

DRAFT River Bank Erodible Soil Source Control Screening Evaluation

Arkema Chemicals Facility
Portland, Oregon

December 2008

Prepared for:
Legacy Site Services, LLC

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On behalf of Legacy Site Services, LLC (LSS), agent for Arkema Inc. (Arkema), ERM-West, Inc. (ERM) has prepared this *River Bank Erodible Soil Source Control Screening Evaluation* (SCSE) for the Former Arkema Chemicals facility in Portland, Oregon (the "Site"). This SCSE is prepared pursuant to the Order on Consent requiring Source Control Measures (SCMs) and Feasibility Study (FS) issued by the Oregon Department of Environmental Quality (DEQ), signed 31 October 2008 (DEQ No. LQVC-NWR-08-04) (Consent Order). The purpose of this river bank erodible soil SCSE is to evaluate existing Site characterization data in accordance with the DEQ and United States Environmental Protection Agency (EPA) Portland Harbor Joint Source Control Strategy (JSCS) (DEQ 2005) guidance document.

This SCSE was prepared in accordance with the JSCS and supplements the *Groundwater Source Control Evaluation, Arkema Portland Facility*, dated April 2007 (Integral 2007) and *Groundwater Source Control Evaluation, Addendum 1, Arkema Portland Facility*, dated March 2008 (Integral 2008a).

LSS notes that the Portland Harbor JSCS by its own terms is not a promulgated rule, and as stated on the cover page of the document, "may not be relied upon to create a right or benefit, substantive or procedural, enforceable in law or equity, by any person including the DEQ or EPA." LSS has concerns about how the JSCS information will be used in the context of its obligations for both in water and upland work and, in particular, disagrees with the usefulness of many of the screening level values (SLVs) included in the strategy. Many of the SLVs are overly conservative and of little practical value in prioritizing sites and informing source control determinations. Many of the SLVs are below analytical method detection limits, are not risk based, and none of them take into consideration site-specific exposure and risk factors. In addition, the "soil" SLVs are applicable for in water sediment, not upland soil. However, despite its reservations about the usefulness and application of the JSCS, LSS has agreed to conduct this bank soil source control evaluation pursuant to the JSCS in the hope that such an evaluation will engender a meaningful discussion among and between DEQ and LSS about practical, protective and achievable source control goals for the Arkema property based on relevant and appropriate standards.

The remainder of this section includes a brief site description and history, regulatory history, history of hazardous chemical releases, site geology,

and summaries of historical, ongoing, or SCMs or other actions that are planned to address the historical chemicals of interest at the site. Additional site information is presented in the *Upland Remedial Investigation Report Lots 3 & 4 and Tract A – Revision 1* (RI Report; ERM 2005), the revised engineering evaluation/cost analysis (EE/CA) work plans (Integral 2006a and EPA 2007), EE/CA work plan addendum (Integral 2008b) and other documents that have presented information on the ongoing or planned SCMs at the site.

1.1 **SITE DESCRIPTION**

The Site is located at 6400 N.W. Front Avenue in the Northwest Industrial Area of Portland, Oregon. The facility is bounded by Front Avenue on the north and west, the Willamette River on the east, and an asphalt roofing manufacturer on the south. The Arkema site is located on the southwest bank of the lower Willamette River (LWR) between River Mile (RM) 6.9 and RM 7.6, immediately upstream of the Burlington Northern Santa Fe (BNSF) Railroad Bridge in the northwest industrial area of Portland, Oregon (Figure 1). The property is located within Portland Harbor, part of which was designated as a federal Superfund site in 2000 by the EPA based on sediment contamination.

The property lies within the Guild’s Lake Industrial Sanctuary Plan (formerly the Northwest Portland Industrial Sanctuary) (Integral 2006). The Site is zoned and designated “IH” for heavy industrial use, which precludes it from most nonindustrial uses (Portland Development Commission 2004). The purpose of the Guild’s Lake Industrial Sanctuary Plan is to maintain and protect this land as a dedicated area for heavy and general industrial uses. Therefore, while future use of the facility is unknown, it will likely be heavy industrial.

This river bank erodible soil SCSE focuses on the Willamette River bank which runs along the site’s eastern upland border. The river bank is generally defined as the area between the top of bank and the water line of the Willamette River (Figure 2). For purposes of this SCSE, “erodible soils” are defined as soil shallower than 2 feet below ground surface (bgs). The river bank is steeply sloped and covered with large chunks of concrete and asphalt for much of its length. The concrete and asphalt rubble serve as riprap for erosion control and slope stability. Vegetation along the river bank is growing in between the riprap, and is characterized by early successional species (mainly invasive weeds) that thrive on disturbed areas.

1.2

SITE HISTORY

Inorganic chemicals were manufactured at the Arkema site from 1941 until 2001, when the facility was closed and chemical manufacturing was discontinued. For most of the site's history, the chemical activities involved electrolytic decomposition of brine solutions to manufacture inorganic chemicals, including sodium chlorate, chlorine, sodium hydroxide, hydrogen, and hydrochloric acid. Other chemical manufacturing processes during the site's operational history included the production of dichloro diphenyl trichloroethane (DDT) from 1947 to 1954 and ammonium perchlorate from 1958 to 1962 (ERM 2005).

Decommissioning and removal of the manufacturing infrastructure were completed in early 2005. The only structure remaining is the office building at the site entrance on Front Street and some concrete floor slabs left in place as environmental caps. Arkema maintains leases from the Oregon Department of State Lands for the docks in the Willamette River, but the docks are not currently in use. Current and historical upland contaminant sources are shown in Appendix A.

Arkema (formerly known as ATOFINA Chemicals, Inc., Elf Atochem North America, Inc., and the Pennwalt Corporation) has conducted investigations and performed a number of Interim Remedial Measures (also referred to herein as SCMs) in the upland portion of the site since 1994. In 1995, Arkema (then known as Elf Atochem) submitted an intent to participate in the DEQ Voluntary Cleanup Program, an agreement that was later signed with DEQ in 1996. In 1998, Arkema signed a voluntary agreement with DEQ to complete a remedial investigation and feasibility study (RI/FS) of the former DDT manufacturing area. The RI/FS was later expanded to include other areas and chemicals at the site (e.g., hexavalent chromium and perchlorate). The final RI report was submitted to DEQ in December 2005 (ERM 2005). For the RI, Arkema completed two phases of in river investigations to assess the extent of chemicals from the former DDT manufacturing process in nearshore Willamette River sediments and groundwater. In addition to the RI work, the Lower Willamette Group has conducted a number of investigations that included sample stations adjacent to the Arkema site as part of the Portland Harbor RI/FS. Brief descriptions of these investigations are provided in the draft EE/CA work plan (Section 3.1, Integral 2006a). In addition, following the submission of the final RI Report, DEQ and EPA issued the Portland Harbor JSCS guidance document (DEQ 2005).

Arkema and EPA entered into an Administrative Order on Consent on 27 June 2005 for the in water portion of the site. The draft EE/CA work

plan was submitted to EPA and stakeholders (the government team) on 26 September 2005, for review and comment. A revised work plan that incorporated responses to comments received from the government team was submitted to the government team on 14 July 2006 (Integral 2006a). The revised work plan included screening results for sediments, river bank soils and groundwater, transition zone water, and surface water at the Arkema site. In 2007, EPA prepared the *Arkema Early Action EE/CA Work Plan* (EPA 2007). An EE/CA work plan addendum was subsequently prepared by Integral and dated 22 July 2008 (Integral 2008b).

Arkema and DEQ entered into an Administrative Order on Consent on 31 October 2008 for the upland portion of the site. The upland Order requires performance of this river bank erodible soil SCSE and an upland Feasibility Study.

1.3 ***SITE GEOLOGY***

The surficial geology at the Site is characterized by fill and alluvial deposits of the Willamette River. Alluvial deposits are underlain by bedrock of the Columbia River Basalt Group. A cross section layout map and cross section diagrams for the Site are provided in Appendix B (RI Figures 4-1 through 4-5).

1.3.1 ***Fill Material***

Fill materials occur from the surface to depths of approximately 25 feet bgs and consist of brown clayey silt to silty sand with occasional wood, brick, concrete, metal piping, and asphalt. Historically, fill materials were used to extend the ground surface out into the Willamette River. Fill thickness ranges from a few feet in the former manufacturing area to approximately 25 feet along the river bank.

The river bank area, generally between the No. 1 and No. 2 Docks received miscellaneous fill for many years. Fill was placed in the Acid Plant area bordering the Willamette River after DDT manufacturing ceased. It appears that the bank adjacent to the Acid Plant area has been filled out toward the Willamette River approximately 200 ft since the 1950s. Fill thickness ranges from a few feet in the former DDT manufacturing area to approximately 25 ft along the riverbank (Integral 2006a). The source of the fill is generally believed to be river dredge spoils and deposits from on- and off-site excavations. This was an accepted practice for near-shore areas of properties along the Portland Harbor. The

City of Portland was reportedly allowed to dispose of used asphalt from roadways.

Fill materials included clean soil, asphalt, concrete, metal piping, and miscellaneous materials from spent chlorine cells. Most of this area lies within the Acid Plant Area. The shallow, fine-grained soils are the result of dredged material from the Willamette River being placed on the upland portions of the Site. In some areas of the Site, this has resulted in an extension of the ground surface into the river by up to 300 feet. The approximate upland extent of fill material is shown in Appendix B.

1.3.2 *Alluvial Deposits*

Based on boring logs completed for the RI, the native soil profile is generally characterized by laterally discontinuous, alternating layers of dark gray-brown sand with varying amounts of silt and thinner silt layers with varying amounts of fine sand. These sands and silts are massive to finely laminated and the contacts between the sand and silt can be gradational. In general, there are four alternating sand and silt layers; a sand layer occurs at the ground surface, underlain by a silt layer at approximately 8 feet bgs, which is underlain by additional sand and silt layers. The sand and silt layers are continuous over most of the Site. The lowest silt layer, approximately 35 feet bgs, becomes less continuous in the southern portion of the Site adjacent to the Willamette River.

Underlying the deepest silt layer, at a depth of approximately 35 feet, is a sand layer with black sands on the northern end of Lots 3 and 4 and dark gray-brown sands toward the south. A deeper silt layer with some clay and fine sand is situated beneath the black and dark gray-brown sand and above the basalt bedrock.

1.3.3 *Bedrock*

Columbia River Basalt is present below the fill and alluvium throughout the site at depths between approximately 50 and 90 feet bgs. Although a limited number of borings have been advanced to the basalt at the site, the basalt generally consists of a weathered basaltic zone overlying a more competent basalt layer. Regionally, the basalt surface dips to the east; site investigations have confirmed the basalt surface dips to the southeast (Plant south).

1.4 SOURCE CONTROL MEASURES

Since 1989, Arkema has conducted a number of SCMs to improve soil, stormwater, groundwater, and sediment quality at the site. Several groundwater and soil SCMs have been completed to date, including two phases of soil excavation and off-site disposal. A groundwater SCM to hydraulically control groundwater at the site is currently under development (see *DRAFT Focused Feasibility Study, Groundwater Source Control Interim Remedial Measure, Arkema Chemicals Facility, Portland, Oregon* [ERM 2008] currently under review by DEQ and EPA). A stormwater SCM is also underway (see *Stormwater Interim Remedial Measures Work Plan, Arkema Portland Facility, Portland, Oregon* [Integral 2006b] currently under review by DEQ and EPA).

A chronological summary of SCMs that have been completed or that are ongoing at the site is presented in the revised EE/CA work plan (Section 4.1.5, Integral 2006a). A comprehensive description of the Interim Remedial Measure conducted on the upland portion of the site is provided in the upland RI report (Section 7 and associated figures, ERM 2005).

1.5 REPORT ORGANIZATION

The remainder of the SCSE Report is organized as follows:

- Section 2.0 presents a discussion of potential contaminant sources, a summary of river bank and beach samples historically collected at the site, the results of the source control screening, and the weight-of-evidence evaluation;
- Section 3.0 presents the conclusions and recommendations from the SCSE; and
- Section 4.0 presents a list references used in preparation of this SCSE.

2.0

RIVER BANK ERODIBLE SOIL SOURCE CONTROL EVALUATION

This river bank erodible soil SCSE follows the JSCS guidance document (DEQ 2005). The primary objective of the JSCS is to identify and evaluate sources of contamination that may impact the Willamette River in a manner that is consistent with the Portland Harbor RI/FS (DEQ 2005). The JSCS guidance includes the groundwater, stormwater, and erodible soil pathways to the river. This document is directed at the erodible soil pathway only. Stormwater (Integral 2006b) and groundwater (Integral 2007, Integral 2008a, and ERM 2008) pathways to the river have been evaluated in separate documents.

As part of an SCSE, site-specific contaminant concentrations for a pathway are initially compared to the highly conservative SLVs provided in the JSCS guidance document. An exceedance of an SLV does not necessarily indicate the upland source of contamination poses an unacceptable risk to human or ecological receptors, but instead only requires further consideration using a weight-of-evidence approach. A weight-of-evidence approach is used to evaluate the magnitude of the priority for each medium or area of the site where source control actions are being considered. A remedial alternative evaluation is then performed, where complete contaminant migration pathways exist, to address upland sources as deemed necessary by the screening process, the weight-of-evidence evaluation, and appropriate risk-based evaluation.

The remainder of this section presents the potential sources, discussion of data sources, river bank erodible soil screening results, and weight-of-evidence analysis of the screening data.

2.1

POTENTIAL SOURCES

Historical site activities and potential sources of COPCs have been previously described in detail in the RI Report (ERM 2005). Site activities and potential sources are summarized in this section for convenience. A figure depicting current and historical upland contaminant sources is provided in Appendix A.

Chemical manufacturing at the Site occurred on Lots 3 and 4 in the Chlorate Plant and Acid Plant Areas. Inorganic chemicals including sodium chlorate, chlorine, sodium hydroxide, hydrogen, and hydrochloric

acid were manufactured at the plant from 1941 until 2001. DDT was manufactured at the Site from approximately 1947 to 1954.

2.1.1 *Chlorate Plant Area*

Based on historical activities, potential source areas of COPCs within the Chlorate Plant Area include the following:

- Chlorate Cell Room;
- Chlorate Process Building;
- Chlorate Warehouse; and
- Chlorate Tank Farm.

Likely COPCs from sources within the Chlorate Plant Area include the following:

- Hexavalent chromium;
- Perchlorate; and
- Chloride.

2.1.2 *Acid Plant Area*

DDT was manufactured in the Acid Plant Area. Discrete areas within the Acid Plant Area that are potential sources of COPCs include the following:

- Former Manufacturing Process Residue Pond and Trench;
- DDT Process Building;
- Monochlorobenzene (MCB) Recovery Unit;
- DDT Dry Storage Area;
- Possible DDT Loading Areas; and
- Fill area between the Willamette River and the former Manufacturing Process Residue Pond and Trench.

Based on historical operations, the likely COPCs released from Acid Plant Area activities include the following:

- Organochlorine pesticides (DDT and co-metabolites dichloro-diphenyl-dichloroethane [DDD] and dichloro-diphenyl-dichloroethene [DDE], hereafter referred to collectively as DDx);
- Chlorodibenzofuran (furan) congeners (present in fill);
- Volatile organic compounds ([VOCs], primarily MCB and chloroform); and
- Perchlorate.

The following additional areas (and COPCs) were investigated as part of the RI and supplemental investigations:

- Salt Pads (chloride);
- Old Caustic Tank Farm (sodium hydroxide, petroleum hydrocarbons, and DDx);
- Former Ammonia Plant (aqueous ammonia);
- Former Transformer Pads (polychlorinated biphenyls [PCBs]);
- BPA Main Substation (PCBs);
- Storm Water Drain System (pesticides, semi-VOCs [SVOCs], perchlorate, and chloride); and
- River bank and beach area (DDx and furans).

2.2

RIVER BANK AND BEACH SOIL SAMPLING

Both composite and discrete soil samples have been collected from the river bank along the Willamette River between 1998 and 2007 in three sampling events. These sampling events are described in the sections below. The sample locations are shown in Figure 1. The analytical results for these sampling events are presented in Table 1.

