Savannah River NUCLEAR SOLUTIONS℠

Resource Conservation and Recovery Act Facility Investigation/Remedial Investigation Report with Baseline Risk Assessment and Corrective Measures Study/Feasibility Study for the Early Construction and Operational Disposal Site L-3 (East of L Area) (NBN), L-Area Rubble Pit (131-1L), and L-Area Rubble Pit (131-4L) Operable Unit (U)

SEMS Number: 91

SRNS-RP-2023-01365

Redline Revision 1~~Revision 0~~

January 2025~~July 2024~~

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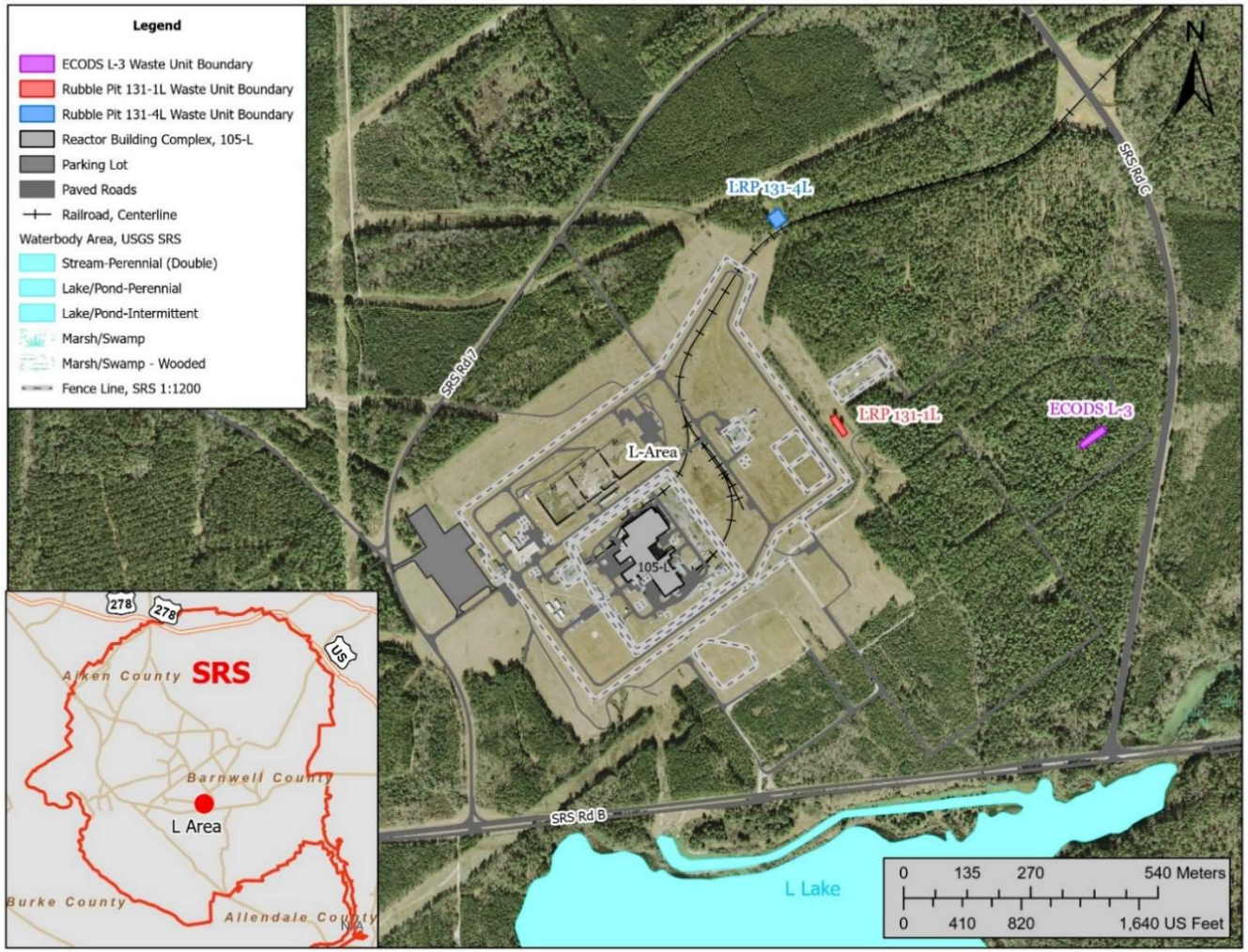


Figure ES-1. Location of Early Construction and Operational Disposal Site L-3 (no building number), L-Area Rubble Pit (131-1L), and L-Area Rubble Pit (131-4L) Operable Unit

Table ES-1. Comparative Alternative Analysis for Early Construction and Operational Disposal Site L-3 (no building number), L-Area Rubble Pit (131-1L), and L-Area Rubble Pit (131-4L) Operable Unit

Alternatives	Overall Protection of Human Health	Compliance with RAOs	Compliance with ARARs	Long-Term Effectiveness and Performance	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost	Overall Ranking (1-20)
Early Construction and Operational Disposal Site L-3 (no building number) Subunit									
A-1) No Action	No	No	No	1	1	1	5	$0	8
A-2) Land Use Controls	Yes	Yes	Yes	~~3~~4	1	5	5	$382,557	~~14~~15
A-3) Soil Cover with Land Use Controls	Yes	Yes	Yes	4	1	4	3	$1,228,712	12
A-4) Excavation and Disposal	Yes	Yes	Yes	5	1	4	3	$1,654,216	13
L-Area Rubble Pit (131-4L) Subunit									
B-1) No Action	No	No	N/A	1	1	1	5	$0	8
B-2) Land Use Controls	Yes	Yes	N/A	~~3~~4	1	5	5	$560,619	~~14~~15
B-3) Soil Cover with Land Use Controls	Yes	Yes	Yes	4	1	4	3	$1,543,338	12
B-4) Excavation and Disposal	Yes	Yes	Yes	5	1	4	3	$7,671,286	13

Note: No impact to the environment was determined at the L-Area Rubble Pit (131-1L) subunit
Numeric Range 1 through 5, where 1 = worse and 5 = best
RAO: remedial action objective
ARAR: applicable or relevant and appropriate requirement

cans, drums and transite were disposed of at the LRP 131-1L subunit (DuPont 1983a and DuPont 1983b). However, the term "pit" may be a misnomer as the 2022 characterization activities did not indicate that a pit was constructed or that waste was placed below ground surface (bgs). Recently discovered photographs of the subunit show land disposal of material on the surface of the subunit during operation between 1973 and 1982 (Figures 1-4 and 1-5). There is no record of hazardous or radioactive material disposed of at the subunit.

A preliminary screening was performed at the LRP 131-1L subunit in 1991, which included a soil-gas survey to determine if hazardous waste may be present in the subsurface soils and to identify potential areas of contamination within the subunit. A total of ten soil-gas samples were collected along the centerline of the subunit. Samples were analyzed for volatile organic compounds (VOCs) and chlorinated VOCs. The survey results determined that VOCs from methane through hexane are likely to be present in the subunit soils. These compounds are expected in relation to breakdown of typical disposal debris in SRS disposal sites, however contamination within the subunit could not be ruled out and further investigation was warranted. No other characterization was performed at the LRP 131-1L subunit prior to the RFI/RI characterization in 2022 (SRNS 2022). The LRP 131-1L subunit is in Appendix C of the FFA, *RCRA/CERCLA Units*, for further assessment (FFA 1993).

1.3.3 LRP 131-4L Subunit

The LRP 131-4L subunit is located north of the L-Area fence and east of Road 7 (Figure 1-1). Orange ball markers are present to designate the subunit boundaries, an area ~30.5 m by 30.5 m (100 ft by 100 ft) (Figure 1-6). However, during site walkdowns to support a 1994 SE effort, the subunit size was questioned due to land disturbance on the northwestern side of the subunit, outside of the orange ball markers. Additionally, during site walkdowns in 2021, in preparation of the RFI/RI Work Plan for the LRP 131-4L subunit, surface disturbance and debris (e.g., rebar, concrete, asphalt) were observed on the northeastern side of subunit outside of the orange ball markers. Therefore, the LRP 131-4L subunit area to be investigated was expanded to ~36.6 m by 36.6 m (120 ft by 120 ft) to include the disturbed land and observed debris (Figure 1-6).

Records indicate the LRP 131-4L subunit received inert rubble from the L-Area Powerhouse Stack and Silo demolition (Dupont 1983a and DuPont 1983b). The rubble consisted primarily of concrete and asphalt material with some metal. The unlined pit was reported to have operated from 1973 to 1983 before it was filled and seeded in 1983. Operating procedures indicate it was to receive inert, non-hazardous materials, and there are no records indicating any disposal of hazardous or radioactive materials.

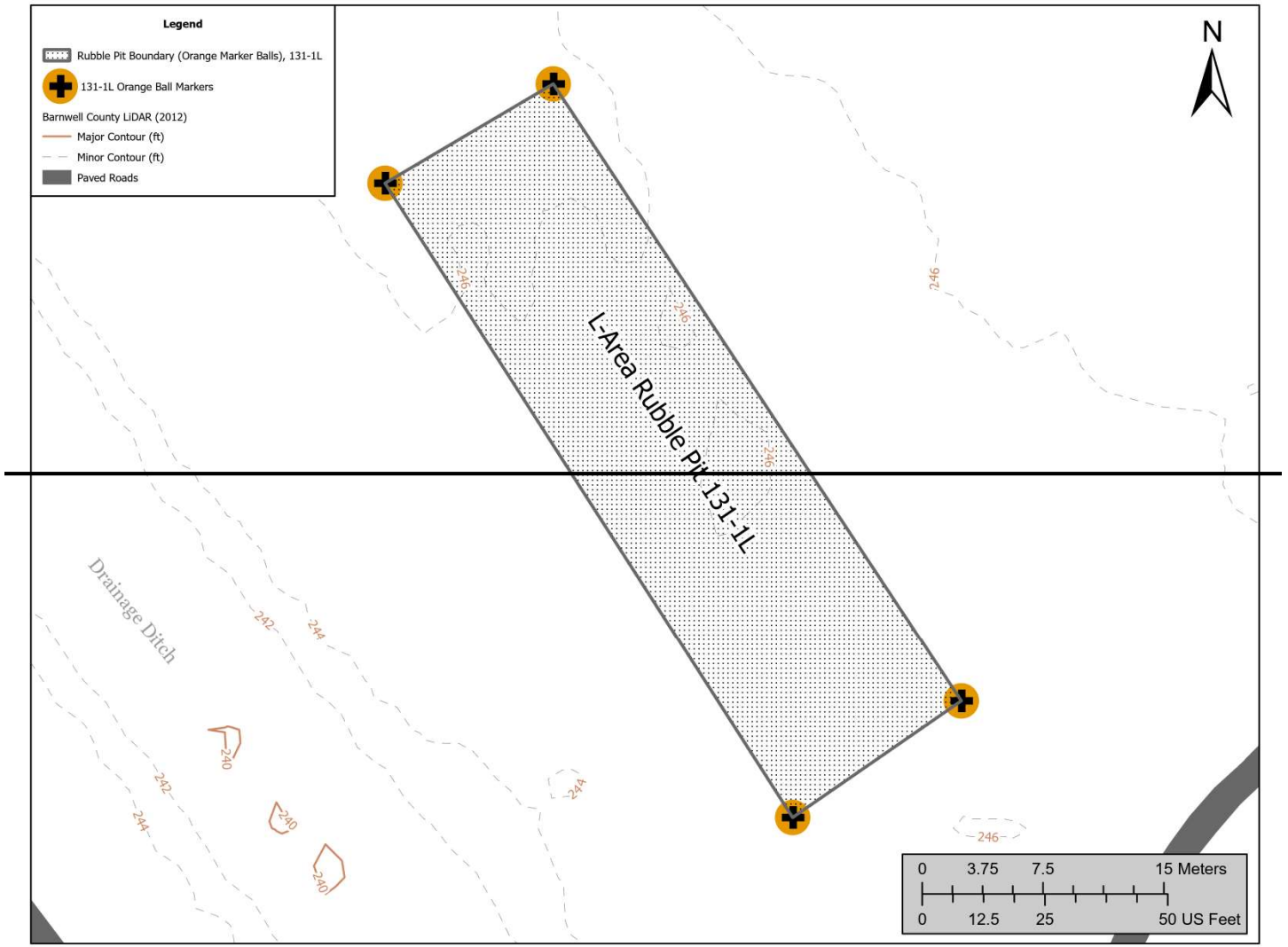
A SE of the LRP 131-4L subunit was conducted from 1992 to 1994, and results were reported in the *Site Evaluation Report for the L-Area Rubble Pit (131-4L) (U)* (WSRC 1994). Based on the SER, in accordance with 300.420(b)(1)(I) of the NCP, the LRP 131-4L subunit was removed from FFA Appendix G.1, *Areas to Be Investigated*, and placed in Appendix C, *RCRA/CERCLA Units*, for further assessment (FFA 1993).

1.4 Land Use

The ECODS L-3, LRP 131-1L, and LRP 131-4L OU is located in an area designated for industrial use as defined by the *Land Use Control Assurance Plan for the Savannah River Site* (WSRC 1999). No current or future development of the OU is planned. Land use controls will be part of any remedial action that leaves contamination in place above levels that allow for unrestricted use (e.g., residential). Groundwater is not part of the OU and is addressed in the LASG OU monitored natural attenuation final remedy. There is no current or projected future use of the groundwater as a drinking water source.

1.5 Natural Resource Trustees Injury Evaluation

The potential for natural resource injuries is documented by completing the NRIE Checklist (Appendix G). The purpose of the NRIE Checklist is to identify potential natural resource injuries associated with CERCLA remedial activities. If potential injuries are identified, consideration is given as to whether trustee involvement is needed. The checklist is a starting point in potential injury identification and is not intended to be all-inclusive. The checklist has been designed as a series of questions to help identify the potential for natural resource injuries and what resources may be affected. It is based on the pre-assessment screen in 43 Code of Federal Regulations (CFR) 11.13.


Legend
Rubble Pit Boundary (Orange Marker Balls), 131-1L
131-1L Orange Ball Markers
Barnwell County LiDAR (2012)
Major Contour (ft)
Minor Contour (ft)
Paved Roads
N
L-Area Rubble Pit 131-1L
Drainage Ditch
240
242
244
246
0 3.75 7.5 15 Meters
0 12.5 25 50 US Feet

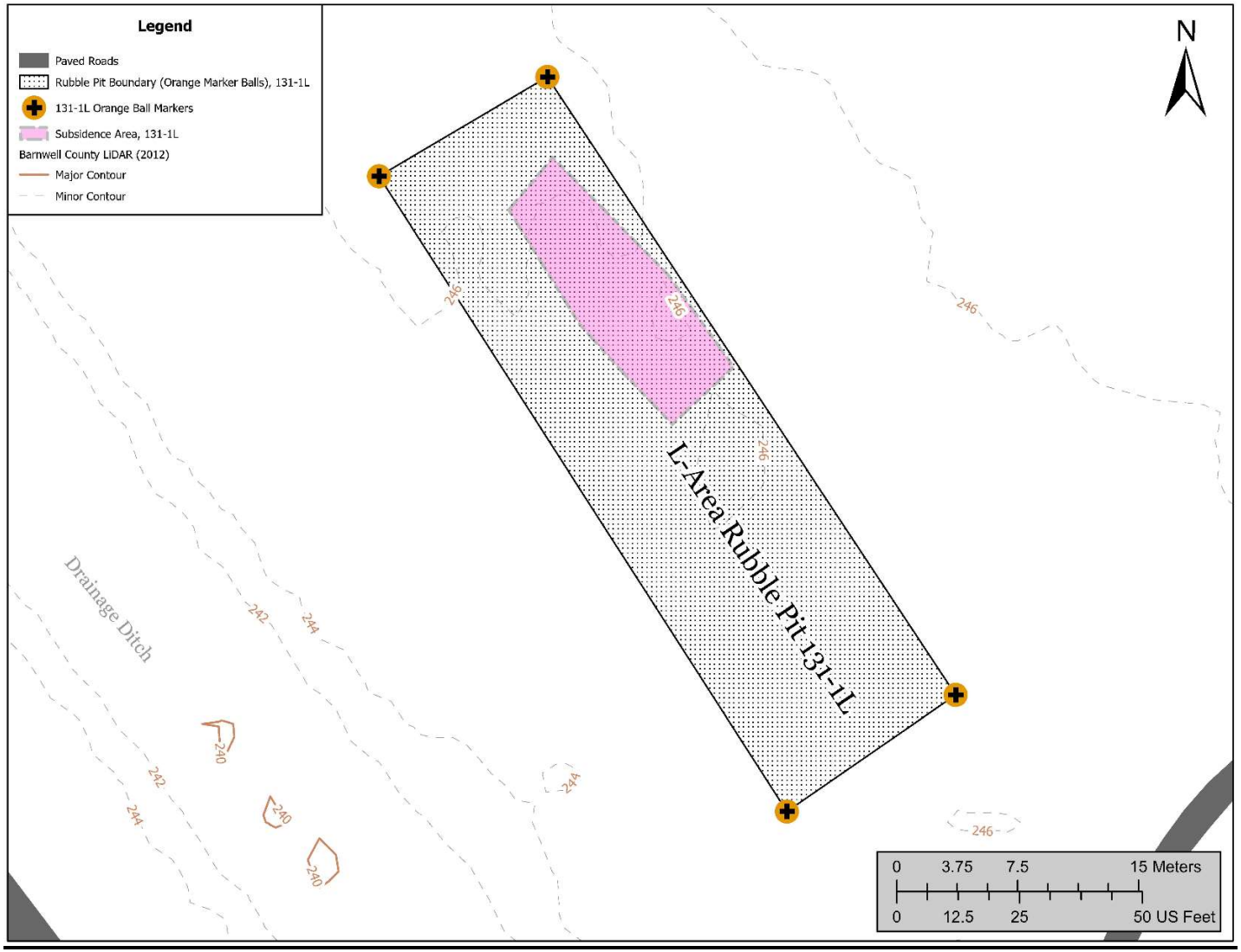


Figure 1-3. L-Area Rubble Pit 131-1L Subunit Boundary

2.1.2 Surface Features

The ECODS L-3 subunit is in a relatively flat area that slopes gradually to the southwest with surface elevation ranging from 75 to 77 m (248 to 254 ft) above mean sea level (amsl) (Figure 1-2). The subunit is covered in mature pine trees with a moderately dense understory (Figure 2-2). The subunit is marked by established signage.

The LRP 131-1L subunit is a relatively flat area that slopes gently to the southwest towards an open drainage ditch with surface elevation ranging from 74 to 75 m (244 to 246 ft) amsl (Figure 1-3). The drainage system discharges to L Lake, ~830 m (2,700 ft) away. A depression, ~1 m (3 ft) in depth and 92 square meters (m^2) (110 square yards [yd^2]) in aerial extent, was observed within the northern end of the subunit (Figure 2-7). The depression receives rainwater runoff, however the soil drains well and does not regularly hold water. The subunit is marked by four orange balls marking the corners of the subunit and established signage (Figure 2-3).

The LRP 131-4L subunit surface elevation ranges from ~81 to 84 m (265 to 275 ft) amsl (Figure 1-6). Surface runoff flows across the subunit to the southeast and collects at the culvert, which then travels under the nearby railroad tracks. This culvert and drainage system discharges to L Lake, ~1,300 m (4,300 ft) away. From this point, L Lake flows southwest and south for 5.6 km (3.5 mi) before discharging into Steel Creek. Steel Creek flows south and west for an additional 12 km (7.5 mi) before discharging into the Savannah River. Drainage from the LRP 131-4L subunit does not discharge to a National Pollutant Discharge Elimination System (NPDES) permitted storm water outfall, as it is in an area not served by storm sewers. The original subunit boundary is delineated by the orange ball markers. The subunit is not marked by established signage.

2.1.3 Meteorology

The climate of the central Savannah River area is humid and subtropical. It is characterized by hot summers and mild winters. Outbreaks of severe thunderstorms occur more frequently during the spring; rainfall is evenly distributed throughout the year (Savannah River National Laboratory [SRNL] 2024). Except for the Savannah River valley, there are no topographic features that would significantly influence the general climate.

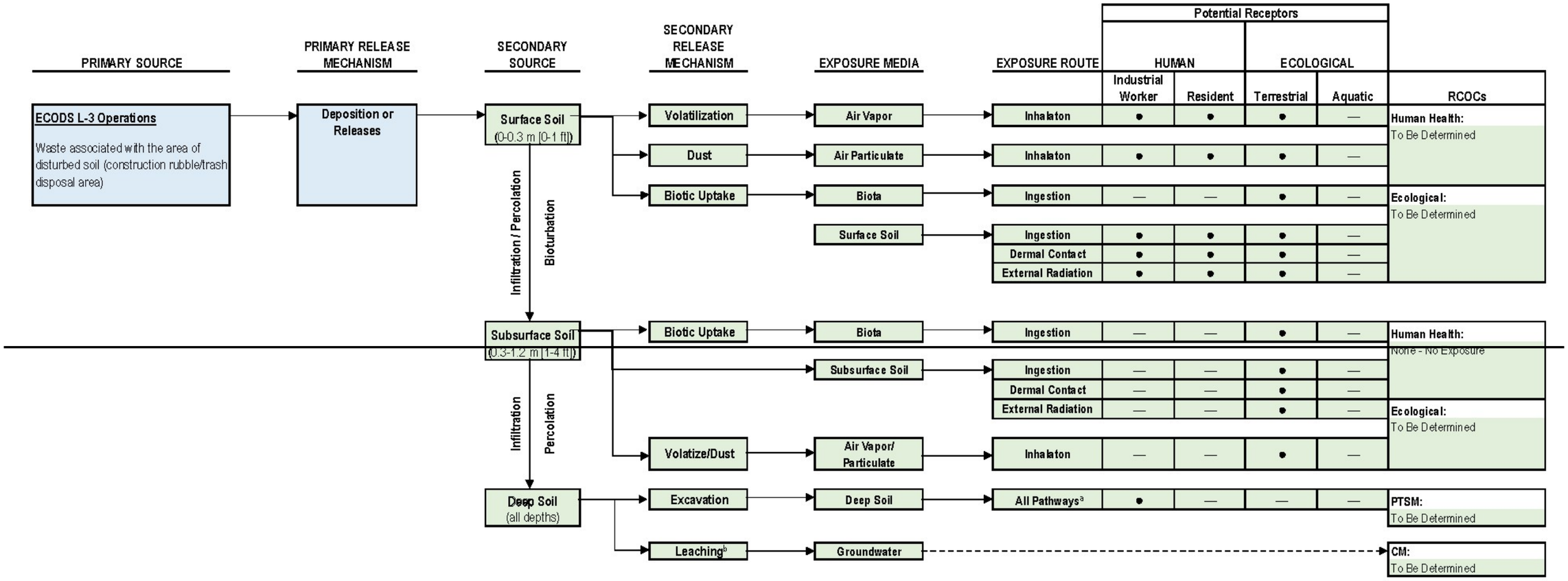
such as rubble and concrete. The ECODS L-3 subunit is estimated to have been used from November 1953 to June 1954, and there are no records of hazardous or radioactive waste disposal at the subunit. Prior to use as a disposal site, the area was used as farmland. Sections of the disposal trenches may have been used as a burn pit for disposal of combustible waste. Based on historical records and the known uses of the ECODS L-3 subunit, per- and polyfluoroalkyl substances (PFAS) are not expected to be present.

The LRP 131-1L subunit is a former waste disposal area reportedly used for various construction debris and operated from 1973 to 1982 (DuPont 1983a). Plant records indicate that metal, lumber, poles, concrete, brick, tile, asphalt, tires, rubber, scrap metal, fence posts, hard plastics, wallboard, asbestos, glass, batteries paint cans, drums, and transite were disposed of at the LRP 131-1L subunit (DuPont 1983a and DuPont 1983b). Based on available records and the results of the RFI/RI characterization, there was no pit constructed at the LRP 131-1L subunit, and waste was placed on the subunit surface between 1973 and 1982. Recently discovered photos of the subunit show land disposal of material on the surface of the subunit (Figure 1-4 and Figure 1-5). It is unknown when the waste was removed. There is no record of hazardous or radioactive material disposed of at the subunit. Based on historical records and the known uses of the LRP 1313-1L subunit, PFAS are not expected to be present.

The LRP 131-4L subunit is an unlined pit, reported to have operated from 1973 to 1983, before it was filled and seeded in 1983. The LRP 131-4L subunit received inert rubble from the L-Area Powerhouse Stack and Silo demolition. The rubble consisted primarily of concrete and asphalt material with some metal. Operating procedures indicate it was to receive inert, non-hazardous materials, and there are no records indicating any disposal of hazardous or radioactive materials. Based on historical records and the known uses of the LRP 131-4L subunit, PFAS are not expected to be present.

