ESHID-600513-03

LA-UR-15-24404
June 2015
EP2015-0102

# 2013 Excavation of the Los Alamos Canyon Low-Head Weir, Revision 1

Los Alamos NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

EP2015-0102

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This revision to the 2013 erxcavation of the Los Alamos low-head weir report incorporates changes required by the New Mexico Environment Department's (NMED's) notice of disapproval, dated March 3, 2015 (NMED 2015, 600271). Excavation of the basins behind the Los Alamos Canyon low-head weir began on April 1, 2013, and was completed on May 6, 2013. The basins were excavated to maximize the sediment-retention capacity for the 2013 summer monsoon season. Much of the total available capacity had been lost as a result of sediment accumulation that followed the Las Conchas fire. An estimated 6000 $yd^3$ (including postexcavation expansion) of sediment was removed from the three basins, transported approximately 0.5 mi up Los Alamos Canyon, and stockpiled at a former borrow pit (Figures 1 and 2). The borrow pit provides an ideal location for the disposition of the excavated sediment because of its available capacity and its isolation from potential storm water runoff. A layer of sediment approximately 6 in. thick was retained in the bottom of each basin to mitigate against potential infiltration into underlying bedrock (Figures 32 through 5).

Excavated sediment was removed from the basins using a front-end loader and transported in tandem wheel dump trucks upcanyon approximately 0.5 mi to a former borrow-pit basin. The borrow pit is bounded on three sides by elevated slopes. The sediment was placed on a plastic liner, compacted and contoured to match existing grade on the north and east sides, and hydroseeded with wood-fiber mulch and Los Alamos National Laboratory– (LANL-) approved native plant seed mix. In addition, a 3-ft-high runoff containment berm was constructed at the base of the open slope, tying in with the existing slope walls. Figures 67 through 9–10 are photographs taken on from June 18, 2015, that show the current grade, vegetation established in the area, and the containment berm located along the west side. Vegetation cover and diversity are exceptional, and a substantial amount of the original hydromulch remains on the soil surface. There is virtually no evidence of soil erosion at the site.

Before excavation, samples were collected to characterize the material planned for excavation (Figure -103). Samples were collected for polychlorinated biphenyls, pesticides, herbicides, dioxins/furans, general chemistry, inorganics, and radionuclides. Four depth-integrated subsamples were collected for analysis from each of six areas within the lower basin to represent the mixed condition of excavated sediment. This approach ensured that finer-grained deposits, with typically higher constituent concentrations and most prevalent in the lower basin, were included in the samples. Table 1 provides information on the samples collected to characterize the material in the basins. The data are provided on the CD included with this report (Appendix A).

A screening comparison was conducted to support decisions regarding disposition of the excavated sediment. The approach used for the analysis is consistent with the approach taken to evaluate the same type of sediment deposits behind the low-head weir structure in 2009 (LANL 2009, 105294).

The data were first compared with sediment background values (BVs) (LANL 1998, 059730) or detection limits (for organic chemicals), and those values that exceeded BVs and detected organic chemicals (chemicals of potential concern [COPCs]) were compared with the residential soil screening levels (SSLs)/screening action levels (SALs) (LANL 2012, 228852; NMED 2012, 219971) and minimum ecological screening levels (ESLs) (LANL 2012, 226667) (Table 21).

The following is a summary of the assessment:

- 51 analytes were detected.
  - ❖ For the 13 detected dioxin and furan congeners, the 2,3,7,8-tetrachlorodibenzodioxin– (TCDD-) equivalent concentration for mammals was calculated from the toxic equivalency factors referenced in NMED guidance (2012, 219971).

- 22 detected analytes were identified as COPCs based on comparisons to background for inorganic compounds and radionuclides and detection status for organic compounds.
- Maximum COPC concentrations were not greater than residential SSLs/SALs, and therefore no potential unacceptable human health risks are present for the materials behind the low-head weir.
- Maximum concentrations of barium, copper, cyanide, lead, manganese, nickel, zinc, and TCDD were greater than the respective minimum ESLs.

COPCs with concentrations greater than the minimum ESLs were further evaluated to determine if they have the potential for causing ecological risk (chemicals of potential ecological concern [COPECs]). The approach taken in this assessment was to compare measured concentrations for a given COPEC with the lowest-effect level ESLs (L-ESLs).

Table 2 3 lists the maximum concentrations of barium, copper, cyanide, lead, manganese, nickel, zinc, and TCDD. For comparison, the sediment and soil BVs as well as the minimum ESLs and L-ESLs are provided. In addition, the maximum concentrations measured in 2009 from the weir are presented as well as the maximum concentrations measured in postfire ash (samples collected after the Cerro Grande fire) (LANL 2004, 087390) because of the high ash content in the weir sediment.