2.2.1 *River Bank/Beach Sediment Sampling*

In November 1998, discrete beach sediment samples were collected from exposed river sediments at six stations (RB-1 through RB-6) during a relatively low river stage (Figure 1). Surface samples were collected using a stainless steel spoon from the depth interval of 0 to 10 cm (0 to 0.33 ft) at each sample station. Sediment coring at depths greater than 10 cm was achieved using a titanium drive corer. The maximum penetration depth was less than 35 cm (1.1 ft), except at station RB-6, where penetration reached 58 cm (1.9 ft) (ERM 2005).

Surface sediments and sediment core samples were submitted for the analysis of SVOCs, VOCs, organochlorine pesticides, total organic carbon (TOC), and grain size. Each sediment increment was also field-screened using a photoionization detector (PID) for VOCs, thin-layer chromatography (TLC) for DDT, and Sudan IV® hydrophobic dye for non-aqueous phase liquid (NAPL).

2.2.2 *River Bank Soil Sampling*

In August 2000, discrete surface (0 to 6 inches) soil samples were collected from six river bank sampling locations (RB-7 through RB-12) and analyzed for organochlorine pesticides, SVOCs, and four metals, including cadmium, total chromium, lead, and zinc. Samples were collected between No. 1 and No. 2 Docks from three paired locations with one sample location near the top of the slope and the second down-slope from the first sample location (Figure 1).

2.2.3 *Supplemental 2007 River Bank Soil Sampling*

A supplemental river bank soil sampling investigation was conducted to further delineate the extent of contamination in support of the terrestrial ecological risk assessment per DEQ's direction. In March 2007, discrete and composited surface (0 to 6 inches) soil samples were collected from 13 river bank stations (Figure 1, Stations RBC-1 through RBC-13) along the entire property boundary, with the exception of the area between No. 1 and No. 2 Docks, which had been adequately sampled during previous sampling events. The stations were located near the top of the bank, as well as between the top of bank and mean high water (approximately 12 ft North American Vertical Datum [NAVD] 88). A single composite sample made up of five discrete samples was collected from each station (Figure

1)¹. In addition, five deeper (18 to 24 inches) discrete soil samples were collected from select river bank stations to characterize the shallow subsurface (Integral 2008c).

All samples were field-screened for VOCs using a PID. A total of 14 surface composite (including one field duplicate sample) and six subsurface discrete samples were collected and analyzed for organochlorine pesticides, SVOCs, PCBs, dioxins/furans, total TPH-D, total TPH-G, VOCs (analysis conducted only on two samples that demonstrated the possible presence of volatile organics by PID field screening), and total metals (arsenic, cadmium, chromium, lead, and zinc) (Integral 2008c).

2.3 SOURCE CONTROL SCREENING RESULTS

Analytical results from all 37 of the river bank and beach samples historically collected at the site were screened against SLVs and other appropriate screening levels as part of the source control screening. These 37 samples included 6 beach soil samples, 18 discrete river bank soil samples, and 13 composited river bank soil samples (Figure 1). A three-tiered screening was performed as part of this SCSE as follows:

- First, all analytical results were screened against the most conservative JSCS SLVs (Tables 1 and 2; Figures 3 through 14). These SLVs are applicable for in water sediment, not soil, are not risk based and are therefore considered very conservative, initial screening values. Only the results for constituents for which an SLV is provided in the JSCS are shown on Table 1. In accordance with the JSCS, all constituents which exceeded the SLVs were carried forward into the weight-of-evidence evaluation;
- Second, sample results which exceeded SLVs were screened against a slightly less conservative screening value of 1,000 times (1,000x) the respective SLVs (Tables 3 and 4; Figures 15 and 16). While still applicable for in water sediment only and are not risk based, this screening value has been adopted by EPA in the EE/CA to screen sediment sample results;

¹ - The five discrete samples for RBC-7 (RBC-7-01 to -05) were erroneously not composited by the laboratory for pesticides analyses only. Instead, these individual discrete samples were analyzed separately for pesticides. In Tables 1 to 4, as a conservative measure, the maximum value of the five discrete values is shown under the RBC-7 result. Each of the five individual discrete sample results for RBC-7 is shown on the applicable figures.

- Third, sample results which exceeded the 1,000x SLVs were screened against EPA Region IX Industrial Preliminary Remediation Goals (PRGs) (Tables 5 and 6; Figure 17). PRGs are conservative risk-based screening values for soil based on an industrial use scenario and are therefore more relevant and appropriate for upland soil than the JSCS sediment SLVs.

In order to quantitatively assess the degree to which each analytical result exceeds the applicable screening value, an exceedance quotient (EQ) was calculated for each analyte detection and screening value, as follows:

$$\text{Exceedance Quotient (EQ)} = \frac{\text{Analytical Result}}{\text{Applicable Screening Value}}$$

A summary of EQs is provided in Tables 2, 4, and 6. Figures depicting EQs of the analytes with the highest frequency of exceedances of a given screening value are provided as Figures 3 through 17. The results of the screening are discussed in the weight-of-evidence evaluation below. Also included below is a discussion of reporting limits for non-detect samples relative to the SLVs.

2.4

WEIGHT-OF-EVIDENCE EVALUATION

A JSCS weight-of-evidence analysis takes into consideration several lines of evidence including chemical concentration data and other relevant information that must be considered in determining whether an area of soil is considered a source or requires source control. Based on JSCS guidance, weight-of-evidence elements that can be considered for river bank erodible soil include, but are not limited to, the following site-specific factors:

- Presence of persistent bioaccumulative chemicals;
- Contaminant concentrations (magnitude of exceedance above SLV);
- Regional background soil concentrations for naturally occurring chemicals (i.e., metals);
- Extent of contaminated soil (e.g., area of exposed and/or erodible soil);
- Proximity of source area soil to the river;
- In-water sediment data in proximity to source area;

- Site surface conditions (e.g., exposed soil, paved, slope);
- River bank stability (e.g., potential for erosion under extreme rainfall events, potential for erosion under flood conditions, bank erosion rates);
- Soil properties (e.g., soil type, compaction, erodability, permeability);
- Storm water management;
- Proximity of source area soils to storm water catch basins;
- Evaluation of potential soil erosion and contaminant transport (e.g., modeling, quantitative erosion calculations); and
- Estimate of potential contaminant loading to the river.

In some cases, many of these lines of evidence will not be relevant or necessary to consider in the source control analysis. However, any of these lines of evidence or others not listed above may be relevant. The following sections provide a discussion of the results of the screening and an initial weight of evidence analysis for river bank erodible soil.

As discussed above, LSS has reservations regarding the applicability and over-conservative nature of the SLVs. Many of the SLVs are below analytical method detection limits, are not risk based, and none of them take into consideration site specific exposure and risk factors. In addition, the “soil” SLVs (MacDonald Probable Effects Concentrations [PECs] and DEQ 2007 Bioaccumulative Sediment value) are applicable for in water sediment - not for upland soil – due to the significant dilution of constituent concentrations that would be expected prior to constituents reaching in water sediment. Therefore, as discussed above, LSS has also screened the river bank erodible soil analytical results against alternative screening values including 1,000x the JSCS SLVs and EPA Region IX PRGs.

2.4.1

Metals

Five metals (arsenic, cadmium, chromium, lead and zinc) exceeded their most conservative sediment-based SLVs in river bank erodible soil. In general, the SLV EQs for metal detections range from 1 to 10 (Table 2). The only exception was the lead concentration for sample RB-8 (SLV EQ = 123). SLV EQs for total chromium and lead are shown on Figures 3 and 4,

respectively. No metals exceeded the 1,000x SLV screening values (Table 4).

The vast majority of reporting limits for non-detects of metals were below the most conservative sediment-based SLVs. The only exceptions were cadmium analyses for samples RB-8 through RB-12.

Metals concentrations are fairly consistent across the river bank area (from Lot 1 to Lot 4) and are generally relatively low concentrations, indicating that metals present are likely naturally-occurring rather than anthropogenic. As a result, metals are not considered constituents of concern in river bank soil at the site.

2.4.2 *Polychlorinated Biphenyls*

No individual polychlorinated biphenyl (PCB) Aroclor concentration exceeded the most conservative sediment-based SLV for any of the samples. The total PCB concentration of one sample (RBC-1) exceeded the most conservative sediment-based total PCB SLV by a small amount (SLV EQ = 1.9) (Table 2). No PCBs exceeded the 1,000x SLV screening values (Table 4). All of the reporting limits for non-detects of PCBs were below the most conservative sediment-based SLVs. Based on the relatively small SLV exceedance in one sample, PCBs are not considered a constituent of concern in river bank soil at the site.

2.4.3 *Pesticides*

Pesticides and pesticide groups detected above the most conservative sediment-based SLVs include DDT, DDD, DDE, DDx, and dieldrin (Table 2). Dieldrin was detected in one sample (RBC-7-1) at a concentration of 2 micrograms per kilogram ($\mu\text{g}/\text{kg}$). This concentration is less than the PEC of 61.8 $\mu\text{g}/\text{kg}$ and the Industrial PRG of 110 $\mu\text{g}/\text{kg}$. No dieldrin detections exceeded the 1,000x SLV screening values. Due to the very low SLV for dieldrin, detection limits for other samples analyzed for dieldrin were above the most conservative sediment-based SLV (DEQ 2007 Bioaccumulative Sediment value), but generally below the PEC and Industrial PRG. Dieldrin is therefore not considered a constituent of concern for river bank soil.

EQs using the most conservative sediment-based SLVs for DDT, DDD, DDE, and DDx ranged from 3 to 376,000 (Table 2). These SLV EQs for DDx are shown on Figure 5. In general, DDx (including individual DDT, DDD, and DDE) concentrations detected in the river bank samples are highest in the Acid Plant area near No. 2 Dock and decrease to the Plant

north and south. Detections in samples collected near the top of the slope are generally higher than those detected in the beach samples. For the beach samples, DDT concentrations generally increased with depth.

1,000x SLV EQs for DDT, DDD, DDE, and DDx ranged from 1 to 376 (Table 4). 1,000x SLV EQs for DDx are shown on Figure 15.

Since these SLVs are still very conservative and based on in water sediment and not industrial soil, detected concentrations were screened against Industrial PRGs (Tables 5 and 6). The only pesticide for which concentrations exceeded the Industrial PRG was DDT. DDT was detected above the PRG in seven of the 36 samples analyzed for DDT with Industrial PRG EQs ranging from 1 to 17. Industrial PRG EQs for DDx are shown on Figure 17.

Figure 17 shows that the only samples with Industrial PRG EQs greater than 10 are adjacent to No. 2 Dock (Samples RB-9 and RB-10). Therefore, this area by No. 2 Dock is considered a medium priority. The remaining river bank samples do not exceed the Industrial PRG by an EQ greater than 10 and therefore the remainder of the river bank is considered low priority.

2.4.4 *Volatile Organic Compounds*

SLVs are provided in the JSCS for only two VOCs: tetrachloroethene (PCE) and trichloroethene (TCE) (Table 2). Neither one of these constituents were detected above the most conservative sediment-based SLVs in the river bank soil samples. All of the reporting limits for non-detects of VOCs were below the most conservative sediment-based SLVs. Therefore, VOCs are not considered a constituent of concern in river bank soil at the site.

2.4.5 *Semi-Volatile Organic Compounds*

Only one SVOC (hexachlorobenzene) was detected above the most conservative sediment-based SLV in one sample (RBC-3 with SLV EQ = 1.2) (Table 2). This concentration was below the 1,000x SLV screening value (Table 4) and Industrial PRG. The vast majority of the reporting limits for non-detects of SVOCs were below the most conservative sediment-based SLVs. Based on the relatively small SLV exceedance in one sample, SVOCs are not considered a constituent of concern in river bank soil at the site.

2.4.6 *Phenols*

Only one phenol compound (pentachlorophenol) was detected above the most conservative sediment-based SLV in one sample (RBC-5 with SLV EQ = 1.5). This concentration was below the 1,000x SLV screening value (Table 4) and Industrial PRG. The majority of the reporting limits for non-detects of phenols were below the most conservative sediment-based SLVs. Based on the relatively small SLV exceedance in one sample, phenols are not considered a constituent of concern in river bank soil at the site.

2.4.7 *Phthalate Esters*

Only one phthalate ester (bis[2-ethylhexyl]phthalate [DEHP]) was detected in the river bank samples at concentrations above the most conservative sediment-based SLV. DEHP was detected in 10 of the 36 river bank samples analyzed for phthalate esters at SLV EQs ranging from 1.2 to 29. No phthalate esters exceeded the 1,000x SLV screening values (Table 4). The maximum detected concentration was 9,500 µg/kg (RBC-1) which is well below the Industrial PRG of 120,000 µg/kg. The majority of the reporting limits for non-detects of phthalate esters were below the most conservative sediment-based SLVs. Based on the relatively low SLV EQs for only one phthalate ester detected, and the fact that all of the concentrations are well below the 1,000x SLV screening value and Industrial PRG, phthalate esters are not considered constituents of concern in the river bank soil.

2.4.8 *Polycyclic Aromatic Hydrocarbons*

Four polycyclic aromatic hydrocarbons (PAHs) compounds (benzo[a]anthracene, Benzo[g,h,i]perylene, chrysene, and indeno[1,2,3-cd]pyrene) were detected at concentrations above the most conservative sediment-based SLVs. These PAHs were detected in 6 of the 36 samples analyzed for PAHs with SLV EQs ranging from 1 to 10. None of these PAHs were detected above their 1,000x SLV screening values (Table 4) or Industrial PRGs. The vast majority of the reporting limits for non-detects of PAHs were below the most conservative sediment-based SLVs. Based on the relatively low frequency of detection, low SLV EQs for detections, and no detections above the 1,000x SLV screening values or Industrial PRGs, PAHs are not considered constituents of concern in the river bank soil.

2.4.9

Dioxins/Furan

Eleven dioxin and furan congeners were detected at concentrations above the most conservative sediment-based SLVs (Table 1). Nine of these 11 congeners were furans. The SLV EQs for these eleven detected congeners ranged from 1 to 8333 (Table 2). SLV EQs for dioxin and furan congeners with the highest EQs are shown on Figures 6 through 14, respectively. Dioxins and/or furans were detected at concentrations exceeding the most conservative sediment-based SLVs in 17 of the 18 samples analyzed for dioxins/furans (dioxins/furans were not analyzed for the RB samples).

The only two dioxin congeners detected were 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) and 1,2,3,7,8-pentachlorodibenzo-p-dioxin (1,2,3,7,8-PeCDD). 2,3,7,8-TCDD was detected above the most conservative sediment-based SLV EQs ranging from 66 to 242 in four of the 18 samples analyzed for 2,3,7,8-TCDD. The SLV for 2,3,7,8-TCDD is extremely low (0.0000091 µg/kg) and is below achievable laboratory method detection limits. 2,3,7,8-TCDD was not detected above the 1,000x SLV screening value or Industrial PRG in any of the river bank samples. Based on this, and the relatively low SLV EQ for the few samples with detected 2,3,7,8-TCDD, this congener is not considered a constituent of concern.

1,2,3,7,8-PeCDD was detected at very low SLV EQs (ranging from 2 to 3) in four of the river bank samples, and as a result this congener is not considered a constituent of concern. Therefore, dioxins are not considered constituents of concern in the river bank soil.

Only one dioxin/furan congener exceeded the 1,000x SLV screening value (2,3,4,7,8-Pentachlorodibenzofuran [2,3,4,7,8-PeCDF]) (Table 4). The maximum 1,000x SLV EQ for 2,3,4,7,8-PeCDF was 8. 1,000x SLV EQs for 2,3,4,7,8-PeCDF are shown on Figure 16.

Because 2,3,4,7,8-PeCDF exceeded screening values in the intermediate screening step, detected concentrations were screened against Industrial PRGs (Table 5). Detected concentrations of 2,3,4,7,8-PeCDF exceeded the respective Industrial PRG with Industrial PRG EQs ranging from 1 to 6 (Table 6).

Based on the above screening, furans are considered a low priority constituent in river bank soil at the site. The furans and DDx appear to be generally co-located in the river bank soil between Docks 1 and 2. The

samples with highest DDx concentrations (RB-9 and RB-10) are also the samples with the highest 2,3,4,7,8-PeCDF concentrations. Therefore, this area of relatively higher 2,3,4,7,8-PeCDF concentrations will be addressed in tandem with this medium priority DDx area.