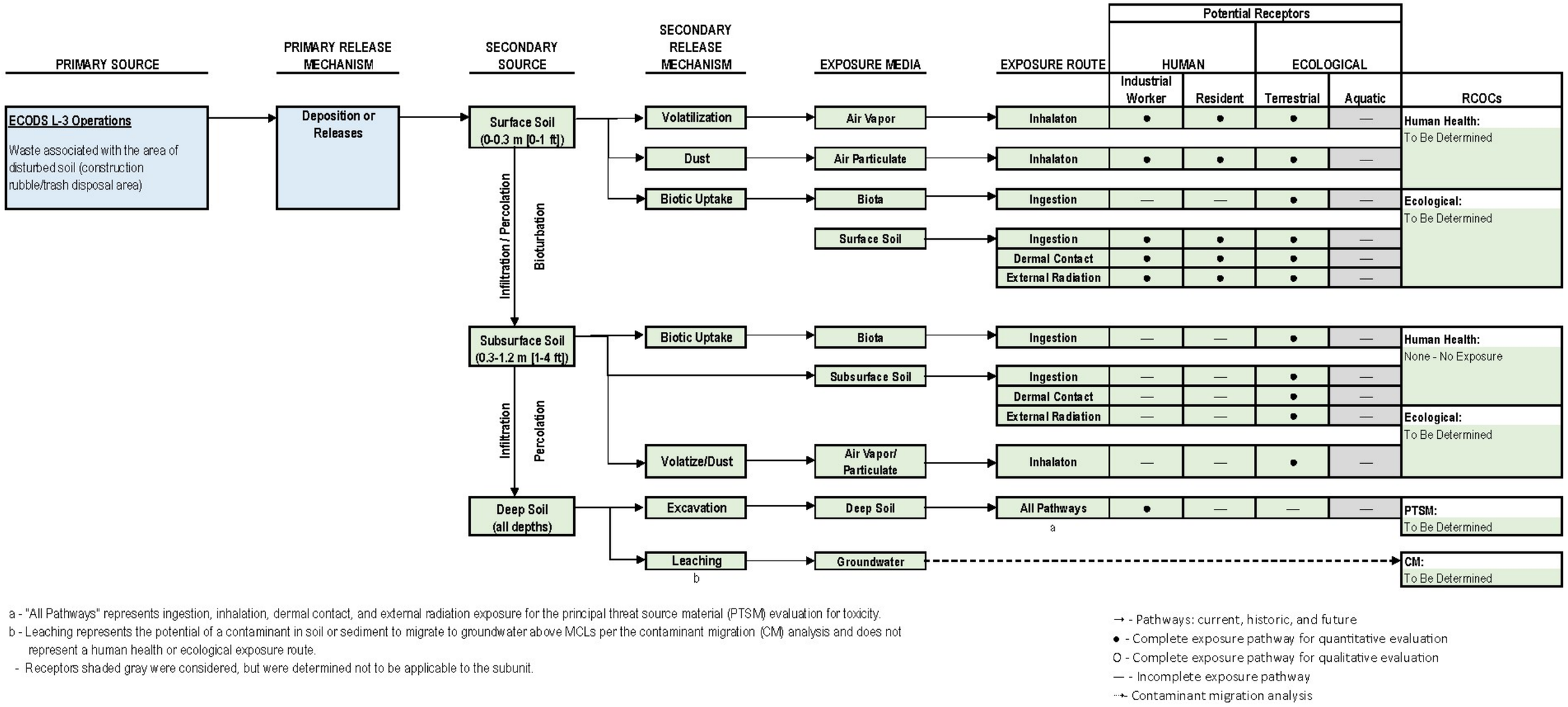
2.3.2 Primary Sources Environmental Release Mechanisms

Environmental release mechanisms evaluated as primary sources of contamination to the ECODS L-3 subunit were solid construction wastes disposed of in the ECODS L-3 subunit during



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.

→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis



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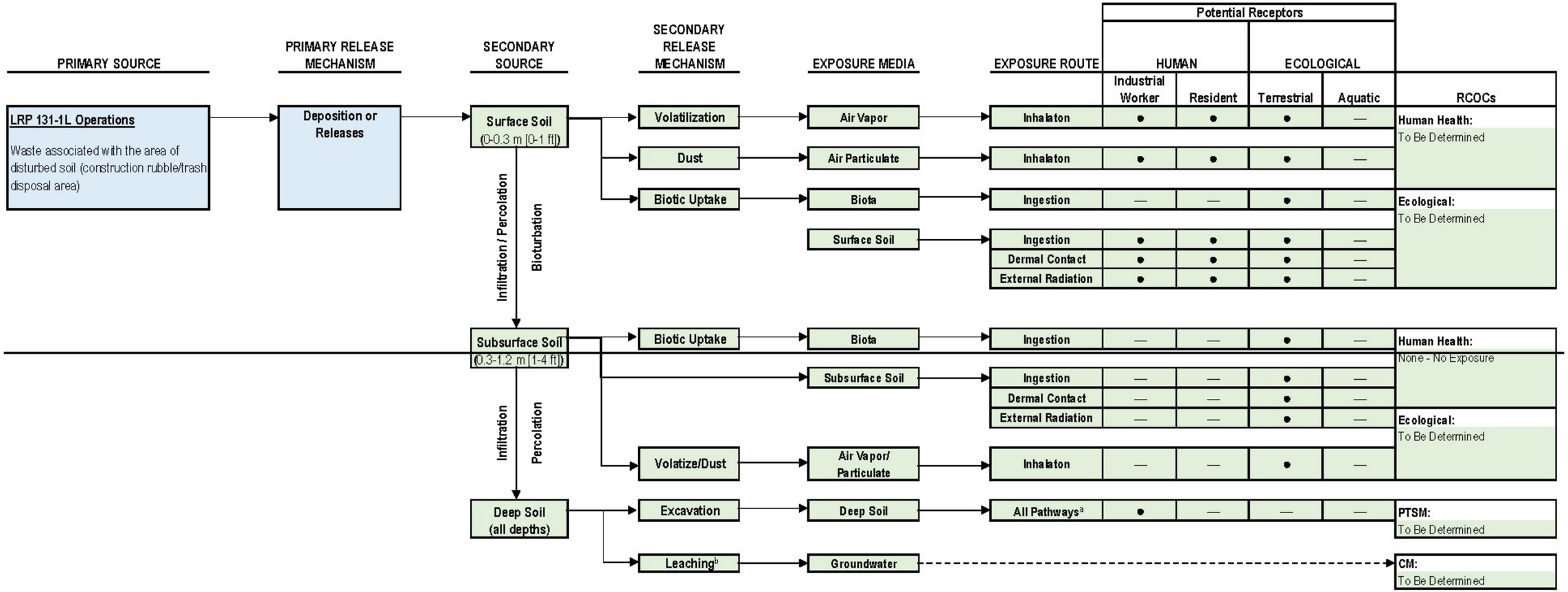
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.
- Receptors shaded gray were considered, but were determined not to be applicable to the subunit.

→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ Contaminant migration analysis

Figure 2-12. Preliminary Conceptual Site Model for the ECODS L-3 Subunit



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→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis

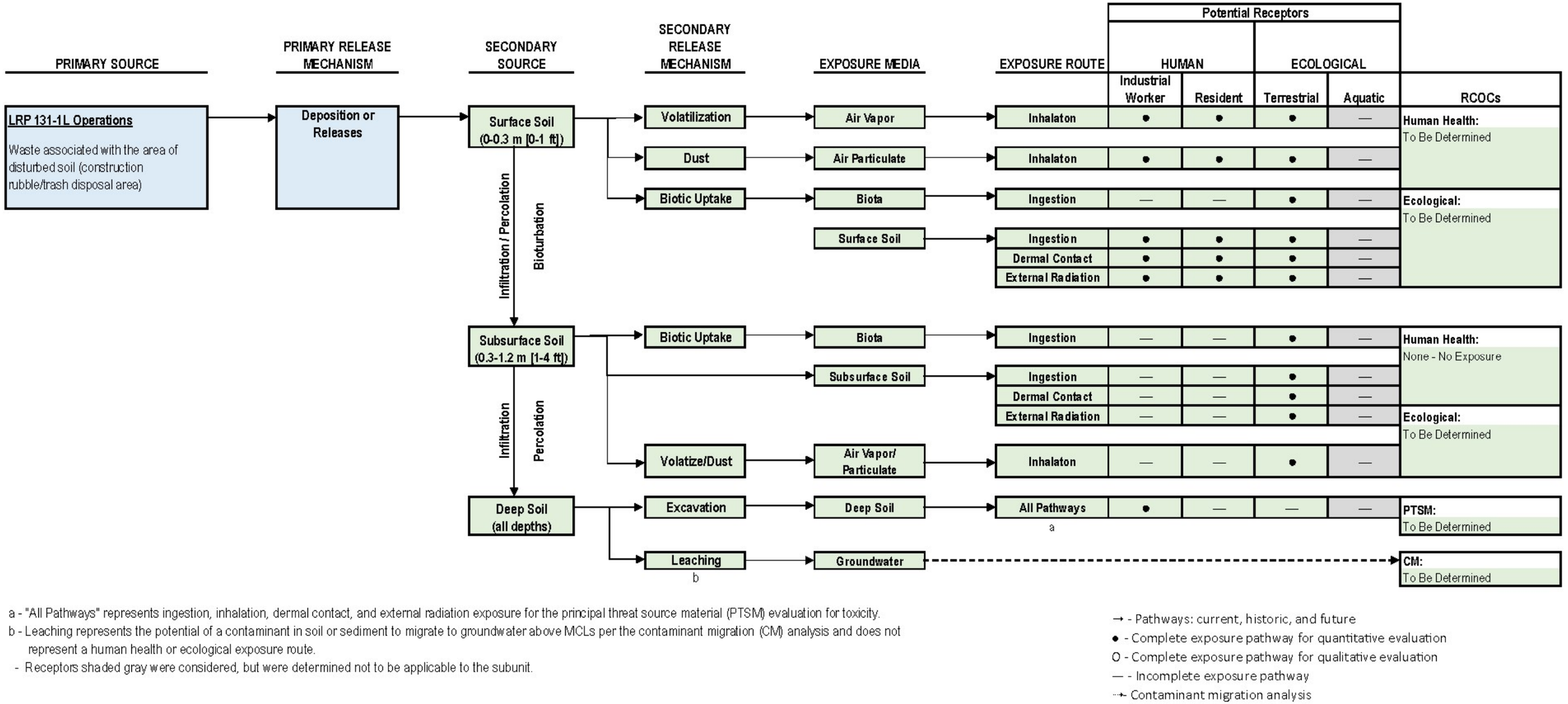
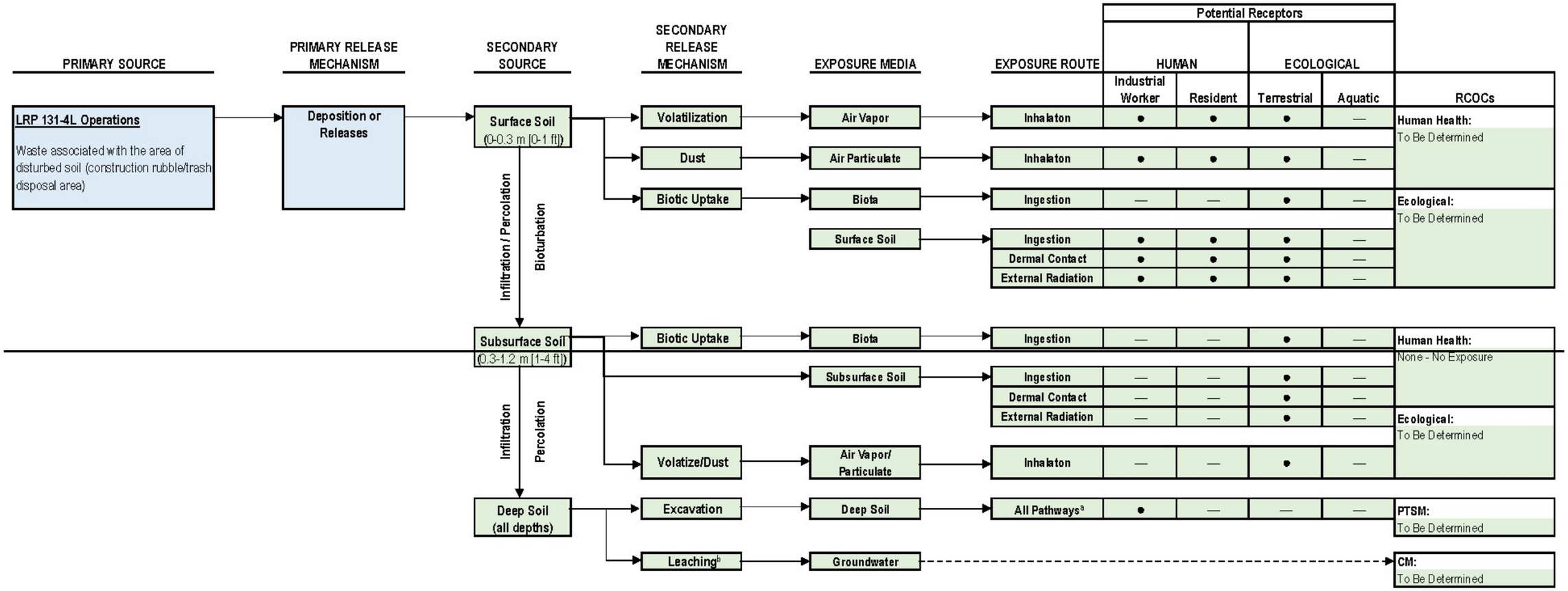


Figure 2-13. Preliminary Conceptual Site Model for the L-Area Rubble Pit 131-1L Subunit



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.

→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis

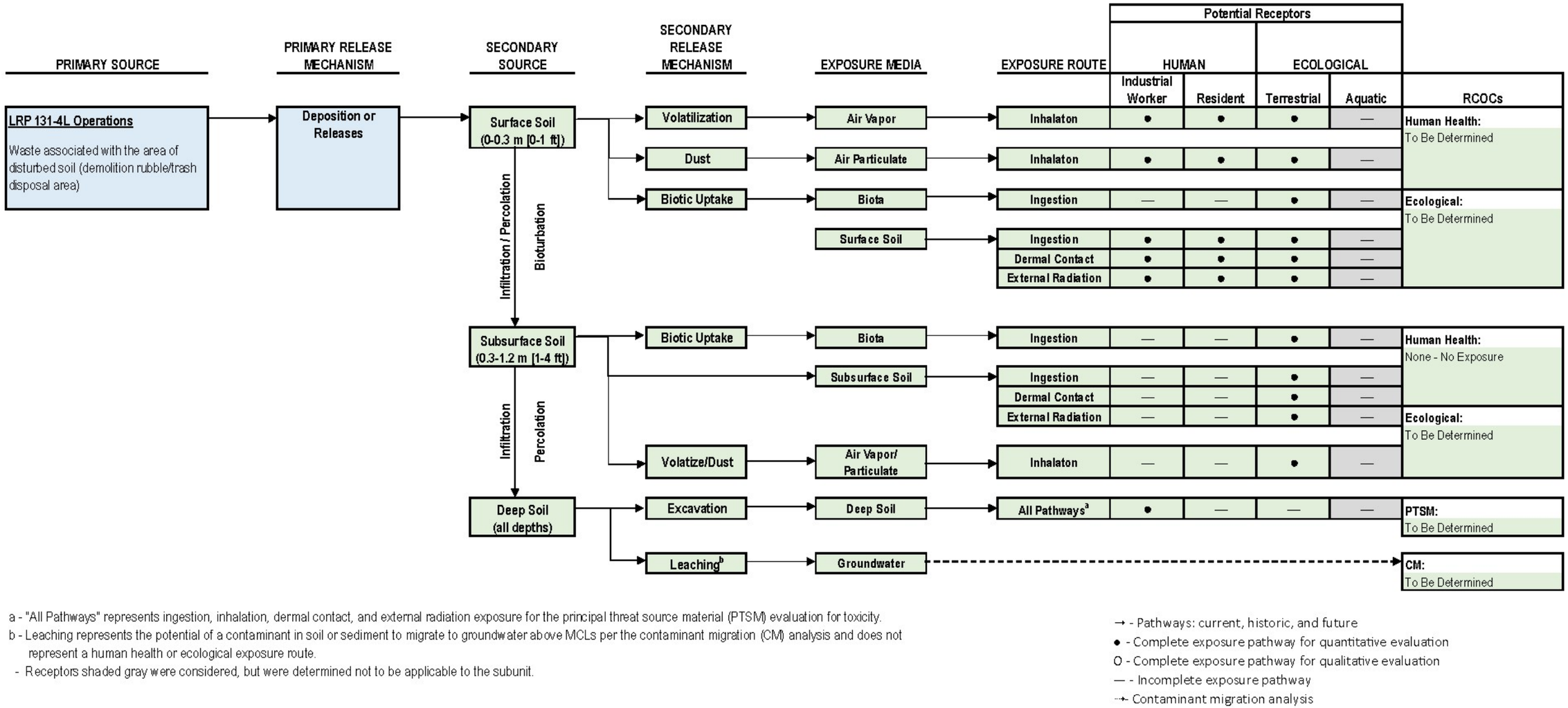


Figure 2-14. Preliminary Conceptual Site Model for the L-Area Rubble Pit 131-4L Subunit

(U) presents a Laboratory Quality Discussion in Section IV and a *Site Evaluation Validation Report* in Section V for the samples that were collected in 2002 (WSRC 2003).

3.2.1 ECODS L-3 Subunit

A SE characterization effort at the ECODS L-3 subunit was conducted in 2002. The SE characterization efforts in 2002 included a radiological control survey, a GPR survey, and soil sampling. The radiological control survey designated the area as a "Clean Area." Two confirmation soil samples were collected from location EL3-09 and EL3-10 (Figure 3-1) and were sent for laboratory analyses of gross alpha and nonvolatile beta. Sample results confirmed both samples were below the screening level of 20 picocuries per gram (pCi/g) for gross alpha and 50 pCi/g for nonvolatile beta.

Based on historical photographs, it is estimated that waste disposed of in the ECODS L-3 subunit was buried in two trenches located end-to-end and each ~18 m (60 ft) wide by 30 m (100 ft) long. The boundaries of the trenches were estimated by the 2002 GPR survey which determined the size of each trench determined to be ~15 m (50 ft) wide by 27 m (90 ft) long and 4.6 m (15 ft) wide by 27 m (90 ft) long (Figure 3-1). The GPR survey estimated the depth as ~7.3 m (24 ft) bgs. However, during soil sampling, the bottom of the two trenches within the subunit were confirmed at depths of 3.4 m (11 ft) bgs or less.

In support of the 2002 SE, composite soil sampling was performed at 23 locations, including five background locations, using direct push technology. Eighteen of the locations were distributed systematically throughout the area using a grid pattern. Sixteen of sampling locations (EL3-01 to EL3-16) were within the trenches; one location (EL3-17) was adjacent to the east end of the eastern trench; and one sample location (EL3-18) was between the two trenches. The five background sampling locations (EL3-19 to EL3-23) were selected based on the groundwater flow path with one side-gradient location, one down-gradient location, and three up-gradient of the subunit.

Sampling was completed at all 23 locations with a total of 90 samples collected (81 regular [REG] samples, 9 field duplicate [FD]) (Figure 3-1). Thirteen sampling locations (EL3-03 to EL3-05, EL3-07 to EL3-09, EL3-11 to EL3-15, and EL3-17 to EL3-18) collected samples from three sample intervals: 0.0 to 0.3 m, 0.3 to 1.2 m, and 1.2 to 2.4 m (0 to 1 ft, 1 to 4 ft, and 4 to 8 ft) bgs.

Three sampling locations (EL3-06, EL3-10, and EL3-16) collected samples from four sample intervals: 0.0 to 0.3 m, 0.3 to 1.2 m, 1.2 to 2.4 m, and 2.4 to 3.7 m (0 to 1 ft, 1 to 4 ft, 4 to 8 ft, and 8 to 12 ft) bgs. Seven sampling locations (EL3-01 to EL3-02 and EL3-19 to EL3-23) collected samples from five intervals: 0.0 to 0.3 m, 0.3 to 1.2 m, 1.2 to 2.4 m, 2.4 to 3.7 m, and 3.7 to 4.9 m (0 to 1 ft, 1 to 4 ft, 4 to 8 ft, 8 to 12 ft, and 12 to 16 ft) bgs. During sampling activities, the presence of waste was noted to include glass, metal, and rubber.

All samples were analyzed for the Target Analyte List (TAL) of inorganic constituents and the Target Compound List (TCL) of organic compounds, pesticides, herbicides, and PCBs. As documented in the *Site Evaluation Report for Early Construction and Operational Disposal Site (ECODS) L-3 (NBN) (U)* (WSRC 2003), seven polycyclic aromatic hydrocarbons (PAHs) (benzo(a)anthracene; benzo(a)pyrene benzo(b)fluoranthene; benzo(k)fluoranthene; bis(2-ethylhexyl)phthalate; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene), two PCBs (Aroclor 1254 and Aroclor 1260), and five metals (antimony; copper; lead; arsenic; and iron) were present in concentrations that exceeded ~~Region IX~~ residential and/or industrial PRGs.

The Core Team agreed at the December 2021 scoping meeting that the definitive level data from the SER was considered usable for the purposes of performing a BRA for the ECODS L-3 subunit to support remedial decision making; therefore, no data gaps were identified for the ECODS L-3 subunit, and sampling at the subunit was not included in the RFI/RI Work Plan (SRNS 2022).

3.2.2 LRP 131-1L Subunit

The 2022 RFI/RI characterization started with an effort to delineate the lateral and vertical extent of the subunit with a GPR survey. The GPR survey at the LRP 131-1L subunit was not able to confirm land disturbance below surface within the subunit boundary. Visual description of the core collected from all sampling locations were described (Appendix J). Subsurface soil appeared to be native and undisturbed throughout, therefore it was determined that a "pit" was not constructed at this subunit. This was further confirmed through historical photos which demonstrated that waste was placed on surface at the subunit, and no pit was constructed.

Soil sampling of the LRP 131-1L subunit was completed in accordance with the RFI/RI Work Plan (SRNS 2022). Twenty-one sampling locations and a total of 131 samples (113 REG, 7 ~~field~~

~~duplicates [~~FD~~]~~, 7 splits [SPL], and 4 rinsate blanks [RB]) were collected to determine nature and extent of contamination. Eight pit boundary locations (LAP1L-001 to LAP1L-008) were chosen to aid in extent determination and 13 locations (LAP1L-009 to LAP1L-021) were placed within the subunit boundary in a random, unbiased sampling pattern (Figure 3-2). Five soil boring intervals were sampled at all locations, including surface soil (0.0 to 0.3 m [0 to 1 ft] bgs), subsurface soil (0.3 to 1.2 m [1 to 4 ft] bgs), and deep soil (1.2 to 2.4 m, 2.4 to 3.7 m, 3.7 to 4.9 m [4 to 8 ft, 8 to 12 ft, 12 to 16 ft] bgs). At the eight boundary locations, an additional subsurface soil interval was sampled 4.9 to 6.1 m (16 to 20 ft) bgs in order to confirm the extent of the subunit was delineated. All samples were successfully collected without any deviations.

For the LRP 131-1L subunit, the seven SPL samples were collected at locations LAP-1L-003 (0.0-0.3 m [0-1 ft]), LAP-1L-006 (0.3-1.2 m [1-4 ft]), LAP-1L-009 (1.2-2.4 m [4-8 ft]), LAP-1L-012 (2.4-3.6 m [8-12 ft]), LAP-1L-015 (3.6-4.9 m [12-16 ft]), LAP-1L-018 (0.0-0.3 m [0-1 ft]), and LAP-1L-021 (0.3-1.2 m [1-4 ft]) (Figure 3-2). SPL samples were collected and prepared using the same methods as REG samples, and were sent to separate laboratories from the REG samples for analyses using the same analytical methods to ensure direct comparison.

Waste was encountered at one location (LAP1L-015) in the bottom of the 0.3 to 1.2 m (1 to 4 ft) interval (Figure 3-4). The observed waste appeared to be a railroad tie, or other creosote wooden material. No potential ACM was observed in any soil borings for the LRP 131-1L subunit.

All samples were analyzed for all constituents on the TAL and TCL, and all requested analyses were completed without deviation. In addition to TAL and TCL constituents, gross alpha and nonvolatile beta screening was performed on all samples. Exceedances of trigger levels for gross alpha (20 pCi/g) and nonvolatile beta (50 pCi/g) prompted analyses of a contingent set of additional radiological analyses. No samples exceeded the nonvolatile beta trigger level. However, 59 of 65 samples (91%) collected from soil boring locations within the subunit exceeded the alpha trigger, with a median result of 27.2 pCi/g and maximum of 46.1 pCi/g. Similarly, 42 of 48 samples (88%) collected from boundary soil boring locations exceeded the gross alpha trigger, with a median result of 28.6 pCi/g and maximum of 46.3 pCi/g. In comparison, seven SPL samples were collected and analyzed by a separate laboratory using the same collection, preparation, and analytical methods with ~~had~~ no trigger level exceedances. The maximum gross alpha result for the

SPL samples was 16.9 pCi/g. The SPL samples were analyzed by alpha spectroscopy for a full alpha speciation and results show the contributing alpha emitting radionuclides were naturally occurring radioactive material (NORM) species and were within site background levels (Table 3-1).

There is no history or any indication that radioactive material was ever sent to the LRP 131-1L subunit. Additionally, no waste debris was encountered during drilling activities, with the exception of ~0.3 m (1 ft) of creosote wood in one soil boring location (LAP1L-015) (Figure 3-4). To verify the origin of the elevated gross alpha results, 10% of the total samples that exceeded the gross alpha trigger were selected for full alpha spectroscopy, using the rationale in Table 3-2, before moving forward with a decision on the remaining samples. Alpha spectroscopy results from the subset of samples support that the gross alpha exceedances were from NORM contributions only (Table 3-3). Therefore, the remaining 90% of samples with gross alpha results exceeding the alpha trigger level of 20 pCi/g were not analyzed for alpha speciation.

3.2.3 LRP 131-4L Subunit

The 2022 RFI/RI characterization started with an effort to delineate the lateral and vertical extent of the subunit with a GPR survey. GPR was performed prior to commencement of soil sampling activities to ascertain if pit size and depth could be determined. However, due to interferences with shallow deposition of material and makeup, as well as shallow roots from the dense underbrush, the findings were inconclusive.

Soil sampling of the LRP 131-4L subunit consisted of 41 total sample locations for a total of ~~226~~220 samples (~~198~~192 REG, 11 FD, 11 SPL, and 6 RB) collected (Figure 3-3). Fifteen~~Seven~~ samples were unable to be collected due to waste material within the sampling depth (LAP-4L-014 [1.2-2.4 m, 2.4-3.6 m {4-8 ft, 8-12 ft}], LAP-4L-015 [1.2-2.4 m, 2.4-3.6 m {4-8 ft, 8-12 ft}], LAP-4L-018 [2.4-3.6 m {8-12 ft}], LAP-4L-021 [1.2 2.4 m {4-8 ft}], LAP-4L-032 [1.2-2.4 m, 2.4-3.6 m {4-8 ft, 8-12 ft}], LAP-4L-035 [2.4 3.6 m {8-12 ft}], LAP-4L-040 [2.4-3.6 m {8-12 ft}], and LAP-4L-041 [1.2-2.4 m, 2.4 3.6 m, 3.6-4.9 m {4 8 ft, 8-12 ft, 12-16 ft}]) or no deep soil recovered in sample barrel (LAP 4L 30 [2.4-3.6 m, 3.6-4.9 m {8-12 ft, 12-16 ft}]). There were fourteen interior sample locations (LAP4L-013 to LAP4L-016, LAP4L-018, LAP4L-020 to

LAP4L-022, LAP4L-024 to LAP4L-026, and LAP4L-028 to LAP4L-030), completed in a random, unbiased sampling pattern spaced 6.1 m (20 ft) apart within the subunit. Along the original subunit boundary, delineated by the orange ball markers, eleven peripheral sample locations were identified (LAP4L-006 to LAP4L-011, LAP4L-017, LAP4L-023, and LAP4L-031 to LAP4L-033). Eight sample locations (LAP4L-001 to LAP4L-005, LAP4L-012, LAP4L-019, and LAP4L-027) were included to investigate the area northeast of the subunit, where debris was observed on surface. Four sample locations (LAP4L-034 to LAP4L-037) were included to bound an area of subsidence that was identified on the northern side of the subunit during site walkdowns. Four step-out sample locations (LAP4L-038 to LAP4L-041) were identified northwest of the subunit as contingent locations based on field observations.

