainlines are under currently developed areas. The septic tank locations and outfall area associated with -002(a,b) and the PCB VCA area associated with -003 are located on the transitional mesa edge classified as Ponderosa Pine habitat.	

Part B: Site Visit Documentation

Site ID	PRSs, 32-002 (a,b), 32-003
Date of Site Visit	Sept. 9, 1998, Sept. 18, 1998
Site Visit Conducted by	Greg McDermott (9/9, 9/18), Lance Voss (9/9), Tracy McFarland (9/18)

Receptor Information:

Estimate cover	% vegetated % wetland % structures/asphalt, etc.	Mesa Top: 5% Canyon Slope: 70% Mesa Top: 0% Canyon Slope: 0% Mesa Top: 80% Canyon Slope: 0%
Field notes on the vegetation class	Mesa Top: Mostly developed, scattered grasses and shrubs over 32-002 septic tanks. Location of 32-003 VCA largely unvegetated. South-facing slope of LA Canyon: Mainly shrubs and small oaks, scattered pines.	
Field notes on T&E Habitat, if applicable	The mesa top at this location does not provide suitable foraging habitat for Peregrine falcon or Mexican Spotted Owl due to the high degree of commercial development.	
Are ecological receptors present at the PRS? (yes/no/uncertain) Provide explanation	Yes. The south-facing slope of LA Canyon is heavily vegetated and numerous birds and chipmunks were observed occupying the area. No receptors are present for the portions of these PRSs located under paved LA county property.	

Contaminant Transport Information:

Surface water transport Field notes on the terminal point of surface water transport (if applicable)	Surface runoff very likely reaches the canyon floor. The stream channel in Los Alamos Canyon is very near the toe of the south-facing slope. Intermediate sediment catchment areas are present on the slope in the form of benches.
Are there any other off-site transport pathways? (yes/no/uncertain). Provide explanation	Air entrainment of fugitive dust is possible in less vegetated areas of the mesa top.

Ecological Effects Information:

Physical Disturbance (provide list of major types of disturbances)	Much of the mesa top is developed and covered with asphalt. A large gravel pile sits ~10 ft to the north of PRS 32-003. The edge of the asphalt parking lot just to the north of PRSs 32-002 and 32-003 is littered with chunks of concrete, pieces of scrap metal and pieces of wooden utility poles.
Are there obvious ecological effects? (yes/no/uncertain). Provide explanation	No obvious ecological effects were observed in the outfall area. Mesa top development and previous VCA activities have heavily impacted mesa top vegetation.

No Receptor/ No Pathways:

If there are no receptors and no offsite transport pathways the remainder of the checklist should not be completed. Stop here and provide any additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). Not applicable

Data Adequacy:

Do existing data provide information on the nature, rate and extent of contamination? (yes/no/uncertain) Provide explanation. (consider if the maximum value was captured by existing sample data).	Uncertain. It is unclear whether vertical and horizontal extent was bounded during the characterization of the 32-002(a,b) outfall. VCA confirmational sampling at 32-003 did not bound vertical extent of contamination, however residual contamination is now under 2 to 5 ft of clean fill material.
Do existing data, process knowledge or observation indicate that other areas of contamination may be influencing the PRS in question or it's area of influence? (yes/no/ uncertain) Explain.	Yes. The area upgradient from these PRSs is an LA County Public Works Facility which includes a vehicle maintenance shop, heavy equipment and vehicle parking areas, road de-icing material storage and general lay down areas. Limited data indicate that the area acts as a source for inorganic metals and semi volatile organics commonly associated with fossil fuel combustion and asphalt paving, i.e., lead, mercury, and PAHs.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors. None

Part C: Ecological Pathways Conceptual Exposure Model

Provide answers to Questions A to R and use this information to complete the Ecological Pathways Conceptual Exposure Model (see Figure 1 on page 12 of the checklist)

Question A:

Could soil contaminants reach receptors via vapors?
- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-me/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: No volatile COPCs were identified. Several semivolatile organics were detected in PRS 32-002(a,b) and 32-004 outfall samples at low concentrations.

Question B:

Could the soil contaminants identified above reach receptors through fugitive dust carried in air?
- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): Likely

Provide explanation: The surficial nature of the contamination and the amount of bare ground present make this pathway complete.

Question C:

Can contaminated soil be transported to aquatic ecological communities via surface erosion?
- **Use AP 4.5 run-off score and terminal point of surface water runoff to help answer this question.**
- **If the AP 4.5 run-off score* equal to zero, this suggests that erosion at PRS is not a transport pathway. (* note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points)**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected.**

Answer (likely/unlikely/uncertain): Likely.

Provide explanation: It is likely that runoff from the site reaches the stream channel in LA Canyon, where ephemeral aquatic communities may be present.

Question D:

Is groundwater contaminated and potentially available to biological receptors through seeps or springs?

- **Known or suspected contaminant *presence in* groundwater.**
- **The potential for contaminants to be carried via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with contaminated groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors will generally only contact groundwater if it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely.

Provide explanation: No groundwater samples taken, but the nearest groundwater is alluvial water present in LA Canyon downstream of TA-2.

Question E:

May groundwater become contaminated from infiltration/percolation from contaminated subsurface material?

- **Suspected ability of contaminants to *migrate to* groundwater.**
- **The potential for contaminants to reach groundwater then discharge into habitats and/or surface waters.**
- **Might contaminants be taken up by terrestrial and rooted aquatic plants whose roots are in contact with potentially contaminated groundwater present within the root zone (~1 m depth)?**
- **Terrestrial wildlife receptors will generally only contact groundwater if it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: The closest groundwater is alluvial water in LA Canyon downstream of TA-2.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- Consider, particularly, the erodability of fill material and the geologic processes of canyon/mesa edges.

Answer (likely/unlikely/uncertain): Uncertain.

Provide explanation: The PRSs are located on the mesa edge, but most of the contamination is surficial.

Airborne contamination
(terrestrial receptors)

Question G:

Could airborne contaminants interact with plants or animals through respiration of vapors?
- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant pathway.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial/Emergent Plants:** 0
⇒ **Terrestrial Animals:** 0

Provide explanation: No VOCs were identified as COPCs.

Question H:

Could airborne contaminants interact with plants or animals through deposition of particulates or with animals through inhalation of fugitive dust?
- **Contaminants must be present as particulates in the air or as dust for this pathway to be viable.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial/Emergent Plants:** 2
⇒ **Terrestrial Animals:** 2

Provide explanation: The surficial nature of the contamination and the amount of bare ground present at 32-002 and 32-003 makes air entrainment of fugitive dust a possibility.

Soil-borne contamination
(terrestrial receptors)

Question I:

Could soil-borne contaminants reach plants via root uptake or rain splash to leaf and stem surfaces from surface soils?
- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 3

Provide explanation: Grasses, forbs, shrubs, and trees are abundant on the south-facing slope of LA Canyon in the vicinity of 32-002 and 32-003.

Question J:

Could soil-borne contaminants reach receptors through food web transport from surface soils?

- **Consider bioaccumulation and biomagnification. See list of potentially persistent bioaccumulators and biomagnifiers, presented in Table 1.**
- **Animals: may ingest contaminated prey.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 3

Provide explanation: Lead, mercury, di-n-butylphthalate, bis(2-ethylhexyl)phthalate, and all of the PAHs detected are considered potentially bioaccumulating chemicals.

Question K:

Could soil-borne contaminants interact with receptors via incidental ingestion of surface soils?

- **Incidental ingestion of contaminated soil may occur while animals grub for food resident in the soil, or feed on plants/animals covered with contaminated soil, or while grooming themselves clean of soil.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 3

Provide explanation: Ground dwelling animals are present on the site, and much of the contamination is surficial.

Question L:

Could soil-borne contaminants interact with receptors through dermal contact with surface soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants which are lipophilic and can cross epidermal barriers.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 1

Provide explanation: Possible pathway, but unlikely due to nature of contaminants present in surficial soils.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination severely attenuates radiological exposure.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 1
⇒ **Terrestrial Animals:** 1

Provide explanation: Slightly elevated levels of Pu-239/240 were detected under the 32-002(a) septic tank. However, the contamination is subsurface, and plutonium is an alpha emitter, making external exposure inconsequential.

Water borne contamination
(terrestrial and aquatic receptors)

Question N:

Could water and sediment-borne contaminants reach plants via direct uptake from water and sediment or rain splash to leaf and stem surfaces from surface sediment?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash on sediments *not* soils). in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**
- **Aquatic plants are in direct contact with water.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 3
⇒ **Aquatic Plants:** 2

Provide explanation: Contaminated sediments probably reach the stream channel in LA Canyon, but surface water and aquatic communities are ephemeral in this reach of the canyon.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioaccumulate in animals (see list of potentially persistent bioaccumulators and biomagnifiers, presented in Table 1.)**
- **Animals: may ingest contaminated prey.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 3
⇒ **Aquatic Animals:** 2

Provide explanation: : Contaminated sediments probably reach the stream channel in LA Canyon, but surface water and aquatic communities are ephemeral in this reach of the canyon.