CONCLUSIONS AND RECOMMENDATIONS

Based on the source control screening and weight-of-evidence evaluation, the following conclusions are reached:

- DDT, DDD, and DDE (collectively DDx) in the area of No. 2 Dock (samples RB-9 and RB-10) are considered a medium priority;
- DDx in the remainder of the river bank is considered a low priority; and
- Furan congeners are considered a low priority. However, the furans and DDx appear to be generally co-located in the river bank soil. Therefore, the area of relatively higher furan concentrations will be addressed in tandem with the medium priority DDx area.

Based on these conclusions, the following actions are recommended:

- An alternatives evaluation for the medium-priority DDx area identified above (adjacent to No. 2 Dock) should be performed. The timing and/or implementation of any alternative should coincide with and be compatible with the in-water early action (EE/CA); and
- An alternatives evaluation for the low priority area should be performed following the development and approval of the Portland Harbor in-water risk assessment.

The alternatives evaluations should evaluate measures to prevent erosion and transport of surface soils to the river. SCMs to be considered may include the following actions or combination thereof:

- Excavation/removal of contaminated soil above Industrial PRGs, SLVs or other applicable screening values;
- Re-grading of the steeply sloped river bank;
- Capping with clean fill; and/or
- Revegetation including the planting of trees and shrubs, planting of native grasses with well-defined root structures. Temporary measures such as the placement of straw or binder materials may be used to prevent erosion until root structures take hold.

- DEQ 2005 *Portland Harbor Joint Source Control Strategy, Final*, Oregon Department of Environmental Quality and United States Environmental Protection Agency, December 2005
- EPA 2007 *Arkema Early Action EE/CA Work Plan*, U.S. Environmental Protection Agency, 11 May 2007.
- ERM 2005 *Upland Remedial Investigation Report Lots 3 & 4 and Tract A - Revision 1*, ERM, December 2005.
- ERM 2008 *DRAFT Focused Feasibility Study, Groundwater Source Control Interim Remedial Measure, Arkema Chemicals Facility*, ERM, May 2008.
- Integral 2006a *Revised Draft Arkema Work Plan: Engineering Evaluation/ Cost Analysis*, Integral Consulting, 14 July 2006.
- Integral 2006b *Stormwater Interim Remedial Measures Work Plan, Arkema Portland Facility*, Integral Consulting, May 2006.
- Integral 2007 *Groundwater Source Control Evaluation, Arkema Portland Facility*, Integral Consulting, April 2007.
- Integral 2008a *Groundwater Source Control Evaluation, Addendum 1, Arkema Portland Facility*, Integral Consulting, March 2008.
- Integral 2008b *Arkema Early Action EE/CA Work Plan, Work Plan Addendum*, Integral Consulting, 22 July 2008.
- Integral 2008c *Draft Arkema Upland Level II Screening Ecological Risk Assessment*, Integral Consulting, 13 February 2008.

Figures



Aerial Photography - July, 2005

Legend

- 1998/2000 Discrete River Bank Soil Sample Location
- 2007 Discrete River Bank Soil Sample Location
- 2007 Composite River Bank Soil Sample
- - - Top of Bank (approximate)
- - - Mean High Water
- - - Ordinary Low Water Line

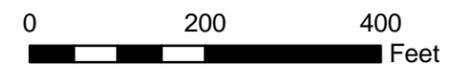
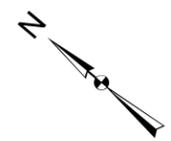
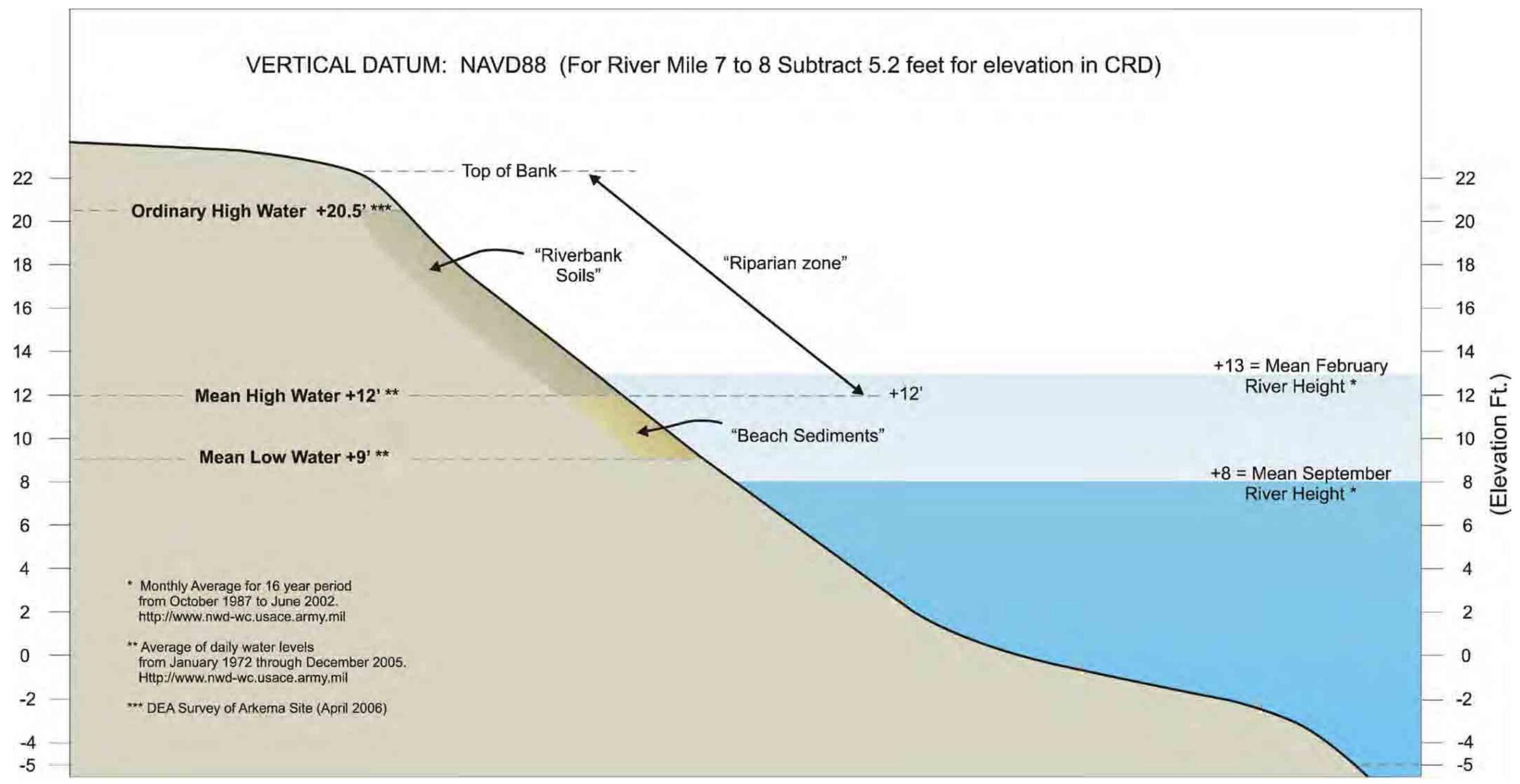


Figure 1
 River Bank Sample Locations
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Cross Section created by Integral Consulting, Inc.

Figure 2
 Schematic Willamette River Bank Cross-Section (River Mile 2 to 11)
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

Legend

1998/2000 Discrete River Bank Soil Sample

- Total Chromium Not Detected at or above the Reporting Limit
- Total Chromium Concentration Below the SLV of 111 mg/kg
- Total Chromium Concentration is between 1 and 10 times the SLV of 111 mg/kg
- Total Chromium Concentration is between 10 and 100 times the SLV of 111 mg/kg

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ Total Chromium Not Detected at or above the Reporting Limit
- ▲ Total Chromium Concentration Below the SLV of 111 mg/kg
- ▲ Total Chromium Concentration is between 1 and 10 times the SLV of 111 mg/kg
- ▲ Total Chromium Concentration is between 10 and 100 times the SLV of 111 mg/kg

2007 Composite River Bank Soil Sample

- ∩ Total Chromium Concentration Not Detected at or above the Reporting Limit
- ∩ Total Chromium Concentration is Below the SLV of 111 mg/kg
- ∩ Total Chromium Concentration is between 1 and 10 times the SLV of 111 mg/kg
- ∩ Total Chromium Concentration is between 10 and 100 times the SLV of 111 mg/kg

Notes:
 SLV = Portland Harbor Joint Source Control Strategy - Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 mg/kg = milligrams per kilogram
 Quotient = Concentration/SLV Value

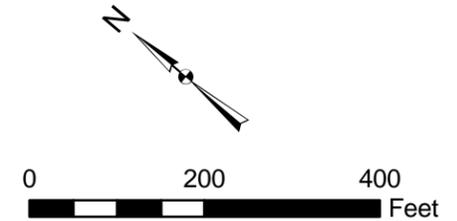


Figure 3
 SLV Quotient Exceedances - Chromium
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

Legend

1998/2000 Discrete River Bank Soil Sample

- Total Lead Not Detected at or above the Reporting Limit
- Total Lead Concentration Below the SLV of 17 mg/kg
- Total Lead Concentration is between 1 and 10 times the SLV of 17 mg/kg
- Total Lead Concentration is between 10 and 100 times the SLV of 17 mg/kg
- Total Lead Concentration is between 100 and 1000 times the SLV of 17 mg/kg

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ Total Lead Not Detected at or above the Reporting Limit
- △ Total Lead Concentration Below the SLV of 17 mg/kg
- △ Total Lead Concentration is between 1 and 10 times the SLV of 17 mg/kg
- △ Total Lead Concentration is between 10 and 100 times the SLV of 17 mg/kg
- △ Total Lead Concentration is between 100 and 1000 times the SLV of 17 mg/kg

2007 Composite River Bank Soil Sample

- ∩ Total Lead Concentration Not Detected at or above the Reporting Limit
- ∩ Total Lead Concentration is Below the SLV of 17 mg/kg
- ∩ Total Lead Concentration is between 1 and 10 times the SLV of 17 mg/kg
- ∩ Total Lead Concentration is between 10 and 100 times the SLV of 17 mg/kg
- ∩ Total Lead Concentration is between 100 and 1000 times the SLV of 17 mg/kg

Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 mg/kg= milligrams per kilogram
 Quotient = Concentration/SLV Value

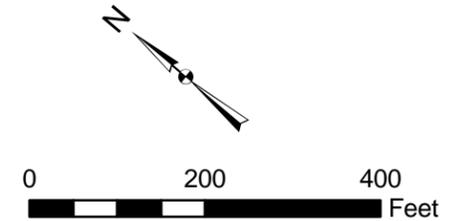


Figure 4
 SLV Quotient Exceedances - Lead
 River Bank Erodible Soil Source
 Control Screening Evaluation
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 Portland, Oregon



Aerial Photography - July, 2005

Legend

1998/2000 Discrete River Bank Soil Sample

- Total DDx Not Detected at or above the Reporting Limit
- Total DDx Concentration Below the SLV of 0.33 ug/kg
- Total DDx Concentration is between 1 and 10 times the SLV of 0.33 ug/kg
- Total DDx Concentration is between 10 and 100 times the SLV of 0.33 ug/kg
- Total DDx Concentration is between 100 and 1000 times the SLV of 0.33 ug/kg
- Total DDx Concentration is greater than 1000 times the SLV of 0.33 ug/kg

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ Total DDx Not Detected at or above the Reporting Limit
- △ Total DDx Concentration Below the SLV of 0.33 ug/kg
- △ Total DDx Concentration is between 1 and 10 times the SLV of 0.33 ug/kg
- △ Total DDx Concentration is between 10 and 100 times the SLV of 0.33 ug/kg
- △ Total DDx Concentration is between 100 and 1000 times the SLV of 0.33 ug/kg
- △ Total DDx Concentration is greater than 1000 times the SLV of 0.33 ug/kg

2007 Composite River Bank Soil Sample

- ∩ Total DDx Not Detected at or above the Reporting Limit
- ∩ Total DDx Concentration Below the SLV of 0.33 ug/kg
- ∩ Total DDx Concentration is between 1 and 10 times the SLV of 0.33 ug/kg
- ∩ Total DDx Concentration is between 10 and 100 times the SLV of 0.33 ug/kg
- ∩ Total DDx Concentration is between 100 and 1000 times the SLV of 0.33 ug/kg
- ∩ Total DDx Concentration is greater than 1000 times the SLV of 0.33 ug/kg

Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 ug/kg= micrograms per kilogram
 Quotient = Concentration/SLV Value

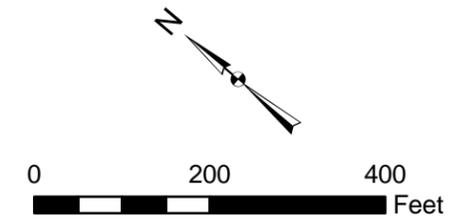


Figure 5
 SLV Quotient Exceedances - Total DDx
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



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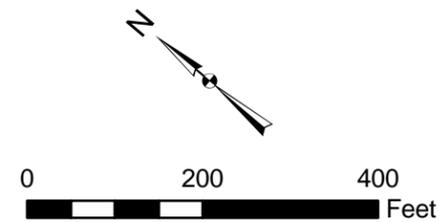
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 2,3,7,8-TCDD in Not Detected at or above the Reporting Limit
- ▲ 2,3,7,8-TCDD Concentration Below the SLV of 0.0000091 ug/kg
- ▲ 2,3,7,8-TCDD Concentration is between 1 and 10 times the SLV of 0.0000091 ug/kg
- ▲ 2,3,7,8-TCDD Concentration is between 10 and 100 times the SLV of 0.0000091 ug/kg
- ▲ 2,3,7,8-TCDD Concentration is between 100 and 1000 times the SLV of 0.0000091 ug/kg
- ▲ 2,3,7,8-TCDD Concentration is greater than 1000 times the SLV of 0.0000091 ug/kg

2007 Composite River Bank Soil Sample

- 2,3,7,8-TCDD Not Detected at or above the Reporting Limit
- 2,3,7,8-TCDD Concentration Below the SLV of 0.0000091 ug/kg
- 2,3,7,8-TCDD Concentration is between 1 and 10 times the SLV of 0.0000091 ug/kg
- 2,3,7,8-TCDD Concentration is between 10 and 100 times the SLV of 0.0000091 ug/kg
- 2,3,7,8-TCDD Concentration is between 100 and 1000 times the SLV of 0.0000091 ug/kg
- 2,3,7,8-TCDD Concentration is greater than 1000 times the SLV of 0.0000091 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Dioxins
 2,3,7,8-TCDD= 2,3,7,8-Tetrachlorodibenzo-p-dioxin
 ug/kg= micrograms per kilogram
 Reporting Limit is greater than the SLV
 Quotient = Concentration/SLV Value

Figure 6
 SLV Quotient Exceedances -
 2,3,7,8-Tetrachlorodibenzo-p-dioxin
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



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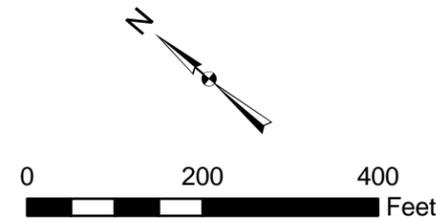
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 1,2,3,7,8-PeCDD in Not Detected at or above the Reporting Limit
- ▲ 1,2,3,7,8-PeCDD Concentration Below the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDD Concentration is between 1 and 10 times the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDD Concentration is between 10 and 100 times the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDD Concentration is between 100 and 1000 times the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDD Concentration is greater than 1000 times the SLV of 0.0026 ug/kg

2007 Composite River Bank Soil Sample

- ∩ 1,2,3,7,8-PeCDD Not Detected at or above the Reporting Limit
- ∩ 1,2,3,7,8-PeCDD Concentration Below the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDD Concentration is between 1 and 10 times the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDD Concentration is between 10 and 100 times the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDD Concentration is between 100 and 1000 times the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDD Concentration is greater than 1000 times the SLV of 0.0026 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Dioxins
 1,2,3,7,8-PeCDD= 1,2,3,7,8-Pentachlorodibenzo-p-dioxin
 ug/kg= micrograms per kilogram
 *= Not Detected, Reporting Limit is greater than the SLV
 Quotient = Concentration/SLV Value