For the LRP 131-4L subunit, the eleven SPL samples were collected at locations LAP-4L-002 (0.0 0.3 m [0-1 ft]), LAP-4L-004 (0.3-1.2 m [1-4 ft]), LAP-4L-006 (1.2-2.4 m [4-8 ft]), LAP 4L 008 (2.4-3.6 m [8-12 ft]), LAP-4L-010 (0.0-0.3 m [0-1 ft]), LAP-4L-012 (0.0-0.3 m [0 1 ft]), LAP-4L-014 (0.3-1.2 m [1-4 ft]), LAP-4L-016 (1.2-2.4 m [4-8 ft]), LAP-4L-020 (1.2-2.4 m [4-8 ft]), LAP-4L-022 (0.0-0.3 m [0-1 ft]), and LAP-4L-025 (3.6-4.9 m [12-16]) (Figure 3-3). SPL samples were collected and prepared using the same methods as REG samples, and were sent to separate laboratories from the REG samples for analyses using the same analytical methods to ensure direct comparison.

All of the 41 locations were sampled with soil sampling depth intervals that included surface soil (0.0 to 0.3 m [0 to 1 ft] bgs), subsurface soil (0.3 to 1.2 m [1 to 4 ft] bgs), and deep soil (1.2 to 2.4 m and 2.4 to 3.6 m [4 to 8 ft and 8 to 12 ft] bgs), unless samples were unable to be collected due to waste in the sample core or no recovery of deep soil in the sample barrel. At three locations of the LRP 131-4L subunit (LAP4L-016, LAP4L-020, and LAP4L-026), the bottom of the pit was confirmed in previous intervals and the tentative interval from 3.6 to 4.9 m (12 to 16 ft) bgs was not sampled. At 33 locations (LAP4L-001 to LAP4L-015, LAP4L-017 to LAP4L-019, LAP4L-021 to LAP4L-025, LAP4L-027 to LAP4L-029, LAP4L-031, LAP4L-033 to LAP4L-034, and LAP4L-036 to LAP4L-039), sampling was completed at 3.6 to 4.9 m (12 to 16 ft) bgs because the bottom of the pit was not confirmed, or waste was determined in the previous sampling depth. At four locations (LAP4L-032, LAP4L-035, LAP4L-040, and LAP4L-041), sampling was completed

is consistent with expected building materials and the time period that the LRP 131-4L subunit was in operation.

Exceedances of trigger levels for gross alpha (20 pCi/g) and nonvolatile beta (50 pCi/g) prompted analyses of a contingent set of additional radiological analyses. No samples exceeded the nonvolatile beta trigger level. However, at the LRP 131-4L subunit, 44 of 60 samples (73%) collected from soil boring locations within the subunit interior exceeded the alpha trigger, with a median result of 23.3 pCi/g and maximum of 44.8 pCi/g. From all LRP 131-4L subunit samples, 109 of 192 samples (57%) exceeded the gross alpha trigger, with a median result of 21.7 pCi/g and maximum of 44.8 pCi/g. Eleven SPL samples were collected from the LRP 131-4L subunit and analyzed by a separate laboratory using the same collection, preparation, and analytical methods with ~~had~~ no trigger level exceedances, with a maximum of 12.7 pCi/g. The SPL samples were analyzed by alpha spectroscopy for a full alpha speciation, and results show the contributing alpha emitting radionuclides were NORM species and were within site background levels (Table 3-4).

There is no history or any indication that radioactive material was ever sent to the LRP 131-4L subunit. To verify the origin of the elevated gross alpha results, a subset of the total samples that exceeded the gross alpha trigger were selected for full alpha spectroscopy using the rationale in Table 3-2 before moving forward with a decision on the remaining samples. Alpha spectroscopy results from the subset of samples support that the gross alpha exceedances are from NORM contributions only (Table 3-5). Therefore, the remaining samples with gross alpha results exceeding the 20 pCi/g threshold were not analyzed for alpha speciation.

3.3 Unit-Specific Constituent Screening

A data evaluation to determine the nature and extent of contamination at the ECODS L-3, LRP 131-1L, and LRP 131-4L OU was conducted by comparing soil data for all depth intervals to SRS background data represented in *Appendix B-2 Upland Soils (All Depth Intervals)* of the approved *Background Soils Statistical Summary Report for the Savannah River Site* (WSRC 2006). A constituent for which the maximum concentration is greater than two-times (2X) the SRS background mean concentration is more likely to be present from unit-related activities and is identified as a unit-specific constituent (USC). Constituents for which no background

Update (USEPA 2018a) and the Los Alamos National Laboratory (LANL) *EcoRisk Database* (LANL 2022).

The ERA is conducted by comparing constituent concentrations in environmental media within each subunit~~, including soil, sediment, and surface water~~ with regulatory or technically defensible screening values called ecological screening values (ESVs), as well as two-times (2X) the mean background concentration in SRS soil (WSRC 2006). Constituents that are less than an ESV are eliminated from further consideration in the ERA, while those that both exceed an ESV, and background are identified as COPECs and are retained for further examination by calculating refinement-level hazard (ecological HQs) using refinement screening values. Constituents with an ecological HQ greater than 1 are identified as COPCs and brought forward in an uncertainty evaluation.

A recommendation of whether a constituent is identified as a RCOC is made following a refinement step. This step considers the following lines of evidence (same as HHRA):

- Unit-related uncertainty related to the nature and extent of contamination, consistency with history of use, and presence in background.
- Data quality and risk assessment uncertainties related to data quality and physical characteristics.
- Risk assessment uncertainty related to toxicity data and changes in constituent concentrations, or lack thereof, due to natural decay or transformation.

The results of this process identify if a remedial action will need to be evaluated to protect ecological receptors. RAOs for protection of ecological receptors are developed for constituents identified as RCOCs as discussed in more detail in Chapter 4.

3.7 Principal Threat Source Material Methodology

The PTSM evaluation for the ECODS L-3, LRP 131-1L, and LRP 131-4L OU is presented in Appendix E. The concept of principal threat waste and low-level threat waste, as developed by the USEPA in the NCP (40 CFR 300.430[a][1][iii]), is to be applied on a site-specific basis when characterizing source material. Source materials include or contain hazardous substances,

historical photographs and a GPR survey completed in 2002 during a SE of the subunit, it was estimated that waste disposed of in the ECODS L-3 subunit was buried in two trenches located end-to-end (Figure 3-1). The 2002 SE effort determined the two trench dimensions were ~15 m (50 ft) wide by 27 m (90 ft) long and 4.6 m (15 ft) wide by 27 m (90 ft) long.

3.8.1.2 ECODS L-3 Subunit Characterization and Data Summary

A SE characterization effort in 2002 performed a radiological control survey, a GPR survey, and soil sampling (WSRC 2003). The SE soil sampling effort collected ~~90~~81 REG samples from 5 depth intervals at 23 locations (Figure 3-1) and were analyzed for the complete list of TAL constituents (inorganics) and the TCL of organic compounds, pesticides, and PCBs. The Core Team agreed at the December 2021 scoping meeting that the definitive level data from the SER was considered usable for the purposes of performing a BRA to support remedial decision making; therefore, the ECODS L-3 subunit was not included in the RFI/RI Work Plan (SRNS 2022). Depth to groundwater at the subunit is 7.6 m (25 ft) bgs.

The locations sampled for the ECODS L-3 subunit include 18 locations within the subunit boundary and five locations designated as background locations. Sampling was completed at all 23 locations with a total of 90 samples (81 REG, 9 FD) collected (Figure 3-1). Sampling intervals were dependent on the depth that waste was observed in sample core. Of the 18~~23~~ locations within the subunit boundary, thirteen sampling locations collected samples from three sample intervals: 0.0 to 0.3 m, 0.3 to 1.2 m, and 1.2 to 2.4 m (0 to 1 ft, 1 to 4 ft, and 4 to 8 ft) bgs. Three sampling locations collected samples from four sample intervals: 0.0 to 0.3 m, 0.3 to 1.2 m, 1.2 to 2.4 m, and 2.4 to 3.7 m (0 to 1 ft, 1 to 4 ft, 4 to 8 ft, and 8 to 12 ft) bgs. Two~~Seven~~ sampling locations collected samples from five intervals: 0.0 to 0.3 m, 0.3 to 1.2 m, 1.2 to 2.4 m, 2.4 to 3.7 m, and 3.7 to 4.9 m (0 to 1 ft, 1 to 4 ft, 4 to 8 ft, 8 to 12 ft, and 12 to 16 ft) bgs. The five background sampling locations collected samples from four sample intervals: 0.0 to 0.3 m, 0.3 to 1.2 m, 2.4 to 3.7 m, and 3.7 to 4.9 m (0 to 1 ft, 1 to 4 ft, 8 to 12 ft, and 12 to 16 ft) bgs. During sampling activities, the presence of waste was noted to include glass, metal, and rubber.

3.8.1.3 ECODS L-3 Subunit Nature and Extent of Contamination

The radiological control survey designated the ECODS L-3 subunit area as a "Clean Area." The GPR survey estimated the ECODS L-3 subunit boundary and estimated the depth as ~7.3 m (24 ft). However, during soil sampling, the bottom of the two trenches within the subunit was confirmed at depths of 3.4 m (11 ft) bgs or less.

Constituents identified as USCs for the ECODS L-3 subunit are shown in Appendix A. Maximum soil concentrations above detection were compared against two-times (2X) the SRS mean background concentrations (WSRC 2006), if applicable, to determine if the constituent was a USC. Constituents above detection limits and constituents without an SRS mean background were considered USCs. The primary contaminants at the ECODS L-3 subunit are inorganics (metals) and semi-volatile organic compounds (SVOCs). An asbestos survey has not been completed at the subunit; however, due to the dates of operation and based on similar waste units at SRS, ACM is assumed to be present at the ECODS L-3 subunit.

For all soil depths at the ECODS L-3 subunit, the following constituents were identified as USCs in one (1) or more sample(s): 1,1'-biphenyl; 1,1-dichloroethylene; 2-methylnaphthalene; acenaphthene; acetone; aluminum; anthracene; antimony; Aroclor 1254; Aroclor 1260; arsenic; barium; benzaldehyde; benzene; benzo(g,h,i)perylene; benzo(a)anthracene; benzo(a)pyrene; benzo(b)fluoranthene; benzo(k)fluoranthene; bis(2-ethylhexyl)phthalate (DEHP); cadmium; calcium; carbazole; carbon disulfide; chromium; chrysene; cobalt; copper; cyanide; dichlorodiphenyldichloroethylene (DDE); dichlorodiphenyltrichloroethane (DDT); dibenz(ah)anthracene; dibenzofuran; dichloromethane (methylene chloride); di-n-butyl phthalate; fluoranthene; fluorene; indeno(1,2,3-cd)pyrene; iron; lead; magnesium; manganese; methyl ethyl ketone; methyl tertiary butyl ether; mercury; naphthalene; nickel; phenanthrene; potassium; pyrene; ~~selenium;~~ sodium; styrene; toluene; vanadium; xylenes; and zinc. Soil sampling at the ECODS L-3 subunit is sufficient enough to determine the nature and extent of contamination and the presence or absence of problems warranting response action. The highest concentrations are relatively immobile. A CM analysis has been performed as described in Section 3.8.1.4.

Results of the CM analysis indicates that the contaminants at the LRP 131-1L subunits are not a potential source for groundwater contamination.

3.8.2.5 LRP 131-1L Subunit Human Health Risk Assessment Results

The HHRA includes risk calculations for the resident and industrial worker scenarios for the LRP 131-1L subunit soil media (Appendix C).

Results of each step of the HHRA for soil media for the LRP 131-1L subunit are summarized below.

- HH COPCs: aluminum, arsenic, cesium-137, chromium, iron, manganese, vanadium, uranium-235 and uranium-238 (thorium-230). These constituents had maximum detected concentrations that exceeded HH (residential) risk-based screening levels and exceeded two-times (2X) SRS mean background concentrations (WSRC 2006).
- HH COCs include the following:
  - Resident scenario: arsenic, cesium-137, chromium, uranium-235, and uranium-238.
  - Industrial worker scenario: arsenic, cesium-137, chromium, uranium-235, and uranium-238.
- HH RCOCs include the following:
  - Resident scenario: none.
  - Industrial worker scenario: none.

3.8.2.6 LRP 131-1L Subunit Ecological Risk Assessment Results

The ERA includes risk calculations for the ecological receptors for the LRP 131-1L subunit soil media (Appendix D).

Results of each step of the ERA for the soil media are summarized below.

- ECO COPECs:
  - Surface soil (0 to 0.3 m [0 to 1 ft]): aluminum, americium-243, chromium, copper, curium-245/246, cyanide, iron, lead, lead-214, and vanadium.

received inert rubble from the L-Area Powerhouse Stack and Silo demolition (Dupont 1983a and DuPont 1983b). The rubble consisted primarily of concrete and asphalt material with some metal. The unlined pit was reported to have operated from 1973 to 1983 before it was filled and seeded in 1983. Operating procedures indicate it was to receive inert, non-hazardous materials and there are no records indicating any disposal of hazardous or radioactive materials. The subunit is located within the Steel Creek Watershed.

3.8.3.2 LRP 131-4L Subunit Characterization and Data Summary

The LRP 131-4L subunit was included in the 2022 RFI/RI characterization. The RFI/RI characterization effort started with a GPR survey to delineate the lateral and vertical extent of the subunit. Soil sampling of the LRP 131-4L subunit was completed in accordance with the RFI/RI Work Plan (SRNS 2022). Sampling consisted of 41 total sample locations for a total of 220~~226~~ samples (192~~198~~ REG, 11 FD, 11 SPL, and 6 RB) collected (Figure 3-3). Fifteen~~Seven~~ samples were unable to be collected due to waste material within the sampling depth or no deep soil recovered in sample barrel. There were fourteen interior sample locations within the original boundary of the subunit, completed in a random, unbiased sampling pattern spaced 6.1 m (20 ft) apart within the subunit. Along the original subunit boundary, delineated by the orange ball markers, eleven peripheral sample locations were identified. Eight sample locations were included to investigate the area northeast of the subunit, where debris was observed on surface. Four sample locations were included to bound an area of subsidence that was identified on the northern side of the subunit during site walkdowns. Four step-out sample locations were identified northwest of the subunit as contingent locations based on field observations.

All of the 41 locations were sampled with soil sampling depth intervals that included surface soil (0.0 to 0.3 m [0 to 1 ft] bgs), subsurface soil (0.3 to 1.2 m [1 to 4 ft] bgs), and deep soil (1.2 to 2.4 m and 2.4 to 3.6 m [4 to 8 ft and 8 to 12 ft] bgs), unless samples were unable to be collected due to waste in the sample core or no recovery of deep soil in the sample barrel. At three locations of the LRP 131-4L subunit, the bottom of the pit was confirmed in previous intervals and the tentative interval from 3.6 to 4.9 m (12 to 16 ft) bgs was not sampled. At 33~~32~~ locations, sampling was completed at 3.6 to 4.9 m (12 to 16 ft) bgs because the bottom of the pit was not confirmed, or waste was determined in the previous sampling depth. At four locations, sampling was completed

With the results of the HHRA, ERA, PTSM, and CM evaluations, the preliminary CSMs (Figure 2-12 through 2-14) were revised to refined CSMs (Figures 3-9 through 3-11) to provide a visual summary of potential risks/hazards for each receptor by exposure route. Filled circles within boxes beneath applicable receptors indicate a potential unacceptable exposure as a result of a quantitative evaluation. Below is a summary of the elements of the refined CSMs by exposure medial in which potential impacts are noted.

3.9.1 ECODS L-3 Subunit

Figure 3-9 presents the refined CSM for the ECODS L-3 subunit. Soil media and its potential for migration to groundwater were evaluated. ACM is presumed to be present in unit soils, based on the waste history at other ECODS, that may pose a risk to human receptors if exposed and will require further evaluation in the CMS/FS.

3.9.2 LRP 131-1L Subunit

Figure 3-10 presents the refined CSM for the LRP 131-1L subunit. Soil media and its potential for migration to groundwater were evaluated. The CSM presents that no further evaluation of surface, subsurface, or deep soils within the subunit is required in the CMS/FS based on results of the HHRA, ERA, CM, and PTSM evaluations.

3.9.3 LRP 131-4L Subunit

Figure 3-11 presents the refined CSM for the LRP 131-4L subunit. Soil media and its potential for migration to groundwater were evaluated. An asbestos survey has not been completed at the subunit; however, presumed ACM was identified by an SRS asbestos inspector. Therefore, ACM is considered a problem warranting response action and will be addressed by the selected remedy.~~ACM is presumed to be present in unit soils, based on the waste history at other ECODS, that may pose a risk to human receptors if exposed and will require further evaluation in the CMS/FS.~~

3.10 Applicable or Relevant and Appropriate Requirements Evaluation

Analytical data are compared to the chemical-specific ARARs. Chemical-specific ARARs or to-be-considered (TBC) requirements exist under federal and state regulations for lead and PCBs.

For lead in soil, the CERCLA value of 400 mg/kg was set by the USEPA Office of Solid Waste Emergency Response and adopted as a TBC for the screening process. At the ECODS L-3 subunit, one (1) of the 61 REG~~81 total~~ soil samples from all soil depth intervals within the subunit boundary was above this concentration. The maximum detected concentration of lead is 1,300 mg/kg from location EL3-06 (0 to 0.3 m [0 to 1 ft] interval. The ARAR TBC screening threshold corresponds to the residential RSL of 400 mg/kg. The 95% UCL in surface soil is 214 mg/kg and the residential HQ is 0.54 (RSL 400 mg/kg). The all-depths soils mean concentration is 49.5 mg/kg. The isolated lead hotspot is not deemed significant enough to warrant a remedial response, and lead is not identified as an ARAR RCOC.

PCBs are governed by the TSCA (40 CFR Part 761). The final rule for PCB disposal was established on August 20, 1998 (as amended); it addresses residual levels of PCB remediation waste that can be left in place. Action levels are based on site-specific conditions.

The regulatory criteria for PCB remediation waste, as defined by 40 CFR 761.50(b)(3), requires action under TSCA for as-found concentrations ≥50 parts per million (ppm) that was either placed in a land disposal facility, spilled, or otherwise released into the environment prior to April 18, 1978. Disposal at the ECODS L-3 subunit took place from November 1953 to June 1954, and the soil concentrations are ≤50 ppm; therefore, no cleanup is required under TSCA and the TSCA ARAR is not applicable.

PCB remediation waste is regulated by the requirements of 40 CFR 761.61. The self-implementing cleanup option under 40 CFR 761.61(a) establishes cleanup levels of 1 mg/kg and 25 mg/kg for high and low occupancy sites, respectively.

At the ECODS L-3 subunit, PCBs are present in surface soil at concentrations above the high occupancy, free-release threshold of 1.0 mg/kg. The maximum Aroclor 1254 result was 5.63 mg/kg and the maximum Aroclor 1260 result was 2.17 mg/kg. Therefore, Aroclor 1254 and Aroclor 1260 were retained as ARAR RCOCs and identified as problems warranting action for the ECODS L-3 subunit.

Per the self-implementing cleanup option outlined in 40 CFR 761.61(a), the PCB contamination at the ECODS L-3 subunit is above the high occupancy cleanup level of 1 mg/kg but below the

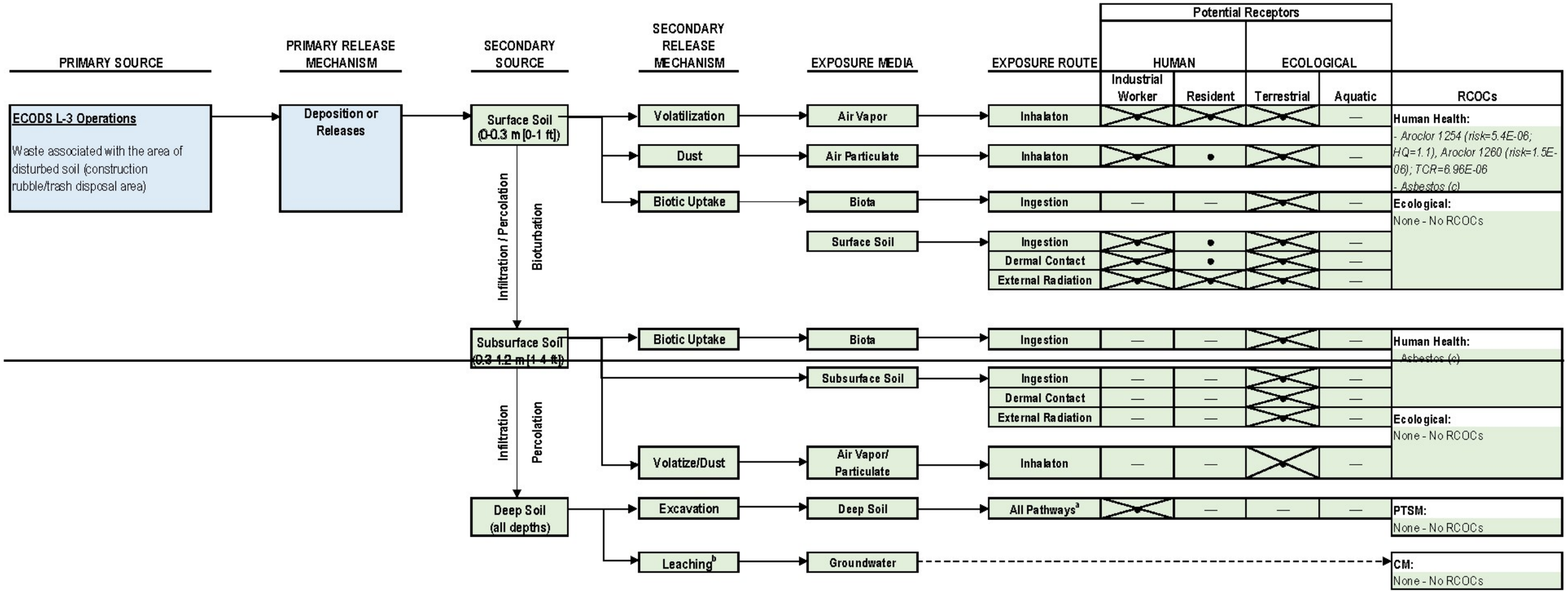
low occupancy cleanup level of 25 mg/kg. Under TSCA, the ECODS L-3 subunit is considered low occupancy. Therefore, under the low occupancy self-implementing clean up level, no further action is required under TSCA.

40 CFR 761.61(c) allows for a risk-based approval for consideration of alternative cleanup levels. This CERCLA Combined Document meets the substantive requirements of the risk-based approval request, and no additional TSCA documentation will be required.

The residential RSL that is used to evaluate risk to the hypothetical resident (0.24 mg/kg) is more restrictive than the high occupancy cleanup levels (1 mg/kg), therefore, PCBs are retained as an RCOC.

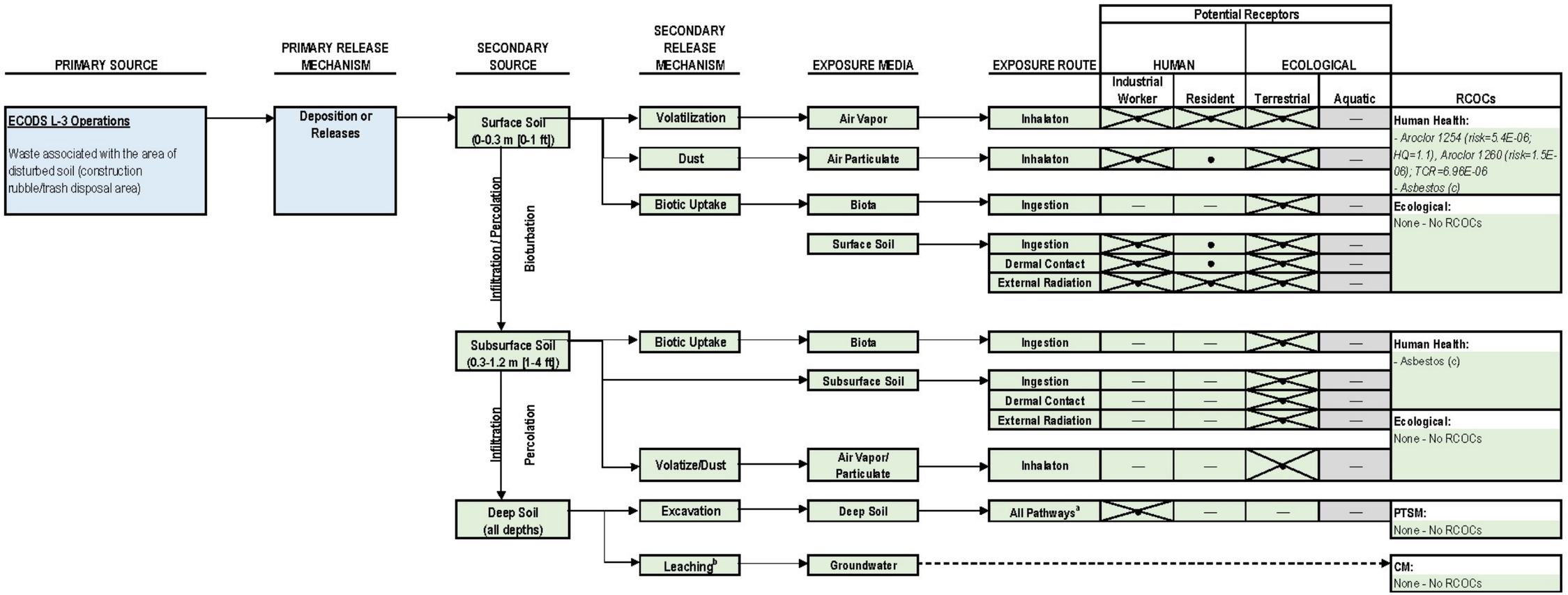
3.11 Natural Resource Injury Evaluation

The NRIE Checklist and supporting descriptions are provided in Appendix G. The purpose of the NRIE Checklist is to identify potential natural resource injuries associated with CERCLA remedial activities. Based on the NRIE Checklist, natural resources in the locale have been impacted by hazardous substances from the unit. Remedial alternatives under consideration may or may not address injuries to the natural resources. Remedial alternatives considered may cause additional injury based on the scope of the action (e.g., excavation). No irreversible resource losses are known to exist.