Question P:

Could contaminants interact with receptors via incidental ingestion of water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**
- **Aquatic receptors may regularly or incidentally ingest sediment while foraging.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 2
⇒ **Aquatic Animals:** 2

Provide explanation: Surface water and aquatic receptors at the site are ephemeral

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?

- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**
- **Aquatic receptors may be directly exposed to sediments or may be exposed through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 1
⇒ **Aquatic Animals:** 1

Provide explanation: Surface water and aquatic receptors are ephemeral at the site, and dermal contact is probably not a significant exposure pathway given the nature of contamination.

Question R:

Could contaminants interact with plants or animals through external irradiation via water and sediment exposure?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination severely attenuates radiological exposure.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

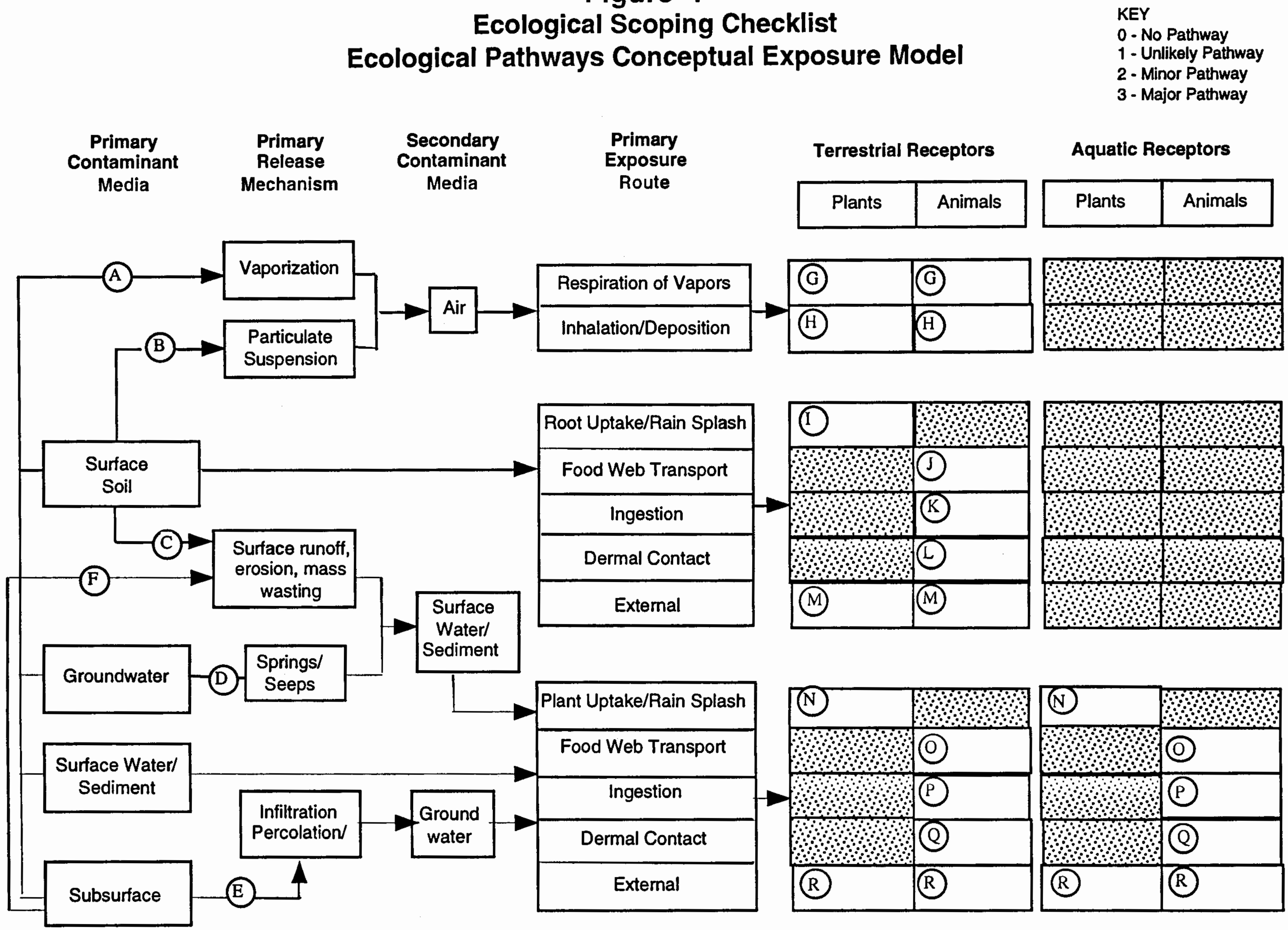
⇒ **Terrestrial Plants:** 1
⇒ **Aquatic Plants:** 1
⇒ **Terrestrial Animals:** 1
⇒ **Aquatic Animals:** 1

Provide explanation: : Slightly elevated levels of Pu-239/240 were detected under the 32-002(a) septic tank. However, the contamination is subsurface, and plutonium is an alpha emitter, making external exposure inconsequential.

Table 1
List of Bioaccumulating Chemicals

Volatile Organics	**PCBs/Pesticides**
Dichlorobenzene[1,4-]	All Aroclors
Trichlorobenzene[1,2,4-]	beta-BHC
Xylene (mixed isomers)	BHC-mixed isomers
	Chlordane
Semivolatile Organics	Chlorecone (Kepone)
Acenaphthene	DDT and metabolites
Anthracene	Dieldrin
Benzo(a)anthracene	Endosulfan
Benzo(a)pyrene	Endrin
Benzo(b)fluoranthene	Heptaclor
Benzo(g,h,i)perylene	Lindane
Benzo(k)fluoranthene	Methoxyclor
Bis(2-ethylhexyl)phthalate	Toxaphene
Butyl benzyl phthalate	
Chrysene	**Inorganics**
Dibenzo(a,h)anthracene	Aluminum
Di-n-butyl phthalate	Cadmium
Di-n-octyl phthalate	Copper
Fluoranthene	Lead
Fluorene	Mercury
Indeno(1,2,3-cd)pyrene	Nickel
Phenanthrene	Selenium
Pyrene	
Pentachloronitrobenzene	**Radionuclides**
Pentachlorophenol	Americium-241
	Cesium-137
Dioxins/Furans	Plutonium-238,239,240
Dibenzofuran	Radium-226,-228
2,3,7,8-tetrachloro-dibenzo(p)dioxin	Strontium-90
2,3,7,8-tetrachloro-dibenzo(p)furan	Thorium-228,-230,-232
	Uranium-234,-235,-238

Figure 1
Ecological Scoping Checklist
Ecological Pathways Conceptual Exposure Model



Signatures and certifications:

Checklist completed by (provide name, organization and phone number)

Name (printed):	Greg McDermott
Name (signature):	
Organization:	Neptune and Company, Inc.
Phone number:	505.662.0730, ext 21
Date completed:	9/21/98

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number)

Name (printed):	Lance Voss
Name (signature):	
Organization:	Neptune and Company, Inc.
Phone number:	505.662.0707, ext 23

Ecological Scoping Checklist for PRS 32-004

Part A: Scoping Meeting Documentation

Site ID	PRS 32-004	
Nature of PRS releases (indicate all that apply)	**Solid** **Liquid** **Gaseous** **Other, explain**	 XXXX
List of Primary Impacted Media (indicate all that apply)	**Surface soil** **Surface water/sediment** **Subsurface** **Groundwater** **Other, explain**	XXXX XXXX
Vegetation class (based on FIMAD or other available sources, indicate all classes that apply)	**Water** **Bare Ground** **Spruce/fir/aspen/mixed conifer** **Ponderosa pine** **Piñon juniper/juniper woodland** **Grassland/shrubland** **Developed**	 XXXX XXXX
Is T&E Habitat Present? List species if applicable. Are there proposed activities that might impact T&E species at the site?	Yes. This PRS is entirely within nesting habitat for Mexican Spotted Owl, and is within an area in which the Peregrine Falcon and the Mexican Spotted Owl can be conservatively assumed to forage at a relatively high frequency (Gil Gonzales memo to Lance Voss, 16 Sept. 1998).	
Provide list and description of Neighboring/ Contiguous/ Upgradient PRSs (consider need to aggregate PRS for screening)	PRSs 32-002(a & b), 32-001, and 32-003 are less than 100 yds east of PRS 32-004. However, PRS 32-004 has a discrete outfall and is being treated separately from 32-001 and the 32-002 (a,b)/32-003 aggregate.	
AP 4.5 Part B Information Run-off score (out of 46) Terminal point of surface water transport	An AP 4.5 evaluation was performed for 32-004, but the outfall was not included in the evaluation. Therefore, the results are of limited value for the purpose of this checklist. It should be assumed however, that the terminal point of surface water transport is the floor of LA Canyon.	
Other Scoping Meeting Notes	PRS 32-004 consisted of a sink drain adjacent to a radiation source vault. This would have resulted in the potential release of liquids at the outfall area. Portions of PRS 32-004, the source vault and drainlines, are under currently developed areas and pavement. The outfall is located on the transitional mesa edge along LA Canyon classified as Ponderosa Pine habitat.	