The hazard quotient (HQ) is calculated by dividing the maximum concentration of each COPEC measured in 2013 by the minimum ESL or L-ESL.

The HQs for the minimum ESLs are all greater than 1; the HQs for the minimum L-ESLs are less than 1 for copper, nickel, zinc, and TCDD; and the HQs for the minimum L-ESLs are slightly above 1 for barium, cyanide, lead, and manganese. The latter COPECs are discussed below. The maximum concentrations for barium, lead, and manganese came from sample CALA-13-28430 at location LA-27, and the maximum concentration for cyanide came from sample CALA-13-28425 at location LA-22 (Figure 103).

- **Barium**: All detected concentrations are above the sediment BV but below the soil BV. The minimum ESL is below the sediment and soil BVs, and the L-ESL is below the soil BV. The maximum HQ based on the L-ESL is 1.1, and the mean HQ is 0.9. Higher concentrations were measured in postfire ash after the Cerro Grande fire (LANL 2004, 087390), indicating the ash is a source of barium in the weir. Therefore, there are no potential ecological risks from barium.
- **Cyanide**: Five of six detected concentrations are above the sediment BV, and all are above the soil BV. The minimum ESL is below the sediment and soil BVs, and the L-ESL is 0.18 mg/kg above the sediment BV. Elevated concentrations for cyanide are also probably related to ash from the Las Conchas fire. The maximum HQ based on the L-ESL is 1.4, and the mean HQ is 1.1.; both are equivalent to 1. Therefore, there are no potential ecological risks from cyanide.
- **Lead**: All detected concentrations are above the sediment and soil BVs, but five of six concentrations are below the maximum soil background concentration. The minimum ESL is below the sediment and soil BVs, and the L-ESL is 8.3 mg/kg above the sediment BV and 5.7 mg/kg above the soil BV but the same as the maximum soil background concentration. The maximum HQ based on the L-ESL is 1.3, and the mean HQ is 1. Higher concentrations were measured in postfire ash after the Cerro Grande fire (LANL 2004, 087390), indicating the ash is a source of lead in the weir. Therefore, there are no potential ecological risks from lead.
- **Manganese:** All detected concentrations are above the sediment and soil BVs, but three of six concentrations are below the maximum soil background concentration. The minimum ESL is below the sediment and soil BVs, and the L-ESL is above the sediment and soil BVs but the same as the maximum soil background concentration. The maximum HQ based on the L-ESL is

1.2, and the mean HQ is 1. Higher concentrations were measured in postfire ash after the Cerro Grande fire (LANL 2004, 087390), indicating the ash is a source of manganese in the weir. ~~Therefore, there are no potential ecological risks from manganese.~~

**REFERENCES**

*The following list includes all documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ER ID or ESH ID. This information is also included in text citations. ER IDs were assigned by the Environmental Programs Directorate's Records Processing Facility (IDs through 599999), and ESH IDs are assigned by the Environment, Safety, and Health (ESH) Directorate (IDs 600000 and above). IDs are used to locate documents in the Laboratory's Electronic Document Management System and, where applicable, in the master reference set.*

*Copies of the master reference set are maintained at the NMED Hazardous Waste Bureau and the ESH Directorate. The set was developed to ensure that the administrative authority has all material needed to review this document, and it is updated with every document submitted to the administrative authority. Documents previously submitted to the administrative authority are not included*

LANL (Los Alamos National Laboratory), September 22, 1998. "Inorganic and Radionuclide Background Data for Soils, Canyon Sediments, and Bandelier Tuff at Los Alamos National Laboratory," Los Alamos National Laboratory document LA-UR-98-4847, Los Alamos, New Mexico. (LANL 1998, 059730)