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.
c - Asbestos Containing Material (ACM) is likely present in unit soils that may pose a risk to human receptors if exposed.

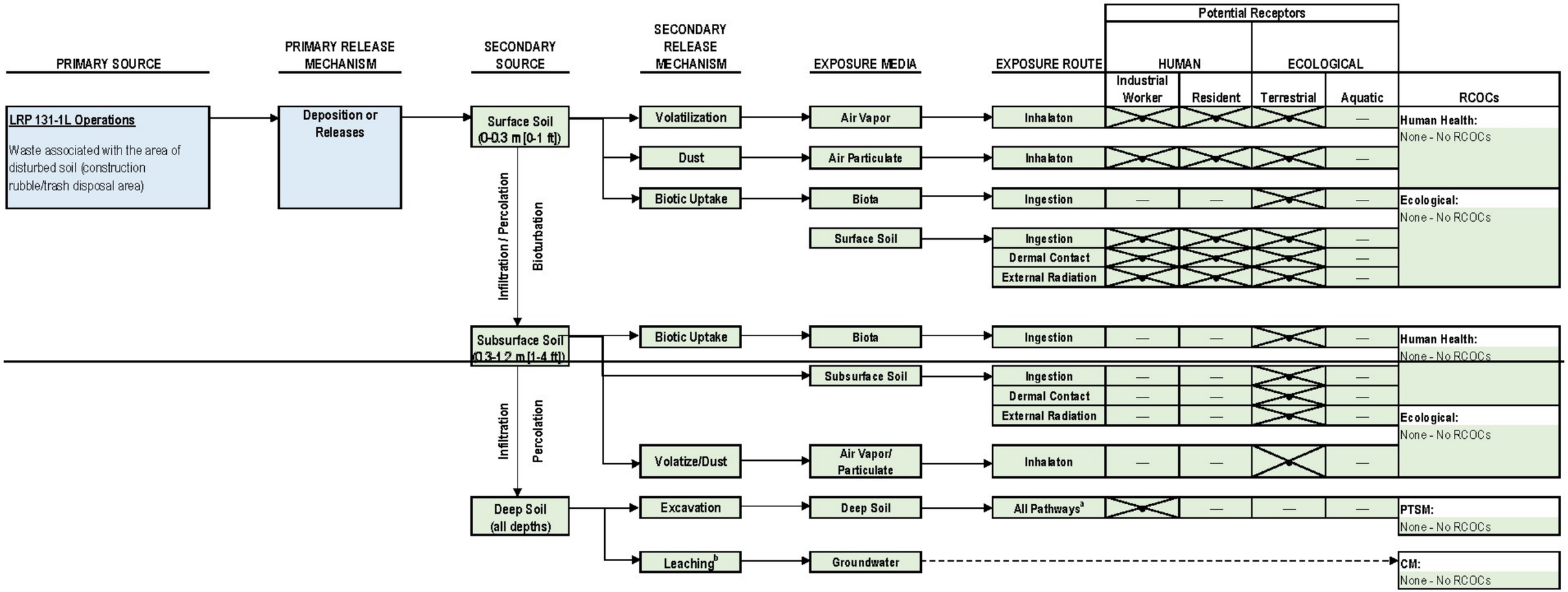
→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis
X - Complete exposure pathway, no RCOCs identified



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.
c - Asbestos Containing Material (ACM) is likely present in unit soils that may pose a risk to human receptors if exposed.
- Receptors shaded gray were considered, but were determined not to be applicable to the subunit.

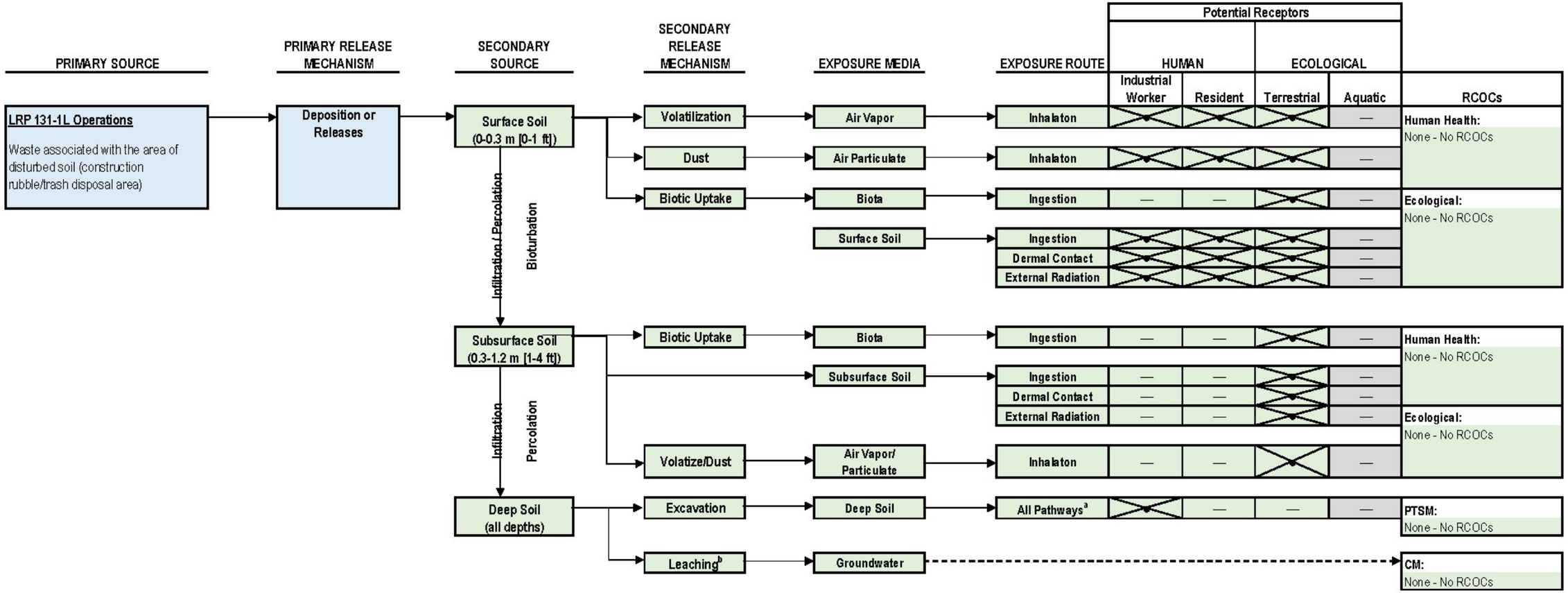
→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis
X - Complete exposure pathway, no RCOCs identified

Figure 3-9. Refined Conceptual Site Model for the ECODS L-3 Subunit



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.
c - Asbestos Containing Material (ACM) is present in subsurface soils (i.e., > 1 ft) that may pose a risk to human receptors

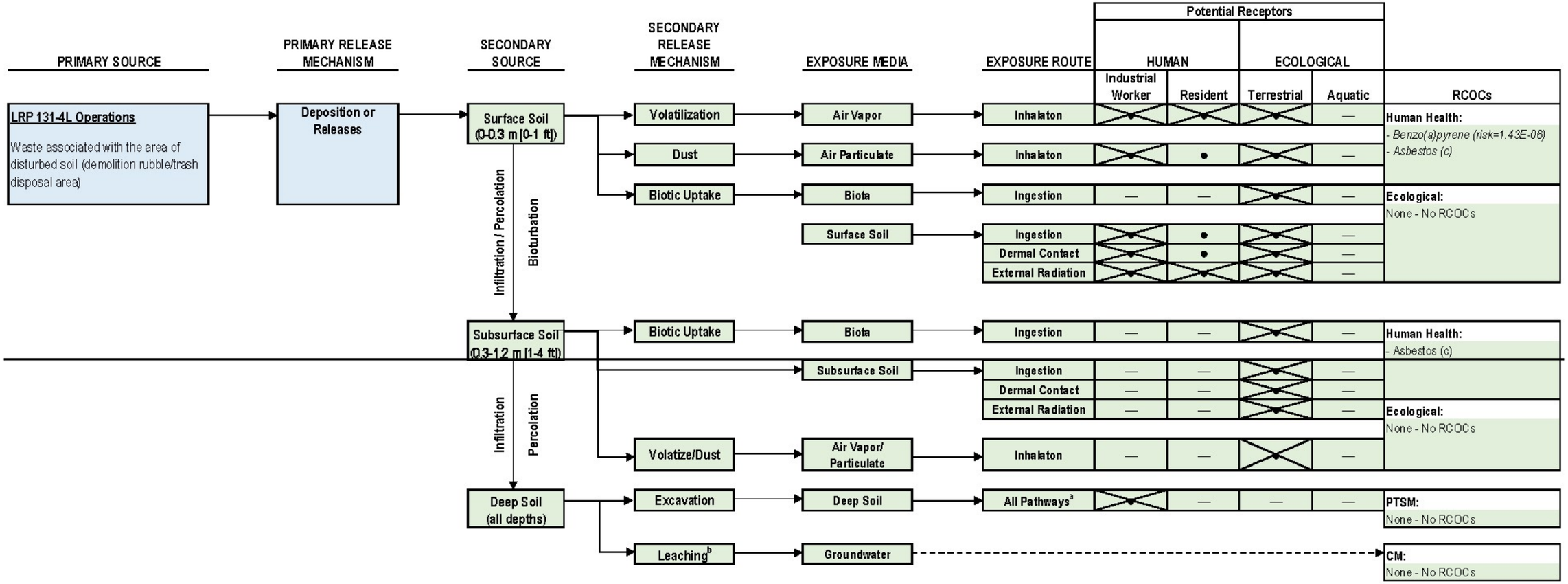
→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢- Contaminant migration analysis
X - Complete exposure pathway, no RCOCs identified



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.
c - Asbestos Containing Material (ACM) is present in subsurface soils (i.e., > 1 ft) that may pose a risk to human receptors
- Receptors shaded gray were considered, but were determined not to be applicable to the subunit.

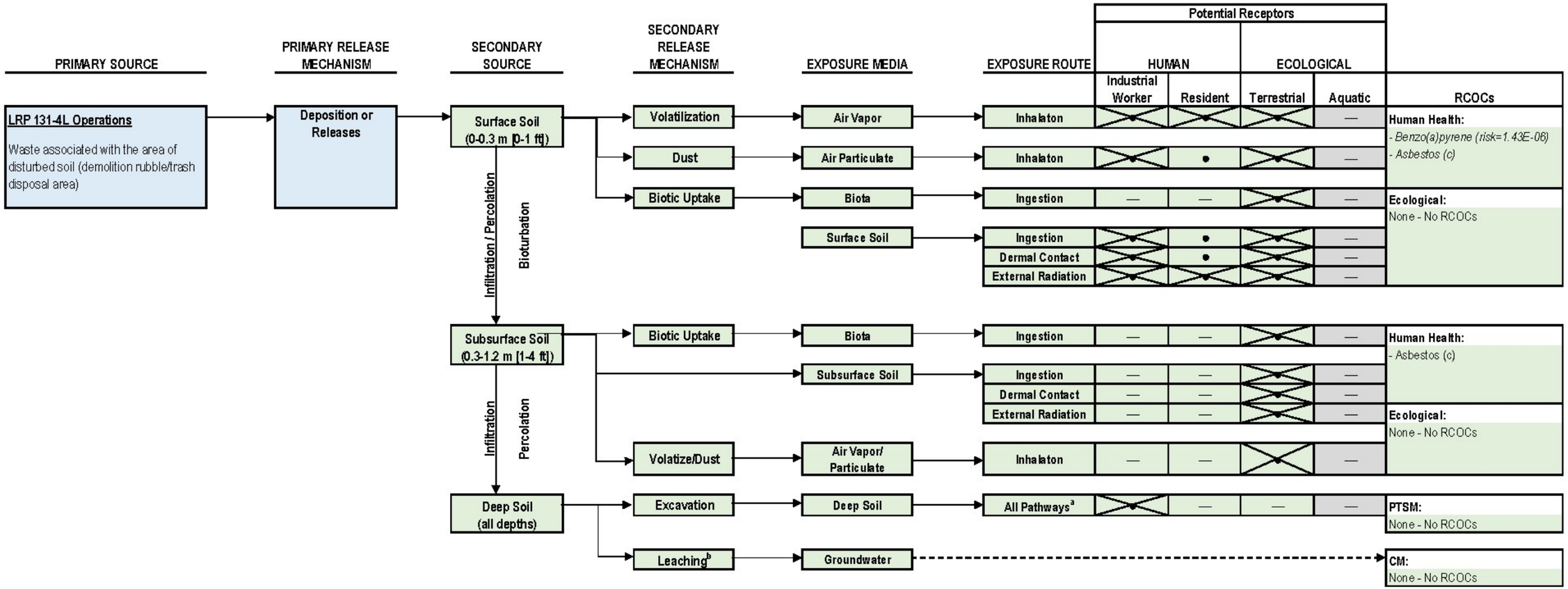
→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis
X - Complete exposure pathway, no RCOCs identified

Figure 3-10. Refined Conceptual Site Model for the LRP 131-1L Subunit



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.
c - Asbestos Containing Material (ACM) is present in unit soils that may pose a risk to human receptors if exposed.

→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis
X - Complete exposure pathway, no RCOCs identified



a - "All Pathways" represents ingestion, inhalation, dermal contact, and external radiation exposure for the principal threat source material (PTSM) evaluation for toxicity.
b - Leaching represents the potential of a contaminant in soil or sediment to migrate to groundwater above MCLs per the contaminant migration (CM) analysis and does not represent a human health or ecological exposure route.
c - Asbestos Containing Material (ACM) is present in unit soils that may pose a risk to human receptors if exposed.
- Receptors shaded gray were considered, but were determined not to be applicable to the subunit.

→ - Pathways: current, historic, and future
● - Complete exposure pathway for quantitative evaluation
O - Complete exposure pathway for qualitative evaluation
— - Incomplete exposure pathway
⇢ - Contaminant migration analysis
X - Complete exposure pathway, no RCOCs identified

Figure 3-11. Refined Conceptual Site Model for the LRP 131-4L Subunit

- ACM is likely present in unit soils that may pose a risk to human receptors if exposed.
- PCBs are present in the surface soil that pose a risk greater than 1.0E-06 and a HQ greater than 1 to the hypothetical resident receptor scenario.
- PCBs are present in surface soil that exceed the TSCA ARAR threshold of 1 mg/kg for high occupancy (i.e., unrestricted land use).

Based on the problems warranting action, the following RAOs, as agreed by the Core Team in the March 2024 scoping meeting, apply for the ECODS L-3 subunit:

- Prevent exposure of human receptors to presumed ACM that is likely present in unit soils if exposed.
- Prevent exposure of a ~~hypothetical~~future resident to Aroclor 1254 and Aroclor 1260 in surface soils at levels exceeding 1.0E-06 risk and HQ of 1.
- Prevent exposure of human receptors to Aroclor 1254 and Aroclor 1260 in surface soils at levels exceeding ARAR threshold of 1 mg/kg.

4.1.2 LRP 131-1L Subunit

According to the analysis performed in Appendices B (CM), C (HHRA), D (ERA), and E (PTSM), and the results summarized in Chapter 3, there are no CM, HH, ECO, or PTSM RCOCs identified for the LRP 131-1L subunit.

There are no problems warranting action identified for the LRP 131-1L subunit.

4.1.3 LRP 131-4L Subunit

According to the analysis performed in Appendices B (CM), C (HHRA), D (ERA), and E (PTSM), and the results summarized in Chapter 3, there are no CM, ECO, or PTSM RCOCs identified for the ECODS L-3 subunit. However, benzo(a)pyrene was identified as a HH RCOC for the hypothetical resident. Additionally, ACM is present in subsurface soils.

The following problems warranting action are identified for the LRP 131-4L subunit:

4.2.1 Contaminant Migration Preliminary Remediation Goals

The CM analysis is presented in Appendix B of this document. No CM RCOCs were identified for any subunits within the ECODS L-3, LRP 131-1L, and LRP 131-4L OU. Therefore, no CM PRGs are developed.

4.2.2 Human Health Preliminary Remediation Goals

The HHRA is presented in Appendix C of this document. Aroclor 1254 and Aroclor 1260 were identified as HH RCOCs in surface soil media at the ECODS L-3 subunit for the resident scenario (Figure 4-1 and Figure 4-2). Aroclor 1254 and Aroclor 1260 were detected above residential PRGs at three locations, EL3-03, EL3-04, and EL3-16. Benzo(a)pyrene was identified as a HH RCOC in surface soil at the LRP 131-4L subunit for the resident scenario (Figure 4-3). Benzo(a)pyrene was detected above residential PRGs at four locations, LAP-4L-025, LAP-4L-032, LAP-4L-034, and LAP-4L-039. The range of HH PRGs (risk = 1E-04 to 1E-06, HQ = 0.1 to 3) for the RCOCs at the ECODS L-3 and LRP 131-4L subunits are provided in Appendix F.

No HH RCOCs were identified for LRP 131-1L subunit. Therefore, no HH PRGs are developed for the LRP 131-1L subunit.

4.2.3 Ecological Preliminary Remediation Goals

The ERA is presented in Appendix D of this document. No ECO RCOCs were identified for any subunits within the ECODS L-3, LRP 131-1L, and LRP 131-4L OU. Therefore, no ECO PRGs are developed.

4.2.4 Principal Threat Source Material Preliminary Remediation Goals

The PTSM analysis is presented in Appendix E of this document. No PTSM RCOCs were identified for any subunits within the ECODS L-3, LRP 131-1L, and LRP 131-4L OU. Therefore, no PTSM PRGs are developed.

4.2.5 Applicable or Relevant and Appropriate Requirements Preliminary Remediation Goals

As presented in the RI (Chapter 3), there are no chemical-specific ARAR RCOCs identified for any media (i.e., soil) within the LRP 131-1L and LRP 131-4L subunits. For the ECODS L-3 subunit, PCBs (Aroclor 1254 and Aroclor 1260) were identified as ARAR RCOCs, exceeding the TSCA ARAR threshold of 1.0 mg/kg for high-occupancy (i.e., unrestricted land use), however, as noted in Section 3.10, the ARAR is not applicable. The PCB ARAR PRGs are provided in Appendix F for purposes of comparison.

4.3 Most Restrictive and Most Likely Preliminary Remediation Goals

The most restrictive of the range of HH PRGs is presented in Appendix F and is shown in Table 4-1 and Figure 4-1 through Figure 4-3 for the resident scenario only (i.e., no RCOCs were identified for the industrial worker scenario). When both a carcinogenic PRG (i.e., risk = 1E-06) and non-carcinogenic PRG (HQ = 1) are calculated for the same chemical, the more conservative of the two is presented. For the ECODS L-3 subunit, the PCB TSCA ARAR threshold for high-occupancy is presented for Aroclor 1254 and Aroclor 1260 for comparison, however, as described in Section 3.10, the ARAR is not applicable. Additionally, a range of background values is also presented in order to assist in the selection of the most restrictive, applicable PRG. The Most Likely PRG is the most restrictive (i.e., residential) risk-based concentration. If the risk-based PRG is less than the SRS background, then the SRS 95th percentile is identified as the Most Likely PRG.

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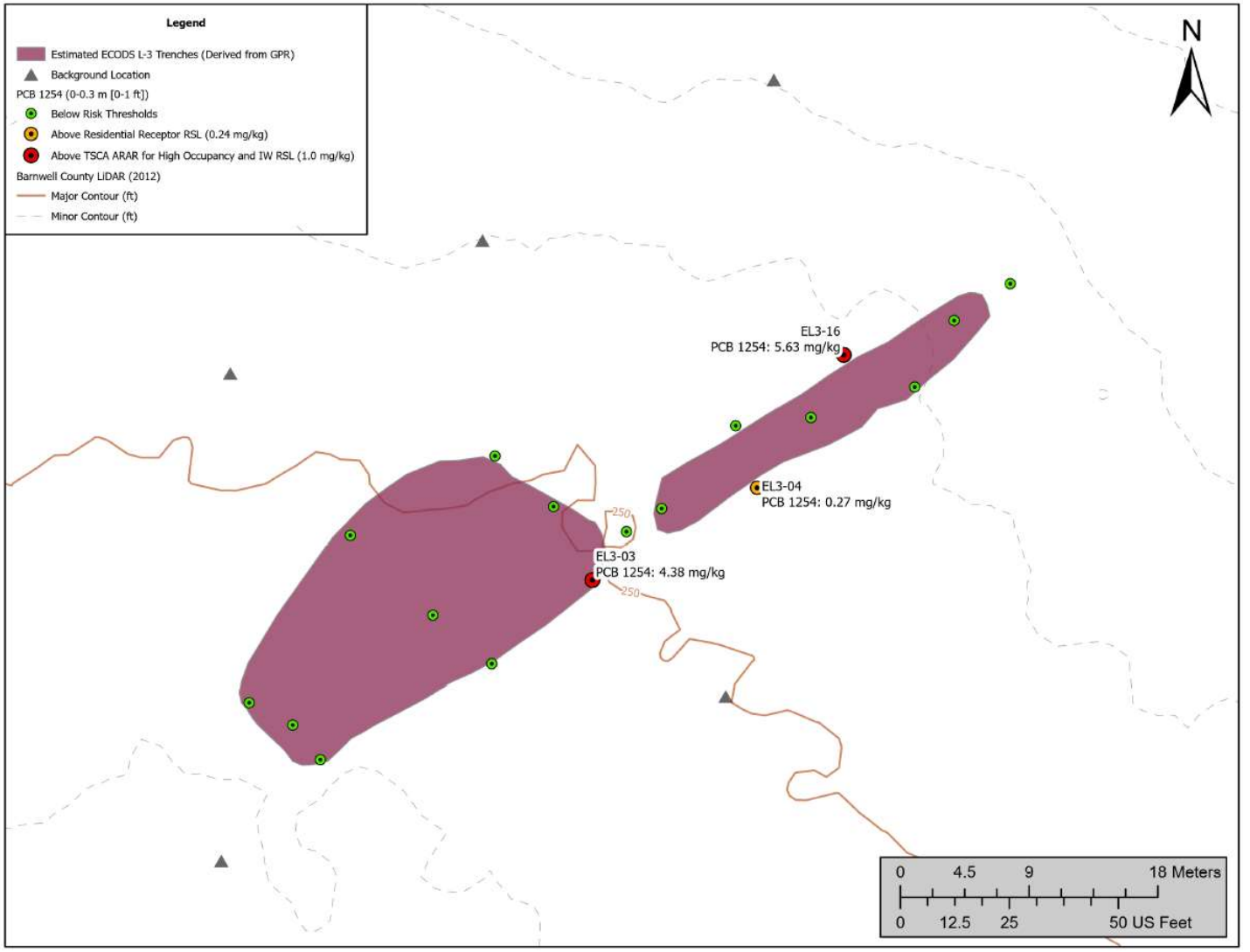

Figure 4-1. Aroclor 1254 Data for Surface Soil Media (0 to 0.3 m [0 to 1 ft]) at the ECODS L-3 Subunit

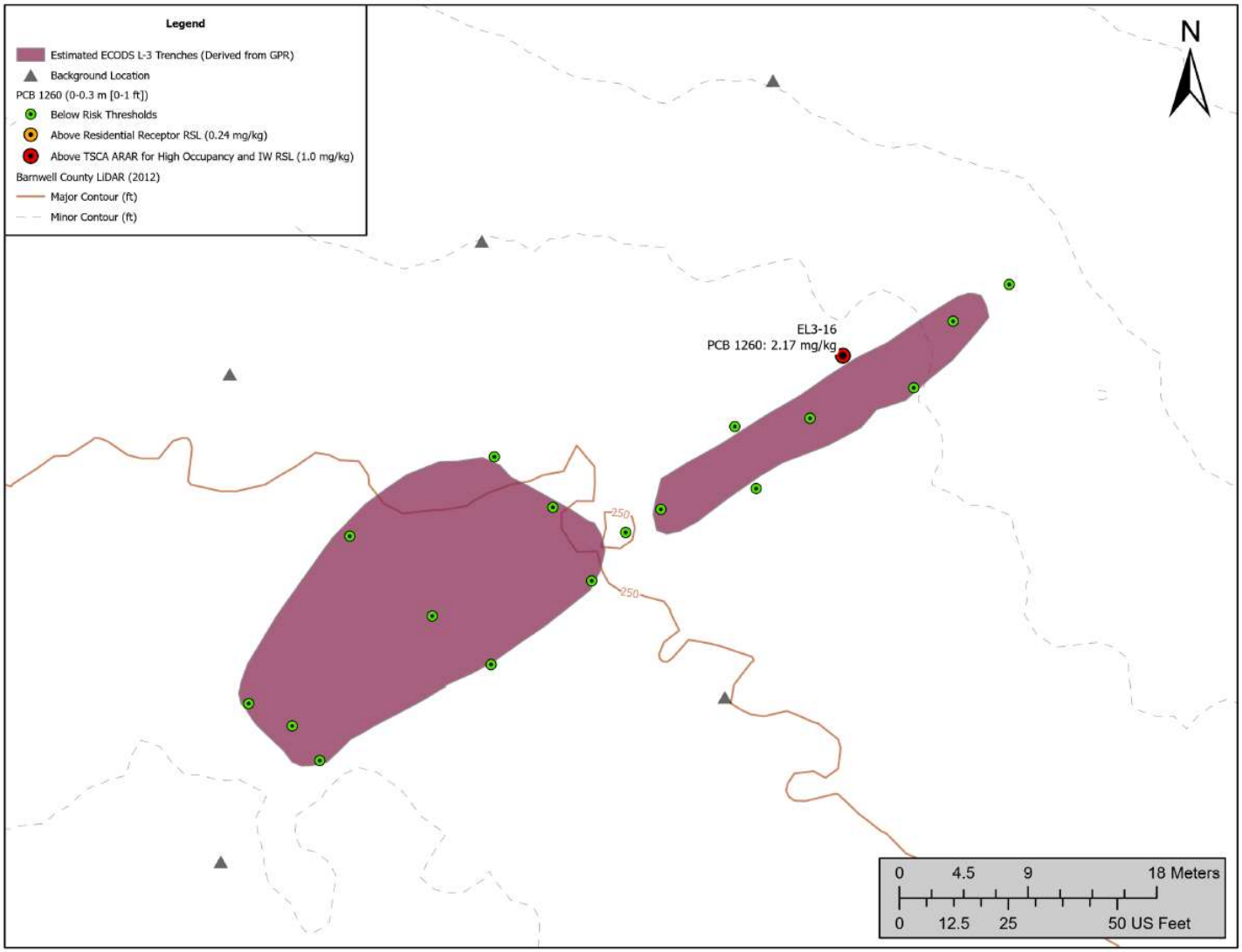

Figure 4-2. Aroclor 1260 Data for Surface Soil Media (0 to 0.3 m [0 to 1 ft]) at the ECODS L-3 Subunit