Part B: Site Visit Documentation

Site ID	PRS 32-004
Date of Site Visit	9/9/98, 9/18/98
Site Visit Conducted by	G. McDermott (both visits), L. Voss (9/9/98), T. McFarland (9/18/98)

Receptor Information:

Estimate cover	% vegetated % wetland % structures/asphalt, etc.	Mesa Top: 10% Canyon Slope: 80% Mesa Top: 80% Canyon Slope: 0%
Field notes on the vegetation class	Mesa top is heavily developed. The outfall is scattered Ponderosa Pine with an understory of oaks and shrubs.	
Field notes on T&E Habitat, if applicable	The mesa top portion of this PRS does not provide suitable foraging or roosting habitat for either Mexican Spotted Owl or Peregrine Falcon, as the mesa top is heavily commercially developed.	
Are ecological receptors present at the PRS? (yes/no/uncertain) Provide explanation	Yes. The outfall is heavily vegetated. Numerous birds and chipmunks were observed utilizing the site. No receptors are present for the portions of this PRS located under paved LA county property.	

Contaminant Transport Information:

Surface water transport Field notes on the terminal point of surface water transport (if applicable)	The terminal point of surface water transport is the floor of LA Canyon. The stream channel in LA Canyon is very close to the toe of the south-facing slope of the canyon.
Are there any other off-site transport pathways? (yes/no/uncertain). Provide explanation	Air entrainment of fugitive dust is a possibility on unvegetated portions of the outfall.

Ecological Effects Information:

Physical Disturbance (provide list of major types of disturbances)	Much of the mesa top lies under asphalt. The immediate area around the PRS is used for parking Los Alamos County maintenance vehicles and storing equipment, construction/maintenance material, etc.
Are there obvious ecological effects? (yes/no/uncertain). Provide explanation	No obvious ecological effects were observed in the outfall area. Mesa top development and previous VCA activities have heavily impacted mesa top vegetation.

No Receptor/ No Pathways:

If there are no receptors and no offsite transport pathways the remainder of the checklist should not be completed. Stop here and provide any additional explanation/justification for proposing an ecological No Further Action recommendation (if needed). Not applicable

Data Adequacy:

Do existing data provide information on the nature, rate and extent of contamination? (yes/no/uncertain) Provide explanation. (consider if the maximum value was captured by existing sample data).	Uncertain. Samples taken on the canyon slope downgradient from the outfall seem to show decreasing trends in concentrations of both metal and organic COPCs. It is not clear that the vertical extent of contamination has been bounded.
Do existing data, process knowledge or observation indicate that other areas of contamination may be influencing the PRS in question or it's area of influence? (yes/no/ uncertain) Explain.	Yes. A sample taken upgradient of the PRS 32-004 outfall shows a pattern of contamination similar to that found at the PRS. The area upgradient from this PRS is an LA County Public Works Facility which includes a vehicle maintenance shop, heavy equipment and vehicle parking areas, road de-icing material storage and general lay down areas. These data indicate that the area acts as a source for inorganic metals and semi volatile organics commonly associated with fossil fuel combustion and asphalt paving, i.e., lead, mercury, and PAHs.

Additional Field Notes:

Provide additional field notes on the site setting and potential ecological receptors. None

Part C: Ecological Pathways Conceptual Exposure Model

Provide answers to Questions A to R and use this information to complete the Ecological Pathways Conceptual Exposure Model (see Figure 1 on page 12 of the checklist)

Question A:

Could soil contaminants reach receptors via vapors?
- **Volatility of the hazardous substance (volatile chemicals generally have Henry's Law constant >10^{-5} atm-me/mol and molecular weight <200 g/mol).**

Answer (likely/unlikely/uncertain): Unlikely

Provide explanation: No VOCs were detected at the site.

Question B:

Could the soil contaminants identified above reach receptors through fugitive dust carried in air?
- **Soil contamination would have to be on the actual surface of the soil to become available for dust.**
- **In the case of dust exposures to burrowing animals, the contamination would have to occur in the depth interval where these burrows occur.**

Answer (likely/unlikely/uncertain): Likely

Provide explanation: Much of the contamination is surficial, and some bare ground is present at the outfall.

Question C:

Can contaminated soil be transported to aquatic ecological communities via surface erosion?
- **Use AP 4.5 run-off score and terminal point of surface water runoff to help answer this question.**
- **If the AP 4.5 run-off score* equal to zero, this suggests that erosion at PRS is not a transport pathway. (* note that the runoff score is not the entire erosion potential score, rather it is a subtotal of this score with a maximum value of 46 points)**
- **If erosion is a transport pathway, evaluate the terminal point to see if aquatic receptors could be affected.**

Answer (likely/unlikely/uncertain): Likely.

Provide explanation: Although the AP 4.5 evaluation for this site is in error (see Part A), it should be assumed that runoff from the site reaches the floor of LA Canyon. Ephemeral aquatic communities may be present in LA Canyon.

Question D:

Is groundwater contaminated and potentially available to biological receptors through seeps or springs?

- **Known or suspected contaminant *presence in* groundwater.**
- **The potential for contaminants to be carried via groundwater and discharge into habitats and/or surface waters.**
- **Contaminants may be taken up by terrestrial and rooted aquatic plants whose roots are in contact with contaminated groundwater present within the root zone (~1 m depth).**
- **Terrestrial wildlife receptors will generally only contact groundwater if it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely.

Provide explanation: The closest groundwater is alluvial water downstream from TA-2.

Question E:

May groundwater become contaminated from infiltration/percolation from contaminated subsurface material?

- **Suspected ability of contaminants to *migrate to* groundwater.**
- **The potential for contaminants to reach groundwater then discharge into habitats and/or surface waters.**
- **Might contaminants be taken up by terrestrial and rooted aquatic plants whose roots are in contact with potentially contaminated groundwater present within the root zone (~1 m depth)?**
- **Terrestrial wildlife receptors will generally only contact groundwater if it is discharged to the surface.**

Answer (likely/unlikely/uncertain): Unlikely.

Provide explanation: The closest groundwater is alluvial water downstream from TA-2.

Question F:

Might erosion or mass wasting events be a potential release mechanism for contaminants from subsurface materials or perched aquifers to the surface?

- **Consider, particularly, the erodability of fill material and the geologic processes of canyon/mesa edges.**

Answer (likely/unlikely/uncertain): Uncertain.

Provide explanation: The outfall is on the mesa edge, but most contamination is surficial. Perched aquifers are not present.

Airborne contamination
(terrestrial receptors)

Question G:

Could airborne contaminants interact with plants or animals through respiration of vapors?
- **Contaminants must be present as volatiles in the air.**
- **Consider the importance of inhalation of vapors for burrowing animals.**
- **Foliar uptake of organic vapors is typically not a significant pathway.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial/Emergent Plants:** 0
⇒ **Terrestrial Animals:** 0

Provide explanation: No volatile COPCs were identified at the site.

Question H:

Could airborne contaminants interact with plants or animals through deposition of particulates or with animals through inhalation of fugitive dust?
- **Contaminants must be present as particulates in the air or as dust for this pathway to be viable.**
- **Exposure via inhalation of fugitive dust is particularly applicable to ground-dwelling species that would be exposed to dust disturbed by their foraging or burrowing activities or by wind movement.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial/Emergent Plants:** 2
⇒ **Terrestrial Animals:** 2

Provide explanation: Much of the contamination is surficial, and air entrainment of dust particles is possible as some bare ground exists at the outfall.

Soil-borne contamination
(terrestrial receptors)

Question I:

Could soil-borne contaminants reach plants via root uptake or rain splash to leaf and stem surfaces from surface soils?
- **Contaminants in bulk soil may partition into soil solution, making them available to roots.**
- **Exposure of terrestrial plants to contaminants present in particulates deposited on leaf and stem surfaces by rain striking contaminated soils (i.e., rain splash).**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 3

Provide explanation: The area around the outfall and down-gradient form the outfall is heavily vegetated.

Question J:

Could soil-borne contaminants reach receptors through food web transport from surface soils?

- **Consider bioaccumulation and biomagnification. See list of potentially persistent bioaccumulators and biomagnifiers, presented in Table 1.**
- **Animals: may ingest contaminated prey.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 3

Provide explanation: With the exception of silver, all of the contaminants identified at the outfall are potential bioaccumulators.

Question K:

Could soil-borne contaminants interact with receptors via incidental ingestion of surface soils?

- **Incidental ingestion of contaminated soil may occur while animals grub for food resident in the soil, or feed on plants/animals covered with contaminated soil, or while grooming themselves clean of soil.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 3

Provide explanation: Much of the contamination is surficial and therefore available for ingestion by ground-dwelling animals.

Question L:

Could soil-borne contaminants interact with receptors through dermal contact with surface soils?

- **Significant exposure via dermal contact would generally be limited to organic contaminants which are lipophilic and can cross epidermal barriers.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 2

Provide explanation: Much of the contamination is surficial, but the nature of the contamination would make this a minor pathway at best.

Question M:

Could contaminants interact with plants or animals through external irradiation?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination severely attenuates radiological exposure.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 0
⇒ **Terrestrial Animals:** 0

Provide explanation: No radionuclides were detected at the site.