Figure 7
 SLV Quotient Exceedances -
 1,2,3,7,8-Pentachlorodibenzo-p-dioxin
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



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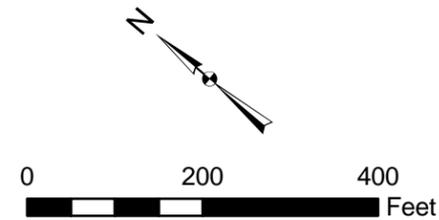
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 2,3,7,8-TCDF in Not Detected at or above the Reporting Limit
- ▲ 2,3,7,8-TCDF Concentration Below the SLV of 0.00077 ug/kg
- ▲ 2,3,7,8-TCDF Concentration is between 1 and 10 times the SLV of 0.00077ug/kg
- ▲ 2,3,7,8-TCDF Concentration is between 10 and 100 times the SLV of 0.00077 ug/kg
- ▲ 2,3,7,8-TCDF Concentration is between 100 and 1000 times the SLV of 0.00077 ug/kg
- ▲ 2,3,7,8-TCDF Concentration is greater than 1000 times the SLV of 0.00077 ug/kg

2007 Composite River Bank Soil Sample

- ∩ 2,3,7,8-TCDF Not Detected at or above the Reporting Limit
- ∩ 2,3,7,8-TCDF Concentration Below the SLV of 0.00077 ug/kg
- ∩ 2,3,7,8-TCDF Concentration is between 1 and 10 times the SLV of 0.00077 ug/kg
- ∩ 2,3,7,8-TCDF Concentration is between 10 and 100 times the SLV of 0.00077 ug/kg
- ∩ 2,3,7,8-TCDF Concentration is between 100 and 1000 times the SLV of 0.00077 ug/kg
- ∩ 2,3,7,8-TCDF Concentration is greater than 1000 times the SLV of 0.00077 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 2,3,7,8-TCDF= 2,3,7,8-Tetrachlorodibenzofuran
 ug/kg= micrograms per kilogram
 Quotient = Concentration/SLV Value

Figure 8
 SLV Quotient Exceedances -
 2,3,7,8-Tetrachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

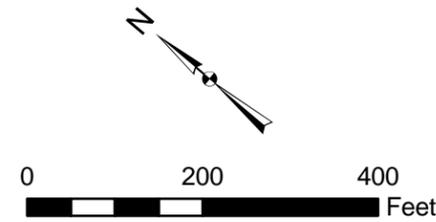
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 1,2,3,7,8-PeCDF in Not Detected at or above the Reporting Limit
- ▲ 1,2,3,7,8-PeCDF Concentration Below the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDF Concentration is between 1 and 10 times the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDF Concentration is between 10 and 100 times the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDF Concentration is between 100 and 1000 times the SLV of 0.0026 ug/kg
- ▲ 1,2,3,7,8-PeCDF Concentration is greater than 1000 times the SLV of 0.0026 ug/kg

2007 Composite River Bank Soil Sample

- ∩ 1,2,3,7,8-PeCDF Not Detected at or above the Reporting Limit
- ∩ 1,2,3,7,8-PeCDF Concentration Below the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDF Concentration is between 1 and 10 times the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDF Concentration is between 10 and 100 times the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDF Concentration is between 100 and 1000 times the SLV of 0.0026 ug/kg
- ∩ 1,2,3,7,8-PeCDF Concentration is greater than 1000 times the SLV of 0.0026 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 1,2,3,7,8-PeCDF= 1,2,3,7,8-Pentachlorodibenzofuran
 ug/kg= micrograms per kilogram
 Quotient = Concentration/SLV Value

Figure 9
 SLV Quotient Exceedances -
 1,2,3,7,8-Pentachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

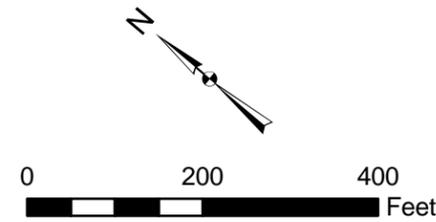
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 2,3,4,7,8-PeCDF in Not Detected at or above the Reporting Limit
- ▲ 2,3,4,7,8-PeCDF Concentration Below the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 1 and 10 times the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 10 and 100 times the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 100 and 1000 times the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is greater than 1000 times the SLV of 0.00003 ug/kg

2007 Composite River Bank Soil Sample

- △ 2,3,4,7,8-PeCDF Not Detected at or above the Reporting Limit
- ▲ 2,3,4,7,8-PeCDF Concentration Below the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 1 and 10 times the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 10 and 100 times the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 100 and 1000 times the SLV of 0.00003 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is greater than 1000 times the SLV of 0.00003 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 2,3,4,7,8-PeCDF= 2,3,4,7,8-Pentachlorodibenzofuran
 ug/kg= micrograms per kilogram
 Reporting Limit is greater than the SLV
 Quotient = Concentration/SLV Value

Figure 10
 SLV Quotient Exceedances -
 2,3,4,7,8-Pentachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

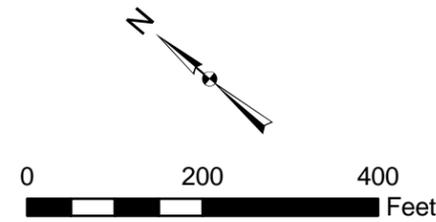
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 1,2,3,4,7,8-HxCDF in Not Detected at or above the Reporting Limit
- ▲ 1,2,3,4,7,8-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg

2007 Composite River Bank Soil Sample

- △ 1,2,3,4,7,8-HxCDF Not Detected at or above the Reporting Limit
- ▲ 1,2,3,4,7,8-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,4,7,8-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 1,2,3,4,7,8-HxCDF= 1,2,3,4,7,8-Hexachlorodibenzofuran
 ug/kg= micrograms per kilogram
 Reporting Limit is greater than the SLV
 Quotient = Concentration/SLV Value

Figure 11
 SLV Quotient Exceedances -
 1,2,3,4,7,8-Hexachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

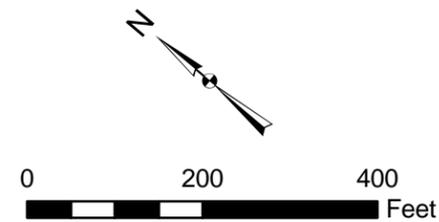
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- 1,2,3,6,7,8-HxCDF in Not Detected at or above the Reporting Limit
- 1,2,3,6,7,8-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg

2007 Composite River Bank Soil Sample

- 1,2,3,6,7,8-HxCDF Not Detected at or above the Reporting Limit
- 1,2,3,6,7,8-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- 1,2,3,6,7,8-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 1,2,3,6,7,8-HxCDF= 1,2,3,6,7,8-Hexachlorodibenzofuran
 ug/kg= micrograms per kilogram
 Quotient = Concentration/SLV Value

Figure 12
 SLV Quotient Exceedances -
 1,2,3,6,7,8-Hexachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

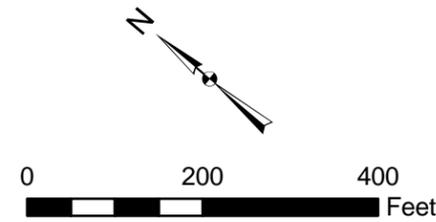
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 1,2,3,7,8,9-HxCDF in Not Detected at or above the Reporting Limit
- ▲ 1,2,3,7,8,9-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- ▲ 1,2,3,7,8,9-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,7,8,9-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,7,8,9-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- ▲ 1,2,3,7,8,9-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg

2007 Composite River Bank Soil Sample

- ∩ 1,2,3,7,8,9-HxCDF Not Detected at or above the Reporting Limit
- ∩ 1,2,3,7,8,9-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- ∩ 1,2,3,7,8,9-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- ∩ 1,2,3,7,8,9-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- ∩ 1,2,3,7,8,9-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- ∩ 1,2,3,7,8,9-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 1,2,3,7,8,9-HxCDF= 1,2,3,7,8,9-Hexachlorodibenzofuran
 ug/kg= micrograms per kilogram
 * = Not Detected, Reporting Limit is greater than the SLV
 Quotient = Concentration/SLV Value

Figure 13
 SLV Quotient Exceedances -
 1,2,3,7,8,9-Hexachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

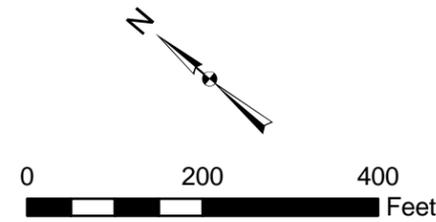
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 2,3,4,6,7,8-HxCDF in Not Detected at or above the Reporting Limit
- ▲ 2,3,4,6,7,8-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg

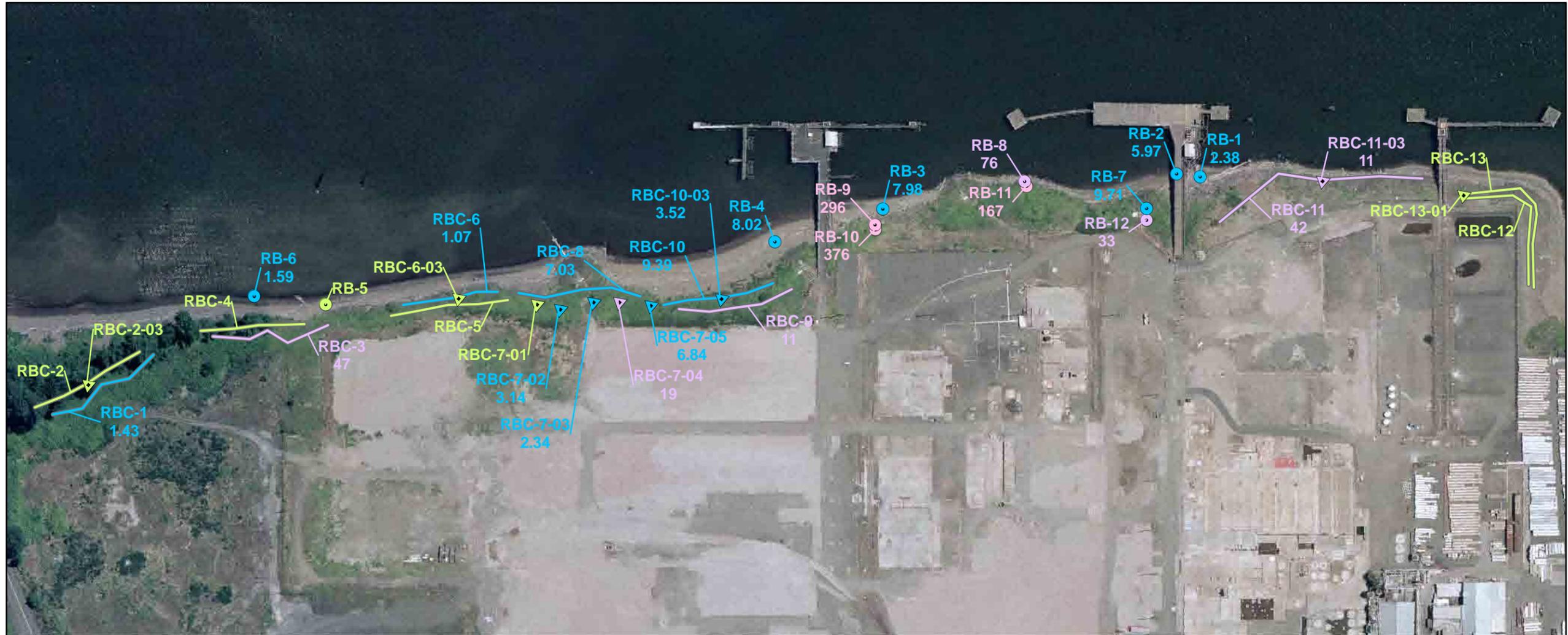
2007 Composite River Bank Soil Sample

- △ 2,3,4,6,7,8-HxCDF Not Detected at or above the Reporting Limit
- ▲ 2,3,4,6,7,8-HxCDF Concentration Below the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is between 1 and 10 times the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is between 10 and 100 times the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is between 100 and 1000 times the SLV of 0.0027 ug/kg
- ▲ 2,3,4,6,7,8-HxCDF Concentration is greater than 1000 times the SLV of 0.0027 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 2,3,4,6,7,8-HxCDF= 2,3,4,6,7,8-Hexachlorodibenzofuran
 ug/kg= micrograms per kilogram
 * = Not Detected, Reporting Limit is greater than the SLV
 Quotient = Concentration/SLV Value

Figure 14
 SLV Quotient Exceedances -
 2,3,4,6,7,8-Hexachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

Legend

1998/2000 Discrete River Bank Soil Sample

- Total DDx Not Detected at or above the Reporting Limit
- Total DDx Concentration Below the 1000x SLV of 330 ug/kg
- Total DDx Concentration is between 1 and 10 times the 1000x SLV of 330 ug/kg
- Total DDx Concentration is between 10 and 100 times the 1000x SLV of 330 ug/kg
- Total DDx Concentration is between 100 and 1000 times the 1000x SLV of 330 ug/kg
- Total DDx Concentration is greater than 1000 times the 1000x SLV of 330 ug/kg

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ Total DDx Not Detected at or above the Reporting Limit
- △ Total DDx Concentration Below the 1000x SLV of 330 ug/kg
- △ Total DDx Concentration is between 1 and 10 times the 1000x SLV of 330 ug/kg
- △ Total DDx Concentration is between 10 and 100 times the 1000x SLV of 330 ug/kg
- △ Total DDx Concentration is between 100 and 1000 times the 1000x SLV of 330 ug/kg
- △ Total DDx Concentration is greater than 1000 times the 1000x SLV of 330 ug/kg

2007 Composite River Bank Soil Sample

- ∩ Total DDx Not Detected at or above the Reporting Limit
- ∩ Total DDx Concentration Below the 1000x SLV of 330 ug/kg
- ∩ Total DDx Concentration is between 1 and 10 times the 1000x SLV of 330 ug/kg
- ∩ Total DDx Concentration is between 10 and 100 times the 1000x SLV of 330 ug/kg
- ∩ Total DDx Concentration is between 100 and 1000 times the 1000x SLV of 330 ug/kg
- ∩ Total DDx Concentration is greater than 1000 times the 1000x SLV of 330 ug/kg

Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 ug/kg= micrograms per kilogram
 Quotient = Concentration/SLV Value

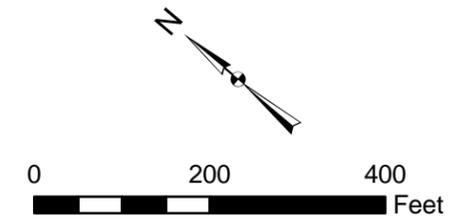


Figure 15
 1000x SLV Quotient Exceedances - Total DDx
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

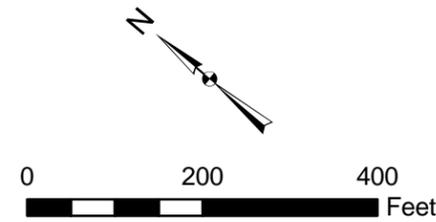
Legend

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ 2,3,4,7,8-PeCDF in Not Detected at or above the Reporting Limit
- ▲ 2,3,4,7,8-PeCDF Concentration Below the 1000x SLV of 0.03 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 1 and 10 times the 1000x SLV of 0.03 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 10 and 100 times the 1000x SLV of 0.03 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is between 100 and 1000 times the 1000x SLV of 0.03 ug/kg
- ▲ 2,3,4,7,8-PeCDF Concentration is greater than 1000 times the 1000x SLV of 0.03 ug/kg