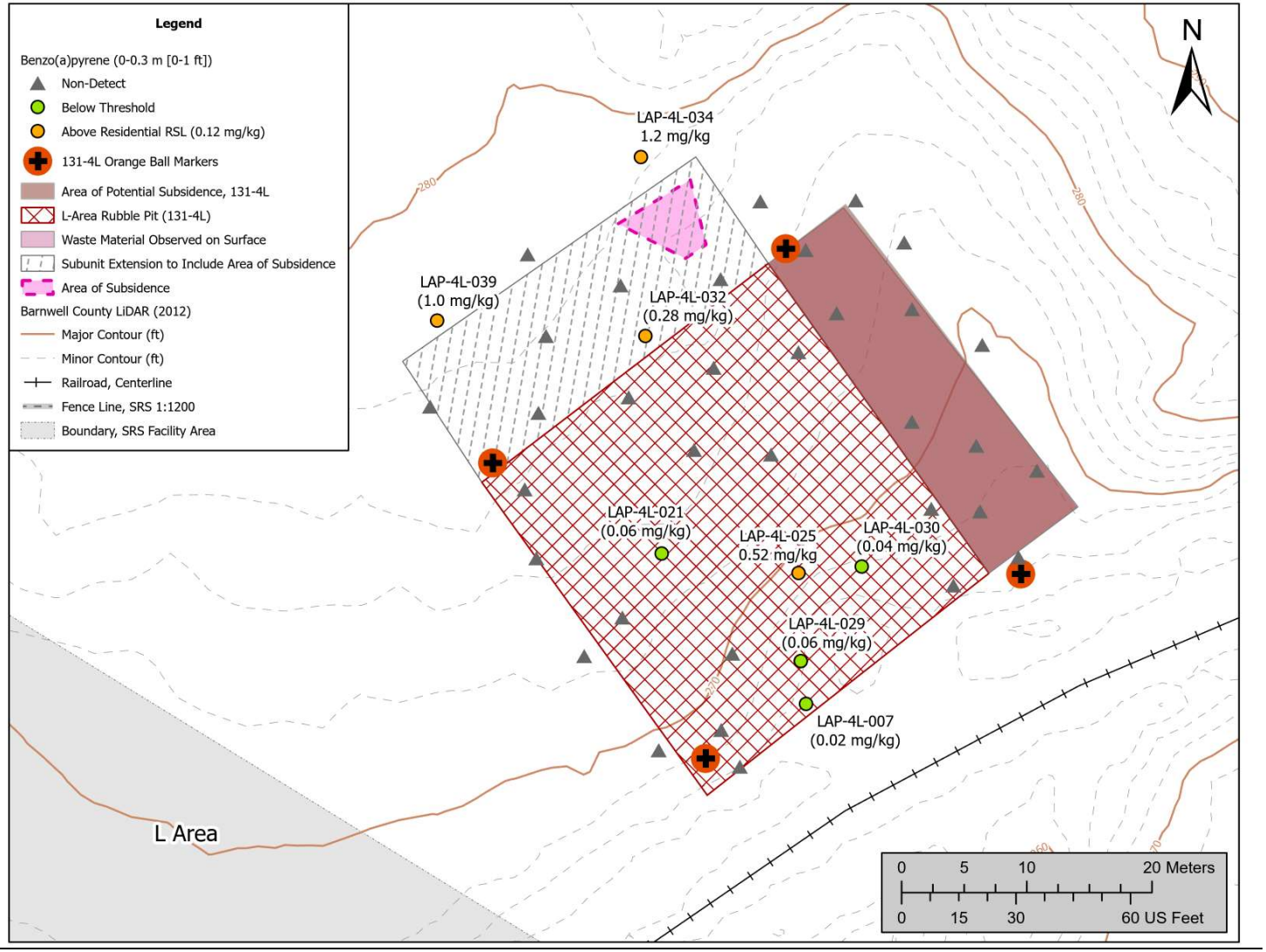

Figure 4-3. Benzo(a)pyrene Data for Surface Soil Media (0 to 0.3 m [0 to 1 ft]) at the LRP 131-4L Subunit

Table 4-1. Cleanup Levels (PRGs) for the ECODS L-3, LRP 131-1L, and LRP 131-4L OU

Media	HH RCOC	Units	Resident PRG[1]	ARAR PRG[2]	SRS Background 2X Average Concentration	SRS Background 95th Percentile[3]	SRS Background Maximum[3]	Most Likely PRG[4]
ECODS L-3 Subunit								
Soil	Aroclor 1254	mg/kg	*0.24*	1.0	NA[5]	NA[5]	NA[5]	0.24
Soil	Aroclor 1260	mg/kg	*0.24*	1.0	NA[5]	NA[5]	NA[5]	0.24
LRP 131-4L Subunit								
Soil	Benzo(a)pyrene	mg/kg	*0.12*	N/A[6]	0.025	0.036	0.008	0.12

1 – Resident PRGs are identified at risk = 1E-06 or HQ = 1 from Appendix F. For Aroclor 1254, the more conservative carcinogenic PRG is shown.
2 – For comparison purposes, the PCB TSCA ARAR threshold for high-occupancy is presented for Aroclor 1254 and Aroclor 1260 (see Section 3.10).
3 – SRS background concentrations from Background Soils Statistical Summary Report for the Savannah River Site (WSRC 2006), Appendix B-2 (all depths interval).
4 – Most Likely PRG is the most restrictive (i.e., residential) risk-based concentration. If the risk-based PRG is less than SRS background, then the SRS 95th percentile is identified as the Most Likely PRG. Source of the Most Likely PRG is identified in *italics*.
5 – Not available; SRS background concentrations not available for PCBs.
6 – Not applicable; not identified as an ARAR RCOC.

5.1.2.4 Excavation and Disposal

Excavation and disposal of contaminated media in an appropriate facility is one of the most aggressive approaches to remediation. Contaminated media could be excavated and hauled to an approved disposal facility. Removing contaminated media from the ECODS L-3, LRP 131-1L, and LRP 131-4L OU would lower risk levels for human receptors by permanently removing the contaminated media.

The earthwork required for excavating the contaminated media is a standard construction practice and is readily accomplished. The action is highly effective in eliminating risk to human and ecological receptors due to the permanence of the removal. The cost of this action could be substantial based upon the volume of contaminated media present and the distance the media must be hauled to an approved waste disposal facility. Excavation and disposal will be retained for further consideration in the development of alternatives.

5.2 Development and Screening of Alternatives

Potential alternatives have been developed to address the contaminated media at the ECODS L-3 and LRP 131-4L subunits. In accordance with the NCP, it is desirable to offer a range of diverse alternatives to compare during the detailed analysis. The range of alternatives includes options that 1) restrict exposure to contaminated media; 2) reduce exposure to contaminated media and require the need for long-term management; and 3) removes all contaminant volume eliminating all exposure to contaminated media. As required by the NCP, the No Action alternative is provided as a baseline for comparison.

The RAOs identified for the ECODS L-3 subunit soil media are:

- Prevent exposure of human receptors to presumed ACM that is likely present in unit soils if exposed.
- Prevent exposure of a ~~hypothetical~~future resident to Aroclor 1254 and Aroclor 1260 in surface soils at levels exceeding 1.0E-06 risk and HQ of 1.
- Prevent exposure of human receptors to Aroclor 1254 and Aroclor 1260 in surface soils at levels exceeding ARAR threshold of 1 mg/kg.

the subunit. Current access from 71-35.2 is via foot traffic for approximately 61 m (200 ft). The limit of disturbance would be ~0.2 ha (0.5 ac) to be cleared and grubbed. Construction of storm water management would be necessary to divert any runoff around the area during implementation of the alternative. Excavation would include removing ~~8,047~~6,728 m^3 (8,800 yd^3) of contaminated media to a depth of 3.7 m (12 ft) bgs. The excavated material would be directly loaded into roll-off containers and staged at the site. This alternative assumes that the wastes would ultimately be hauled to the Three Rivers Landfill for disposal following the route shown on Figure 5-2. After excavation of the soils, confirmatory soil samples would be taken to determine that clean up levels have been met. Once confirmed, the area would be backfilled using ~~8,047~~6,728 m^3 (8,800 yd^3) of clean fill and 223 m^3 (244 yd^3) of topsoil to fill the excavated areas to grade. The clean fill would be hauled to the site from an on-site borrow pit. A vegetative cover would be constructed using ~ 2,012 m^2 (2,200 yd^2) of fertilizer, lime, seed, and mulch.

Protection of Human Health and the Environment

By removing all contaminated media from the unit and backfilling to grade, exposure to the human receptors is eliminated. Because there are no ECO RCOCs, CM RCOCs, or PTSM identified for the ECODS L-3 subunit, no additional physical controls are needed for protection of the environment to prevent ecological exposure to contamination or to control migration of contaminants through environmental media. Alternative A-4 provides protection of human health and the environment and would achieve the identified RAOs. Alternative A-4 would not cause additional natural resource injury.

Compliance with ARARs

Table 5-4 lists the potential ARARs applicable to the ECODS L-3 subunit. The specific ARARs applicable to each alternative are listed below.

- ***Chemical-Specific ARARs***: 40 CFR 761.61 provides cleanup and disposal options for PCB remediation waste.
- ***Location-Specific ARARs***: No location-specific ARARs are associated with Alternative A-4.

Compliance with ARARs

No chemical-specific, location-specific, or action-specific ARARs are associated with the Alternative B-2.

Long-Term Effectiveness

The long-term effectiveness for protecting human health can be achieved under this alternative as long as LUCs are maintained. LUCs would be maintained until the concentration of hazardous substances in the media is at such levels to allow for unrestricted use and exposure. The timeframe for LUCs is assumed for 30 years of duration as a basis for a cost estimate. The actual time requirement would likely be longer, as PAHs and asbestos do not quickly degrade. Remedy reviews would be performed every five (5) years. A LUCIP would be prepared by the USDOE that describes the implementation and maintenance actions for the remedial action, including periodic inspections. Periodic inspections would be performed to ensure warning signs are in place and no unauthorized encroachment onto the controlled area is occurring. Signs would be replaced and/or repaired as needed and records for site use/site control permits would be maintained within the SRS infrastructure. The USDOE is responsible for implementing, maintaining, monitoring, reporting upon, and enforcing the LUCs. The LUCIP would remain in effect unless and until modifications are approved by the USEPA and SCDES as needed to be protective of human health and the environment.

Reduction of Toxicity, Mobility, or Volume

There is no reduction in the toxicity, mobility or volume of contaminated media associated with Alternative B-2. This alternative prevents human exposure to the contaminants through controlling access and limiting use.

Short-Term Effectiveness

~~This alternative poses no risk to workers or the community during implementation because no construction work would be performed which disturbs the contaminated media within the LRP 131-4L subunit.~~ This alternative can be completed in a short timeframe while posing no risk to remedial workers. Remedial workers would have the greatest risk of exposure during the

confirmatory drilling activities. Worker exposure to hazardous material would be managed by strict adherence to the project specific health and safety plan. All of the contaminated media is also within an area with restricted access (site boundary); therefore, it is not accessible to members of the public or community. Since the LRP 131-4L subunit is located ~11.3 km, (7 mi) away from the nearest SRS boundary, there are no hazards to nearby communities since there are none in proximity. Under this alternative localized soil would remain impacted by leaving hazardous contaminants in place.

Implementability

LUCs have been easily implemented at many waste units at SRS. The implementation of LUCs presents no technical or administrative impediments.

Cost

Costs associated with this alternative include posting approximately four (4) warning signs around the perimeter of the subunit and periodic inspections to confirm the signs remain in place. SRS would also control access to and prohibit excavation of the subunit through the Site Use/Site Clearance permit system. For the long term, deed restrictions would be put into place to preclude activities that could cause exposure to contaminated media exceeding acceptable risk levels in the event the property were to be transferred out of federal ownership. A review of the remedy would be performed every five (5) years over an assumed 30-year duration. The detailed cost estimate is provided in Appendix I. A summary of the estimated present-worth cost is presented below:

Total Present-Worth Cost $560,619

5.3.2.3 Alternative B-3: Soil Cover with Land Use Controls

Alternative B-3 was carried forward for a detailed analysis. This alternative consists of placing a 0.6 m (2 ft) soil cover over the LRP 131-4L subunit to prevent exposure to human receptors. A soil cover would be constructed using standard earth-moving equipment. This alternative would also require LUCs (e.g., signage and maintenance) to maintain the integrity of the soil cover.

Specifically, access for Alternative B-3 as shown on Figure 5-3 would be via the gravel road off of SRS 71-36 Road. The limit of disturbance would be ~0.2 ha (1.2 ac) to be cleared and grubbed.

5.4.2.3 Long-term Effectiveness

Alternative B-1 is not effective in the long-term since exposure is not prevented and therefore, ranked the lowest. Alternatives B-2 and B-3 are ranked equally due to remaining effective as long as LUCs are in place. Alternative B-4 is the most effective in the long-term due to the elimination of all contaminated media within the subunit.

5.4.2.4 Reduction of Toxicity, Mobility, or Volume

None of the alternatives employ any treatment to reduce the toxicity, mobility, or volume of the contaminated media. As such, all alternatives are given an equally low ranking.

5.4.2.5 Short Term Effectiveness

Alternative B-1 is not effective in the short-term since exposure is not prevented and therefore, ranked lowest of all alternatives. Alternatives B-3 and B-4 were ranked equal due to the injury risk to the industrial worker during implementation, although this is typically mitigated by health and safety measures. Implementation of Alternatives B-3 and B-4 would also require a longer time-frame. Alternative B-2 was ranked highest due to only posing ~~no risk to~~a slight risk to the industrial worker ~~or surrounding community~~ during ~~implementation~~ the confirmatory drilling activities and the short time frame to implement.

5.4.2.6 Implementability

No implementation is required of Alternative B-1; therefore, this alternative was ranked highest. Alternative B-2 was ranked the same as Alternative B-1 even though this alternative requires administrative and engineering controls that are easy to implement. Alternatives B-3 and B-4 were ranked below Alternative B-2 and equally ranked due to the extended time frame to implement.

5.4.2.7 Cost

The total present-worth cost for each of the alternatives is provided below:

- Alternative B-1 No Action $0
- Alternative B-2 Land Use Controls *$560,619*
- Alternative B-3 Soil Cover with LUCs *$1,543,338*

Table 5-6. Comparison of the LRP 131-4L Subunit Alternatives to the CERCLA Criteria (*continued/end)*

Criterion	B-1 No Action	B-2 Land Use Controls	B-3 Soil Cover with LUCs	B-4 Excavation and Disposal
Short-Term Effectiveness				
Amount of Hazardous Material Destroyed or Treated	No reduction	No reduction	No reduction	No reduction
Risk to Remedial Worker	No risk	~~No risk~~ Minimal; Health and Safety Plan will be implemented to minimize potential for injury to remedial workers	Minimal; Health and Safety Plan will be implemented to minimize potential for injury to remedial workers	Minimal; Health and Safety Plan will be implemented to minimize potential for injury to remedial workers
Risk to Community	None	None	None	None
Risk to Environment	None	None	None	None
Time to Implement and achieve RAO	Never	6 Months	12 Months	12 Months
Implementability				
Availability of Materials, Equipment, Contractors	N/A	Readily available	Readily available	Readily available
Ability to Construct and Operate the Technology	N/A	Proven technology at SRS	Proven technology at SRS	Proven technology at SRS
Ability to Obtain Permits/Approvals from Other Agencies	N/A	Prior history with similar permits/approvals at SRS	Prior history with similar permits/approvals at SRS	Prior history with similar permits/approvals at SRS
Cost				
Total Capital Cost	$0	$174,213	$1,294,659	$7,671,286
Present Worth O&M Cost	$0	$386,406	$248,679	$0
Total Cost	$0	$560,619	$1,543,338	7,671,286

Table 5-7. Comparative Alternative Analysis for ECODS L-3 Subunit

Response Action	Overall Protection of Human Health	Compliance with RAOs	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-Term Effectiveness	Implementability	Cost	Overall Ranking (1-20)
A-1) No Action	No	No	No	1	1	1	5	$0	8
A-2) Land Use Controls	Yes	Yes	Yes	~~3~~4	1	5	5	$382,557	~~14~~15
A-3) Soil Cover with LUCs	Yes	Yes	Yes	4	1	4	3	$1,228,712	12
A-4) Excavation and Disposal	Yes	Yes	Yes	5	1	4	3	$1,654,216	13

Note: Numeric range 1 through 5, where 1= worst and 5 = best

Table 5-8. Comparative Alternative Analysis for LRP 131-4L Subunit

Response Action	Overall Protection of Human Health	Compliance with RAOs	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost	Overall Ranking (1-20)
B-1) No Action	No	No	N/A	1	1	1	5	$0	8
B-2) Land Use Controls	Yes	Yes	N/A	~~3~~4	1	5	5	$560,619	~~1~~415
B-3) Soil Cover with LUCs	Yes	Yes	Yes	4	1	4	3	$1,543,338	12
B-4) Excavation and Disposal	Yes	Yes	Yes	5	1	4	3	$7,671,286	13

Note: Numeric range 1 through 5, where 1= worst and 5 = best

6.0 SUMMARY CONCLUSION

The subunits of the ECODS L-3, LRP 131-1L, and LRP 131-4L OU were evaluated per the EC&ACP Regulatory Handbook protocols for RFI/RI/BRA with CMS/FS. Based on the results of the BRA, the ECODS L-3 and the LRP 131-4L subunits present unacceptable human health risks to a hypothetical future resident. Additionally, ACM was identified as a problem warranting action for the ECODS L-3 and LRP 131-4L subunits. There were no problems warranting action identified for the LRP 131-1L subunit, and no response action was needed for this subunit.

6.1 ECODS L-3 Subunit

6.1.1 Problem Warranting Action

The problems warranting action for the ECODS L-3 subunit include:

- ACM is likely present in unit soils that may pose a risk to human receptors if exposed.
- PCBs are present in the surface soil (0 to 0.3 m [0 to 1 ft]) that pose a risk greater than 1.0E-06 and a HQ greater than 1 to the hypothetical resident receptor scenario. More specifically, Aroclor 1254 (EPC = 1.28 mg/kg) has a residential risk = 5.4E-06 and Aroclor 1260 (EPC = 0.356 mg/kg) has a residential risk of 1.5E-06. PCB TCR = 6.9E-06. Aroclor 1254 also has a HQ = 1.1 for a hypothetical residential scenario.
- PCBs are present in surface soil (0 to 0.3 m [0 to 1 ft]) that exceed the TSCA ARAR threshold of 1 mg/kg for high occupancy (i.e., unrestricted land use). Aroclor 1254 maximum detected concentration = 5.63 mg/kg and Aroclor 1260 maximum detected concentration = 2.17 mg/kg.

6.1.2 Remedial Action Objective(s)

The RAOs for the ECODS L-3 subunit include:

- Prevent exposure of human receptors to presumed ACM that is likely present in unit soils.
- Prevent exposure of a ~~hypothetical~~ future resident to Aroclor 1254 and Aroclor 1260 in surface soils at levels exceeding 1E-06 risk and HQ of 1.

- Prevent exposure of human receptors to Aroclor 1254 and Aroclor 1260 in surface soils at levels exceeding ARAR threshold of 1 mg/kg.

6.1.3 Remedial Alternatives Evaluation

Four (4) remedial alternatives were considered in the CMS/FS for the ECODS L-3 subunit. These are identified as Alternatives A-1 through A-4.

A-1. No Action

A-2. LUCs

A-3. Soil Cover with LUCs

A-4. Excavate and Disposal

6.2 LRP 131-4L Subunit

6.2.1 Problem Warranting Action

The problems warranting action for the ECODS L-3 subunit include:

- ACM is present in unit soils that may pose a risk to human receptors if exposed.
- Benzo(a)pyrene (EPC = 0.164 mg/kg) is present in the surface soil (0 to 0.3 m [0 to 1 ft]) that poses a risk greater than 1.0E-06 for the hypothetical resident receptor scenario (risk = 1.4E-06).

6.2.2 Remedial Action Objective(s)

The RAOs for the ECODS L-3 subunit include:

- Prevent exposure of human receptors to presumed ACM that is present in the unit soils.
- Prevent exposure of a future resident to benzo(a)pyrene in surface soils (0 to 0.3 m [0 to 1 ft]) at levels exceeding 1E-06 risk.

APPENDIX A

INVESTIGATION DATA/ DATA SUMMARY TABLES

APPENDIX A. INVESTIGATION DATA/DATA SUMMARY TABLES

A.1 DATA SUMMARY TABLES

This appendix provides the data used in the contaminant migration analysis, human health and ecological risk assessments, and principal threat source material evaluation. Data summary and unit specific constituent screening tables are provided for Early Construction and Operational Disposal Site (ECODS) L-3, L-Area Rubble Pit (LRP) 131-1L, and LRP 131-4L subunits. Investigation data for each subunit is provided under separate cover on the electronic version of this document.

The data generated by the ProUCL software (v 5.2) for each detected analyte is presented in this appendix. Outputs from the software are used to summarize the data from each of the three (3) subunits to develop the data summary tables per Protocol DP-1 – *Unit-Source Data Processing* in the EC&ACP Regulatory Document Handbook. Distribution codes, Upper Confidence Limit (UCL) method, and 95% UCL are reported for each soil exposure group (0 to 0.3 m, 0.3 to 1.2 m, and all depths [0 to 1 ft, 1 to 4 ft, all depths]) as determined from the outputs. The output from the ProUCL data processing is not included due to the robust nature of the output files that are run for each individual analyte per depth interval. These results were verified by peer checking and can be reverified, if needed, by processing the soil data provided in electronic format through the ProUCL software that is available online (https://www.epa.gov/land-research/proucl-version-5100-documentation-downloads).

A.2 ECODS L-3 SUBUNIT SOIL DATA

The tables in this section present analytical data for the ECODS L-3 subunit soil in the following depth intervals: 0 to 0.3 m (0 to 1 ft) (Table A.2.1), 0.3 to 1.2 m (1 to 4 ft) (Table A.2.2), and all depths (Table A.2.3). These tables are followed by the unit-specific constituent screening table for the subunit soil at all depths (Table A.2.4).

APPENDIX C

HUMAN HEALTH RISK ASSESSMENT

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series, including its daughter products (e.g., uranium-234, thorium-230, radium-226, lead-214, and bismuth-214). Therefore, background comparisons for the thorium-232 decay series and the uranium-238 decay series includes consideration of the range of concentrations for the entire decay chain (i.e., includes daughter products).

There is uncertainty in assessing human health risk if RSLs or PRGs are not available due to the lack of a screening threshold. This uncertainty is inherent in the HHRA process and is documented in the uncertainty discussion for individual analytes that lack screening thresholds as indicated in Table C-1. The lack of human health thresholds presents an uncertainty that may under- or over-represent the risk to human receptors. The HHRA presented herein follows the currently accepted approach and methodologies to assessing risk to support informed management decisions for the ECODS L-3, LRP 131-1L, and LRP 131-4L OU.

C-2.2.1 ECODS L-3 Subunit

C-2.2.1.1 Soil Media

Table C-1 presents the results of soil screening for the ECODS L-3 subunit. Human health COPCs for soil include aluminum, antimony, Aroclor 1254, Aroclor 1260, benzo[a]pyrene, cadmium, chromium, iron, and lead. These constituents had maximum detected concentrations that exceeded human health (residential) risk-based screening levels and exceeded two times SRS mean background concentrations.

Table C-2 presents the total HI (2.37) and total media risk (6.62E-05) for the resident exposure scenario and the associated COCs: Aroclor 1254, Aroclor 1260, and chromium.

Table C-3 presents the total HI (0.406) and total media risk (4.50E-06) for the industrial worker exposure scenario and the associated COCs: Aroclor 1254 and chromium.

The refinement/uncertainty evaluation is presented for each of these COCs.

Aroclor 1254 is identified as a COC for the residential (risk = 5.44E-06 and HQ = 1.1) and the industrial worker (risk = 1.32E-06) scenarios. It was detected in 17/18 samples, with 14 results being estimated values (i.e., J-qualified). Concentrations range from nondetect to 5.63 mg/kg, with

The risk estimate used the hexavalent chromium RSL (residential RSL = 0.3 mg/kg, industrial worker RSL = 6.33 mg/kg) to perform the data screening. This overly conservative approach tends to bias the calculation high. Based on unit history, it is likely the trivalent form of chromium is most prevalent at the site. The RSLs for trivalent chromium are 85,000 mg/kg for the residential exposure scenario, and 360,000 mg/kg for the industrial worker exposure scenario. The maximum detected concentration at the waste unit is much less than these concentrations, and a calculation using the 95% UCL would yield a HQ = 2.08E-04 for the residential scenario and a HQ = 4.92E-05 for the industrial worker scenario.