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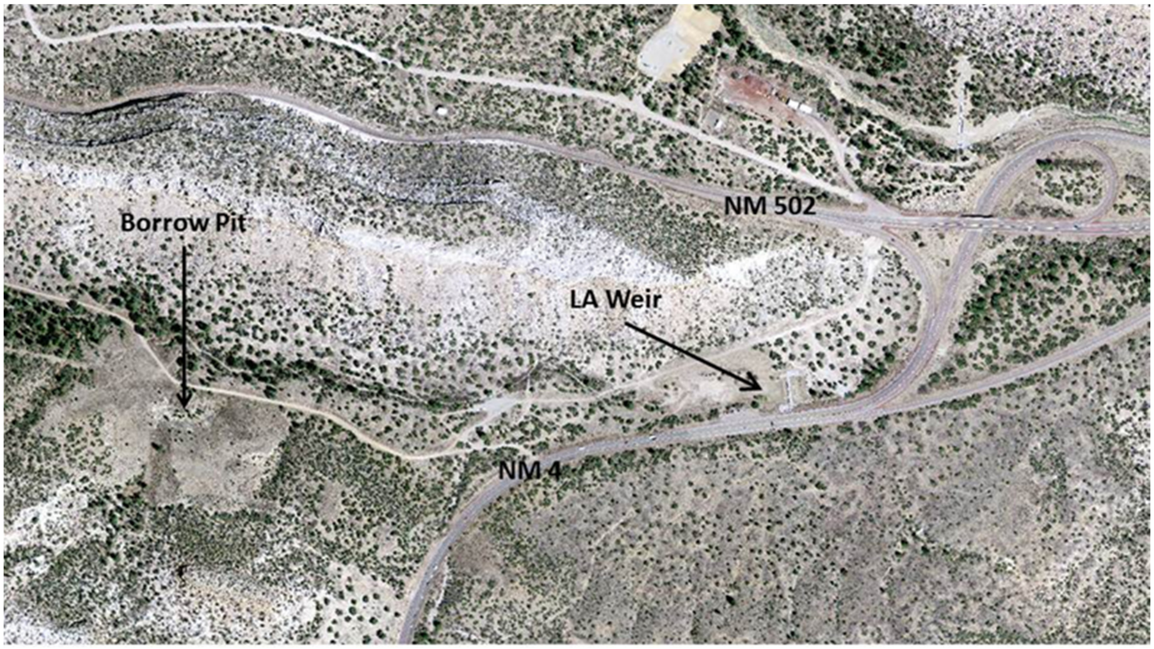


**Figure 1 Orthophoto map showing locations of the Los Alamos Canyon weir and borrow pit near the intersection of NM 502 and NM 4**

**Figure 2 Excavated sediment being placed in former borrow pit in Los Alamos Canyon**

**Figure 3 Sediment removal activities in basin 3**


**Figure 4 Postexcavation view upcanyon from weir. Basin 3 is in the foreground.**


**Figure 5 Postexcavation view downcanyon into basin 3**

**Figure 6 Sediment placement in the borrow pit. Sediment was compacted and contoured to a gradual slope and then hydromulched. Berm is located in foreground of photo.**

Figure 7 Looking NW at sediment placement within the former borrow pit. Stream channel is located in the ponderosas at the top of the photo.

Figure 8 Looking northeast at sediment placement within the former borrow pit. Run-off berm is located at base of slope, just right of vehicle.