2007 Composite River Bank Soil Sample

- ∩ 2,3,4,7,8-PeCDF Not Detected at or above the Reporting Limit
- ∩ 2,3,4,7,8-PeCDF Concentration Below the 1000x SLV of 0.03 ug/kg
- ∩ 2,3,4,7,8-PeCDF Concentration is between 1 and 10 times the 1000x SLV of 0.03 ug/kg
- ∩ 2,3,4,7,8-PeCDF Concentration is between 10 and 100 times the 1000x SLV of 0.03 ug/kg
- ∩ 2,3,4,7,8-PeCDF Concentration is between 100 and 1000 times the 1000x SLV of 0.03 ug/kg
- ∩ 2,3,4,7,8-PeCDF Concentration is greater than 1000 times the 1000x SLV of 0.03 ug/kg



Notes:
 SLV= Portland Harbor Joint Source Control Strategy- Screening Level Value from Portland Harbor JSCS, Final - December 2005, Table 3-1, 7/16/07
 The 1998/2000 River Bank samples were not analyzed for Furans
 2,3,4,7,8-PeCDF= 2,3,4,7,8-Pentachlorodibenzofuran
 ug/kg= micrograms per kilogram
 Reporting Limit is greater than the SLV
 Quotient = Concentration/SLV Value

Figure 16
 1000x SLV Quotient Exceedances -
 2,3,4,7,8-Pentachlorodibenzofuran
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon



Aerial Photography - July, 2005

Legend

1998/2000 Discrete River Bank Soil Sample

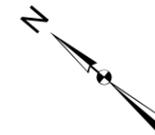
- Total DDT Not Detected at or above the Reporting Limit
- Total DDT Concentration Below the PRG of 7 mg/kg
- Total DDT Concentration is between 1 and 10 times the PRG of 7 mg/kg
- Total DDT Concentration is between 10 and 100 times the PRG of 7 mg/kg
- Total DDT Concentration is between 100 and 1000 times the PRG of 7 mg/kg
- Total DDT Concentration is greater than 1000 times the PRG of 7 mg/kg

2007 1.5-2 ft Discrete River Bank Soil Sample

- △ Total DDT Not Detected at or above the Reporting Limit
- △ Total DDT Concentration Below the PRG of 7 mg/kg
- △ Total DDT Concentration is between 1 and 10 times the PRG of 7 mg/kg
- △ Total DDT Concentration is between 10 and 100 times the PRG of 7 mg/kg
- △ Total DDT Concentration is between 100 and 1000 times the PRG of 7 mg/kg
- △ Total DDT Concentration is greater than 1000 times the PRG of 7 mg/kg

2007 Composite River Bank Soil Sample

- ∩ Total DDT Not Detected at or above the Reporting Limit
- ∩ Total DDT Concentration is greater than the PRG of 7 mg/kg
- ∩ Total DDT Concentration is between 1 and 10 times the PRG of 7 mg/kg
- ∩ Total DDT Concentration is between 10 and 100 times the PRG of 7 mg/kg
- ∩ Total DDT Concentration is between 100 and 1000 times the PRG of 7 mg/kg
- ∩ Total DDT Concentration is greater than 1000 times the PRG of 7 mg/kg



Notes:
 PRG= US Environmental Protection Agency Region 9 Preliminary
 Remediation Goal for Industrial Soil, Sept. 2008
 mg/kg= milligrams per kilogram
 Quotient = Concentration/PRG Value

Figure 17
 Industrial PRG Quotient Exceedances - Total DDT
 River Bank Erodible Soil Source
 Control Screening Evaluation
 Arkema, Inc.
 Portland, Oregon

Tables

Table 1
Comparison of 1998 through 2008 Soil Sampling Results to JSCS SLVs
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	Upland Soil/Stormwater Sediment		SAMPLING LOCATION																			
				MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	RBC-1	RBC-2	RBC-3	RBC-4	RBC-5	RBC-6	RBC-7 ^a	RBC-8	RBC-9	RBC-10	RBC-11	RBC-12	RBC-13	RBC-2-03	RBC-4-02	RBC-6-03	RBC-10-03	RBC-11-03	RBC-13-01	
Date				Toxicity	Bioaccumulation	3/19/2007	3/19/2007	3/20/2007	3/20/2007	3/20/2007	3/21/2007	3/21/2007	3/22/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	3/23/2007	3/19/2007	3/20/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	
Max Depth (ft)						0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	2.00	0.50	2.00	2.00	2.00	2.00	
Sample Type						RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - discrete (deep)						
Inorganics	Arsenic	mg/kg	EPA 6020	33	7	4.3	4.5	5.1	5.7	3.9	4	14	70	13	63	9.3	4.2	3.9	3.3	NS	2.1	6.8	8.1	2.1	
	Cadmium	mg/kg	EPA 6020	4.98	1	0.27	0.1	0.15	ND	ND	ND	0.11	0.17	0.1	ND	0.39	0.43	ND	NS	ND	ND	0.074	ND	0.59	
	Chromium	mg/kg	EPA 6020	111	N/A	810	410	71	170	21	19	27	24	51	19	150	17	16	31	NS	17	16	57	14	
	Lead	mg/kg	EPA 6020	128	17	40	39	120	19	30	20	77	100	110	50	130	59	42	7.5	NS	23	9.6	110	16	
	Zinc	mg/kg	EPA 6020	459	N/A	480	200	150	66	130	66	130	130	120	85	180	110	78	63	NS	57	51	98	100	
PCBs	Aroclor 1016	mg/kg	EPA 8082	0.530	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	
	Aroclor 1248	mg/kg	EPA 8082	1.5	N/A	0.74	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Aroclor 1254	mg/kg	EPA 8082	0.300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Aroclor 1260	mg/kg	EPA 8082	0.200	N/A	ND	ND	ND	ND	ND	ND	ND	0.024	ND	ND	ND	0.078	0.028	ND	NS	ND	ND	ND	ND	
	PCBs (total)	µg/kg	N/A	676	0.39	0.74	0.12	0	0	0	0	0	0.024	0	0	0	0.078	0.028	0	NS	0	0	0	0	
Pesticides	Aldrin	µg/kg	EPA 8081	40	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	delta-Hexachlorocyclohexane	µg/kg	EPA 8081	4.99	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Dieldrin	µg/kg	EPA 8081	61.8	0.0081	ND	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Endrin	µg/kg	EPA 8081	207	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Heptachlor	µg/kg	EPA 8081	10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Heptachlor epoxide	µg/kg	EPA 8081	16	N/A	ND	ND	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Chlordane	µg/kg	EPA 8081	17.6	0.37	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	DDD (Total)	µg/kg	EPA 8081	28	0.33	8.5	3.7	930	6.8	4.9	35	196	0	0	0	800	21	6.9	0	NS	0	0	0	0	
	DDE (Total)	µg/kg	EPA 8081	31.3	0.33	106	28	3500	30.4	31	80	2010	500	820	450	1000	115.9	55.8	3.3	NS	13.76	240	270	6	
	DDT (Total)	µg/kg	EPA 8081	62.9	0.33	358	121	11200	170	215	237	4170	1820	2880	2650	12100	191	82	16	NS	15.1	920	3270	29.8	
DDX (Total)	µg/kg	EPA 8081	N/A	0.33	472.5	152.7	15630	207.2	250.9	352	6376	2320	3700	3100	13900	327.9	144.7	19.3	NS	28.86	1160	3540	35.8		
VOCs	Tetrachloroethene	µg/kg	EPA 8260	500	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	Trichloroethene	µg/kg	EPA 8260	2,100	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
SVOCs	1,2,4-Trichlorobenzene	µg/kg	EPA 8270	9,200	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	1,2-Dichlorobenzene	µg/kg	EPA 8270	1,700	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	1,3-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	1,4-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Carbazole	µg/kg	EPA 8270	1,600	N/A	12	4.6	22	ND	4.1	ND	ND	ND	ND	ND	6.6	ND	ND	NS	ND	ND	ND	ND	ND	
	Hexachlorobenzene	µg/kg	EPA 8081	100	19	ND	ND	22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Hexachlorobutadiene	µg/kg	EPA 8081	600	N/A	ND	ND	6.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Hexachlorocyclopentadiene	µg/kg	EPA 8270	400	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	N-Nitrosodipropylamine	µg/kg	EPA 8270	1,300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	N-Nitrosodiphenylamine	µg/kg	EPA 8270	300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
Phenols	Bis(2-chloroisopropyl) ether	µg/kg	EPA 8270	561	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Phenol	µg/kg	EPA 8270	50	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	Pentachlorophenol	µg/kg	EPA 8270	1,000	250	ND	ND	16	ND	385	ND	ND	ND	100	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	2-Methylphenol	µg/kg	EPA 8270	13	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	

Table 1
Comparison of 1998 through 2008 Soil Sampling Results to JSCS SLVs
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	Upland Soil/Stormwater Sediment		SAMPLING LOCATION																			
				MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	RBC-1	RBC-2	RBC-3	RBC-4	RBC-5	RBC-6	RBC-7 ^a	RBC-8	RBC-9	RBC-10	RBC-11	RBC-12	RBC-13	RBC-2-03	RBC-4-02	RBC-6-03	RBC-10-03	RBC-11-03	RBC-13-01	
Date				Toxicity	Bioaccumulation	3/19/2007	3/19/2007	3/20/2007	3/20/2007	3/20/2007	3/21/2007	3/21/2007	3/22/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	3/23/2007	3/19/2007	3/20/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	
Max Depth (ft)						0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	2.00	0.50	2.00	2.00	2.00	2.00	
Sample Type						RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - discrete (deep)						
Phthalate Esters	Diethylphthalate	µg/kg	EPA 8270	600	N/A	ND	ND	ND	26	ND	ND	26	ND	24	ND	ND	ND	ND	ND	NS	ND	23	ND	ND	
	Di-n-butylphthalate	µg/kg	EPA 8270	100	60	ND	ND	ND	ND	ND	ND	25	ND	21	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	
	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800	330	9500	3900	1300	770	83	ND	ND	1100	ND	4600	82	120	68	NS	ND	ND	5100	150	150	
PAHs	2-Methylnaphthalene	µg/kg	EPA 8270	200	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	15	2.3	ND	0.69	NS	ND	ND	ND	ND	ND	
	Acenaphthene	µg/kg	EPA 8270	300	N/A	4.9	2.7	ND	15	2.65	ND	ND	ND	ND	ND	4.6	ND	ND	NS	ND	ND	7.3	ND	ND	
	Acenaphthylene	µg/kg	EPA 8270	200	N/A	3.9	3.2	11	ND	1.55	ND	7.4	ND	3	3.4	27	16	5.4	1.2	NS	ND	ND	17	ND	
	Anthracene	µg/kg	EPA 8270	845	N/A	9.6	5.6	47	ND	2.8	ND	7.1	6.6	11	7.5	19	17	5.1	1.4	NS	ND	ND	11	0.73	
	Fluorene	µg/kg	EPA 8270	536	N/A	4.1	2	8.9	ND	1.8	ND	ND	ND	ND	ND	9.5	4.6	1.1	0.37	NS	ND	ND	3.6	ND	
	Naphthalene	µg/kg	EPA 8270	561	N/A	2.4	3.5	5.3	ND	1.55	ND	ND	ND	ND	ND	45	6.6	1.1	2.3	NS	ND	ND	9.8	ND	
	Phenanthrene	µg/kg	EPA 8270	1,170	N/A	51	37	67	19	17.5	6.2	45	16	33	17	120	58	14	5	NS	ND	5.4	46	2.2	
	Dibenzo(a,h)anthracene	µg/kg	EPA 8270	1,300	N/A	19	10	92	31	2.1	ND	ND	ND	18	ND	ND	13	5.4	2.5	NS	ND	ND	17	ND	
	Benzo(a)anthracene	µg/kg	EPA 8270	1,050	N/A	83	34	340	110	20.5	14	46	34	ND	28	130	80	24	7.3	NS	ND	8.7	92	3.2	
	Benzo(a)pyrene	µg/kg	EPA 8270	1,450	N/A	120	58	530	270	34	13	71	48	140	68	150	96	26	13	NS	ND	11	130	6.8	
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300	N/A	99	58	310	200	21.5	15	61	46	100	77	130	54	14	12	NS	ND	13	110	5.7	
	Benzo(k)fluoranthene	µg/kg	EPA 8270	13,000	N/A	64	20	260	120	15	11	25	25	110	19	65	43	10	4.1	NS	ND	ND	51	2.3	
	Chrysene	µg/kg	EPA 8270	1,290	N/A	110	44	650	130	29	11	58	50	410	55	150	81	23	8.6	NS	ND	ND	98	5	
	Fluoranthene	µg/kg	EPA 8270	2,230	37,000	130	66	150	77	36.5	10	84	32	100	38	250	150	41	13	NS	ND	12	150	5.9	
	Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100	N/A	110	56	270	230	25	17	52	45	110	77	130	57	15	12	NS	ND	ND	93	6	
Pyrene	µg/kg	EPA 8270	1,520	1,900	130	65	230	94	33	10	97	37	100	47	240	140	38	13	NS	ND	17	150	5.8		
Dioxins/ Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	0.009	0.0000091	ND	ND	ND	ND	ND	ND	0.0022	0.0022	0.00092	ND	0.0006	ND	ND	NS	ND	ND	ND	ND	ND	
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.0026	ND	ND	ND	ND	0.0082	ND	0.0061	0.0071	0.0041	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	ND	ND	ND	ND	0.017	ND	0.0054	0.0045	0.0087	ND	0.004	0.0034	ND	NS	ND	ND	ND	ND	ND	
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	0.05	0.083	0.087	0.025	1.7	0.085	0.15	0.077	0.7	0.26	0.32	0.22	0.074	0.034	NS	0.012	0.019	0.44	0.023	
	2,3,7,8-Tetrachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00077	0.038	0.018	0.26	0.015	0.0049	0.0053	0.2	0.055	0.2	0.046	0.37	0.14	0.047	ND	NS	0.0029	0.0035	0.51	0.0079	
	1,2,3,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0026	0.031	0.018	0.57	0.011	0.011	0.012	0.16	0.088	0.27	0.078	0.53	0.25	0.093	ND	NS	0.0036	0.0055	0.64	0.011	
	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00003	0.012	0.008	0.17	0.0048	0.0069	0.0044	0.091	0.052	0.11	0.031	0.19	0.09	0.033	ND	NS	ND	ND	0.25	0.004	
	1,2,3,4,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	0.029	0.025	1.1	0.014	0.023	0.029	0.21	0.13	0.42	0.13	0.85	0.39	0.13	ND	NS	0.0065	0.01	0.68	0.017	
	1,2,3,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	0.0088	0.0073	0.37	0.0039	0.0099	0.011	0.074	0.055	0.12	0.034	0.22	0.11	0.038	ND	NS	ND	0.0029	0.17	0.0049	
	1,2,3,7,8,9-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	ND	ND	0.022	ND	ND	ND	0.0062	0.0034	0.008	ND	0.013	0.0077	0.0036	ND	NS	ND	ND	ND	ND	
	2,3,4,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	ND	ND	0.049	ND	0.0076	ND	0.037	0.03	0.028	0.0084	0.036	0.019	0.0063	ND	NS	ND	ND	0.033	ND	
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	0.023	0.03	0.9	0.0091	0.091	0.038	0.2	0.13	0.32	0.076	0.41	0.19	0.052	0.01	NS	0.009	0.016	0.3	0.0099	
	1,2,3,4,7,8,9-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	0.0048	0.0037	0.38	ND	0.0068	0.01	0.04	0.022	0.077	0.027	0.14	0.058	0.019	ND	NS	ND	0.0031	0.11	ND	

Notes:
a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
DEQ - Oregon Department of Environmental Quality
mg/kg - milligrams per kilogram
µg/kg - micrograms per kilogram
N/A - Not Applicable
ND - Not detected
NS - Analyte not sampled

RB - River bank
PAHs - Polyaromatic Hydrocarbons
PCBs - Polychlorinated Biphenyls
PEC - Probable Effects Concentration
SLV - Portland Harbor Joint Source Control Strategy Screening Level Value, Table 3-1, Revision 7/17/07
SQV - Sediment Quality Value
Bold - Analyte detected

Indicates screening value used for evaluation
Indicates concentration exceeds SLV
Indicates ND result where reporting limit>SLV

Table 1
Comparison of 1998 through 2008 Soil Sampling Results to JSCS SLVs
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December 2008