~~The USEPA published a total chromium RSL of 280 mg/kg for the residential scenario and 1,400 mg/kg for the industrial worker scenario in the April 2009 version of the tables. If these values were used in the risk calculation, the risk for the resident would equal 6.32E-08 and the risk for the industrial worker would equal 1.26E-08.~~

Hexavalent chromium was not analyzed for in the soil samples collected as part of the SRS Background Soil Study (WSRC 2006). Since there is no SRS background value for hexavalent chromium, a recent characterization effort was conducted at similar waste sites, ECODS N-1 and Central Shops Scrap Lumber Pile (CSSLP), to evaluate the unit related concentrations versus the site-specific background concentrations. The risk assessment determined that unit-related concentrations of hexavalent chromium were not significantly different from the site-specific background concentrations (SRNS 2021).

Chromium is not recommended for further remedial evaluation as a human health RCOC in the surface soil for either receptor scenario based on the following lines-of-evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- Only one location (EL3-06) is above the SRS background soil concentration range for total chromium. If the field duplicate value (26.3 mg/kg) at EL3-06 would have been used instead of the regular value (71.9 mg/kg), none of the results would have exceeded the background soil concentration range.
- The valence state of chromium was not determined. The analytical result was for total chromium.

- Risk estimate is biased high because the most conservative RSL (hexavalent chromium) was used, but this form is not expected to be present based on unit history.
- Using the trivalent chromium RSL, the revised HQ = 2.08E-04 for the resident and 4.92E-05 for the industrial worker, which are less than the threshold value of HQ =1.
- ~~Using the total chromium RSL that was available in 2009, the revised risk estimate = 6.32E-08 for the resident and 1.26E-08 for the industrial worker, which are less than the threshold value of 1E-06.~~
- Recent hexavalent chromium analyses at a similar site waste site determined that unit related concentrations vs background concentrations were indistinguishable.

C-2.2.1.2 HHRA Conclusion for ECODS L-3

Soil media:

Resident scenario: Human health RCOCs include Aroclor 1254 (risk = 5.44E-06; HQ = 1.1) and Aroclor 1260 (risk = 1.48E-06) with a total cumulative risk (TCR) = 6.9E-06. Figures C-4 and C-5 show the concentrations of the identified RCOCs at each sampling location, respectively.

Industrial Worker scenario: none.

C-2.2.2 LRP 131-1L Subunit

C-2.2.2.1 Soil Media

Table C-4 presents the results of soil screening for the LRP 131-1L subunit. Human health COPCs for soil include aluminum, arsenic, chromium, iron, manganese, vanadium, cesium-137, uranium-235 and uranium-238 (thorium-230). These constituents had maximum detected concentrations that exceeded human health (residential) risk-based screening levels and exceeded two times SRS mean background concentrations.

Table C-5 presents the total HI (8.~~11~~49E-01) and total media risk (1.58E-04) for the resident exposure scenario and the associated COCs: arsenic, chromium, cesium-137, uranium-235 and uranium-238.

Table C-6 presents the total HI (5.~~56~~83E-02) and total media risk (5.87E-05) for the industrial worker exposure scenario and the associated COCs: arsenic, chromium, cesium-137, uranium-235 and uranium-238.

The refinement/uncertainty evaluation is presented for each of these COCs.

Arsenic is identified as a COC for the residential (risk = 5.29E-06) and the industrial worker (risk = 1.19E-06) scenarios. It was detected in 21/21 samples, with all results being quantifiable values. Concentrations range from 0.77 mg/kg to 6.5 mg/kg, with a mean concentration of 2.94 mg/kg. Sample location LAP1L-018 (Figure C-2) had the highest detected concentration. The EPC used in the risk calculations was 3.58 mg/kg.

Arsenic is a naturally occurring constituent that is common in the environment. The maximum detected concentration in the SRS Soil background dataset is 22.9 mg/kg. Soil concentrations from this subunit are within the range of concentrations found in background soil at SRS.

Arsenic is widely distributed in the earth's crust, being present in soil and minerals. Organic arsenic compounds are used as pesticides, primarily in cotton fields and fruit orchards. However, no significant quantities of pressure treated wood were used in LRP 131-1L subunit and no arsenic pesticides were used at SRS. Arsenic pesticides were commonly used to combat the boll weevil by local cotton farmers prior to the establishment of SRS.

Arsenic is not recommended for further remedial evaluation as human health RCOC in soil for any receptor scenario based on the following lines of evidence:

- Unit concentrations are within the background soil concentration range.
- It is a naturally occurring constituent that is common in SRS background soils.
- Arsenic products were either not used or were of limited use at SRS.

Chromium is identified as a COC for the residential (risk = 6.63E-05) and the industrial worker (risk = 3.15E-06) scenarios. Chromium was detected in 21/21 samples, with all results being quantifiable values. Concentrations range from 7.9 mg/kg to 28.0 mg/kg, with a mean concentration of 17.9 mg/kg. Sample location LAP1L-006 (Figure C-2) had the highest detected concentration. The EPC used in the risk calculations was 20.0 mg/kg.

The maximum detected concentration in the SRS Soil background dataset is 54.3 mg/kg. Soil concentrations from this subunit are within the range of concentrations found in background soil at SRS.

Chromium occurs in the environment primarily in two valence states, trivalent chromium and hexavalent chromium. Trivalent chromium is much less toxic than hexavalent chromium. The trivalent form is considered noncancerous, whereas the hexavalent form is considered cancerous. Chromium compounds in the trivalent chromium or hexavalent chromium forms are used for chrome plating, the manufacture of dyes and pigments, and leather and wood preservation.

Hexavalent chromium is not a naturally occurring constituent that is common in the environment. Hexavalent chromium is an environmental concern where burning was used. Trivalent chromium is converted to hexavalent chromium during the burning process. Hexavalent chromium is more toxic and mobile in the environment as compared to trivalent chromium. The USEPA recommends that valence-specific state data for chromium be collected when chromium is likely to be an important contaminant at the site. Since this was not the case at this waste unit (i.e., chromium not a significant contaminant or risk driver), the valence state of chromium was not determined, the chemical analysis was for total chromium.

The risk estimate used the hexavalent chromium RSL (residential RSL = 0.3 mg/kg, industrial worker RSL = 6.33 mg/kg) to perform the data screening. This overly conservative approach tends to bias the calculation high. Based on unit history, it is likely the trivalent form of chromium is most prevalent at the site. The RSLs for trivalent chromium are 85,000 mg/kg for the residential exposure scenario, and 360,000 mg/kg for the industrial worker exposure scenario. The maximum detected concentration at the waste unit is much less than these concentrations, and a calculation using the 95% UCL would yield a HQ = 2.35E-04 for the residential scenario and a HQ = 5.56E-05 for the industrial worker scenario.

~~The USEPA published a total chromium RSL of 280 mg/kg for the residential scenario and 1,400 mg/kg for the industrial worker scenario in the April 2009 version of the tables. If these values were used in the risk calculation, the risk for the resident would equal 7.13E-08 and the risk for the industrial worker would equal 1.43E-08.~~

Hexavalent chromium was not analyzed for in the soil samples collected as part of the SRS Background Soil Study (WSRC 2006). Since there is no SRS background value for hexavalent chromium, a recent characterization effort was conducted at similar waste sites, ECODS N-1 and CSSLP, to evaluate the unit related concentrations versus the site-specific background concentrations. The risk assessment determined that unit related concentrations of hexavalent chromium were not significantly different from the site-specific background concentrations (SRNS 2021).

Chromium is not recommended for further remedial evaluation as a human health RCOC in the surface soil for either receptor scenario based on the following lines-of-evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- All sample results are within the SRS background soil concentration range for total chromium.
- The valence state of chromium was not determined, analytical result was for total chromium.
- Risk estimate is biased high because the most conservative RSL (hexavalent chromium) was used, but this form is not expected to be present based on unit history.
- Using the trivalent chromium RSL, the revised HQ = 2.35E-04 for the resident and 5.56E-05 for the industrial worker, which are less than the threshold value of HQ =1.
- ~~Using the total chromium RSL that was available in 2009, the revised risk estimate = 7.13E-08 for the resident and 1.43E-08 for the industrial worker, which are less than the threshold value of 1E-06.~~
- Recent hexavalent chromium analyses at a similar site waste site determined that unit related concentrations vs background concentrations were indistinguishable.

Cesium-137 is a COC for the residential (risk = 6.45E-06) and the industrial worker (risk = 4.30E-06) scenarios. Cesium-137 was only analyzed in one sample and was detected with an activity concentration of 3.90E-01 pCi/g. The sample was taken at location LAP1L-012 (Figure C-2).

not a significant contaminant or risk driver), the valence state of chromium was not determined, the chemical analysis was for total chromium.

The risk estimate used the hexavalent chromium RSL (residential RSL = 0.3 mg/kg, industrial worker RSL = 6.33 mg/kg) to perform the data screening. This overly conservative approach tends to bias the calculation high. Based on unit history, it is likely the trivalent form of chromium is most prevalent at the site. The RSLs for trivalent chromium are 85,000 mg/kg for the residential exposure scenario, and 360,000 mg/kg for the industrial worker exposure scenario. The maximum detected concentration at the waste unit is much less than these concentrations, and a calculation using the 95% UCL would yield a HQ = 1.66E-04 for the residential scenario and a HQ = 3.92E-05 for the industrial worker scenario.

~~The USEPA published a total chromium RSL of 280 mg/kg for the residential scenario and 1,400 mg/kg for the industrial worker scenario in the April 2009 version of the tables. If these values were used in the risk calculation, the risk for the resident would equal 5.04E-08 and the risk for the industrial worker would equal 1.01E-08.~~

Hexavalent chromium was not analyzed for in the soil samples collected as part of the SRS Background Soil Study (WSRC 2006). Since there is no SRS background value for hexavalent chromium a recent characterization effort was conducted at similar waste sites, ECODS N-1 and CSSLP, to evaluate the unit related concentrations versus the site-specific background concentrations. The risk assessment determined that unit related concentrations of hexavalent chromium were not significantly different from the site-specific background concentrations (SRNS 2021).

Chromium is not recommended for further remedial evaluation as a human health RCOC in the surface soil for either receptor scenario based on the following lines-of-evidence:

- It is a naturally occurring constituent that is common in SRS background soils.
- All sample results are within the SRS background soil concentration range for total chromium.
- The valence state of chromium was not determined, analytical result was for total chromium.

- Risk estimate is biased high because the most conservative RSL (hexavalent chromium) was used, but this form is not expected to be present based on unit history.
- Using the trivalent chromium RSL, the revised HQ = 1.66E-04 for the resident and 3.92E-05 for the industrial worker, which are less than the threshold value of HQ =1.
- ~~Using the total chromium RSL that was available in 2009, the revised risk estimate = 5.04E-08 for the resident and 1.01E-08 for the industrial worker, which are less than the threshold value of 1E-06.~~
- Recent hexavalent chromium analyses at a similar site waste site determined that unit related concentrations vs background concentrations were indistinguishable.

Benzo(a)pyrene is a COC for the resident (risk = 1.43E-06) scenario only. It was detected in 8/41 samples with six results being estimated values (i.e., J-qualified). Concentrations range from nondetect to 1.2 mg/kg, with a mean concentration of 9.56E-02 mg/kg. The highest detected was at sample location LAP4L-34 (Figure C-3). The EPC used in the risk calculation was 0.164 mg/kg.

Benzo(a)pyrene is a polycyclic aromatic hydrocarbon (PAH). PAHs are sourced from asphalt, coal tar, fumes produced by internal combustion engines, and smoke from the burning of organic materials (i.e., wood burning, cigarette smoke). Its presence is consistent with the historical use of the unit as it received inert rubble from the L-Area Powerhouse Stack and Silo demolition. The rubble consisted primarily of concrete and asphalt material with some metal.

Benzo(a)pyrene is recommended for further remedial evaluation as a human health RCOC in surface soil for the future resident scenario based on the following lines-of-evidence:

- Its presence is consistent with the historical use of the unit.
- The residential risk is >1E-06.

N-Nitrosodipropylamine is a COC for the resident (risk = 5.81E-06) and the industrial worker (risk = 1.37E-06) scenarios. It was detected in 1/41 samples, with a concentration of 0.45 mg/kg. The only detected result was an estimated value (i.e., J-qualified) at sample location LAP4L-015 (Figure C-3). The maximum detected concentration was used as the EPC in the risk calculation.

Table C-4. Human Health COPC Screening for LRP 131-1L Subunit Soil Media (0-0.3 m [0-1 ft])

Analyte	Detected Maximum Concentration[1]	Qualifier	Human Health Screening Value[2,6,7]	Human Health Screening Value Source	Exceeds Human Health Screening Value?	2X Average Background Concentration[3,7,8]	Exceeds 2X Average Background?[4]	COPC?[5]
Inorganics *(mg/kg)*								
ALUMINUM	3.50E+04		7.70E+03	0.1xRSL	YES	1.05E+04	YES	**YES**
ANTIMONY	3.10E-01		3.10E+00	0.1xRSL	no	2.69E+00	no	no
ARSENIC	6.50E+00		6.80E-01	RSL	YES	4.28E+00	YES	**YES**
BARIUM	4.50E+01		1.50E+03	0.1xRSL	no	3.91E+01	YES	no
BERYLLIUM	5.50E-01		1.60E+01	0.1xRSL	no	2.88E-01	YES	no
CADMIUM	1.30E-01		7.10E-01	0.1xRSL	no	4.83E-01	no	no
CALCIUM	1.20E+03		EN	--	--	4.76E+02	YES	no
CHROMIUM	2.80E+01		3.00E-01	RSL	YES	1.54E+01	YES	**YES**
COBALT	2.00E+00		2.30E+00	0.1xRSL	no	1.55E+00	YES	no
COPPER	3.10E+01		3.10E+02	0.1xRSL	no	4.34E+00	YES	no
CYANIDE	1.20E+00		2.30E+00	0.1xRSL	no	NA	--	no
IRON	1.90E+04		5.50E+03	0.1xRSL	YES	1.27E+04	YES	**YES**
LEAD	1.30E+01		4.00E+01	0.1xRSL	no	1.03E+01	YES	no
MAGNESIUM	4.40E+02		EN	--	--	2.75E+02	YES	no
MANGANESE	1.80E+02		1.80E+02	0.1xRSL	no	1.53E+02	YES	~~no~~**YES**
MERCURY	6.10E-02		1.10E+00	0.1xRSL	no	7.10E-02	no	no
NICKEL	8.80E+00		1.40E+02	0.1xRSL	no	3.48E+00	YES	no
POTASSIUM	3.50E+02		EN	--	--	2.16E+02	YES	no
SELENIUM	5.80E-01		3.90E+01	0.1xRSL	no	2.99E+00	no	no
SILVER	2.00E-02	J	3.90E+01	0.1xRSL	no	7.28E-01	no	no
THALLIUM	1.60E-01		7.80E-02	0.1xRSL	YES	3.12E+00	no	no
VANADIUM	5.70E+01		3.90E+01	0.1xRSL	YES	3.91E+01	YES	YES
ZINC	3.60E+01		2.30E+03	0.1xRSL	no	9.47E+00	YES	no

Table C-4. Human Health COPC Screening for LRP 131-1L Subunit Soil Media (0-0.3 m [0-1 ft]) *(continued)*

Analyte	Detected Maximum Concentration[1]	Qualifier	Human Health Screening Value[2,6,7]	Human Health Screening Value Source	Exceeds Human Health Screening Value?	2X Average Background Concentration[3,7,8]	Exceeds 2X Average Background?[4]	COPC?[5]
Organics *(mg/kg)*								
2-HEXANONE	3.98E-03	J	2.00E+01	0.1xRSL	no	NA	--	no
ACETONE	3.97E-01		7.00E+03	0.1xRSL	no	NA	--	no
CUMENE (ISOPROPYLBENZENE)	1.88E-03		1.90E+02	0.1xRSL	no	NA	--	no
METHYL ETHYL KETONE	4.39E-02		2.70E+03	0.1xRSL	no	NA	--	no
STYRENE	1.85E-03	J	6.00E+02	0.1xRSL	no	NA	--	no
Radionuclides *(pCi/g)*								
AMERICIUM-243	8.88E-02	J	1.67E-01	PRG	no	NA	--	no
CURIUM-245/246	4.29E-02	J	2.75E+00	PRG	no	NA	--	no
CESIUM-137	3.90E-01		6.05E-02	PRG	YES	2.84E-01	YES	**YES**
PLUTONIUM-238	9.10E-02	J	4.28E+00	PRG	no	5.77E-01	no	no
PLUTONIUM-239/240	5.69E-02	J	3.79E+00	PRG	no	8.36E-02	no	no
POTASSIUM-40	1.06E+00	J	1.44E-01	PRG	YES	2.33E+00	no	no
STRONTIUM-90	8.14E-01	J	4.21E+00	PRG	no	7.43E-01	YES	no
THORIUM-232	1.54E+00		9.85E-03	PRG	YES	1.80E+00	no	no
RADIUM-228	1.70E+00		9.85E-03	+D-Th	YES	1.80E+00	no	no
ACTINIUM-228	1.42E+00		9.85E-03	+D-Th	YES	1.80E+00	no	no
THORIUM-228	1.72E+00		9.85E-03	+D-Th	YES	1.80E+00	no	no
LEAD-212	1.09E+00		9.85E-03	+D-Th	YES	1.80E+00	no	no

Table C-5. Human Health Risk/Hazard Calculation for LRP 131-1L Subunit Soil Media (0-0.3 m [0-1 ft]) Residential Scenario

Analyte[1]	Exposure Point Concentration[2,7]	Residential RSL/PRG[3,8]	Residential Hazard Estimate[4]	Residential Risk Estimate[5]	Target Organ	COC?[6]
Noncarcinogenic Hazard Estimate						
Chemical Constituents *(mg/kg)*						
ALUMINUM	2.30E+04	7.74E+04	2.97E-01	--	Neurological	no
ARSENIC	3.58E+00	3.49E+01	1.03E-01	--	Dermal	no
CHROMIUM	2.00E+01	2.34E+02	8.53E-02	--	Other	no
IRON	1.26E+04	5.48E+04	2.31E-01	--	Hepatic	no
MANGANESE	6.91E+01	1.83E+03	3.78E-02	--	Neurological	no
VANADIUM	3.76E+01	3.93E+02	9.57E-02	--	Dermal	no
	Total Hazard Index (HI)=		**8.~~11~~49E-01**			
Carcinogenic Risk Estimate						
Chemical Constituents *(mg/kg)*						
ARSENIC	3.58E+00	6.77E-01	--	5.29E-06	NA	**YES**
CHROMIUM	2.00E+01	3.01E-01	--	6.63E-05	NA	**YES**
		Total Chemical Risk =		**7.16E-05**		
Radionuclide Constituents *(pCi/g)*						
CESIUM-137	3.90E-01	6.05E-02	--	6.45E-06	NA	**YES**
URANIUM-235	9.02E-02	4.58E-02	--	1.97E-06	NA	**YES**
URANIUM-238	9.75E-01	1.25E-02	--	7.80E-05	NA	**YES**
		Total Radionuclide Risk =		**8.64E-05**		
		Total Media Risk =		**1.58E-04**		

1 - Analytes from Table C-4 that were identified as constituents of potential concern (COPCs).
2 - EPC - reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration (see Table A.3.1).
3 - Nonradiological Regional Screening Levels (RSLs) are residential soil default values from the USEPA RSLs website, accessed December 2023 (see Attachment C-1). Radiological Preliminary Remediation Goals (PRGs) are site-specific residential soil values derived using the USEPA Radionuclide PRGs for Superfund website calculator and eliminating the fruit and vegetable pathways. All other inputs are default parameters, accessed December 2023. (see Attachment C-2).
4 - Residential Hazard Estimate = EPC/RSL
5 - Residential Risk Estimate = (EPC/[RSL or PRG])*1E-06
6 - For noncarcinogens, no constituents are identified as constituents of concern (COCs) if the total media Hazard Index (HI) < 1. If the total media HI ≥ 1, then the constituents are segregated based on relevant target organs. Hazard quotients (HQs) are summed according to target organs. Constituents are identified as COCs if the total organ HI > 1. For carcinogens, constituents are identified as COCs if the individual cancer risk ≥ 1E-06.
7 - For radionuclides within a decay chain (i.e., thorium-232 and uranium-238) the most conservative EPC (highest activity) within each series is used to estimate the risk. Risk is calculated using parent PRG.
8 - RSL for hexavalent chromium (most conservative) used.

NA - not applicable

Table C-6. Human Health Risk/Hazard Calculation for LRP 131-1L Subunit Soil Media (0-0.3 m [0-1 ft]) Industrial Scenario

Analyte[1]	Exposure Point Concentration[2,7]	Industrial RSL/PRG[3,8]	Industrial Hazard Estimate[4]	Industrial Risk Estimate[5]	Target Organ	COC?[6]
Noncarcinogenic Hazard Estimate						
Chemical Constituents *(mg/kg)*						
ALUMINUM	2.30E+04	1.12E+06	2.05E-02	--	Neurological	no
ARSENIC	3.58E+00	4.79E+02	7.48E-03	--	Dermal	no
CHROMIUM	2.00E+01	3.48E+03	5.73E-03	--	Other	no
IRON	1.26E+04	8.18E+05	1.55E-02	--	Hepatic	no
MANGANESE	6.91E+01	2.56E+04	2.70E-03	--	Neurological	no
VANADIUM	3.76E+01	5.83E+03	6.45E-03	--	Dermal	no
	Total Hazard Index (HI)=		**5.~~56~~83E-02**			
Carcinogenic Risk Estimate						
Chemical Constituents *(mg/kg)*						
ARSENIC	3.58E+00	3.00E+00	--	1.19E-06	NA	**YES**
CHROMIUM	2.00E+01	6.33E+00	--	3.15E-06	NA	**YES**
		Total Chemical Risk=		**4.35E-06**		
Radionuclide Constituents *(pCi/g)*						
CESIUM-137	3.90E-01	9.07E-02	--	4.30E-06	NA	**YES**
URANIUM-235	9.02E-02	7.31E-02	--	1.23E-06	NA	**YES**
URANIUM-238	9.75E-01	2.00E-02	--	4.88E-05	NA	**YES**
		Total Radionuclide Risk =		**5.43E-05**		
		Total Media Risk =		**5.87E-05**		

1 - Analytes from Table C-4 that were identified as constituents of potential concern (COPCs).
2 - EPC - reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration (see Table A.3.1).
3 - Nonradiological Regional Screening Levels (RSLs) are industrial soil default values from the USEPA RSLs website, accessed December 2023 (see Attachment C-1). Radiological Preliminary Remediation Goals (PRGs) are industrial soil default values from the USEPA Radionuclide PRGs for Superfund website, accessed December 2023 (see Attachment C-3).
4 - Industrial Hazard Estimate = EPC/RSL
5 - Industrial Risk Estimate = (EPC/[RSL or PRG])*1E-06
6 - For noncarcinogens, no constituents are identified as constituents of concern (COCs) if the total media Hazard Index (HI) < 1. If the total media HI ≥ 1, then the constituents are segregated based on relevant target organs. Hazard quotients (HQs) are summed according to target organs. Constituents are identified as COCs if the total organ HI > 1. For carcinogens, constituents are identified as COCs if the individual cancer risk ≥ 1E-06.
7 - For radionuclides within a decay chain (i.e., thorium-232 and uranium-238) the most conservative EPC (highest activity) within each series is used to estimate the risk. Risk is calculated using parent PRG.
8 - RSL for hexavalent chromium (most conservative) used.

NA - not applicable

APPENDIX D

ECOLOGICAL RISK ASSESSMENT

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confidence limit (UCL) on the arithmetic mean; these data are presented in Appendix A. The data distribution and recommended 95%UCL as determined by ProUCL for each constituent are presented as footnotes to the tables in Appendix A. Non-detected constituent concentrations were processed in accordance with the ProUCL User's Guide. The LRP 131-1L and LRP 131-4L Data Usability Reports (DURs) for the 2022 Workplan Characterization Samples are presented in Appendices I.1 and I.2. The reports provide an assessment of the precision, accuracy, representativeness, comparability, and completeness data quality indicators and measurement performance criteria. The DURs concluded that that the data quality objectives were met, and that the data are considered usable for the purposes of decision-making in the Remedial Investigation/Baseline Risk Assessment. In addition, the *Site Evaluation Report for Early Construction and Operational Disposal Site (ECODS) L-3 (U)* presents a Laboratory Quality Discussion (Section IV) and a Site Evaluation Validation Report (Section V) for the samples that were collected in 2002 (WSRC 2003).

D-1.3 Habitats/Receptors/Preliminary Assessment and Measurement Endpoints

The ECODS L-3, LRP 131-1L and LRP 131-4L OU includes soil media. The ecological setting, including wildlife~~,~~ and habitats~~, and threatened and endangered species (TES),~~ are discussed in Section 2.1. A review of threatened, endangered, and sensitive (TES) species survey information and Geographic Information System (GIS) data were reviewed for the ECODS L-3, LRP 131-1L, and LRP 131-4L OU. Field surveys were conducted within the vicinity of these units in 1993 and 1994 and found little in the way of specialized habitats that may support TES species. The TES survey for the L-Area Oil and Chemicals and Acid/Caustic Basins (United States Forest Service [USFS] 1993) was conducted in May 1993, showing no occurrence of any TES plant or animal populations/individuals. The survey did note that bald eagle and ospreys feed on adjacent L Lake which is ~ 750 m (2,460 ft) from the ECODS L-3 unit, the closest unit, but no observations of these species were noted in the survey. The TES survey of the L-Area Bingham Pump Outage Pit, conducted in 1994, also indicated that the vicinity of the Bingham Pump Outage Pit does not meet the needs of most SRS listed TES plants or animal species with the exception of the Loggerhead Shrike, although no observations were made for this species. No unique or sensitive ecosystems were found within the ECODS L-3, LRP 131-1L, and LRP 131-4L OU area or TES flora within

the vicinity. Most SRS TES species are associated with Carolina bays or mesic valley conditions associated with floodplains or wetlands located within/near wet areas. The area within and around the ECODS L-3, LRP 131-1L, and LRP 131-4L OU is a modified habitat and TES species are unlikely to be present because of the modified upland habitat, disturbance, and historic use. Additionally, review of current GIS data did not reveal any TES species observations or protected areas within the vicinity of the ECODS L-3, LRP 131-1L, and LRP 131-4L OU. The habitats within the ECODS L-3, LRP 131-1L and LRP 131-4L OU support terrestrial receptors.