Water borne contamination
(terrestrial and aquatic receptors)

Question N:

Could water and sediment-borne contaminants reach plants via direct uptake from water and sediment or rain splash to leaf and stem surfaces from surface sediment?

- **Contaminants may be taken-up by terrestrial plants whose roots are in contact with surface waters.**
- **Terrestrial plants may be exposed to particulates deposited on leaf and stem surfaces by rain striking contaminated sediments (i.e., rain splash on sediments *not* soils). in an area that is only periodically inundated with water.**
- **Contaminants in sediment may partition into soil solution, making them available to roots.**
- **Aquatic plants are in direct contact with water.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 2
⇒ **Aquatic Plants:** 2

Provide explanation: Surface water is ephemeral at the site. Aquatic communities in LA Canyon are also ephemeral.

Question O:

Could contaminants interact with receptors through food web transport from water and sediment?

- **The chemicals may bioaccumulate in animals (see list of potentially persistent bioaccumulators and biomagnifiers, presented in Table 1.)**
- **Animals: may ingest contaminated prey.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 2
⇒ **Aquatic Animals:** 2

Provide explanation: Surface water is ephemeral at the site. Aquatic communities in LA Canyon are also ephemeral.

Question P:

Could contaminants interact with receptors via incidental ingestion of water and sediment?
- **If sediments are present in an area that is only periodically inundated with water, terrestrial receptors may incidentally ingest sediments.**
- **Terrestrial receptors may ingest water-borne contaminants if contaminated surface waters are used as a drinking water source.**
- **Aquatic receptors may regularly or incidentally ingest sediment while foraging.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 2
⇒ **Aquatic Animals:** 2

Provide explanation: Surface water is ephemeral at the site. Aquatic communities in LA Canyon are also ephemeral.

Question Q:

Could contaminants interact with receptors through dermal contact with water and sediment?
- **If sediments are present in an area that is only periodically inundated with water, terrestrial species may be dermally exposed during dry periods.**
- **Terrestrial organisms may be dermally exposed to water-borne contaminants as a result of wading or swimming in contaminated waters.**
- **Aquatic receptors may be directly exposed to sediments or may be exposed through osmotic exchange, respiration, or ventilation of sediment pore waters.**
- **Aquatic receptors may be exposed through osmotic exchange, respiration, or ventilation of surface waters.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Animals:** 1
⇒ **Aquatic Animals:** 1

Provide explanation: Given the ephemeral nature of surface water and aquatic communities at the site, the nature of contamination present makes this an unlikely pathway.

Question R:

Could contaminants interact with plants or animals through external irradiation via water and sediment exposure?

- **External irradiation effects are most relevant for gamma emitting radionuclides.**
- **Burial of contamination severely attenuates radiological exposure.**
- **The water column acts to absorb radiation, thus external irradiation is typically more important for sediment dwelling organisms.**

Provide quantification of pathway (0=no pathway, 1=unlikely pathway, 2=minor pathway, 3=major pathway):

⇒ **Terrestrial Plants:** 0
⇒ **Aquatic Plants:** 0
⇒ **Terrestrial Animals:** 0
⇒ **Aquatic Animals:** 0

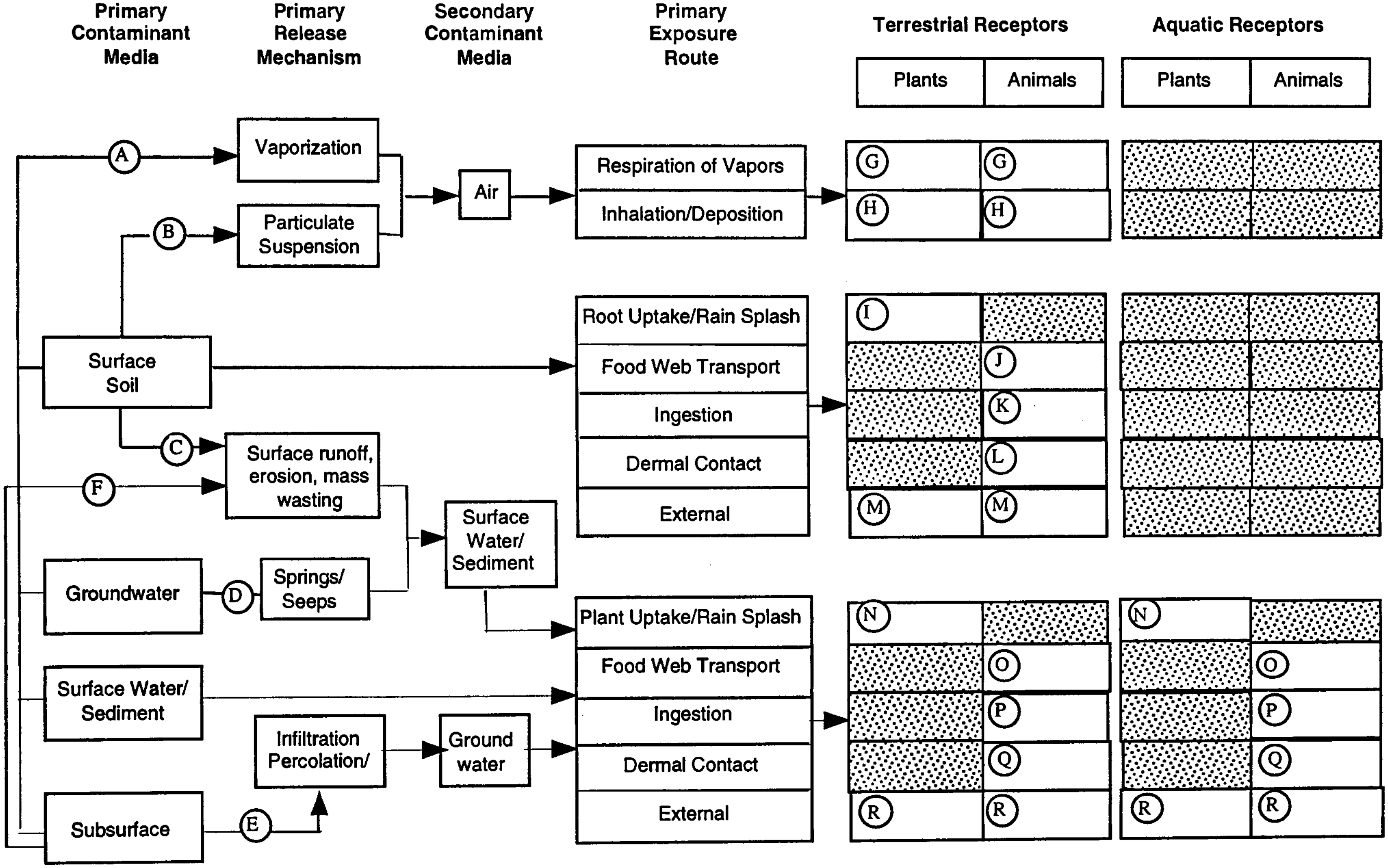
Provide explanation: No radionuclides were detected at the site.

Table 1
List of Bioaccumulating Chemicals

Volatile Organics	**PCBs/Pesticides**
Dichlorobenzene[1,4-]	All Aroclors
Trichlorobenzene[1,2,4-]	beta-BHC
Xylene (mixed isomers)	BHC-mixed isomers
	Chlordane
Semivolatile Organics	Chlorecone (Kepone)
Acenaphthene	DDT and metabolites
Anthracene	Dieldrin
Benzo(a)anthracene	Endosulfan
Benzo(a)pyrene	Endrin
Benzo(b)fluoranthene	Heptaclor
Benzo(g,h,i)perylene	Lindane
Benzo(k)fluoranthene	Methoxyclor
Bis(2-ethylhexyl)phthalate	Toxaphene
Butyl benzyl phthalate	
Chrysene	**Inorganics**
Dibenzo(a,h)anthracene	Aluminum
Di-n-butyl phthalate	Cadmium
Di-n-octyl phthalate	Copper
Fluoranthene	Lead
Fluorene	Mercury
Indeno(1,2,3-cd)pyrene	Nickel
Phenanthrene	Selenium
Pyrene	
Pentachloronitrobenzene	**Radionuclides**
Pentachlorophenol	Americium-241
	Cesium-137
Dioxins/Furans	Plutonium-238,239,240
Dibenzofuran	Radium-226,-228
2,3,7,8-tetrachloro-dibenzo(p)dioxin	Strontium-90
2,3,7,8-tetrachloro-dibenzo(p)furan	Thorium-228,-230,-232
	Uranium-234,-235,-238

Figure 1
Ecological Scoping Checklist
Ecological Pathways Conceptual Exposure Model

KEY
0 - No Pathway
1 - Unlikely Pathway
2 - Minor Pathway
3 - Major Pathway



Signatures and certifications:

Checklist completed by (provide name, organization and phone number)

Name (printed):	Greg McDermott
Name (signature):	Gregory J. McDermott
Organization:	Neptune and Company, Inc.
Phone number:	505.662.0730, ext 21
Date completed:	9/21/98

Verification by a member of ER Project Ecological Risk Task Team (provide name, organization and phone number)

Name (printed):	Lance Voss
Name (signature):	Lance Voss
Organization:	Neptune and Company, Inc.
Phone number:	505.662.0707, ext 23

Attachment 2

Selected tables and figures from previous TA-32 RFI reports

TABLE 2.1.3-1

INORGANICS WITH CONCENTRATIONS ABOVE BACKGROUND SCREENING VALUES IN PRS 32-001 PHASE II CHARACTERIZATION SAMPLES

LOCATION ID	SAMPLE ID	DEPTH (in.)	COPPER (mg/kg)	MANGANESE (mg/kg)	MERCURY (mg/kg)	SODIUM (mg/kg)	ZINC (mg/kg)
UTL	N/A[a]	N/A	15.5	714	0.1	915	50.8
SAL[b]	N/A	N/A	2 800	n/a[c]	23	n/a	23 000
32-06446	0132-96-0209	2–10	**16.5**[d]	298	**0.41**	**1 130**	**79.3**
32-06447	0132-96-0210	2–11	7.3[e]	**780**[e]	**0.24**	**1 150**[e]	36[e]

[a] N/A = Not applicable.
[b] SAL = Screening action level.
[c] n/a = Not available.
[d] Values in bold exceed the background screening value.
[e] Value is the maximum of a sample and its laboratory duplicate.