Group	Constituent	Units	Analytical Method	Upland Soil/Stormwater Sediment		SAMPLING LOCATION																	
				MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	RB-1		RB-2		RB-3		RB-4		RB-5		RB-6		RB-7	RB-8	RB-9	RB-10	RB-11	RB-12
				Toxicity	Bioaccumulation	11/23/1998	0.72	0.33	0.75	0.33	1.00	0.33	1.10	0.33	0.82	0.33	1.90	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000
Date	Max Depth (ft)	Sample Type			Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	RB - discrete						
Inorganics	Arsenic	mg/kg	EPA 6020	33	7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Cadmium	mg/kg	EPA 6020	4.98	1	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Chromium	mg/kg	EPA 6020	111	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Lead	mg/kg	EPA 6020	128	17	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Zinc	mg/kg	EPA 6020	459	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
PCBs	Aroclor 1016	mg/kg	EPA 8082	0.530	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Aroclor 1248	mg/kg	EPA 8082	1.5	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Aroclor 1254	mg/kg	EPA 8082	0.300	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Aroclor 1260	mg/kg	EPA 8082	0.200	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	PCBs (total)	µg/kg	N/A	676	0.39	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pesticides	Aldrin	µg/kg	EPA 8081	40	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	delta-Hexachlorocyclohexane	µg/kg	EPA 8081	4.99	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Dieldrin	µg/kg	EPA 8081	61.8	0.0081	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Endrin	µg/kg	EPA 8081	207	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Heptachlor	µg/kg	EPA 8081	10	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Heptachlor epoxide	µg/kg	EPA 8081	16	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Chlordane	µg/kg	EPA 8081	17.6	0.37	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	DDD (Total)	µg/kg	EPA 8081	28	0.33	66	360	100	360	84	75	0	18	0	26	28	94	1700	1100	530	500	770	
	DDE (Total)	µg/kg	EPA 8081	31.3	0.33	73	310	130	310	150	110	34	28	23	58	11	71	810	2400	1600	3500	2700	2900
	DDT (Total)	µg/kg	EPA 8081	62.9	0.33	320	1300	700	1300	2400	2000	410	2600	34	64	64	360	2300	21000	95000	120000	52000	7100
DDX (Total)	µg/kg	EPA 8081	N/A	0.33	459	1970	930	1970	2634	2185	444	2646	57	122	101	459	3204	25100	97700	124030	55200	10770	
VOCs	Tetrachloroethene	µg/kg	EPA 8260	500	N/A	ND	ND	ND	ND	ND	8	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	
	Trichloroethene	µg/kg	EPA 8260	2,100	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	
SVOCs	1,2,4-Trichlorobenzene	µg/kg	EPA 8270	9,200	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	1,2-Dichlorobenzene	µg/kg	EPA 8270	1,700	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	1,3-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	1,4-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Carbazole	µg/kg	EPA 8270	1,600	N/A	ND	ND	ND	23	ND	NS	NS	NS	NS	NS	NS							
	Hexachlorobenzene	µg/kg	EPA 8081	100	19	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hexachlorobutadiene	µg/kg	EPA 8081	600	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	Hexachlorocyclopentadiene	µg/kg	EPA 8270	400	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	N-Nitrosodipropylamine	µg/kg	EPA 8270	1,300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	N-Nitrosodiphenylamine	µg/kg	EPA 8270	300	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenols	Bis(2-chloroisopropyl) ether	µg/kg	EPA 8270	561	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Phenol	µg/kg	EPA 8270	50	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Pentachlorophenol	µg/kg	EPA 8270	1,000	250	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	2-Methylphenol	µg/kg	EPA 8270	13	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	

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				MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	RB-1		RB-2		RB-3		RB-4		RB-5		RB-6		RB-7	RB-8	RB-9	RB-10	RB-11	RB-12	
				Toxicity	Bioaccumulation	11/23/1998	0.33	0.72	0.33	0.75	0.33	1.00	0.33	1.10	0.33	0.82	0.33	1.90	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000
Date	Max Depth (ft)	Sample Type			Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete		
Phthalate Esters	Diethylphthalate	µg/kg	EPA 8270	600	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Di-n-butylphthalate	µg/kg	EPA 8270	100	60	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800	330	155	280	275	410	20	820	20	20	ND	ND	120	70	ND	ND	ND	ND	380	ND	
PAHs	2-Methylnaphthalene	µg/kg	EPA 8270	200	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Acenaphthene	µg/kg	EPA 8270	300	N/A	ND	ND	ND	15	ND	ND													
	Acenaphthylene	µg/kg	EPA 8270	200	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Anthracene	µg/kg	EPA 8270	845	N/A	ND	ND	ND	17	ND	ND													
	Fluorene	µg/kg	EPA 8270	536	N/A	ND	ND	ND	11	ND	ND													
	Naphthalene	µg/kg	EPA 8270	561	N/A	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
	Phenanthrene	µg/kg	EPA 8270	1,170	N/A	ND	ND	12	97	ND	ND													
	Dibenzo(a,h)anthracene	µg/kg	EPA 8270	1,300	N/A	ND	7	5	18	ND	6	9	ND	360	ND	ND	ND	ND						
	Benzo(a)anthracene	µg/kg	EPA 8270	1,050	N/A	11	30.5	29	70	12	ND	ND	19	14	ND	12.5	50	ND	1800	ND	ND	ND	ND	ND
	Benzo(a)pyrene	µg/kg	EPA 8270	1,450	N/A	20	49.5	25.5	82.5	18	ND	ND	16	15	ND	28.5	65	ND	1400	ND	ND	ND	ND	ND
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300	N/A	16.5	51.5	27.5	50	13.5	10	6.5	14	11.5	7	33.5	69	ND	810	ND	ND	ND	ND	ND
	Benzo(k)fluoranthene	µg/kg	EPA 8270	13,000	N/A	31	48.5	26	69.5	22	11	ND	16	15	ND	24	50.5	ND	2300	ND	ND	ND	ND	ND
	Chrysene	µg/kg	EPA 8270	1,290	N/A	25	47.5	37.5	80.5	16	12	ND	26	15	ND	17	65	ND	1900	ND	ND	ND	ND	ND
	Fluoranthene	µg/kg	EPA 8270	2,230	37,000	12.5	62.5	36	172	11.5	17	ND	28	20	ND	13	87	ND	2100	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100	N/A	21.5	58.5	27	68.5	18	12	7	11.5	14	7	41	75.5	ND	1000	ND	ND	ND	ND	ND	
Pyrene	µg/kg	EPA 8270	1,520	1,900	14	83.5	43	142	11	16	ND	37	22	ND	12.5	107	ND	1400	ND	ND	ND	ND	ND	
Dioxins/ Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	0.009	0.0000091	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.0026	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	2,3,7,8-Tetrachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00077	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0026	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00003	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,4,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,7,8,9-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	2,3,4,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
	1,2,3,4,7,8,9-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

Notes:
a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
DEQ - Oregon Department of Environmental Quality
mg/kg - milligrams per kilogram
µg/kg - micrograms per kilogram
N/A - Not Applicable
ND - Not detected
NS - Analyte not sampled
RB - River bank
PAHs - Polyaromatic Hydrocarbons
PCBs - Polychlorinated Biphenyls
PEC - Probable Effects Concentration
SLV - Portland Harbor Joint Source Control Strategy Screening Level Value, Table 3-1, Revision 7/17/07
SQV - Sediment Quality Value
Bold - Analyte detected
Indicates screening value used for evaluation
Indicates concentration exceeds SLV
Indicates ND result where reporting limit>SLV

Table 2
JSCS Exceedance Quotients
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	SAMPLING LOCATION												
						RBC-1	RBC-2	RBC-3	RBC-4	RBC-5	RBC-6	RBC-7 ^a	RBC-8	RBC-9	RBC-10	RBC-11	RBC-12	RBC-13
Date				Toxicity	Bioaccumulation	3/19/2007	3/19/2007	3/20/2007	3/20/2007	3/20/2007	3/21/2007	3/21/2007	3/22/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	3/23/2007
Max Depth (ft)						0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Sample Type						RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	
Inorganics	Arsenic	mg/kg	EPA 6020	33	7	<1	<1	<1	<1	<1	<1	2	10	2	9	1	<1	<1
	Cadmium	mg/kg	EPA 6020	4.98	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chromium	mg/kg	EPA 6020	111	N/A	7	4	<1	2	<1	<1	<1	<1	<1	<1	1	<1	<1
	Lead	mg/kg	EPA 6020	128	17	2	2	7	1	2	1	5	6	6	3	8	3	2
	Zinc	mg/kg	EPA 6020	459	N/A	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
PCBs	Aroclor 1016	mg/kg	EPA 8082	0.530	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Aroclor 1248	mg/kg	EPA 8082	1.5	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Aroclor 1254	mg/kg	EPA 8082	0.300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Aroclor 1260	mg/kg	EPA 8082	0.200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	PCBs (total)	µg/kg	N/A	676	0.39	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pesticides	Aldrin	µg/kg	EPA 8081	40	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	delta-Hexachlorocyclohexane	µg/kg	EPA 8081	4.99	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dieldrin	µg/kg	EPA 8081	61.8	0.0081	<1	<1	<1	<1	<1	<1	247	<1	<1	<1	<1	<1	<1
	Endrin	µg/kg	EPA 8081	207	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Heptachlor	µg/kg	EPA 8081	10	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Heptachlor epoxide	µg/kg	EPA 8081	16	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chlordane	µg/kg	EPA 8081	17.6	0.37	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	DDD (Total)	µg/kg	EPA 8081	28	0.33	26	11	2818	21	15	106	594	<1	<1	<1	2424	64	21
	DDE (Total)	µg/kg	EPA 8081	31.3	0.33	321	85	10606	92	94	242	6091	1515	2485	1364	3030	351	169
	DDT (Total)	µg/kg	EPA 8081	62.9	0.33	1085	367	33939	515	652	718	12636	5515	8727	8030	36667	579	248
DDX (Total)	µg/kg	N/A		0.33	1432	463	47364	628	760	1067	19321	7030	11212	9394	42121	994	438	
VOCs	Tetrachloroethene	µg/kg	EPA 8260	500	N/A	--	--	--	--	--	--	--	--	--	--	--	--	--
	Trichloroethene	µg/kg	EPA 8260	2,100	N/A	--	--	--	--	--	--	--	--	--	--	--	--	--
SVOCs	1,2,4-Trichlorobenzene	µg/kg	EPA 8270	9,200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	1,2-Dichlorobenzene	µg/kg	EPA 8270	1,700	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	1,3-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	1,4-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Carbazole	µg/kg	EPA 8270	1,600	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Hexachlorobenzene	µg/kg	EPA 8081	100	19	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Hexachlorobutadiene	µg/kg	EPA 8081	600	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Hexachlorocyclopentadiene	µg/kg	EPA 8270	400	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	N-Nitrosodipropylamine	µg/kg	EPA 8270	1,300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	N-Nitrosodiphenylamine	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenols	Bis(2-chloroisopropyl) ether	µg/kg	EPA 8270	561	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Phenol	µg/kg	EPA 8270	50	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Pentachlorophenol	µg/kg	EPA 8270	1,000	250	<1	<1	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1
	2-Methylphenol	µg/kg	EPA 8270	13	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Table 2
JSCS Exceedance Quotients
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	SAMPLING LOCATION												
						RBC-1	RBC-2	RBC-3	RBC-4	RBC-5	RBC-6	RBC-7 ^a	RBC-8	RBC-9	RBC-10	RBC-11	RBC-12	RBC-13
Date				Toxicity	Bioaccumulation	3/19/2007	3/19/2007	3/20/2007	3/20/2007	3/20/2007	3/21/2007	3/21/2007	3/22/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	3/23/2007
Max Depth (ft)						0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Sample Type						RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite
Phthalate Esters	Dimethylphthalate	µg/kg	EPA 8270	N/A	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Diethylphthalate	µg/kg	EPA 8270	600	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Di-n-butylphthalate	µg/kg	EPA 8270	100	60	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800	330	29	12	4	2	<1	<1	<1	<1	3	<1	14	<1	<1
PAHs	2-Methylnaphthalene	µg/kg	EPA 8270	200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Acenaphthene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Acenaphthylene	µg/kg	EPA 8270	200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Anthracene	µg/kg	EPA 8270	845	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Fluorene	µg/kg	EPA 8270	536	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Naphthalene	µg/kg	EPA 8270	561	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Phenanthrene	µg/kg	EPA 8270	1,170	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dibenzo(a,h)anthracene	µg/kg	EPA 8270	1,300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(a)anthracene	µg/kg	EPA 8270	1,050	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(a)pyrene	µg/kg	EPA 8270	1,450	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300	N/A	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(k)fluoranthene	µg/kg	EPA 8270	13,000	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chrysene	µg/kg	EPA 8270	1,290	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Fluoranthene	µg/kg	EPA 8270	2,230	37,000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100	N/A	1	<1	3	2	<1	<1	<1	<1	1	<1	1	<1	<1
Pyrene	µg/kg	EPA 8270	1,520	1,900	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Dioxins/Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	0.009	0.0000091	<1	<1	<1	<1	<1	242	242	101	<1	66	<1	<1	
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.0026	<1	<1	<1	<1	3	<1	3	2	<1	<1	<1	<1	
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	<1	<1	<1	<1	2	<1	<1	1	<1	<1	<1	<1	
	2,3,7,8-Tetrachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00077	49	23	338	19	6	7	260	71	260	60	481	182	61
	1,2,3,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0026	12	7	219	4	4	5	62	34	104	30	204	96	36
	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00003	400	267	5667	160	230	147	3033	1733	3667	1033	6333	3000	1100
	1,2,3,4,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	11	9	407	5	9	11	78	48	156	48	315	144	48
	1,2,3,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	3	3	137	1	4	4	27	20	44	13	81	41	14
	1,2,3,7,8,9-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	<1	<1	8	<1	<1	<1	2	1	3	<1	5	3	1
	2,3,4,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	<1	<1	18	<1	3	<1	14	11	10	3	13	7	2
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	<1	<1	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	1,2,3,4,7,8,9-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Notes:
^a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
 DEQ = Oregon Department of Environmental Quality
 mg/kg - milligrams per kilogram
 µg/kg - micrograms per kilogram
 N/A - Not Applicable
 ND = Not detected.
 NS - Analyte not sampled
 RB - River bank
 PAHs - Polyaromatic Hydrocarbons
 -- - Analyte not sampled
 PCBs - Polychlorinated Biphenyls
 PEC - Probable Effects Concentration
 SLV = Portland Harbor Joint Source Control Strategy Screening Level Value, Table 3-1, Revision 7/17/07
 SQV - Sediment Quality Value
Bold = Analyte detected

Indicates screening value used for evaluation
 Indicates result concentration exceeds SLV by factor of 1 to 10
 Indicates result concentration exceeds SLV by factor of 10 to 100
 Indicates result concentration exceeds SLV by factor greater than 100