Assessment endpoints are tailored to groups of organisms with similar feeding strategies and/or exposure scenarios appropriate for the ECODS L-3, LRP 131-1L and LRP 131-4L OU. Based on these considerations, the following assessment and measurement endpoints and their representative receptors were selected as discussed below. The assessment endpoints are assessed by a preliminary comparison that is expressed as a hazard quotient (HQ) calculation based on the screening of ECODS L-3, LRP 131-1L and LRP 131-4L OU soil data summarized in Appendix A.:

- Protection of soil-dwelling invertebrate communities to maintain species diversity and nutrient cycling. Soil-dwelling invertebrate communities are selected because the soil invertebrate community is ecologically important, is susceptible to constituents in soil, and may be exposed at the ECODS L-3, LRP 131-1L and LRP 131-4L OU. The soil-dwelling invertebrate community is essential for decomposition of detritus and for energy and nutrient cycling. It is also an important component of the diet of insectivorous mammals and birds. Earthworms are chosen as the representative species of soil-dwelling invertebrates because they are important in promoting soil fertility, are highly exposed to soil constituents, and have toxicity information available. The measurement endpoint is a comparison of the measured constituent concentration in soil-to-earthworm toxicity benchmarks.

- Protection of herbivorous mammal communities to ensure that exposure of contaminants in forage and soils does not have a negative impact on growth, survival, and reproduction. Herbivorous mammals are ecologically important because they provide a food base for higher trophic level receptors and are susceptible to soil constituents within the

HQ by comparing the Exposure Point Concentration (EPC) to a LOAEL RSV. LOAEL-based RSVs are derived from Low Effect ESLs. The EPC is represented by the lower of the 95% UCL on the mean and maximum detected concentrations. Calculation of the HQ is illustrated in the equation below:

$$HQ = EPC/(LOAEL - based\ RSV)$$

Constituents with an HQ >1 are further discussed in Section D.2.3.

D-2.2.1 RSV Screening - Soil Media

For the COPECs identified in Section D.2.1.1, the refinement level process is outlined below:

- Calculate a refinement level HQ using the EPC and RSV (LOAEL-based ESL).
- Carry forward constituents with refinement-levels HQ > 1 or with no RSV identified as COPCs to Section D.2.3. Constituents that are not identified as COPCs are dropped from further evaluation.

D-2.3 Results/Refinement of Constituents of Concern

The refinement level risk calculation is based on LOAEL thresholds. Constituents that fail the refinement-level screening are considered COPCs. Tables summarizing the ecological refinement-level effects evaluation for the ECODS L-3, LRP 131-1L, and 131-4L OU subunits are as follows:

- Table D-2 (for soil 0 to 0.3 m [0 to 1 ft] interval in the ECODS L-3 Subunit)
- Table D-4 (for soil 0.3 to 1.2 m [1 to 4 ft] interval in the ECODS L-3 Subunit)
- Table D-6 (for soil 0 to 0.3 m [0 to 1 ft] interval in the LRP 131-1L Subunit)
- Table D-8 (for soil 0.3 to 1.2 m [1 to 4 ft] interval in the LRP 131-1L Subunit)
- Table D-10 (for soil 0 to 0.3 m [0 to 1 ft] interval in the LRP 131-4L Subunit)
- Table D-12 (for soil 0.3 to 1.2 m [1 to 4 ft] interval in the LRP 131-4L Subunit)

There is uncertainty associated with the ESVs and TRVs used in this ERA because the toxicity data are not unit specific. There are also limitations in toxicity values from the established sources

used that may not include variations in physiological or biochemical factors that may influence the risk among species, behavioral and ecological parameters that may make a species' sensitivity to a contaminant different from that of the test organism, limited information on long-term effects on natural populations, or the exposure of the receptors based on contaminant distribution within the landscape in relation to the receptors' movement/exposure within the landscape. In addition, the ERA estimates the risk to populations of ecological receptors from individual contaminants and although cumulative risk is possible with exposure to multiple contaminants simultaneously, these effects are not addressed and can be antagonistic or synergistic resulting in differing threats from exposure. Finally, the lack of toxicity thresholds adds to the uncertainty of assessing risk. If ESVs/TRVs are not available, there is uncertainty in assessing the risk to receptors because of the lack of thresholds from which to compare and is documented in the lines of evidence presented in the uncertainty discussion. These uncertainties may under- or over-represent the risk to receptors, but the ERA presented herein follows the currently accepted approach and methodologies to assessing risk to support informed management decisions for the ECODS L-3, LRP 131-1L, and LRP 131-4L OU.

Uncertainties associated with the screening thresholds, background concentrations, nature and extent of contamination, age of data, or constituents that result from the screening and refinement processes are discussed in the uncertainty evaluation presented below. The uncertainty discussion concludes with a determination of whether the constituent is considered a RCOC. The major categories of uncertainty used in this evaluation and the major emphasis include the following:

- Unit-related uncertainty, which includes uncertainties related to the nature and extent of contamination, consistency with history of use, and presence in background;
- Data quality uncertainty and risk assessment uncertainties, which include uncertainties related to data quality and physical characteristics; and
- Risk assessment uncertainty, which includes uncertainties related to toxicity data and changes in constituent activity concentrations due to radioactive decay.

Using the three considerations described above, the COPCs identified in Section D.2.3 are further evaluated to generate the results of the ERA as presented below by subunit.

omnivore), and HQ = 2.11E-02 (American robin (avian insectivore) based on a 0.134 ha unit size for ECODS L-3, and a population area of 4,240 ha for the American kestrel and 16.8 ha for the American robin. PAUF adjusted calculations are shown in Attachment D-7, Table D.7-1. In addition, bis(2-ethylhexyl)phthalate is a common laboratory artifact, which was detected in unit-specific and field QA/QC field duplicate samples, with the highest levels detected in background samples. Therefore, bis(2-ethylhexyl)phthalate ~~and it~~ is not likely unit related.

Bis(2-ethylhexyl)phthalate is not recommended for further remedial evaluation as an ecological RCOC in surface soil based on the following lines of evidence:

- It is a common laboratory artifact.
- PAUF-adjusted HQs were < 1.
- The RSV may be overly protective.

Summary: The constituents identified as COPCs were ultimately screened out based on various lines of evidence. For all constituents, PAUF-adjusted HQs were well below 1.0. Aluminum, cadmium, iron, lead, and zinc are naturally occurring. Aluminum, cadmium, iron, and lead are within SRS background levels. Cadmium, cyanide, and zinc have mean detected concentrations less than the RSV. In summary, no constituents are identified as RCOCs for the ECODS L-3 subunit for the 0 to 0.3 m (0 to 1 ft) ft surface soil interval.

D-2.3.1.4 Screening Results for ECODS L-3 Subunit for Soil Media (0.3 to 1.2 m [1 to 4 ft])

Using maximum detected values, Table D-3 identifies the following constituents as COPECs based on ESV screening in the soil media (0.3 to 1.2 m [1 to 4 ft] interval) evaluated for terrestrial receptors: aluminum; antimony; arsenic; cadmium; chromium; copper; iron; lead; manganese; mercury; nickel; vanadium; zinc; 1,1'-biphenyl; Aroclor 1254; Aroclor 1260; benzo(g,h,i)perylene; benzo[a]anthracene; benzo[a]pyrene; benzo[b]fluoranthene; benzo[k]fluoranthene; bis(2-ethylhexyl)phthalate; carbazole; chrysene; dibenz[a,h]anthracene; dibenzofuran; fluoranthene; fluorene; indeno[1,2,3-c,d]pyrene; naphthalene; phenanthrene; and pyrene. Sampling locations described for the ECODS L-3 Subunit are shown in Figure D-2.

D-2.3.1.5 Refinement Results for ECODS L-3 Subunit for Soil Media (0.3 to 1.2 m [1 to 4 ft])

Using EPC values (i.e., 95% UCL on the mean), Table D-4 identifies the following constituents as COPCs based on RSV screening in the soil medium (0.3 to 1.2 m [1 to 4 ft]): aluminum;

resultant PAUF-adjusted HQ = 9.36E-03 for the American robin (avian insectivore) (Attachment D-7, Table D.7-2). The maximum SRS background for all-depths for cadmium is 2.01 mg/kg.

Cadmium is not recommended for further remedial evaluation as an ecological RCOC in surface soil based on the following lines of evidence:

- The mean detected concentration is less than the RSV.
- The PAUF-adjusted HQs are <1.
- It is naturally occurring

Copper was detected in 18 of 18 samples with 13 J-qualified results. In 2002, the maximum was 3,890 mg/kg (sampling location EL3-06) with a detected mean of 302 mg/kg, and an EPC of 685 mg/kg. The uncertainty evaluation (Attachment D-4, Table D.4-2) shows HQ exceedances for the American kestrel (insectivore/carnivore) HQ = 2.86E+00, American robin (avian herbivore) HQ = 6.85E+00, American robin (avian omnivore) HQ = 1.14E+01, American robin (avian insectivore) HQ = 1.59E+01, Earthworm (soil-dwelling invertebrate) HQ =1.29E+00, Deer mouse (mammalian omnivore) HQ = 6.85E+00, Montane shrew (mammalian insectivore) HQ = 9.79E+00, Mountain cottontail (mammalian herbivore) HQ = 1.59E+00 using a protective AUF set to 1 indicating the animal receives all of its exposure from the contaminated site. When the AUF is adjusted to a unit-specific PAUF (Mirenda 2012) using the mean concentration of copper, the resultant PAUF-adjusted HQ = 3.98E-05 (American kestrel, insectivore/carnivore), HQ = 2.41E-02 (American robin, avian herbivore), HQ = 4.02E-02 (American robin, avian omnivore), and HQ = 5.61E-02 (American robin (avian insectivore), HQ = 5.70E-01 (Earthworm, soil-dwelling invertebrate), HQ = 1.35E-01 (Deer mouse, mammalian omnivore), HQ = 3.71E-02 (Montane shrew, mammalian insectivore), and HQ = 7.60E-04 (Mountain cottontail, mammalian herbivore), (Attachment D-7, Table D.7-2). The maximum value for all depth intervals based on SRS background soil is 74.2 mg/kg (WSRC 2006) which is less than the unit detected mean. The maximum unit background for copper is 3.76 mg/kg at the EL3-19 location (Table A.1.6) which is lower than the detected mean at the unit. Copper is naturally occurring~~ and screening thresholds may be overprotective for this constituent~~.

Copper is not recommended for further remedial evaluation as an ecological RCOC in surface soil based on the following lines of evidence:

Aroclor 1254 is not recommended for further remedial evaluation as an ecological RCOC in surface soil based on the following lines of evidence:

- PAUF-adjusted HQs were <1.0.
- The mean concentration < the RSV may be overly protective.

Bis(2-ethylhexyl)phthalate was detected in 13 of 18 samples with three J-qualified (i.e., estimated) results. The maximum was 37.1 mg/kg from the EL3-06 location in 2002. The detected mean was 2.4 mg/kg, and the EPC was 6.0 mg/kg. The detected mean and EPC are greater than the RSV (0.2 mg/kg). The uncertainty evaluation (Attachment D-4, Table D.4-2) shows HQ exceedances for the American kestrel (insectivore/carnivore) HQ = 6.25 and American robin (avian omnivore) HQ = 15 using a protective AUF set to 1 indicating the animal receives all of its exposure from the contaminated site. When the AUF is adjusted to a unit-specific PAUF (Mirenda 2012) using the mean concentration of bis(2-ethylhexyl)phthalate (2.4 mg/kg), the resultant PAUF-adjusted HQ = 7.90E-05 for American kestrel, insectivore/carnivore, and HQ = 4.79E-02 for the American robin, avian omnivore (Attachment D-7, Table D.7-2). In addition, bis(2-ethylhexyl)phthalate is a common laboratory artifact, which was detected in unit-specific and field QA/QC field duplicate samples, with the highest levels detected in background samples. Therefore, bis(2-ethylhexyl)phthalate ~~and it~~ is not likely unit related.

Bis(2-ethylhexyl)phthalate is not recommended for further remedial evaluation as an ecological RCOC in surface soil based on the following lines of evidence:

- It is a common laboratory artifact
- PAUF-adjusted HQs were <1.0
- The RSV may be overly protective

Summary: The constituents identified as COPCs were ultimately screened out based on various lines of evidence. For all constituents with receptor-species thresholds, PAUF-adjusted HQs were well below 1.0. Aluminum, cadmium, copper, lead, vanadium, and zinc are naturally occurring and fall within or near background levels. Aroclor 1254 has a RSV value that may be overly protective. 1,1'-Biphenyl had a low frequency of detection with a mean value less than the RSV. In summary, no constituents are identified as RCOCs for the ECODS L-3 subunit for the 0.3 to 1.2 m (1 to 4 ft) surface soil interval.

SRNS, 2023. *Environmental Compliance and Area Completion Project Regulatory Document Handbook*, SRNS-RP-2022-00330, Revision 0, Savannah River Nuclear Solutions, LLC, Savannah River Site, Aiken, SC.

USEPA, 2022. Statistical Software ProUCL v5.2 for Environmental Applications for Data Sets With and Without Nondetect Observations, United States Environmental Protection Agency

USEPA, 2018. *Region 4 Ecological Risk Assessment Supplemental Guidance March 2018 Update* U.S. Environmental Protection Agency, Scientific Support Section, Superfund Division, Atlanta, GA

USFS, 1993. *Threatened, Endangered, and Sensitive Species Listing, L-Area Oil & Chemical and Acid/Caustic Basins, Savannah River Site,* United States Forest Service, Savannah River Forest Station, Aiken, SC.

USFS, 1994. *Threatened, Endangered, and Sensitive Species Listing, 1994 Savannah River Forest Station Site 5, L-Area Bingham Pump Outage Pit (Waste Site #41),* United States Forest Service, Savannah River Forest Station, Aiken, SC.

WSRC, 2003. *Site Evaluation Report for Early Construction and Operational Disposal Site (ECODS) L-3*, WSRC-RP-2003-4148, Revision 0, Westinghouse Savannah River Company, Savannah River Site, Aiken SC

WSRC, 2006. *Background Soils Statistical Summary Report for the Savannah River Site*. ERD-EN-2005-0223, Revision 1, Washington Savannah River Company, Savannah River Site, Aiken, SC.

Table D.4-1. Uncertainty Evaluation for ECODS L-3 Subunit (Soil 0-0.3 m [0-1 ft])

Analyte[1]	EPC[2]	RSV Source[3]	American Kestrel			
			Avian Top Predator		Insectivore/Carnivore	
			RSV	HQ	RSV	HQ
Inorganics (mg/kg)						
ALUMINUM	7.19E+03	NA	NA	NC	NA	NC
CADMIUM	2.07E+00	b	2.30E+03	8.98E-04	7.70E+00	2.68E-01
CYANIDE	1.22E+00	b	5.90E+00	2.07E-01	3.60E+00	3.39E-01
IRON	6.45E+03	NA	NA	NC	NA	NC
LEAD	2.14E+02	b	1.00E+03	2.14E-01	1.60E+02	1.34E+00
ZINC	1.21E+02	b	7.00E+03	1.73E-02	5.90E+02	2.06E-01
Organics (mg/kg)						
AROCLOR 1254	1.28E+00	b	7.60E+01	1.68E-02	1.90E+00	6.73E-01
BIS(2-ETHEYLHEXYL) PHTHLATE (DEHP)	2.63E+00	b	9.30E+01	2.83E-02	9.60E-01	2.74E+00

Analyte[1]	EPC[2]	RSV Source[3]	American Robin					
			Avian Herbivore		Avian Omnivore		Avian Insectivore	
			RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)								
ALUMINUM	7.19E+03	NA	NA	NC	NA	NC	NA	NC
CADMIUM	2.07E+00	b	2.30E+01	8.98E-02	1.60E+00	1.29E+00	3.00E+00	6.89E-01
CYANIDE	1.22E+00	b	1.00E+00	1.22E+00	9.80E-01	1.24E+00	9.90E-01	1.23E+00
IRON	6.45E+03	NA	NA	NC	NA	NC	NA	NC
LEAD	2.14E+02	b	3.60E+01	5.96E+00	2.30E+01	9.32E+00	2.80E+01	7.66E+00
ZINC	1.21E+02	b	1.20E+02	1.01E+00	1.20E+02	1.01E+00	2.20E+02	5.52E-01
Organics (mg/kg)								
AROCLOR 1254	1.28E+00	b	1.10E+01	1.16E-01	4.10E-01	3.12E+00	7.90E-01	1.62E+00
BIS(2-ETHEYLHEXYL) PHTHLATE (DEHP)	2.63E+00	b	1.60E+02	1.64E-02	2.00E-01	1.32E+01	4.00E-01	6.58E+00

Table D.4-1. Uncertainty Evaluation for ECODS L-3 Subunit (Soil 0-0.3 m [0-1 ft]) *(continued/end)*

Analyte[1]	EPC[2]	RSV Source[3]	Deer Mouse Mammalian Omnivore		Montane Shrew Mammalian Insectivore		Mountain Cottontail Mammalian Herbivore		Gray Fox Mammalian Top Carnivore	
			RSV	HQ	RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)										
ALUMINUM	7.19E+03	b	NA	NC	NA	NC	NA	NC	NA	NC
CADMIUM	2.07E+00	b	NA	NC	3.60E+00	5.74E-01	NA	NC	NA	NC
CYANIDE	1.22E+00	b	NA	NC	3.30E+03	3.70E-04	NA	NC	NA	NC
IRON	6.45E+03	NA	NA	NC	NA	NC	NA	NC	NA	NC
LEAD	2.14E+02	b	NA	NC	1.70E+02	1.26E+00	NA	NC	NA	NC
ZINC	1.21E+02	b	NA	NC	9.80E+02	1.24E-01	NA	NC	NA	NC
Organics (mg/kg)										
AROCLOR 1254	1.28E+00	b	NA	NC	2.40E+00	5.33E-01	NA	NC	NA	NC
BIS(2-ETHEYLHEXYL) PHTHLATE (DEHP)	2.63E+00	b	NA	NC	6.00E+00	4.39E-01	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	Earthworm Soil-dwelling Invertebrate	
			RSV	HQ
Inorganics (mg/kg)				
ALUMINUM	1.16E+04	NA	NA	NC
CADMIUM	2.90E+00	b	NA	NC
COPPER	6.85E+02	b	NA	NC
IRON	1.73E+04	NA	NA	NC
LEAD	8.17E+01	b	NA	NC
VANADIUM	3.12E+01	b	NA	NC
ZINC	2.54E+02	b	NA	NC
Organics (mg/kg)				
1,1'-BIPHENYL	6.29E-01	NA	NA	NC
AROCLOR 1254	8.46E-01	NA	NA	NC
BIS(2-ETHYLHEXYL) PHTHALATE (DEHP)	6.00E+00	NA	NA	NC

1 – Analytes identified as COPCs from Table D-2
2 - EPC = reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration. RME from Appendix A Table A.1.1 ECODS L-3 Subunit Soil (0-1 ft)
3 – RSV Source
a = Table 3 in EPA Region 4 Ecological Risk Assessment Supplemental Guidance March Update (2018).
b = Los Alamos National Laboratory Low Effect ESL for soil media (2022)
Hazard Quotient (HQ) = EPC/RSV
Highlighted cells indicate analytes with a HQ greater than 1.
NA = Not available; NC = Not calculated

Table D.4-2. Uncertainty Evaluation for ECODS L-3 Subunit (Soil 0.3-1.2 m [1-4 ft])

Analyte[1]	EPC[2]	RSV Source[3]	American Kestrel			
			Avian Top Predator		Insectivore/Carnivore	
			RSV	HQ	RSV	RSV
Inorganic (mg/kg)						
ALUMINUM	1.16E+04	NA	NA	NC	NA	NC
CADMIUM	2.90E+00	b	2.30E+03	1.26E-03	7.70E+00	3.76E-01
COPPER	6.85E+02	b	3.50E+03	1.96E-01	2.40E+02	2.86E+00
IRON	1.73E+04	NA	NA	NC	NA	NC
LEAD	8.17E+01	b	1.00E+03	8.17E-02	1.60E+02	5.11E-01
VANADIUM	3.12E+01	b	2.30E+02	1.36E-01	1.10E+02	2.84E-01
ZINC	2.54E+02	b	7.00E+03	3.63E-02	5.90E+02	4.31E-01
Organics (mg/kg)						
1,1'-BIPHENYL	6.29E-01	NA	NA	NC	NA	NC
AROCLOR 1254	8.46E-01	b	7.60E+01	1.11E-02	1.90E+00	4.45E-01
BIS(2-ETHYLHEXYL) PHTHALATE (DEHP)	6.00E+00	b	9.30E+01	6.45E-02	9.60E-01	6.25E+00

Analyte[1]	EPC[2]	RSV Source[3]	American Robin					
			Avian Omnivore		Avian Insectivore		Avian Omnivore	
			RSV	RSV	RSV	HQ	RSV	HQ
Inorganic (mg/kg)								
ALUMINUM	1.16E+04	NA	NA	NC	NA	NC	NA	NC
CADMIUM	2.90E+00	b	2.30E+01	1.26E-01	1.60E+00	1.81E+00	3.00E+00	9.66E-01
COPPER	6.85E+02	b	1.00E+02	6.85E+00	4.30E+01	1.59E+01	6.00E+01	1.14E+01
IRON	1.73E+04	NA	NA	NC	NA	NC	NA	NC
LEAD	8.17E+01	b	3.60E+01	2.27E+00	2.30E+01	3.55E+00	2.80E+01	2.92E+00
VANADIUM	3.12E+01	b	1.30E+01	2.40E+00	9.50E+00	3.29E+00	1.10E+01	2.84E+00
ZINC	2.54E+02	b	1.20E+02	2.12E+00	1.20E+02	2.12E+00	2.20E+02	1.16E+00
Organics (mg/kg)								
1,1'-BIPHENYL	6.29E-01	NA	NA	NC	NA	NC	NA	NC
AROCLOR 1254	8.46E-01	b	1.10E+01	7.69E-02	4.10E-01	2.06E+00	7.90E-01	1.07E+00
BIS(2-ETHYLHEXYL) PHTHALATE (DEHP)	6.00E+00	b	1.60E+02	3.75E-02	2.00E-01	3.00E+01	4.00E-01	1.50E+01

Table D.4-2. Uncertainty Evaluation ECODS L-3 Subunit (Soil 0.3-1.2 m [1-4 ft])) *(continued/end)*

Analyte[1]	EPC[2]	RSV Source[3]	Deer Mouse Mammalian Omnivore RSV	Deer Mouse Mammalian Omnivore HQ	Montane Shrew Mammalian Insectivore RSV	Montane Shrew Mammalian Insectivore RSV	Mountain Cottontail Mammalian Herbivore RSV	Mountain Cottontail Mammalian Herbivore HQ	Gray Fox Mammalian Top Carnivore RSV	Gray Fox Mammalian Top Carnivore HQ
Inorganic (mg/kg)										
ALUMINUM	1.16E+04		0.00E+00	NC	NA	NC	0.00E+00	NC	NA	NC
CADMIUM	2.90E+00	b	6.80E+00	4.26E-01	3.60E+00	8.05E-01	1.40E+02	2.07E-02	NA	NC
COPPER	6.85E+02	b	1.00E+02	6.85E+00	7.00E+01	9.79E+00	4.30E+02	1.59E+00	NA	NC
IRON	1.73E+04	NA	NA	NC	NA	NC	NA	NC	NA	NC
LEAD	8.17E+01	b	2.30E+02	3.55E-01	1.70E+02	4.81E-01	6.00E+02	1.36E-01	NA	NC
VANADIUM	3.12E+01	b	1.00E+03	3.12E-02	6.10E+02	5.12E-02	1.50E+03	2.08E-02	NA	NC
ZINC	2.54E+02	b	1.70E+03	1.50E-01	9.80E+02	2.60E-01	1.80E+04	1.41E-02	NA	NC
Organic (mg/kg)										
1,1'-BIPHENYL	6.29E-01	NA	NA	NC	NA	NC	NA	NC		
AROCLOR 1254	8.46E-01	b	4.80E+00	1.76E-01	2.40E+00	3.53E-01	NA	NC	NA	NC
BIS(2-ETHYLHEXYL) PHTHALATE (DEHP)	6.00E+00	b	1.10E+01	5.45E-01	6.00E+00	1.00E+00	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	Earthworm Soil-dwelling Invertebrate RSV	Earthworm Soil-dwelling Invertebrate HQ
Inorganics (mg/kg)				
ALUMINUM	1.16E+04	NA	NA	NC
CADMIUM	2.90E+00	b	7.60E+02	3.81E-03
COPPER	6.85E+02	b	5.30E+02	1.29E+00
IRON	1.73E+04	NA	NA	NC
LEAD	8.17E+01	b	8.40E+03	9.73E-03
VANADIUM	3.12E+01	b	NA	NC
ZINC	2.54E+02	b	9.30E+02	2.74E-01
Organics (mg/kg)				
1,1'-BIPHENYL	6.29E-01	NA	NA	NC
AROCLOR 1254	8.46E-01	NA	NA	NC
BIS(2-ETHYLHEXYL) PHTHALATE (DEHP)	6.00E+00	NA	NA	NC

1 – Analytes identified as COPCs from Table D-4
2 – EPC = reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration. RME from Appendix A Table A.1.2 ECODS L-3 Subunit Soil (1-4 ft)
3 – RSV Source
a = Table 3 in EPA Region 4 Ecological Risk Assessment Supplemental Guidance March Update (2018).
b = Los Alamos National Laboratory Low Effect ESL for soil media (2022
Hazard Quotient (HQ) = EPC/RSV
Highlighted cells indicate analytes with a HQ greater than 1.
NA = Not available
NC = Not calculated

Table D.4-3. Uncertainty Evaluation for LRP 131-1L Subunit (Soil 0-0.3 m [0-1 ft])