TABLE 2.1.3-2

ORGANIC COMPOUNDS DETECTED IN PRS 32-001 PHASE II CHARACTERIZATION SAMPLES

LOCATION ID	SAMPLE ID	DEPTH (in.)	TRICHLOROETHENE (mg/kg)
SAL	N/A[a]	N/A	7.1
32-06446	0132-96-0209	2–10	0.009
32-06447	0132-96-0210	2–11	0.006

[a] N/A = Not applicable.

2.1.4 Screening Assessment for Phase II Samples at PRS 32-001

This subsection discusses the comparison with screening action levels (SALs) for COPCs detected at levels greater than background screening levels in the Phase II investigation at PRS 32-001. Five inorganics (copper, manganese, mercury, sodium, and zinc) and one organic (trichloroethene) were detected at levels above background screening values.

Greater than or equal to SAL. No chemicals were detected at concentrations greater than or equal to their SALs.

No SAL. Two chemicals, manganese and sodium, have no SALs. To evaluate their potential for toxicity, manganese and sodium were compared to the recommended daily allowances

TABLE 2.1.2-1

PCB RESULTS FOR PRS 32-001 PHASE II CHARACTERIZATION SAMPLES

LOCATION ID	SAMPLE ID	DEPTH (in.)	AROCLOR 1242™ (mg/kg)	AROCLOR 1254™ (mg/kg)	AROCLOR 1260™ (mg/kg)
32-06428	0132-96-0151	0–10	<0.1	<0.1	0.976
32-06429	0132-96-0152	10–15	<0.1	<0.1	<0.1
32-06429	0132-96-0153	0–10	<0.1	<0.1	0.194
32-06430	0132-96-0154	0–10	<0.1	<0.1	<0.1
32-06430	0132-96-0155	10–15	<0.1	<0.1	<0.1
32-06431	0132-96-0156	0–10	<0.1	<0.1	0.513
32-06431	0132-96-0157	10–15	<0.1	<0.1	0.354
32-06432	0132-96-0158	0–10	<0.1	<0.1	0.278
32-06433	0132-96-0159	0–10	<0.1	<0.1	0.980
32-06433	0132-96-0160	10–15	<0.1	<0.1	0.155
32-06434	0132-96-0161	0–10	<0.1	<0.1	0.099
32-06434	0132-96-0162	10–15	<0.1	<0.1	<0.1
32-06435	0132-96-0163	0–10	<0.1	<0.1	0.279
32-06435	0132-96-0164	10–15	<0.1	<0.1	0.579
32-06436	0132-96-0165	0–10	<0.1	<0.1	0.447
32-06436	0132-96-0166	10–15	<0.1	<0.1	<0.1
32-06428	0132-96-0167	10–15	<0.1	<0.1	<0.1
32-06432	0132-96-0168	10–15	<0.1	<0.1	<0.1

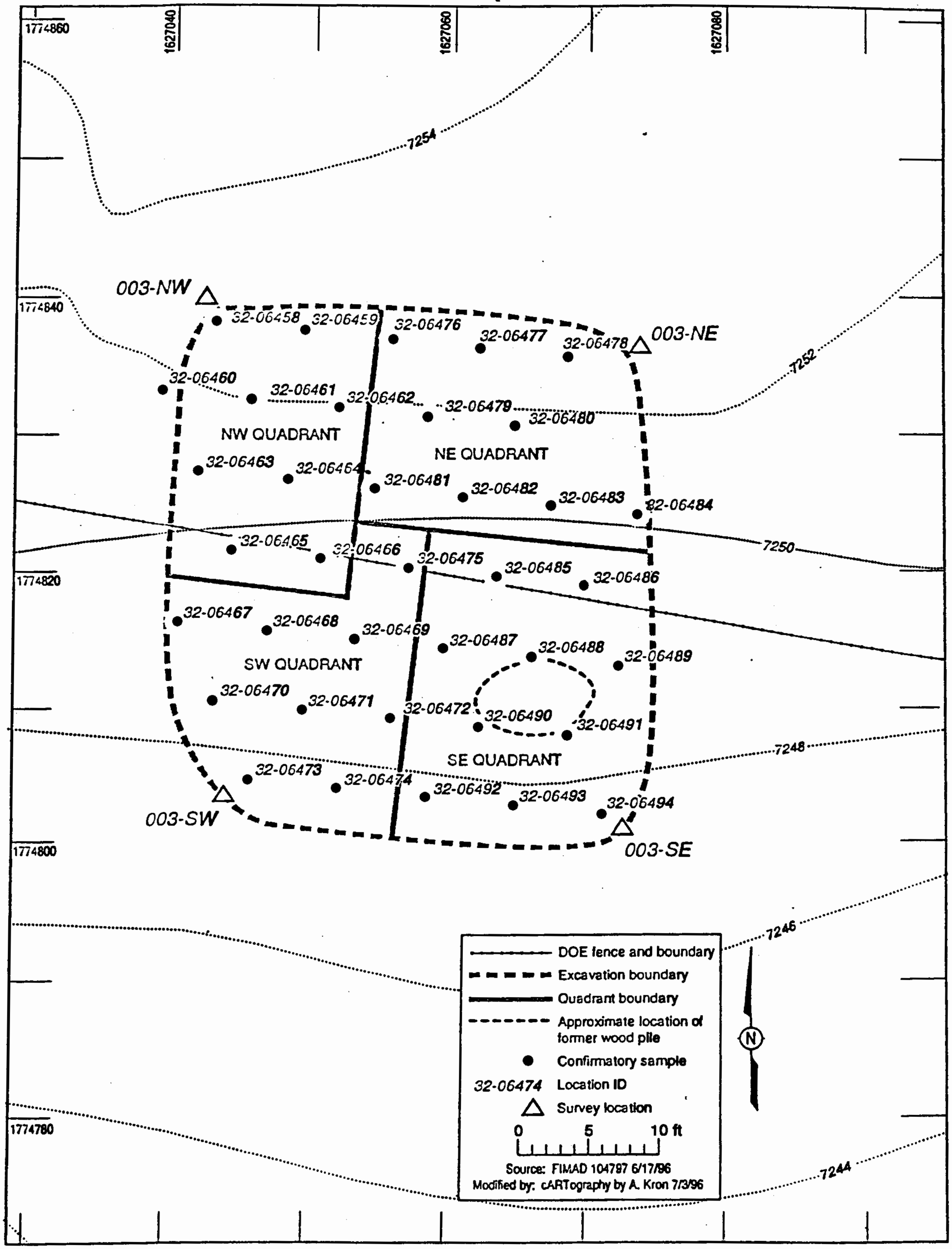


Fig. 4.1.3-1. Locations of samples collected at PRS 32-003.