**Figure 9 Looking west at sediment placement within the former borrow pit**

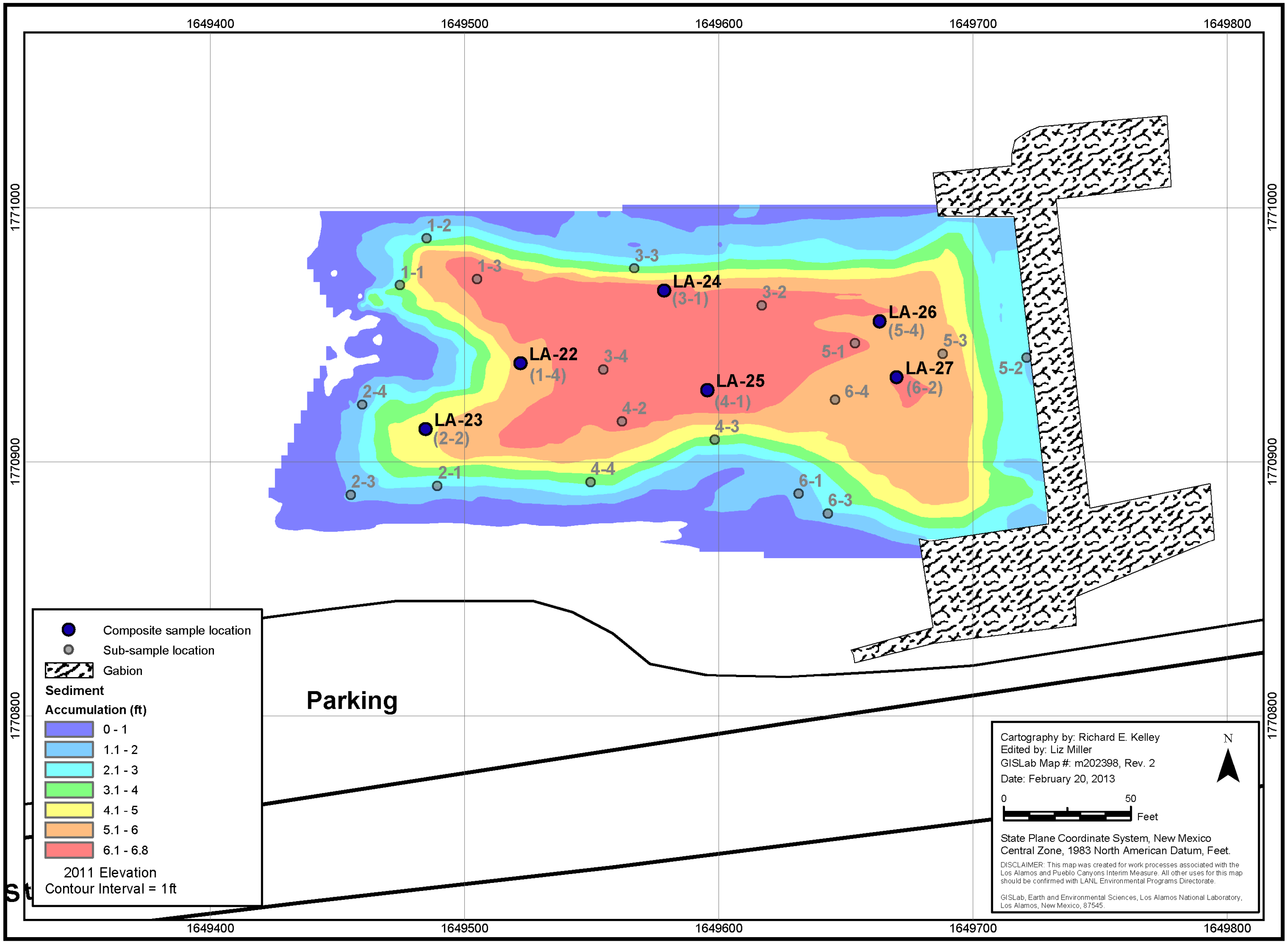


Figure 103 Sampling locations of material collected before excavation

**Table 1**
**Samples Collected and Analyses Requested for the Los Alamos Weir Excavation**

| Sample ID | Location ID | Sample Depth (ft) | Media | Sample Date | Gamma Spec | Strontium-90 | Tritium | Americium-241 | Isotopic Plutonium | Metals | Pesticides/PCBs | Herbicides | Dioxan/Furans | Total Cyanide |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CALA-13-28425 | LA-22 | 0.0–5.6 | SED | 01/31/2013 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-505 | 2013-504 |
| CALA-13-28426 | LA-23 | 0.0–4.85 | SED | 01/31/2013 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-505 | 2013-504 |
| CALA-13-28427 | LA-24 | 0.0–6.5 | SED | 01/31/2013 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-505 | 2013-504 |
| CALA-13-28428 | LA-25 | 0.0–6.7 | SED | 01/31/2013 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-505 | 2013-504 |
| CALA-13-28429 | LA-26 | 0.0–6.25 | SED | 01/31/2013 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-505 | 2013-504 |
| CALA-13-28430 | LA-27 | 0.0–6.1 | SED | 01/31/2013 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-504 | 2013-505 | 2013-504 |

**Table ~~1~~2**
**Comparison of Maximum Detected Concentrations in Depth-Integrated Samples to Sediment BVs, Residential SSLs/SALs, and Minimum ESLs**

| Analyte | Analyte Code | Units | Maximum Concentration | Canyon Sediment BVs[a] | Residential SSL[b] or SAL[c] | Minimum ESL[d] |
|---|---|---|---|---|---|---|
| Aluminum | Al | mg/kg | 14,500 | 15,400 | n/a[e] | n/a |
| Arsenic | As | mg/kg | 2.8 | 3.98 | n/a | n/a |
| Barium | Ba | mg/kg | 275 | 127 | 15,600 | 110 |
| Beryllium | Be | mg/kg | 1.82 | 1.31 | 156 | 2.5 |
| Cadmium | Cd | mg/kg | 0.207 | 0.4 | n/a | n/a |
| Chromium | Cr | mg/kg | 9.81 | 10.5 | n/a | n/a |
| Cobalt | Co | mg/kg | 6.06 | 4.73 | 23[f] | 13 |
| Copper | Cu | mg/kg | 17.3 | 11.2 | 3130 | 15 |
| Cyanide (Total) | Cn(total) | mg/kg | 1.35 | 0.82 | 46.9 | 0.1 |
| Iron | Fe | mg/kg | 14,700 | 13,800 | 54,800 | n/a |
| Lead | Pb | mg/kg | 35.2 | 19.7 | 400 | 14 |
| Manganese | Mn | mg/kg | 1270 | 543 | 1860 | 220 |
| Mercury | Hg | mg/kg | 0.0398 | 0.1 | n/a | n/a |
| Nickel | Ni | mg/kg | 12.3 | 9.38 | 1560 | 9.7 |
| Silver | Ag | mg/kg | 0.222 | 1 | n/a | n/a |
| Thallium | Tl | mg/kg | 0.438 | 0.73 | n/a | n/a |
| Vanadium | V | mg/kg | 19 | 19.7 | n/a | n/a |
| Zinc | Zn | mg/kg | 84.8 | 60.2 | 23,500 | 48 |
| Americium-241 | Am-241 | pCi/g | 0.0993 | 0.04 | 30 | 44 |
| Cesium-137 | Cs-137 | pCi/g | 1.48 | 0.9 | 5.6 | 680 |