Analyte[1]	EPC[2]	RSV Source[3]	American Kestrel			
			Avian Top Predator		Insectivore/Carnivore	
			RSV	HQ	RSV	HQ
Inorganics (mg/kg)						
ALUMINUM	2.04E+04	NA	NA	NC	NA	NC
IRON	1.10E+04	NA	NA	NC	NA	NC
VANADIUM	3.31E+01	b	2.30E+02	1.34E-01	1.10E+02	3.95E-06
Radionuclides (pCi/g)						
CURIUM-245/246	2.76E-02	NA	NA	NC	NA	NC
LEAD-214	9.13E-01	NA	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	American Robin					
			Avian Herbivore		Avian Omnivore		Avian Insectivore	
			RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)								
ALUMINUM	2.04E+04	NA	NA	NC	NA	NC	NA	NC
IRON	1.10E+04	NA	NA	NC	NA	NC	NA	NC
VANADIUM	3.31E+01	b	1.30E+01	2.89E+00	9.50E+00	3.96E+00	1.10E+01	3.42E+00
Radionuclides (pCi/g)								
CURIUM-245/246	2.76E-02	NA	NA	NC	NA	NC	NA	NC
LEAD-214	9.13E-01	NA	NA	NC	NA	NC	NA	NC

Table D.4-3. Uncertainty Evaluation for LRP 131-1L Subunit (Soil 0-0.3 m [0-1 ft]) *(continued/end)*

Analyte[1]	EPC[2]	RSV Source[3]	Deer Mouse Mammalian Omnivore		Montane Shrew Mammalian Insectivore		Mountain Cottontail Mammalian Herbivore		Gray Fox Mammalian Top Carnivore	
			RSV	HQ	RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)										
ALUMINUM	2.04E+04	NA	NA	NC	NA	NC	NA	NC	NA	NC
IRON	1.10E+04	NA	NA	NC	NA	NC	NA	NC	NA	NC
VANADIUM	3.31E+01	b	1.00E+03	3.76E-02	6.10E+02	6.16E-02	1.50E+03	2.51E-02	6.90E+03	5.45E-03
Radionuclides (pCi/g)										
CURIUM-245/246	2.76E-02	NA	NA	NC	NA	NC	NA	NC	NA	NC
LEAD-214	9.13E-01	NA	NA	NC	NA	NC	NA	NC	NA	NC

Analyte[1]	EPC[2] *(mg/kg)*	RSV Source[3]	Earthworm Soil-Dwelling Invertebrate	
			RSV	HQ
Inorganic (mg/kg)				
ALUMINUM	2.04E+04	NA	NA	NC
IRON	1.10E+04	NA	NA	NC
VANADIUM	3.31E+01	b	NA	NC
Radionuclides (pCi/g)				
CURIUM-245/246	2.76E-02	NA	NA	NC
LEAD-214	9.13E-01	NA	NA	NC

1 – Analytes identified as COPCs from Table D-6
2 - EPC = reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration. RME from Appendix A Table A.2.1 LRP 131-1L Subunit Soil (0-1 ft)
3 – RSV Source
a = Table 3 in EPA Region 4 Ecological Risk Assessment Supplemental Guidance March Update (2018).
b = Los Alamos National Laboratory Low Effect ESL for soil media (2022)
Hazard Quotient (HQ) = EPC/RSV
Highlighted cells indicate analytes with a HQ greater than 1.
NA = Not available
NC = Not calculated

Table D.4-4. Uncertainty Evaluation for LRP 131-1L Subunit (Soil 0.3-1.2 m [1-4 ft])

Analyte[1]	EPC[2]	RSV Source[3]	American Kestrel			
			Avian Top Carnivore		Insectivore/Carnivore	
			RSV	HQ	RSV	HQ
Inorganics (mg/kg)						
ALUMINUM	1.88E+04	NA	NA	NC	NA	NC
IRON	1.13E+04	NA	NA	NC	NA	NC
VANADIUM	3.08E+01	b	2.30E+02	1.34E-01	1.10E+02	2.80E-01
Organics (pCi/g)						
FLUORANTHENE	3.00E+01	b	NA	NC	NA	NC
HEXACHLOROBUTADIENE	2.90E-01	NA	NA	NC	NA	NC
PHENANTHRENE	2.40E+01	b	NA	NC	NA	NC
Radionuclides (pCi/g)						
LEAD-214	7.03E-01	NA	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	American Robin					
			Avian Herbivore		Avian Omnivore		Avian Insectivore	
			RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)								
ALUMINUM	1.88E+04	NA	NA	NC	NA	NC	NA	NC
IRON	1.13E+04	NA	NA	NC	NA	NC	NA	NC
VANADIUM	3.08E+01	b	1.30E+01	2.37E+00	9.50E+00	3.24E+00	1.10E+01	2.80E+00
Organics (pCi/g)								
FLUORANTHENE	3.00E+01	b	NA	NC	NA	NC	NA	NC
HEXACHLOROBUTADIENE	2.90E-01	NA	NA	NC	NA	NC	NA	NC
PHENANTHRENE	2.40E+01	b	NA	NC	NA	NC	NA	NC
Radionuclides (pCi/g)								
LEAD-214	7.03E-01	NA	NA	NC	NA	NC	NA	NC

Table D.4-4. Uncertainty Evaluation for LRP 131-1L Subunit (Soil 0.3-1.2 m [1-4 ft]) *(continued/end)*

Analyte[1]	EPC[2]	RSV Source[3]	Deer Mouse Mammalian Omnivore		Montane Shrew Mammalian Insectivore		Mountain Cottontail Mammalian Herbivore		Grey Fox Mammalian Top Carnivore	
			RSV	HQ	RSV	HQ	RSV	HQ	RSV	HQ
Inorganic (mg/kg)										
ALUMINUM	1.88E+04	NA	NA	NC	NA	NC	NA	NC	NA	NC
IRON	1.13E+04	NA	NA	NC	NA	NC	NA	NC	NA	NC
VANADIUM	3.08E+01	b	1.00E+03	3.08E-02	6.10E+02	5.04E-02	1.50E+03	2.05E-02	6.90E+03	4.46E-03
Organics (mg/kg)										
FLUORANTHENE	3.00E+01	b	3.80E+02	7.89E-02	2.20E+02	1.36E-01	2.70E+03	1.11E-01	3.90E+04	7.69E-04
HEXACHLOROBUTADIENE	2.90E-01	NA	NA	NC	NA	NC	NA	NC	NA	NC
PHENANTHRENE	2.40E+01	b	1.50E+02	1.60E-01	1.10E+02	2.18E-01	6.20E+02	3.87E-02	1.90E+04	1.26E-03
Radionuclides (pCi/g)										
LEAD-214	7.03E-01	NA	NA	NC	NA	NC	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	Earthworm Soil-dwelling Invertebrate	
			RSV	HQ
Inorganics (mg/kg)				
ALUMINUM	1.88E+04	NA	NA	NC
IRON	1.13E+04	NA	NA	NC
VANADIUM	3.08E+01	b	NA	NC
Organics (mg/kg)				
FLUORANTHENE	3.00E+01	b	2.30E+01	1.3E+00
HEXACHLOROBUTADIENE	2.90E-01	NA	NA	NC
PHENANTHRENE	2.40E+01	b	1.20E+01	2.00E+00
Radionuclides (pCi/g)				
LEAD-214	7.03E-01	NA	NA	NC

1 - Analytes identified as COPCs from Table D-8
2 - EPC = reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration. RME from Appendix A Table A.1.2 LRP 131-1L Subunit Soil (1-4 ft)
3 – RSV Source
a = Table 3 in EPA Region 4 Ecological Risk Assessment Supplemental Guidance March Update (2018).
b = Los Alamos National Laboratory Low Effect ESL for soil media (2022)
Hazard Quotient (HQ) = EPC/RSV
Highlighted cells indicate analytes with a HQ greater than 1.
NA = Not Available
NC = Not Calculated

Table D.4-5. Uncertainty Evaluation for LRP 131-4L Subunit (Soil 0-0.3 m [0-1 ft])

Analyte[1]	EPC[2]	RSV Source[3]	American Kestrel			
			Avian Top Carnivore		Insectivore/Carnivore	
			RSV	HQ	RSV	HQ
Inorganics (mg/kg)						
ALUMINUM	1.31E+04	NA	NA	NC	NA	NC
CYANIDE	1.63E+00	b	5.9E+00	2.77E-01	3.60E+00	4.53E-01
IRON	9.84E+03	NA	NA	NC	NA	NC
VANADIUM	2.65E+01	b	2.30E+02	1.15E-01	1.10E+02	2.41E-01
Organics (mg/kg)						
2-NITROPHENOL	3.00E-02	NA	NA	NC	NA	NC
METYL ACETATE	2.64E-03	NA	NA	NC	NA	NC
N-NITROSODIPROPYLAMINE	4.50E-01	NA	NA	NC	NA	NC
Radionuclides (pCi/g)						
ACTINIUM-228	4.18E+00	NA	NA	NC	NA	NC
LEAD 212	2.74E+00	NA	NA	NC	NA	NC
LEAD-214	1.61E+00	NA	NA	NC	NA	NC
POTASSIUM-40	5.64E+00	NA	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	American Robin					
			Avian Herbivore		Avian Insectivore		Avian Omnivore	
			RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)								
ALUMINUM	1.31E+04	NA	NA	NC	NA	NC	NA	NC
CYANIDE	1.63E+00	b	1.00E+00	1.63E+00	9.80E-01	1.67E+00	9.90E-01	1.65E+00
IRON	9.84E+03	NA	NA	NC	NA	NC	NA	NC
VANADIUM	2.65E+01	b	1.30E+01	2.04E+00	9.50E+00	2.79E+00	1.10E+01	2.41E+00
Organics (mg/kg)								
2-NITROPHENOL	3.00E-02	NA	NA	NC	NA	NC	NA	NC
METYL ACETATE	2.64E-03	NA	NA	NC	NA	NC	NA	NC
N-NITROSODIPROPYLAMINE	4.50E-01	NA	NA	NC	NA	NC	NA	NC
Radionuclides (pCi/g)								
ACTINIUM-228	4.18E+00	NA	NA	NC	NA	NC	NA	NC
LEAD 212	2.74E+00	NA	NA	NC	NA	NC	NA	NC
LEAD-214	1.61E+00	NA	NA	NC	NA	NC	NA	NC
POTASSIUM-40	5.64E+00	NA	NA	NC	NA	NC	NA	NC

Table D.4-5. Uncertainty Evaluation for LRP 131-4L Subunit (Soil 0-0.3 m [0-1 ft]) *(continued/end)*

Analyte[1]	EPC[2]	RSV Source[3]	Deer Mouse Avian Herbivore RSV	Deer Mouse Avian Herbivore HQ	Montane Shrew Avian Omnivore RSV	Montane Shrew Avian Omnivore HQ	Mountain Cottontail Avian Omnivore RSV	Mountain Cottontail Avian Omnivore HQ	Grey Fox Mammalian Top Carnivore RSV	Grey Fox Mammalian Top Carnivore HQ
Inorganics (mg/kg)										
ALUMINUM	1.31E+04	NA	NA	NC	NA	NC	NA	NC	NA	NC
CYANIDE	1.63E+00	b	3.30E+03	4.95E-04	3.30E+03	4.95E-04	7.90E+03	2.07E-04	3.30E+04	4.95E-05
IRON	9.84E+03	NA	NA	NC	NA	NC	NA	NC	NA	NC
VANADIUM	2.65E+01	b	1.00E+03	2.65E-02	6.10E+02	4.34E-02	1.50E+03	1.77E-02	6.90E+03	3.84E-03
Organics (mg/kg)										
2-NITROPHENOL	3.00E-02	NA	NA	NC	NA	NC	NA	NC	NA	NC
METYL ACETATE	2.64E-03	NA	NA	NC	NA	NC	NA	NC	NA	NC
N-NITROSODIPROPYLAMINE	4.50E-01	NA	NA	NC	NA	NC	NA	NC	NA	NC
Radionuclides (pCi/g)										
ACTINIUM-228	4.18E+00	NA	NA	NC	NA	NC	NA	NC	NA	NC
LEAD 212	2.74E+00	NA	NA	NC	NA	NC	NA	NC	NA	NC
LEAD-214	1.61E+00	NA	NA	NC	NA	NC	NA	NC	NA	NC
POTASSIUM-40	5.64E+00	NA	NA	NC	NA	NC	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	Earthworm Soil-Dwelling Invertebrates RSV	Earthworm Soil-Dwelling Invertebrates HQ
Inorganics (mg/kg)				
ALUMINUM	1.31E+04	NA	NA	NC
CYANIDE	1.63E+00	b	3.30E+03	4.95E-04
IRON	9.84E+03	NA	NA	NC
VANADIUM	2.65E+01	b	1.00E+03	2.65E-02
Organics (mg/kg)				
2-NITROPHENOL	3.00E-02	NA	NA	NC
METYL ACETATE	2.64E-03	NA	NA	NC
N-NITROSODIPROPYLAMINE	4.50E-01	NA	NA	NC
Radionuclides (pCi/g)				
ACTINIUM-228	4.18E+00	NA	NA	NC
LEAD 212	2.74E+00	NA	NA	NC
LEAD-214	1.61E+00	NA	NA	NC
POTASSIUM-40	5.64E+00	NA	NA	NC

1 - Analytes identified as COPCs from Table D-10
2 - EPC = reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration. RME from Appendix A Table A.3.1 LRP 131-4L Subunit Soil (0-1 ft)
3 – RSV Source
a = Table 3 in EPA Region 4 Ecological Risk Assessment Supplemental Guidance March Update (2018).
b = Los Alamos National Laboratory Low Effect ESL for soil media (2022)
Hazard Quotient (HQ) = EPC/RSV
Highlighted cells indicate analytes with a HQ greater than 1.
NA = Not available; NC = Not calculated

Table D.4-6. Uncertainty Evaluation for LRP 131-4L Subunit (Soil 0.3-1.2 m [1-4 ft])

Analyte[1]	EPC[2]	RSV Source[3]	American Kestrel			
			Avian Top Carnivore		Insectivore/Carnivore	
			RSV	HQ	RSV	HQ
Inorganics (mg/kg)						
ALUMINUM	1.43E+04	NA	NA	NC	NA	NC
CYANIDE	1.10E+00	b	5.90E+00	1.87E-01	3.60E+00	3.06E-01
IRON	1.13E+04	NA	NA	NC	NA	NC
VANADIUM	2.86E+01	b	2.30E+02	1.24E-01	1.10E+02	2.60E-01
Organics (mg/kg)						
CYCLOHEXANE	5.00E-04	NA	NA	NC	NA	NC
METYL ACETATE	2.75E-03	NA	NA	NC	NA	NC
METHYLCYCLOHEXANE	3.87E-04	NA	NA	NC	NA	NC
Radionuclides (pCi/g)						
ACTINIUM-228	3.43E+00	NA	NA	NC	NA	NC
AMERICIUM-243	4.95E-02	NA	NA	NC	NA	NC
LEAD-212	2.21E+00	NA	NA	NC	NA	NC
LEAD-214	1.97E+00	NA	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	American Robin					
			Avian Herbivore		Avian Omnivore		Avian Omnivore	
			RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)								
ALUMINUM	7.19E+03	NA	NA	NC	NA	NC	NA	NC
CYANIDE	1.22E+00	b	1.00E+00	1.10E+00	9.80E-01	1.13E+00	9.90E-01	1.11E+00
IRON	6.45E+03	NA	NA	NC	NA	NC	NA	NC
VANADIUM	2.14E+02	b	1.30E+01	2.20E+00	9.50E+00	3.01E+00	1.10E+01	2.60E+00
Organics (mg/kg)								
CYCLOHEXANE	5.00E-04	NA	NA	NC	NA	NC	NA	NC
METYL ACETATE	2.75E-03	NA	NA	NC	NA	NC	NA	NC
METHYLCYCLOHEXANE	3.87E-04	NA	NA	NC	NA	NC	NA	NC
Radionuclides (pCi/g)								
ACTINIUM-228	3.43E+00	NA	NA	NC	NA	NC	NA	NC
AMERICIUM-243	4.95E-02	NA	NA	NC	NA	NC	NA	NC
LEAD-212	2.21E+00	NA	NA	NC	NA	NC	NA	NC
LEAD-214	1.97E+00	NA	NA	NC	NA	NC	NA	NC

Table D.4-6. Uncertainty Evaluation for LRP 131-4L Subunit (Soil 0.3-1.2 m [1-4 ft])

Analyte[1]	EPC[2]	RSV Source[3]	Deer Mouse Mammalian Omnivore		Montane Shrew Mammalian Insectivore		Mountain Cottontail Mammalian Herbivore		Gray Fox Mammalian Top Carnivore	
			RSV	HQ	RSV	HQ	RSV	HQ	RSV	HQ
Inorganics (mg/kg)										
ALUMINUM	7.19E+03	NA	NA	NC	NA	NC	NA	NC	NA	NC
CYANIDE	1.22E+00	b	3.30E+03	3.34E-04	3.30E+03	3.34E-04	7.90E+03	1.40E-04	3.30E+04	3.34E-05
IRON	6.45E+03	NA	NA	NC	NA	NC	NA	NC	NA	NC
VANADIUM	2.14E+02	b	1.00E+03	2.86E-02	6.10E+02	4.68E-02	1.50E+03	1.90E-02	6.90E+03	4.14E-03
Organics (mg/kg)										
CYCLOHEXANE	5.00E-04	NA	NA	NC	NA	NC	NA	NC	NA	NC
METYL ACETATE	2.75E-03	NA	NA	NC	NA	NC	NA	NC	NA	NC
METHYLCYCLOHEXANE	3.87E-04	NA	NA	NC	NA	NC	NA	NC	NA	NC
Radionuclides (pCi/g)										
ACTINIUM-228	3.43E+00	NA	NA	NC	NA	NC	NA	NC	NA	NC
AMERICIUM-243	4.95E-02	NA	NA	NC	NA	NC	NA	NC	NA	NC
LEAD-212	2.21E+00	NA	NA	NC	NA	NC	NA	NC	NA	NC
LEAD-214	1.97E+00	NA	NA	NC	NA	NC	NA	NC	NA	NC

Analyte[1]	EPC[2]	RSV Source[3]	Earthworm Soil-Dwelling Invertebrate	
			RSV	HQ
Inorganics (mg/kg)				
ALUMINUM	1.43E+04	NA	NA	NC
CYANIDE	1.10E+00	b	NA	NC
IRON	1.13E+04	NA	NA	NC
VANADIUM	2.86E+01	b	NA	NC
Organics (mg/kg)				
CYCLOHEXANE	5.00E-04	NA	NA	NC
METYL ACETATE	2.75E-03	NA	NA	NC
METHYLCYCLOHEXANE	3.87E-04	NA	NA	NC
Radionuclides (pCi/g)				
ACTINIUM-228	3.43E+00	NA	NA	NC
AMERICIUM-243	4.95E-02	NA	NA	NC
LEAD-212	2.21E+00	NA	NA	NC
LEAD-214	1.97E+00	NA	NA	NC

1 - Analytes identified as COPCs from Table D-12
2 - EPC = reasonable maximum exposure (RME) exposure point concentration (EPC) is the lesser of the maximum detected concentration and the 95% upper confidence limit (UCL) on the mean concentration. RME from Appendix A Table A.3.2 LRP 131-4L Subunit Soil (1-4 ft)
3 – RSV Source
a = Table 3 in EPA Region 4 Ecological Risk Assessment Supplemental Guidance March Update (2018).
b = Los Alamos National Laboratory Low Effect ESL for soil media (2022)
Hazard Quotient (HQ) = EPC/RSV
Highlighted cells indicate analytes with a HQ greater than 1.
NA = Not available
NC = Not calculated

APPENDIX I

DATA USABILITY REPORTS

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Table of MDL > RSL or PRG at L-Area Rubble Pit (131-1L)

INTERPRETED QUALIFIERS: U or UJ Qualifiers
MATRIX CODE: Soil only
LAB GROUP COMBO: ALL
SAMPLE TYPE CODE: REG Samples ONLY
START DEPTH: 0 ft
END DEPTH: 1 ft

RECORD GROUPS	ANALYTE GROUP	CHEMICAL NAME	ANALYTICAL METHOD	RSL or PRG[1]	UNITS	MDL Min	MDL Max	# of Non-Detects	# of Results	# of MDL> RSL or PRG
Chemical	SVOCs	2,6-DINITROTOLUENE	EPA 8270E	3.60E-01	mg/kg	2.70E-02	5.50E-01	21	21	1
Chemical	SVOCs	3,3-DICHLOROBENZIDINE	EPA 8270E	1.20E+00	mg/kg	8.70E-02	1.80E+00	21	21	1
~~Chemical~~	~~SVOCs~~	~~BENZO[A]PYRENE~~	~~EPA 8270E~~	~~1.10E-01~~	~~mg/kg~~	~~1.90E-02~~	~~3.90E-01~~	~~21~~	~~21~~	~~1~~
Chemical	SVOCs	BIS(2-CHLOROETHYL)ETHER	EPA 8270E	2.30E-01	mg/kg	1.60E-02	3.30E-01	21	21	1
Chemical	SVOCs	DIBENZ[AH]ANTHRACENE	EPA 8270E	1.10E-01	mg/kg	1.80E-02	3.70E-01	21	21	1
Chemical	SVOCs	DINITRO-O-CRESOL	EPA 8270E	5.10E+00	mg/kg	3.20E-01	6.50E+00	21	21	1
Chemical	SVOCs	HEXACHLOROBENZENE	EPA 8270E	2.10E-01	mg/kg	2.80E-02	5.70E-01	21	21	1
Chemical	SVOCs	HEXACHLOROCYCLOPENTADIENE	EPA 8270E	1.80E+00	mg/kg	1.10E-01	2.20E+00	21	21	1
Chemical	SVOCs	N-NITROSODIPROPYLAMINE	EPA 8270E	7.80E-02	mg/kg	6.50E-02	1.30E+00	21	21	2
Chemical	SVOCs	PENTACHLOROPHENOL	EPA 8270E	1.00E+00	mg/kg	3.20E-01	6.50E+00	21	21	2
Chemical	VOCs	1,2-DIBROMO-3-CHLOROPROPANE	EPA 8260D	5.30E-03	mg/kg	4.99E-04	6.24E-02	21	21	1
Chemical	VOCs	1,2-DIBROMOETHANE	EPA 8260D	3.60E-02	mg/kg	3.32E-04	4.16E-02	21	21	1
Radiochemical	ALPHA SPEC	URANIUM-235	A01R	4.58E-02	pCi/g	4.55E-02	8.70E-02	4	5	3
Radiochemical	BETA SPEC	TRITIUM	EPA 906.0	2.37E-01	pCi/g	4.32E-01	4.32E-01	1	1	1
Radiochemical	GAMMA SPEC	COBALT-60	GA-01-RMOD	3.30E-02	pCi/g	9.76E-02	9.76E-02	1	1	1
Radiochemical	GAMMA SPEC	EUROPIUM-154	GA-01-RMOD	4.73E-02	pCi/g	1.75E-01	1.75E-01	1	1	1

1 - RSL or PRG = residential regional screening level or preliminary remediation goal

Table of MDL > RSL or PRG at L-Area Rubble Pit (131-1L)

INTERPRETED QUALIFIERS: U or UJ Qualifiers
MATRIX CODE: Soil only
LAB GROUP COMBO: ALL
SAMPLE TYPE CODE: REG Samples ONLY
START DEPTH: 0 ft
END DEPTH: 1 ft

RECORD GROUPS	ANALYTE GROUP	CHEMICAL NAME	ANALYTICAL METHOD	RSL or PRG	UNITS	MDL Min	MDL Max	# of Non-Detects	# of Results	# of MDL> RSL or PRG
Chemical	SVOCs	2,6-DINITROTOLUENE	EPA8270E	3.60E-01	mg/kg	2.70E-02	5.50E-01	21	21	6
Chemical	SVOCs	3,3-DICHLOROBENZIDINE	EPA8270E	1.20E+00	mg/kg	8.70E-02	1.80E+00	21	21	6
Chemical	SVOCs	BENZO[A]PYRENE	EPA8270E	1.10E-01	mg/kg	1.90E-02	3.90E-01	21	21	17
Chemical	SVOCs	BIS(2-CHLOROETHYL)ETHER	EPA8270E	2.30E-01	mg/kg	1.60E-02	3.30E-01	21	21	6
Chemical	SVOCs	DIBENZ[AH]ANTHRACENE	EPA8270E	1.10E-01	mg/kg	1.80E-02	3.70E-01	21	21	17
Chemical	SVOCs	DINITRO-O-CRESOL	EPA8270E	5.10E+00	mg/kg	3.20E-01	6.50E+00	21	21	6
Chemical	SVOCs	HEXACHLOROBENZENE	EPA8270E	2.10E-01	mg/kg	2.80E-02	5.70E-01	21	21	17
Chemical	SVOCs	HEXACHLOROCYCLOPENTADIENE	EPA8270E	1.80E+00	mg/kg	1.10E-01	2.20E+00	21	21	6
Chemical	SVOCs	N-NITROSODIPROPYLAMINE	EPA8270E	7.80E-02	mg/kg	6.50E-02	1.30E+00	21	21	20
Chemical	SVOCs	PENTACHLOROPHENOL	EPA8270E	1.00E+00	mg/kg	3.20E-01	6.50E+00	21	21	20
Chemical	VOCs	1,2-DIBROMO-3-CHLOROPROPANE	EPA8260D	5.30E-03	mg/kg	4.99E-04	6.24E-02	21	21	2
Chemical	VOCs	1,2-DIBROMOETHANE	EPA8260D	3.60E-02	mg/kg	3.32E-04	4.16E-02	21	21	2
Radiochemical	ALPHA SPEC	URANIUM-235	A01R	4.58E-02	pCi/g	4.55E-02	8.70E-02	4	5	3
Radiochemical	BETA SPEC	TRITIUM	EPA906.0	2.37E-01	pCi/g	4.32E-01	4.32E-01	1	1	1
Radiochemical	GAMMA SPEC	COBALT-60	GA-01-RMOD	3.30E-02	pCi/g	9.76E-02	9.76E-02	1	1	1
Radiochemical	GAMMA SPEC	EUROPIUM-154	GA-01-RMOD	4.73E-02	pCi/g	1.75E-01	1.75E-01	1	1	1