TABLE 4.1.4-1

RESULTS OF CONFIRMATION SAMPLING AT PRS 32-003

LOCATION ID	SAMPLE ID	DEPTH[a] (ft bgs)	MATRIX	PCB CONCENTRATION (mg/kg)
NE Quadrant Composite	0132-96-0410	4.5 - 5	Soil	2.8
NW Quadrant Composite	0132-96-0409	4 - 4.5	Soil	2.9
SE Quadrant Composite	0132-96-0411	2.5 - 3	Soil	0.71
SW Quadrant Composite	0132-96-0412	2.5 - 3	Soil	0.49
32-06458	0132-96-0715	1.5–2.0	Soil	4.83
32-06459	0132-96-0252	2.5 - 3	Soil	<0.1
32-06460	0132-96-0256	0.8–1.1	Soil	0.54
32-06461	0132-96-0705	2.5 - 3	Soil	3.58
32-06462	0132-96-0706	4 - 4.5	Soil	<0.1
32-06463	0132-96-0709	4 - 4.5	Soil	0.1
32-06464	0132-96-0710	4 - 4.5	Soil	0.46
32-06465	0132-96-0716	4 - 4.5	Soil	0.55
32-06466	0132-96-0717	4 - 4.5	Soil	3.53
32-06467	0132-96-0721	0.8–1.1	Soil	1.89
32-06468	0132-96-0722	2.5 - 3	Soil	0.16
32-06469	0132-96-0723	2.5 - 3	Soil	3.27
32-06470	0132-96-0727	2.5 - 3	Soil	0.13
32-06471	0132-96-0728	2.5 - 3	Soil	0.26
32-06472	0132-96-0729	2.5 - 3	Soil	0.37
32-06473	0132-96-0732	2.5 - 3	Soil	0.63
32-06474	0132-96-0733	2.5 - 3	Soil	1.45
32-06475	0132-96-0718	4.5 - 5	Soil	0.83
32-06476	0132-96-0253	4.5 - 5	Soil	0.63
32-06477	0132-96-0254	4.5 - 5	Soil	2.16
32-06478	0132-96-0255	4.5 - 5	Soil	1.28
32-06479	0132-96-0707	4.5 - 5	Soil	<0.1
32-06480	0132-96-0708	4.5 - 5	Soil	0.1
32-06481	0132-96-0711	4.5 - 5	Soil	<0.1

TABLE 4.1.4-1 (CONTINUED)

RESULTS OF CONFIRMATION SAMPLING AT PRS 32-003

LOCATION ID	SAMPLE ID	DEPTH[a] (ft bgs)	MATRIX	CONCENTRATION (mg/kg)
32-06482	0132-96-0712	4.5 - 5	Soil	<0.1
32-06483	0132-96-0713	4.5 - 5	Soil	<0.1
32-06484	0132-96-0714	1.3–1.8	Soil	3.12
32-06485	0132-96-0719	4.5 - 5	Soil	3.57
32-06486	0132-96-0720	4.5 - 5	Soil	4.51
32-06487	0132-96-0724	2.5 - 3	Soil	1.44
32-06488	0132-96-0725	2.5 - 3	Soil	1.62
32-06489	0132-96-0726	2.5 - 3	Soil	0.92
32-06490	0132-96-0730	2.5 - 3	Soil	<0.1
32-06491	0132-96-0731	2.5 - 3	Soil	<0.1
32-06492	0132-96-0734	2.5 - 3	Soil	0.18
32-06493	0132-96-0735	2.5 - 3	Soil	0.68
32-06494	0132-96-0736	2.5 - 3	Soil	3.03

[a] Depths are approximate.

4.2 Preliminary Ecological Assessment

In cooperation with the New Mexico Environment Department and EPA Region 6, the Laboratory ER Project is developing an approach for ecological risk assessment. Further ecological risk assessment at PRS 32-003 will be deferred until this site can be assessed as part of the ecological exposure unit methodology currently being developed.

4.3 Recommendations for PRS 32-003

PRS 32-003 is recommended for NFA based on LANL's No Further Action Criteria Policy, criterion 4, which states that the PRS has been characterized or remediated in accordance with current applicable state or federal regulations, and available data indicate that chemicals of concern are either not present or are present in concentrations that pose an acceptable level of risk. A Class III permit modification will be requested to remove this site from the HSWA Module of LANL's Hazardous Waste Facility Permit (Environmental Restoration Project 1995, 1173).

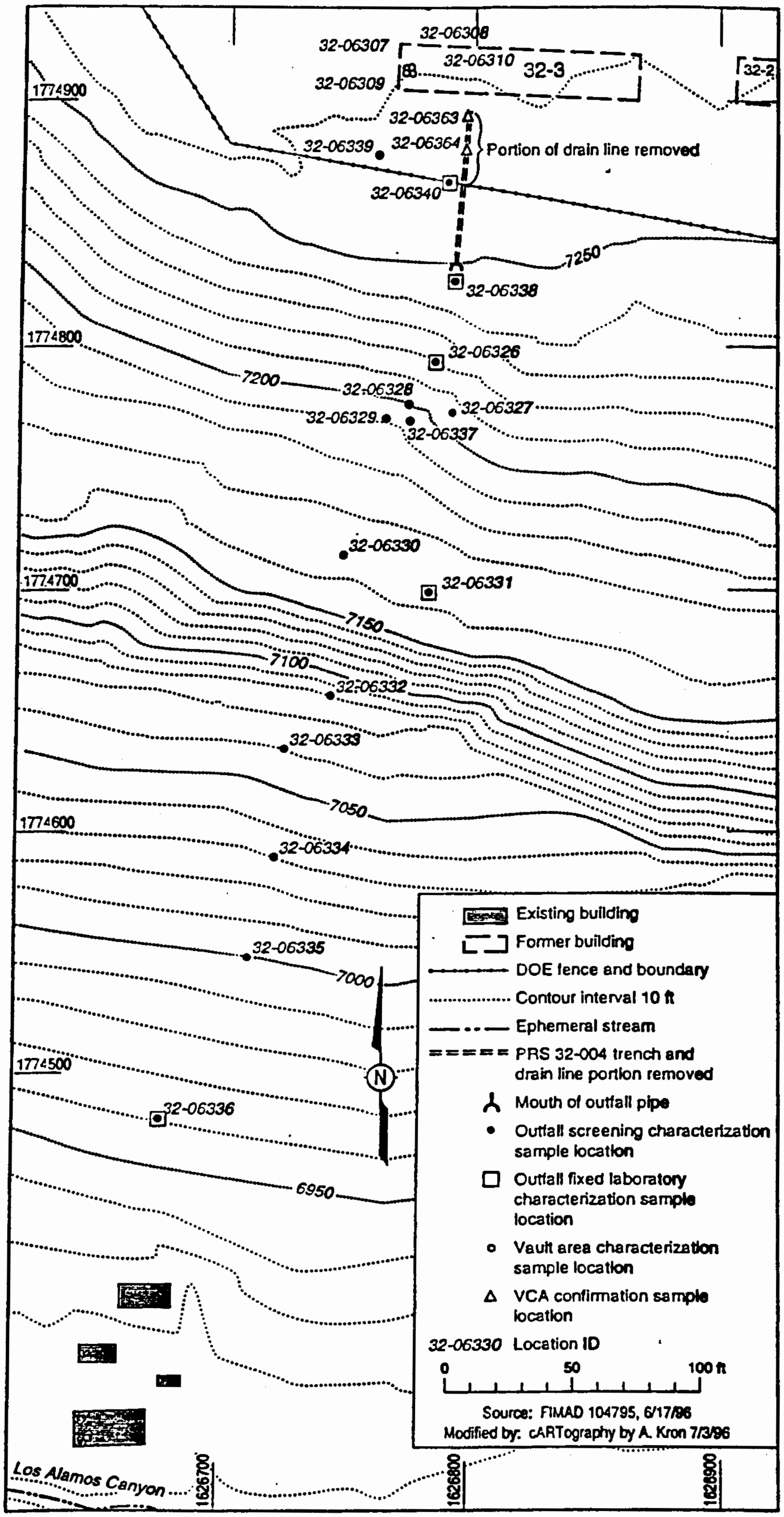


Fig. 5.1.2-1. Locations of samples collected at the PRS 32-004 radiation source vault.

Attachment 3

Ecological screening calculations for terrestrial receptors

Analyte	Maximum Sample result	Plant	HQ	Invert	HQ	Robin	HQ	Kestrel
Non-Radiological Effects	(mg/kg)	(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)
Antimony (U)	12	5.00E+00	2.4E+00	n/a		n/a		n/a
Cadmium	5.6	3.00E+00	1.9E+00	2.00E+01	2.8E-01	4.40E+00	1.3E+00	4.57E+01
Chromium VI	440	1.00E+00	4.4E+02	4.00E-01	1.1E+03	n/a		n/a
Copper	170	1.00E+02	1.7E+00	5.00E+01	3.4E+00	2.85E+02	6.0E-01	3.18E+03
Lead	1600	5.00E+01	3.2E+01	5.00E+02	3.2E+00	5.84E+01	2.7E+01	9.69E+02
Mercury (methyl) (J)	303	n/a		n/a		1.23E-02	2.5E+04	1.00E-01
Silver	150	2.00E+00	7.5E+01	5.00E+01	3.0E+00	n/a		n/a
Thallium	2.4	1.00E+00	2.4E+00	n/a		n/a		n/a
Zinc	320	5.00E+01	6.4E+00	1.00E+02	3.2E+00	7.69E+01	4.2E+00	5.97E+02
Acetone (U)	0.033	n/a		n/a		n/a		n/a
Bis(2-ethylhexyl)phthalate	5.5	n/a		n/a		7.66E-01	7.2E+00	4.55E-01
Di-n-butylphthalate	2.9	2.00E+02	1.5E-02	n/a		1.03E-01	2.8E+01	9.81E-01
Methylene chloride	0.008	n/a		n/a		n/a		n/a
Benzo(a)pyrene	0.35	n/a		n/a		n/a		n/a
Benzo(b)fluoranthene	0.51	1.80E+01	2.8E-02	n/a		n/a		n/a
Benzo(g,h,i)perylene	1.2	n/a		n/a		n/a		n/a
Benzo(k)fluoranthene	0.28	n/a		n/a		n/a		n/a
Chrysene	0.34	n/a		n/a		n/a		n/a
Pyrene	0.8	n/a		n/a		n/a		n/a
Aroclor-1260	4.83	n/a		n/a		n/a		n/a
Fluoranthene	0.53	n/a		n/a		n/a		n/a
Indeno(1,2,3-cd)pyrene	0.64	n/a		n/a		n/a		n/a
			5.62E+02		1.11E+03		2.46E+04	
Radiological Effects	pCi/g							
Americium-241 (J)	1.07	6.93E+05	1.5E-06	8.74E+01	1.2E-02	4.66E+01	2.3E-02	4.68E+02
Cesium-137 + Barium-137	2.56	1.17E+04	2.2E-04	1.09E+03	2.3E-03	4.24E+01	6.0E-02	3.14E+02
Plutonium-238	0.079	8.56E+05	9.2E-08	8.63E+01	9.2E-04	3.07E+01	2.6E-03	3.08E+02
Plutonium-239/240 (U)	5	9.22E+05	5.4E-06	9.26E+01	5.4E-02	3.28E+01	1.5E-01	3.29E+02
Uranium-234	3.55	4.00E+05	8.9E-06	1.00E+02	3.5E-02	2.92E-01	1.2E+01	2.93E+00
Uranium-238	3.04	2.99E+04	1.0E-04	1.10E+02	2.8E-02	3.32E-01	9.2E+00	3.33E+00
			3.37E-04		1.33E-01		2.15E+01	