**Table ~~1~~ 2 (continued)**

| Analyte | Analyte Code | Units | Maximum Concentration | Canyon Sediment BVs[a] | Residential SSL[b] or SAL[c] | Minimum ESL[d] |
|---|---|---|---|---|---|---|
| Plutonium-239/240 | Pu-239/240 | pCi/g | 0.177 | 0.068 | 33 | 47 |
| Dichlorodiphenyltrichloroethane [4,4'-] | 50-29-3 | mg/kg | 0.000823 | na[g] | 17.2 | 0.044 |
| Dichlorodiphenyldichloroethane [4,4'-] | 72-55-9 | mg/kg | 0.00299 | na | 14.3 | 0.11 |
| Methyl-4-chlorophenoxypropionic(2-) acid | 93-65-2 | mg/kg | 1.32 | na | 61f | na |
| 4-(2,4-Dichlorophenoxy)butyric acid | 94-82-6 | mg/kg | 0.0234 | na | 490f | na |
| TCDD-equivalent concentration | 1746-01-6 | mg/kg | 3.88E-07 | na | 4.50E-05 | 2.90E-07 |

[a] Sediment BVs from LANL (1998, 059730).

[b] Residential SSLs from NMED (2012, 219971), unless otherwise noted.

[c] Residential SALs from LANL (2012, 228852).

[d] Minimum ESLs from LANL (2012, 226667).

[e] n/a = Not applicable; maximum concentration less than the sediment BV.

[f] Residential SSLs from EPA regional screening table(http://www.epa.gov/region06/6pd/rcra_c/pd-n/screen.htm).

[g] na = Not available.

**Table ~~2~~3**
**Summary of COPECs with Maximum Detected Concentrations Greater than Minimum ESLs**

| COPECs | Maximum Concentration in 2013 (mg/kg) | Maximum Concentration in 2009[a] (mg/kg) | Canyon Sediment BV[b] (mg/kg) | Soil BV[b] (mg/kg) | Maximum Concentration in Ash (mg/kg) | Minimum ESL[c] (mg/kg) | HQ | Minimum L-ESL[c] (mg/kg) | HQ |
|---|---|---|---|---|---|---|---|---|---|
| Barium | 275 | 57.6 | 127 | 295 | 1300 | 110 | 2.5 | 260 | 1.1 |
| Copper | 17.3 | 32.6 | 11.2 | 14.7 | 45 | 15 | 1.2 | 46 | 0.4 |
| Cyanide (Total) | 1.35 | 2.21 | 0.82 | 0.5 | n/a | 0.1 | 13.5 | 1 | 1.4 |
| Lead | 35.2 | 22 | 19.7 | 22.3 | 84 | 14 | 2.5 | 28 | 1.3 |
| Manganese | 1270 | 301 | 543 | 671 | 8200 | 220 | 5.8 | 1100 | 1.2 |
| Nickel | 12.3 | 3.24 | 9.38 | 15.4 | 15 | 9.7 | 1.3 | 19 | 0.6 |
| Zinc | 84.8 | 52.7 | 60.2 | 48.8 | 180 | 48 | 1.8 | 480 | 0.2 |
| TCDD-equivalent concentration | 3.88E-07 | na[d] | n/a[e] | n/a | n/a | 2.90E-07 | 1.3 | 1.90E-06 | 0.2 |

Note: Grey shading indicates an HQ >1.

[a] From LANL (2009, 105294).

[b] Sediment and soil BVs from LANL (1998, 059730).

[c] Minimum ESLs and L-ESLs from LANL (2012, 226667).

[d] na = Not available.

[e] n/a = Not applicable.