Table 2
JSCS Exceedance Quotients
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	SAMPLING LOCATION																
						RBC-2-03	RBC-4-02	RBC-6-03	RBC-10-03	RBC-11-03	RBC-13-01	RB-1		RB-2		RB-3		RB-4		RB-5		
Date				Toxicity	Bioaccumulation	3/19/2007	3/20/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	11/23/1998		11/23/1998		11/24/1998		11/24/1998		11/24/1998		
Max Depth (ft)						2.00	0.50	2.00	2.00	2.00	2.00	0.33	0.72	0.33	0.75	0.33	1.00	0.33	1.10	0.33	0.82	
Sample Type						RB - discrete (deep)	Beach - discrete															
Inorganics	Arsenic	mg/kg	EPA 6020	33	7	<1	--	<1	<1	1	<1	--	--	--	--	--	--	--	--	--	--	--
	Cadmium	mg/kg	EPA 6020	4.98	1	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	Chromium	mg/kg	EPA 6020	111	N/A	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	Lead	mg/kg	EPA 6020	128	17	<1	--	1	<1	6	<1	--	--	--	--	--	--	--	--	--	--	--
	Zinc	mg/kg	EPA 6020	459	N/A	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
PCBs	Aroclor 1016	mg/kg	EPA 8082	0.530	N/A	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	Aroclor 1248	mg/kg	EPA 8082	1.5	N/A	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	Aroclor 1254	mg/kg	EPA 8082	0.300	N/A	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	Aroclor 1260	mg/kg	EPA 8082	0.200	N/A	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	PCBs (total)	µg/kg	N/A	676	0.39	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
Pesticides	Aldrin	µg/kg	EPA 8081	40	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	delta-Hexachlorocyclohexane	µg/kg	EPA 8081	4.99	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dieldrin	µg/kg	EPA 8081	61.8	0.0081	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Endrin	µg/kg	EPA 8081	207	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Heptachlor	µg/kg	EPA 8081	10	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Heptachlor epoxide	µg/kg	EPA 8081	16	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chlordane	µg/kg	EPA 8081	17.6	0.37	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	DDD (Total)	µg/kg	EPA 8081	28	0.33	<1	--	<1	<1	<1	<1	200	1091	303	1091	255	227	<1	55	<1	<1	<1
	DDE (Total)	µg/kg	EPA 8081	31.3	0.33	10	--	42	727	818	18	221	939	394	939	455	333	103	85	70	176	
	DDT (Total)	µg/kg	EPA 8081	62.9	0.33	48	--	46	2788	9909	90	970	3939	2121	3939	7273	6061	1242	7879	103	194	
	DDX (Total)	µg/kg	N/A		0.33	58	--	87	3515	10727	108	1391	5970	2818	5970	7982	6621	1345	8018	173	370	
	VOCs	Tetrachloroethene	µg/kg	EPA 8260	500	N/A	--	<1	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Trichloroethene		µg/kg	EPA 8260	2,100	N/A	--	<1	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
SVOCs	1,2,4-Trichlorobenzene	µg/kg	EPA 8270	9,200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	1,2-Dichlorobenzene	µg/kg	EPA 8270	1,700	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	1,3-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	1,4-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Carbazole	µg/kg	EPA 8270	1,600	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Hexachlorobenzene	µg/kg	EPA 8081	100	19	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Hexachlorobutadiene	µg/kg	EPA 8081	600	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Hexachlorocyclopentadiene	µg/kg	EPA 8270	400	N/A	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
	N-Nitrosodipropylamine	µg/kg	EPA 8270	1,300	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	N-Nitrosodiphenylamine	µg/kg	EPA 8270	300	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Bis(2-chloroisopropyl) ether	µg/kg	EPA 8270	561	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Phenols	Phenol	µg/kg	EPA 8270	50	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pentachlorophenol		µg/kg	EPA 8270	1,000	250	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol		µg/kg	EPA 8270	13	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	

Table 2
JSCS Exceedance Quotients
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	SAMPLING LOCATION																	
						RBC-2-03	RBC-4-02	RBC-6-03	RBC-10-03	RBC-11-03	RBC-13-01	RB-1		RB-2		RB-3		RB-4		RB-5			
Date				Toxicity	Bioaccumulation	3/19/2007	3/20/2007	3/21/2007	3/22/2007	3/23/2007	3/23/2007	11/23/1998		11/23/1998		11/24/1998		11/24/1998		11/24/1998			
Max Depth (ft)						2.00	0.50	2.00	2.00	2.00	2.00	0.33	0.72	0.33	0.75	0.33	1.00	0.33	1.10	0.33	0.82		
Sample Type						RB - discrete (deep)	Beach - discrete																
Phthalate	Dimethylphthalate	µg/kg	EPA 8270	N/A	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Diethylphthalate	µg/kg	EPA 8270	600	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Esters	Di-n-butylphthalate	µg/kg	EPA 8270	100	60	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800	330	<1	--	<1	<1	15	<1	<1	<1	<1	1	<1	2	<1	<1	<1	<1	<1	
PAHs	2-Methylnaphthalene	µg/kg	EPA 8270	200	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Acenaphthene	µg/kg	EPA 8270	300	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Acenaphthylene	µg/kg	EPA 8270	200	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Anthracene	µg/kg	EPA 8270	845	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Fluorene	µg/kg	EPA 8270	536	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
	Naphthalene	µg/kg	EPA 8270	561	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Phenanthrene	µg/kg	EPA 8270	1,170	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Dibenzo(a,h)anthracene	µg/kg	EPA 8270	1,300	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(a)anthracene	µg/kg	EPA 8270	1,050	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(a)pyrene	µg/kg	EPA 8270	1,450	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Benzo(k)fluoranthene	µg/kg	EPA 8270	13,000	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Chrysene	µg/kg	EPA 8270	1,290	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Fluoranthene	µg/kg	EPA 8270	2,230	37,000	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100	N/A	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	µg/kg	EPA 8270	1,520	1,900	<1	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	
Dioxins/ Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	0.009	0.0000091	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.0026	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	
	2,3,7,8-Tetrachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00077	<1	--	<1	5	662	10	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0026	<1	--	1	2	246	4	--	--	--	--	--	--	--	--	--	--	--	
	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00003	<1	--	<1	<1	8333	133	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,4,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	<1	--	2	4	252	6	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	<1	--	<1	1	63	2	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,7,8,9-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	
	2,3,4,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	<1	--	<1	<1	12	<1	--	--	--	--	--	--	--	--	--	--	--	
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--	
1,2,3,4,7,8,9-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	<1	--	<1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--	--		

Notes:
 * - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
 DEQ = Oregon Department of Environmental Quality
 mg/kg - milligrams per kilogram
 µg/kg - micrograms per kilogram
 N/A - Not Applicable
 ND = Not detected.
 NS - Analyte not sampled
 RB - River bank
 PAHs - Polycyclic Aromatic Hydrocarbons
 -- - Analyte not sampled
 PCBs - Polychlorinated Biphenyls
 PEC - Probable Effects Concentration
 SLV = Portland Harbor Joint Source Control Strategy Screening Level Value, Table 3-1, Revision 7/17/07
 SQV - Sediment Quality Value
Bold = Analyte detected

Indicates screening value used for evaluation
 Indicates result concentration exceeds SLV by factor of 1 to 10
 Indicates result concentration exceeds SLV by factor of 10 to 100
 Indicates result concentration exceeds SLV by factor greater than 100

Table 2
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Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	SAMPLING LOCATION							Maximum Exceedance Quotient	Minimum Exceedance Quotient	
						RB-6		RB-7	RB-8	RB-9	RB-10	RB-11			RB-12
						11/24/1998		8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000			8/3/2000
Date				Toxicity	Bioaccumulation	0.33	1.90	0.50	0.50	0.50	0.50	0.50	0.50		
Max Depth (ft)						Beach - discrete	Beach - discrete	RB - discrete							
Sample Type															
Inorganics	Arsenic	mg/kg	EPA 6020	33	7	--	--	--	--	--	--	--	--	10	1
	Cadmium	mg/kg	EPA 6020	4.98	1	--	--	1	<1	<1	<1	<1	<1	1	1
	Chromium	mg/kg	EPA 6020	111	N/A	--	--	<1	<1	<1	<1	<1	<1	7	1
	Lead	mg/kg	EPA 6020	128	17	--	--	4	123	3	4	3	3	123	1
	Zinc	mg/kg	EPA 6020	459	N/A	--	--	<1	<1	<1	<1	<1	<1	1	1
PCBs	Aroclor 1016	mg/kg	EPA 8082	0.530	N/A	--	--	--	--	--	--	--	--	0	0
	Aroclor 1248	mg/kg	EPA 8082	1.5	N/A	--	--	--	--	--	--	--	--	0	0
	Aroclor 1254	mg/kg	EPA 8082	0.300	N/A	--	--	--	--	--	--	--	--	0	0
	Aroclor 1260	mg/kg	EPA 8082	0.200	N/A	--	--	--	--	--	--	--	--	0	0
	PCBs (total)	µg/kg	N/A	676	0.39	--	--	--	--	--	--	--	--	2	2
Pesticides	Aldrin	µg/kg	EPA 8081	40	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	delta-Hexachlorocyclohexane	µg/kg	EPA 8081	4.99	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Dieldrin	µg/kg	EPA 8081	61.8	0.0081	<1	<1	<1	<1	<1	<1	<1	<1	247	247
	Endrin	µg/kg	EPA 8081	207	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Heptachlor	µg/kg	EPA 8081	10	N/A	<1	<1	<1	<1	<1	<1	<1	<1	5	5
	Heptachlor epoxide	µg/kg	EPA 8081	16	N/A	<1	<1	<1	<1	<1	<1	<1	<1	3	3
	Chlordane	µg/kg	EPA 8081	17.6	0.37	--	--	--	--	--	--	--	--	0	0
	DDD (Total)	µg/kg	EPA 8081	28	0.33	79	85	285	5152	3333	1606	1515	2333	5152	11
	DDE (Total)	µg/kg	EPA 8081	31.3	0.33	33	215	2455	7273	4848	10606	8182	8788	10606	10
	DDT (Total)	µg/kg	EPA 8081	62.9	0.33	194	1091	6970	63636	287879	363636	157576	21515	363636	46
DDX (Total)	µg/kg	N/A		0.33	306	1391	9709	76061	296061	375848	167273	32636	375848	58	
VOCs	Tetrachloroethene	µg/kg	EPA 8260	500	N/A	<1	<1	--	--	--	--	--	--	0	0
	Trichloroethene	µg/kg	EPA 8260	2,100	N/A	<1	<1	--	--	--	--	--	--	0	0
SVOCs	1,2,4-Trichlorobenzene	µg/kg	EPA 8270	9,200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	1,2-Dichlorobenzene	µg/kg	EPA 8270	1,700	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	1,3-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	1,4-Dichlorobenzene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Carbazole	µg/kg	EPA 8270	1,600	N/A	<1	<1	--	--	--	--	--	--	0	0
	Hexachlorobenzene	µg/kg	EPA 8081	100	19	<1	<1	<1	<1	<1	<1	<1	<1	1	1
	Hexachlorobutadiene	µg/kg	EPA 8081	600	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Hexachlorocyclopentadiene	µg/kg	EPA 8270	400	N/A	--	--	<1	<1	<1	<1	<1	<1	0	0
	N-Nitrosodipropylamine	µg/kg	EPA 8270	1,300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	N-Nitrosodiphenylamine	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
Phenols	Bis(2-chloroisopropyl) ether	µg/kg	EPA 8270	561	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Phenol	µg/kg	EPA 8270	50	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Pentachlorophenol	µg/kg	EPA 8270	1,000	250	--	--	<1	<1	<1	<1	<1	<1	2	2
	2-Methylphenol	µg/kg	EPA 8270	13	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0

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December 2008

Group	Constituent	Units	Analytical Method	MacDonald PECs and other SQVs	DEQ 2007 Bioaccumulative Sediment SLVs	SAMPLING LOCATION								Maximum Exceedance Quotient	Minimum Exceedance Quotient
						RB-6		RB-7	RB-8	RB-9	RB-10	RB-11	RB-12		
						11/24/1998		8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000		
Date				Toxicity	Bioaccumulation	0.33	1.90	0.50	0.50	0.50	0.50	0.50	0.50		
Max Depth (ft)						Beach - discrete	Beach - discrete	RB - discrete							
Sample Type															
Phthalate Esters	Dimethylphthalate	µg/kg	EPA 8270	N/A	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Diethylphthalate	µg/kg	EPA 8270	600	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Di-n-butylphthalate	µg/kg	EPA 8270	100	60	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800	330	<1	<1	<1	<1	<1	1	<1	<1	29	1
PAHs	2-Methylnaphthalene	µg/kg	EPA 8270	200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Acenaphthene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Acenaphthylene	µg/kg	EPA 8270	200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Anthracene	µg/kg	EPA 8270	845	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Fluorene	µg/kg	EPA 8270	536	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Naphthalene	µg/kg	EPA 8270	561	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Phenanthrene	µg/kg	EPA 8270	1,170	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Dibenzo(a,h)anthracene	µg/kg	EPA 8270	1,300	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Benzo(a)anthracene	µg/kg	EPA 8270	1,050	N/A	<1	<1	<1	2	<1	<1	<1	<1	2	2
	Benzo(a)pyrene	µg/kg	EPA 8270	1,450	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300	N/A	<1	<1	<1	3	<1	<1	<1	<1	3	1
	Benzo(k)fluoranthene	µg/kg	EPA 8270	13,000	N/A	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Chrysene	µg/kg	EPA 8270	1,290	N/A	<1	<1	<1	1	<1	<1	<1	<1	1	1
	Fluoranthene	µg/kg	EPA 8270	2,230	37,000	<1	<1	<1	<1	<1	<1	<1	<1	0	0
Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100	N/A	<1	<1	<1	10	<1	<1	<1	<1	10	1	
Pyrene	µg/kg	EPA 8270	1,520	1,900	<1	<1	<1	<1	<1	<1	<1	<1	0	0	
Dioxins/ Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	0.009	0.0000091	--	--	--	--	--	--	--	--	242	66
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.0026	--	--	--	--	--	--	--	--	3	2
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	--	--	--	--	--	--	--	--	0	0
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	0.69	--	--	--	--	--	--	--	--	2	1
	2,3,7,8-Tetrachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00077	--	--	--	--	--	--	--	--	662	4
	1,2,3,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0026	--	--	--	--	--	--	--	--	246	1
	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.00003	--	--	--	--	--	--	--	--	8333	133
	1,2,3,4,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	--	--	--	--	--	--	--	--	407	2
	1,2,3,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	--	--	--	--	--	--	--	--	137	1
	1,2,3,7,8,9-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	--	--	--	--	--	--	--	--	8	1
	2,3,4,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.0027	--	--	--	--	--	--	--	--	18	2
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	--	--	--	--	--	--	--	--	1	1
1,2,3,4,7,8,9-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.69	--	--	--	--	--	--	--	--	0	0	

Notes:
^a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
 DEQ = Oregon Department of Environmental Quality
 mg/kg - milligrams per kilogram
 µg/kg - micrograms per kilogram
 N/A - Not Applicable
 ND = Not detected.
 NS - Analyte not sampled
 RB - River bank
 PAHs - Polyaromatic Hydrocarbons
 -- - Analyte not sampled
 PCBs - Polychlorinated Biphenyls
 PEC - Probable Effects Concentration
 SLV = Portland Harbor Joint Source Control Strategy
 Screening Level Value, Table 3-1, Revision 7/17/07
 SQV - Sediment Quality Value
Bold = Analyte detected

Indicates screening value used for evaluation
 Indicates result concentration exceeds SLV by factor of 1 to 10
 Indicates result concentration exceeds SLV by factor of 10 to 100
 Indicates result concentration exceeds SLV by factor greater than 100