Analyte	Maximum Sample result	HQ	Kestrel (falcon)	HQ	Cottontail	HQ	Mouse	HQ
Non-Radiological Effects	(mg/kg)		(mg/kg)		v		(mg/kg)	
Antimony (U)	12		n/a		1.55E+01	7.7E-01	1.02E+00	1.2E+01
Cadmium	5.6	1.2E-01	7.19E+02	7.8E-03	4.84E+01	1.2E-01	8.49E+00	6.6E-01
Chromium VI	440		n/a		1.42E+03	3.1E-01	1.58E+02	2.8E+00
Copper	170	5.3E-02	1.69E+04	1.0E-02	3.94E+02	4.3E-01	1.08E+02	1.6E+00
Lead	1600	1.7E+00	1.93E+03	8.3E-01	1.95E+03	8.2E-01	4.75E+02	3.4E+00
Mercury (methyl) (J)	303	3.0E+03	2.39E-01	1.3E+03	8.68E-01	3.5E+02	1.58E-01	1.9E+03
Silver	150		n/a		4.83E+02	3.1E-01	1.39E+02	1.1E+00
Thallium	2.4		n/a		7.34E+00	3.3E-01	7.16E-02	3.4E+01
Zinc	320	5.4E-01	8.60E+02	3.7E-01	2.92E+03	1.1E-01	8.78E+02	3.6E-01
Acetone (U)	0.033		n/a		5.21E+00	6.3E-03	1.85E+00	1.8E-02
Bis(2-ethylhexyl)phthalate	5.5	1.2E+01	2.42E-01	2.3E+01	1.93E+04	2.8E-04	6.18E+01	8.9E-02
Di-n-butylphthalate	2.9	3.0E+00	1.46E+01	2.0E-01	1.42E+05	2.0E-05	2.43E+03	1.2E-03
Methylene chloride	0.008		n/a		2.21E+01	3.6E-04	6.68E+00	1.2E-03
Benzo(a)pyrene	0.35		n/a		7.85E+02	4.5E-04	3.85E+00	9.1E-02
Benzo(b)fluoranthene	0.51		n/a		8.15E+02	6.3E-04	3.81E+00	1.3E-01
Benzo(g,h,i)perylene	1.2		n/a		9.52E+02	1.3E-03	3.61E+00	3.3E-01
Benzo(k)fluoranthene	0.28		n/a		8.15E+02	3.4E-04	3.81E+00	7.3E-02
Chrysene	0.34		n/a		6.36E+02	5.3E-04	4.02E+00	8.5E-02
Pyrene	0.8		n/a		3.11E+03	2.6E-04	3.19E+01	2.5E-02
Aroclor-1260	4.83		n/a		3.14E+01	1.5E-01	1.54E-01	0.0E+00
Fluoranthene	0.53		n/a		5.22E+03	1.0E-04	5.31E+01	1.0E-02
Indeno(1,2,3-cd)pyrene	0.64		n/a		9.40E+02	6.8E-04	3.63E+00	1.8E-01
		3.05E+03		1.29E+03		3.52E+02		1.97E+03
Radiological Effects	pCi/g							
Americium-241 (J)	1.07	2.3E-03	1.17E+04	9.1E-05	2.48E+04	4.3E-05	2.34E+02	4.6E-03
Cesium-137 + Barium-137	2.56	8.1E-03	9.32E+02	2.7E-03	1.11E+03	2.3E-03	1.86E+02	1.4E-02
Plutonium-238	0.079	2.6E-04	7.96E+03	9.9E-06	1.76E+04	4.5E-06	1.54E+02	5.1E-04
Plutonium-239/240 (U)	5	1.5E-02	8.51E+03	5.9E-04	1.88E+04	2.7E-04	1.64E+02	3.0E-02
Uranium-234	3.55	1.2E+00	7.50E+01	4.7E-02	1.58E+04	2.2E-04	1.46E+02	2.4E-02
Uranium-238	3.04	9.1E-01	8.30E+01	3.7E-02	2.72E+03	1.1E-03	1.58E+02	1.9E-02
		2.15E+00		8.74E-02		3.95E-03		9.28E-02

Analyte	Maximum Sample result	Shrew	HQ	Fox	HQ	Minimum ESL	HQ	Screening Receptor with Minimum ESL
Non-Radiological Effects	(mg/kg)	(mg/kg)		(mg/kg)		(mg/kg)		
Antimony (U)	12	1.15E+00	1.0E+01	9.00E+01	1.3E-01	1.02E+00	1.2E+01	Mouse
Cadmium	5.6	1.44E+01	3.9E-01	7.36E+02	7.6E-03	3.00E+00	1.9E+00	Plant
Chromium VI	440	1.44E+02	3.1E+00	2.16E+03	2.0E-01	4.00E-01	1.1E+03	Invert
Copper	170	3.37E+02	5.0E-01	6.87E+03	2.5E-02	5.00E+01	3.4E+00	Invert
Lead	1600	5.76E+02	2.8E+00	5.94E+03	2.7E-01	5.00E+01	3.2E+01	Plant
Mercury (methyl) (J)	303	2.93E-01	1.0E+03	2.55E+00	1.2E+02	1.23E-02	2.5E+04	Robin
Silver	150	5.13E+02	2.9E-01	1.14E+04	1.3E-02	2.00E+00	7.5E+01	Plant
Thallium	2.4	6.78E-02	3.5E+01	2.36E+00	1.0E+00	6.78E-02	3.5E+01	Shrew
Zinc	320	4.03E+03	7.9E-02	1.98E+04	1.6E-02	5.00E+01	6.4E+00	Plant
Acetone (U)	0.033	7.53E+01	4.4E-04	7.44E+03	4.4E-06	1.85E+00	1.8E-02	Mouse
Bis(2-ethylhexyl)phthalate	5.5	6.05E+01	9.1E-02	8.93E+00	6.2E-01	2.42E-01	2.3E+01	Kestrel (falcon)
Di-n-butylphthalate	2.9	2.45E+03	1.2E-03	1.43E+05	2.0E-05	1.03E-01	2.8E+01	Robin
Methylene chloride	0.008	3.76E+01	2.1E-04	4.34E+03	1.8E-06	6.68E+00	1.2E-03	Mouse
Benzo(a)pyrene	0.35	3.77E+00	9.3E-02	9.37E+00	3.7E-02	3.77E+00	9.3E-02	Shrew
Benzo(b)fluoranthene	0.51	3.74E+00	1.4E-01	7.51E+00	6.8E-02	3.74E+00	1.4E-01	Shrew
Benzo(g,h,i)perylene	1.2	3.53E+00	3.4E-01	2.17E+00	5.5E-01	2.17E+00	5.5E-01	Fox
Benzo(k)fluoranthene	0.28	3.74E+00	7.5E-02	7.51E+00	3.7E-02	3.74E+00	7.5E-02	Shrew
Chrysene	0.34	3.95E+00	8.6E-02	2.55E+01	1.3E-02	3.95E+00	8.6E-02	Shrew
Pyrene	0.8	3.16E+01	2.5E-02	7.46E+02	1.1E-03	3.16E+01	2.5E-02	Shrew
Aroclor-1260	4.83	1.51E-01	3.2E+01	3.75E-01	1.3E+01	1.51E-01	3.2E+01	Shrew
Fluoranthene	0.53	5.26E+01	1.0E-02	1.22E+03	4.4E-04	5.26E+01	1.0E-02	Shrew
Indeno(1,2,3-cd)pyrene	0.64	3.55E+00	1.8E-01	2.46E+00	2.6E-01	2.46E+00	2.6E-01	Fox
			1.12E+03		1.35E+02		2.59E+04	
Radiological Effects	pCi/g							
Americium-241 (J)	1.07	2.21E+02	4.8E-03	1.69E+04	6.3E-05	4.66E+01	2.3E-02	Robin
Cesium-137 + Barium-137	2.56	1.77E+02	1.4E-02	1.03E+03	2.5E-03	4.24E+01	6.0E-02	Robin
Plutonium-238	0.079	1.46E+02	5.4E-04	1.17E+04	6.8E-06	3.07E+01	2.6E-03	Robin
Plutonium-239/240 (U)	5	1.56E+02	3.2E-02	1.25E+04	4.0E-04	3.28E+01	1.5E-01	Robin
Uranium-234	3.55	1.39E+02	2.6E-02	1.11E+04	3.2E-04	2.92E-01	1.2E+01	Robin
Uranium-238	3.04	1.50E+02	2.0E-02	2.55E+03	1.2E-03	3.32E-01	9.2E+00	Robin
			9.78E-02		4.48E-03		2.15E+01	

Analyte	Maximum Sample Result	Plant	HQ	Invert	HQ	Robin	HQ
Non-Radiological Effects	(mg/kg)	(mg/kg)		(mg/kg)		(mg/kg)	
Lead	89	5.00E+01	1.8E+00	5.00E+02	1.8E-01	5.84E+01	1.5E+00
Mercury (methyl)	0.137	n/a		n/a		1.23E-02	1.1E+01
Silver	3.3	2.00E+00	1.7E+00	5.00E+01	6.6E-02	n/a	
Bis(2-ethylhexyl)phthalate	0.88	n/a		n/a		7.66E-01	1.1E+00
Butyl benzyl phthalate	3.1	n/a		n/a		n/a	
Acenaphthene **(U)**	0.53	n/a		n/a		n/a	
Anthracene **(U)**	0.53	n/a		n/a		n/a	
Benzo(a)anthracene	1.7	1.80E+01	9.4E-02	n/a		n/a	
Benzo(a)pyrene	1.9	n/a		n/a		n/a	
Benzo(b)fluoranthene	2.2	1.80E+01	1.2E-01	n/a		n/a	
Benzo(g,h,i)perylene	1.4	n/a		n/a		n/a	
Benzo(k)fluoranthene	1.7	n/a		n/a		n/a	
Chrysene	3.5	n/a		n/a		n/a	
Fluoranthene	4.8	n/a		n/a		n/a	
Indeno(1,2,3-cd)pyrene	1.3	n/a		n/a		n/a	
Naphthalene **(U)**	0.53	n/a		n/a		n/a	
Phenanthrene	2.2	n/a		n/a		n/a	
Pyrene	3.8	n/a		n/a		n/a	
			3.6E+00		2.4E-01		1.4E+01

Analyte	Maximum Sample Result	Kestrel	HQ	Kestrel (falcon)	HQ	Cottontail	HQ
Non-Radiological Effects	(mg/kg)	(mg/kg)		(mg/kg)		v	
Lead	89	9.69E+02	9.2E-02	1.93E+03	4.6E-02	1.95E+03	4.6E-02
Mercury (methyl)	0.137	1.00E-01	1.4E+00	2.39E-01	5.7E-01	8.68E-01	1.6E-01
Silver	3.3	n/a		n/a		4.83E+02	6.8E-03
Bis(2-ethylhexyl)phthalate	0.88	4.55E-01	1.9E+00	2.42E-01	3.6E+00	1.93E+04	4.6E-05
Butyl benzyl phthalate	3.1	n/a		n/a		5.15E+04	6.0E-05
Acenaphthene (U)	0.53	n/a		n/a		1.19E+02	4.5E-03
Anthracene (U)	0.53	n/a		n/a		2.42E+04	2.2E-05
Benzo(a)anthracene	1.7	n/a		n/a		6.36E+02	2.7E-03
Benzo(a)pyrene	1.9	n/a		n/a		7.85E+02	2.4E-03
Benzo(b)fluoranthene	2.2	n/a		n/a		8.15E+02	2.7E-03
Benzo(g,h,i)perylene	1.4	n/a		n/a		9.52E+02	1.5E-03
Benzo(k)fluoranthene	1.7	n/a		n/a		8.15E+02	2.1E-03
Chrysene	3.5	n/a		n/a		6.36E+02	5.5E-03
Fluoranthene	4.8	n/a		n/a		5.22E+03	9.2E-04
Indeno(1,2,3-cd)pyrene	1.3	n/a		n/a		9.40E+02	1.4E-03
Naphthalene (U)	0.53	n/a		n/a		2.98E+02	1.8E-03
Phenanthrene	2.2	n/a		n/a		2.42E+02	9.1E-03
Pyrene	3.8	n/a		n/a		3.11E+03	1.2E-03
			3.4E+00		4.3E+00		2.5E-01

Analyte	Maximum Sample Result	Mouse	HQ	Shrew	HQ	Fox	HQ
Non-Radiological Effects	(mg/kg)	(mg/kg)		(mg/kg)		(mg/kg)	
Lead	89	4.75E+02	1.9E-01	5.76E+02	1.5E-01	5.94E+03	1.5E-02
Mercury (methyl)	0.137	1.58E-01	8.6E-01	2.93E-01	4.7E-01	2.55E+00	5.4E-02
Silver	3.3	1.39E+02	2.4E-02	5.13E+02	6.4E-03	1.14E+04	2.9E-04
Bis(2-ethylhexyl)phthalate	0.88	6.18E+01	1.4E-02	6.05E+01	1.5E-02	8.93E+00	9.9E-02
Butyl benzyl phthalate	3.1	6.91E+02	4.5E-03	6.90E+02	4.5E-03	2.75E+04	1.1E-04
Acenaphthene **(U)**	0.53	4.49E+00	1.2E-01	4.80E+00	1.1E-01	5.58E+02	9.5E-04
Anthracene **(U)**	0.53	4.43E+02	1.2E-03	4.48E+02	1.2E-03	2.86E+04	1.9E-05
Benzo(a)anthracene	1.7	4.02E+00	4.2E-01	3.95E+00	4.3E-01	2.55E+01	6.7E-02
Benzo(a)pyrene	1.9	3.85E+00	4.9E-01	3.77E+00	5.0E-01	9.37E+00	2.0E-01
Benzo(b)fluoranthene	2.2	3.81E+00	5.8E-01	3.74E+00	5.9E-01	7.51E+00	2.9E-01
Benzo(g,h,i)perylene	1.4	3.61E+00	3.9E-01	3.53E+00	4.0E-01	2.17E+00	6.4E-01
Benzo(k)fluoranthene	1.7	3.81E+00	4.5E-01	3.74E+00	4.6E-01	7.51E+00	2.3E-01
Chrysene	3.5	4.02E+00	8.7E-01	3.95E+00	8.9E-01	2.55E+01	1.4E-01
Fluoranthene	4.8	5.31E+01	9.0E-02	5.26E+01	9.1E-02	1.22E+03	3.9E-03
Indeno(1,2,3-cd)pyrene	1.3	3.63E+00	3.6E-01	3.55E+00	3.7E-01	2.46E+00	5.3E-01
Naphthalene **(U)**	0.53	2.14E+01	2.5E-02	2.55E+01	2.1E-02	3.44E+03	1.5E-04
Phenanthrene	2.2	4.43E+00	5.0E-01	4.48E+00	4.9E-01	2.86E+02	7.7E-03
Pyrene	3.8	3.19E+01	1.2E-01	3.16E+01	1.2E-01	7.46E+02	5.1E-03
			5.5E+00		5.1E+00		2.3E+00

Analyte	Maximum Sample Result	Minimum ESL	HQ	Screening Receptor with Minimum ESL
Non-Radiological Effects	(mg/kg)	(mg/kg)		
Lead	89	5.00E+01	1.8E+00	Plant
Mercury (methyl)	0.137	1.23E-02	1.1E+01	Robin
Silver	3.3	2.00E+00	1.7E+00	Plant
Bis(2-ethylhexyl)phthalate	0.88	2.42E-01	3.6E+00	Kestrel (falcon)
Butyl benzyl phthalate	3.1	6.90E+02	4.5E-03	Shrew
Acenaphthene **(U)**	0.53	4.49E+00	1.2E-01	Mouse
Anthracene **(U)**	0.53	4.43E+02	1.2E-03	Mouse
Benzo(a)anthracene	1.7	3.95E+00	4.3E-01	Shrew
Benzo(a)pyrene	1.9	3.77E+00	5.0E-01	Shrew
Benzo(b)fluoranthene	2.2	3.74E+00	5.9E-01	Shrew
Benzo(g,h,i)perylene	1.4	2.17E+00	6.4E-01	Fox
Benzo(k)fluoranthene	1.7	3.74E+00	4.6E-01	Shrew
Chrysene	3.5	3.95E+00	8.9E-01	Shrew
Fluoranthene	4.8	5.26E+01	9.1E-02	Shrew
Indeno(1,2,3-cd)pyrene	1.3	2.46E+00	5.3E-01	Fox
Naphthalene **(U)**	0.53	2.14E+01	2.5E-02	Mouse
Phenanthrene	2.2	4.43E+00	5.0E-01	Mouse
Pyrene	3.8	3.16E+01	1.2E-01	Shrew
			2.3E+01	