Table 3
Comparison of 1998 through 2008 Soil Sampling Results to 1000x JSCS SLVs
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	Upland Soil/Stormwater Sediment		SAMPLING LOCATION																							
				1000x MacDonald PECs and other SQVs	1000x DEQ 2007 Bioaccumulative Sediment SLVs	RBC-1	RBC-2	RBC-3	RBC-4	RBC-5	RBC-6	RBC-7 ^a	RBC-8	RBC-9	RBC-10	RBC-11	RBC-12	RBC-13	RBC-2-03	RBC-4-02	RBC-6-03	RBC-10-03	RBC-11-03	RBC-13-01	RB-1	RB-2			
Date				Toxicity	Bioaccumulation	3/19/2007	3/19/2007	3/20/2007	3/20/2007	3/20/2007	3/21/2007	3/21/2007	3/22/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	3/23/2007	3/19/2007	3/20/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	11/23/1998	11/23/1998			
Max Depth (ft)						0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	2.00	0.50	2.00	2.00	2.00	2.00	0.33	0.72	0.33	0.75	
Sample Type						RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - discrete (deep)	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete						
Inorganics	Arsenic	mg/kg	EPA 6020	33000	7000	4.3	4.5	5.1	5.7	3.9	4	14	70	13	63	9.3	4.2	3.9	3.3	NS	2.1	6.8	8.1	2.1	NS	NS	NS	NS	
	Cadmium	mg/kg	EPA 6020	4980	1000	0.27	0.1	0.15	ND	ND	ND	0.11	0.17	0.1	ND	ND	0.39	0.43	ND	NS	ND	ND	0.074	0.59	NS	NS	NS	NS	
	Chromium	mg/kg	EPA 6020	111000	N/A	810	410	71	170	21	19	27	24	51	19	150	17	16	31	NS	NS	17	16	57	14	NS	NS	NS	NS
	Lead	mg/kg	EPA 6020	128000	17000	40	39	120	19	30	20	77	100	110	50	130	59	42	7.5	NS	NS	23	9.6	110	16	NS	NS	NS	NS
	Zinc	mg/kg	EPA 6020	459000	N/A	480	200	150	66	130	66	130	130	120	85	180	110	78	63	NS	NS	57	51	98	100	NS	NS	NS	NS
PCBs	PCBs (total)	µg/kg	N/A	676000	390	0.74	0.12	0	0	0	0	0	0.024	0	0	0	0.078	0.028	0	NS	0	0	0	0	NS	NS	NS	NS	
Pesticides	Dieldrin	µg/kg	EPA 8081	61800	8.1	ND	ND	ND	ND	ND	2	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	
	DDD (Total)	µg/kg	EPA 8081	28000	330	8.5	3.7	930	9.4	0	35	196	0	0	0	800	21	6.9	0	NS	0	0	0	0	0	66	360	100	360
	DDE (Total)	µg/kg	EPA 8081	31300	330	106	28	3500	30.4	31	80	2010	500	820	450	1000	115.9	55.8	3.3	NS	13.76	240	270	6	73	310	130	310	
	DDT (Total)	µg/kg	EPA 8081	62900	330	358	121	11200	170	256	237	4170	1820	2880	2650	12100	191	82	16	NS	15.1	920	3270	29.8	320	1300	700	1300	
	DDX (Total)	µg/kg	EPA 8081	N/A	330	472.5	152.7	15630	209.8	287	352	6376	2320	3700	3100	13900	327.9	144.7	19.3	NS	28.86	1160	3540	35.8	459	1970	930	1970	
SVOCs	Hexachlorobenzene	µg/kg	EPA 8081	100000	19000	ND	ND	22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND	ND	ND	ND	ND	ND	ND	
Phenols	Pentachlorophenol	µg/kg	EPA 8270	1000000	250000	ND	ND	16	ND	385	ND	ND	ND	100	ND	ND	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	NS	NS	
Phthalate Esters	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800000	330000	9500	3900	1300	770	83	ND	ND	ND	1100	ND	4600	82	120	68	NS	ND	ND	5100	150	155	280	275	410	
PAHs	Benzo(a)anthracene	µg/kg	EPA 8270	1050000	N/A	83	34	340	110	20.5	14	46	34	ND	28	130	80	24	7.3	NS	NS	ND	8.7	92	3.2	11	30.5	29	70
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300000	N/A	99	58	310	200	21.5	15	61	46	100	77	130	54	14	12	NS	NS	ND	13	110	5.7	16.5	51.5	27.5	50
	Chrysene	µg/kg	EPA 8270	1290000	N/A	110	44	650	130	29	11	58	50	410	55	150	81	23	8.6	NS	NS	ND	ND	98	5	25	47.5	37.5	80.5
	Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100000	N/A	110	56	270	230	25	17	52	45	110	77	130	57	15	12	NS	NS	ND	ND	93	6	21.5	58.5	27	68.5
Dioxins/Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	9	0.0091	ND	ND	ND	ND	ND	0.0022	0.0022	0.00092	ND	0.0006	ND	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	NS	NS	
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	2.6	ND	ND	ND	ND	0.0082	ND	0.0061	0.0071	0.0041	ND	ND	ND	ND	NS	NS	ND	ND	ND	ND	NS	NS	NS	NS	
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	690	0.05	0.083	0.087	0.025	1.7	0.085	0.15	0.077	0.7	0.26	0.32	0.22	0.074	0.034	NS	0.012	0.019	0.44	0.023	NS	NS	NS	NS	
	2,3,7,8-Tetrachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.77	0.038	0.018	0.26	0.015	0.0049	0.0053	0.2	0.055	0.2	0.046	0.37	0.14	0.047	ND	NS	0.0029	0.0035	0.51	0.0079	NS	NS	NS	NS	
	1,2,3,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.6	0.031	0.018	0.57	0.011	0.011	0.012	0.16	0.088	0.27	0.078	0.53	0.25	0.093	ND	NS	0.0036	0.0055	0.64	0.011	NS	NS	NS	NS	
	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.03	0.012	0.008	0.17	0.0048	0.0069	0.0044	0.091	0.052	0.11	0.031	0.19	0.09	0.033	ND	NS	NS	ND	0.25	0.004	NS	NS	NS	NS	
	1,2,3,4,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	0.029	0.025	1.1	0.014	0.023	0.029	0.21	0.13	0.42	0.13	0.85	0.39	0.13	ND	NS	0.0065	0.01	0.68	0.017	NS	NS	NS	NS	
	1,2,3,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	0.0088	0.0073	0.37	0.0039	0.0099	0.011	0.074	0.055	0.12	0.034	0.22	0.11	0.038	ND	NS	NS	ND	0.0029	0.17	0.0049	NS	NS	NS	NS
	1,2,3,7,8,9-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	ND	ND	0.022	ND	ND	ND	0.0062	0.0034	0.008	ND	0.013	0.0077	0.0036	ND	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS
	2,3,4,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	ND	ND	0.049	ND	0.0076	ND	0.037	0.03	0.028	0.0084	0.036	0.019	0.0063	ND	NS	NS	ND	ND	0.033	ND	NS	NS	NS	NS
1,2,3,4,6,7,8-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	690	0.023	0.03	0.9	0.0091	0.091	0.038	0.2	0.13	0.32	0.076	0.41	0.19	0.052	0.01	NS	0.009	0.016	0.3	0.0099	NS	NS	NS	NS	NS	

Notes:
a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
DEQ - Oregon Department of Environmental Quality
mg/kg - milligrams per kilogram
µg/kg - micrograms per kilogram
N/A - Not Applicable
ND - Not detected
NS - Analyte not sampled

RB - River bank
PAHs - Polycyclic Aromatic Hydrocarbons
PCBs - Polychlorinated Biphenyls
PEC - Probable Effects Concentration
SLV - Portland Harbor Joint Source Control Strategy Screening Level Value, Table 3-1, Revision 7/17/07
SQV - Sediment Quality Value
Bold - Analyte detected

Indicates screening value used for evaluation
Indicates concentration exceeds 1000x SLV
Indicates ND result where reporting limit > 1000x SLV

Table 3
Comparison of 1998 through 2008 Soil Sampling Results to 1000x JSCS SLVs
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	Upland Soil/Stormwater Sediment		SAMPLING LOCATION														
				1000x MacDonald PECs and other SQVs	1000x DEQ 2007 Bioaccumulative Sediment SLVs	RB-3		RB-4		RB-5		RB-6		RB-7	RB-8	RB-9	RB-10	RB-11	RB-12	
Date				Toxicity	Bioaccumulation	11/24/1998		11/24/1998		11/24/1998		11/24/1998		8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	
Max Depth (ft)						0.33	1.00	0.33	1.10	0.33	0.82	0.33	1.90	0.50	0.50	0.50	0.50	0.50	0.50	
Sample Type						Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	RB - discrete						
Inorganics	Arsenic	mg/kg	EPA 6020	33000	7000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Cadmium	mg/kg	EPA 6020	4980	1000	NS	NS	NS	NS	NS	NS	NS	NS	1.4	ND	ND	ND	ND	ND	ND
	Chromium	mg/kg	EPA 6020	111000	N/A	NS	NS	NS	NS	NS	NS	NS	NS	20.4	40.7	19.2	17	21.3	19.5	
	Lead	mg/kg	EPA 6020	128000	17000	NS	NS	NS	NS	NS	NS	NS	NS	62.8	2090	45.7	63	51.5	56.2	
	Zinc	mg/kg	EPA 6020	459000	N/A	NS	NS	NS	NS	NS	NS	NS	NS	113	130	78.9	72.2	212	107	
PCBs	PCBs (total)	µg/kg	N/A	676000	390	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pesticides	Dieldrin	µg/kg	EPA 8081	61800	8.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	DDD (Total)	µg/kg	EPA 8081	28000	330	84	75	0	18	0	26	28	94	1700	1100	530	500	770		
	DDE (Total)	µg/kg	EPA 8081	31300	330	150	110	34	28	23	58	11	71	810	2400	1600	3500	2700	2900	
	DDT (Total)	µg/kg	EPA 8081	62900	330	2400	2000	410	2600	34	64	64	360	2300	21000	95000	120000	52000	7100	
	DDX (Total)	µg/kg	EPA 8081	N/A	330	2634	2185	444	2646	57	122	101	459	3204	25100	97700	124030	55200	10770	
SVOCs	Hexachlorobenzene	µg/kg	EPA 8081	100000	19000	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenols	Pentachlorophenol	µg/kg	EPA 8270	1000000	250000	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Phthalate Esters	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800000	330000	20	820	20	20	ND	ND	120	70	ND	ND	ND	ND	ND	380	ND
PAHs	Benzo(a)anthracene	µg/kg	EPA 8270	1050000	N/A	12	ND	ND	19	14	ND	12.5	50	ND	1800	ND	ND	ND	ND	ND
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300000	N/A	13.5	10	6.5	14	11.5	7	33.5	69	ND	810	ND	ND	ND	ND	ND
	Chrysene	µg/kg	EPA 8270	1290000	N/A	16	12	ND	26	15	ND	17	65	ND	1900	ND	ND	ND	ND	ND
	Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100000	N/A	18	12	7	11.5	14	7	41	75.5	ND	1000	ND	ND	ND	ND	ND
	Dioxins/Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	9	0.0091	NS	NS	NS	NS	NS	NS	NS	NS						
1,2,3,7,8-Pentachlorodibenzo-p-dioxin		µg/kg	EPA 1613b	N/A	2.6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin		µg/kg	EPA 1613b	N/A	690	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
2,3,7,8-Tetrachlorodibenzofuran		µg/kg	EPA 1613b	N/A	0.77	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2,3,7,8-Pentachlorodibenzofuran		µg/kg	EPA 1613b	N/A	2.6	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
2,3,4,7,8-Pentachlorodibenzofuran		µg/kg	EPA 1613b	N/A	0.03	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2,3,4,7,8-Hexachlorodibenzofuran		µg/kg	EPA 1613b	N/A	2.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2,3,6,7,8-Hexachlorodibenzofuran		µg/kg	EPA 1613b	N/A	2.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2,3,7,8,9-Hexachlorodibenzofuran		µg/kg	EPA 1613b	N/A	2.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
2,3,4,6,7,8-Hexachlorodibenzofuran		µg/kg	EPA 1613b	N/A	2.7	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
1,2,3,4,6,7,8-Heptachlorodibenzofuran		µg/kg	EPA 1613b	N/A	690	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Notes:
a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
 DEQ - Oregon Department of Environmental Quality
 mg/kg - milligrams per kilogram
 µg/kg - micrograms per kilogram
 N/A - Not Applicable
 ND - Not detected
 NS - Analyte not sampled

RB - River bank
 PAHs - Polycyclic Aromatic Hydrocarbons
 PCBs - Polychlorinated Biphenyls
 PEC - Probable Effects Concentration
 SLV - Portland Harbor Joint Source Control Strategy Screening Level Value, Table 3-1, Revision 7/17/07
 SQV - Sediment Quality Value
Bold - Analyte detected

Indicates screening value used for evaluation
 Indicates concentration exceeds 1000x SLV
 Indicates ND result where reporting limit > 1000x SLV

Table 4
Exceedance Quotients for 1000x JCS SLV's
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	Upland Soil/Stormwater Sediment		SAMPLING LOCATION												Maximum Exceedance Quotient	Minimum Exceedance Quotient			
				1000x MacDonald PECs and other SQVs	1000x DEQ 2007 Bioaccumulative Sediment SLVs	RB-3		RB-4		RB-5		RB-6		RB-7	RB-8	RB-9	RB-10			RB-11	RB-12	
				Toxicity	Bioaccumulation	11/24/1998	11/24/1998	11/24/1998	11/24/1998	11/24/1998	11/24/1998	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000			8/3/2000		
Date						0.33	1.00	0.33	1.10	0.33	0.82	0.33	1.90	0.50	0.50	0.50	0.50	0.50	0.50			
Max Depth (ft)						0.33	1.00	0.33	1.10	0.33	0.82	0.33	1.90	0.50	0.50	0.50	0.50	0.50	0.50			
Sample Type						Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	RB - discrete	RB - discrete							
Inorganics	Arsenic	mg/kg	EPA 6020	33000	7000	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0	
	Cadmium	mg/kg	EPA 6020	4980	1000	--	--	--	--	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	0	0
	Chromium	mg/kg	EPA 6020	111000	N/A	--	--	--	--	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	0	0
	Lead	mg/kg	EPA 6020	128000	17000	--	--	--	--	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	0	0
	Zinc	mg/kg	EPA 6020	459000	N/A	--	--	--	--	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	0	0
PCBs	PCBs (total)	µg/kg	N/A	676000	390	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
Pesticides	Dieldrin	µg/kg	EPA 8081	61800	8.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	DDD (Total)	µg/kg	EPA 8081	28000	330	<1	<1	<1	<1	<1	<1	<1	<1	2	5	3	2	2	2	2	5	1
	DDE (Total)	µg/kg	EPA 8081	31300	330	<1	<1	<1	<1	<1	<1	<1	<1	2	7	5	11	8	9	11	11	1
	DDT (Total)	µg/kg	EPA 8081	62900	330	7	6	1	8	<1	<1	<1	1	7	64	288	364	158	22	364	1	1
	DDX (Total)	µg/kg	N/A	N/A	330	8	7	1	8	<1	<1	<1	1	10	76	296	376	167	33	376	1	1
SVOCs	Hexachlorobenzene	µg/kg	EPA 8081	100000	19000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
Phenols	Pentachlorophenol	µg/kg	EPA 8270	1000000	250000	--	--	--	--	--	--	--	--	<1	<1	<1	<1	<1	<1	<1	0	0
Phthalate Esters	bis(2-Ethylhexyl)phthalate	µg/kg	EPA 8270	800000	330000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
PAHs	Benzo(a)anthracene	µg/kg	EPA 8270	1050000	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Benzo(g,h,i)perylene	µg/kg	EPA 8270	300000	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Chrysene	µg/kg	EPA 8270	1290000	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	Indeno(1,2,3-cd)pyrene	µg/kg	EPA 8270	100000	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	0	0
	2,3,7,8-Tetrachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	9	0.0091	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0
Dioxins/ Furans	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	2.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	µg/kg	EPA 1613b	N/A	690	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	2,3,7,8-Tetrachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.77	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	1,2,3,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.6	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	N/A	0.03	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8	1
	1,2,3,4,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	1,2,3,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	1,2,3,7,8,9-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	2,3,4,6,7,8-Hexachlorodibenzofuran	µg/kg	EPA 1613b	N/A	2.7	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	µg/kg	EPA 1613b	N/A	690	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	0

Notes:
 * - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
 DEQ = Oregon Department of Environmental Quality
 mg/kg - milligrams per kilogram
 µg/kg - micrograms per kilogram
 N/A - Not Applicable
 ND - Not detected.
 NS - Analyte not sampled
 RB - River bank
 PAHs - Polycyclic Aromatic Hydrocarbons
 -- - Analyte not sampled
 PCBs - Polychlorinated Biphenyls
 PEC - Probable Effects Concentration
 SLV = Portland Harbor Joint Source Control Strategy
 Screening Level Value, Table 3-1, Revision 7/17/07
 SQV - Sediment Quality Value
Bold = Analyte detected

Indicates screening value used for evaluation
 Indicates result concentration exceeds 1000x SLV by factor of 1 to 10
 Indicates result concentration exceeds 1000x SLV by factor of 10 to 100
 Indicates result concentration exceeds 1000x SLV by factor greater than 100

Table 5
Comparison of 1998 through 2008 Soil Sampling Results to US EPA Industrial PRGs
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	USEPA Industrial PRG's		SAMPLING LOCATION												
				Total for all Exposure Pathways		RBC-1	RBC-2	RBC-3	RBC-4	RBC-5	RBC-6	RBC-7 ^a	RBC-8	RBC-9	RBC-10	RBC-11	RBC-12	RBC-13
Date				Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1	3/19/2007	3/19/2007	3/20/2007	3/20/2007	3/20/2007	3/21/2007	3/21/2007	3/22/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	3/23/2007
Max Depth (ft)						0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Sample Type						RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite
Pesticides	DDD (Total)	µg/kg	EPA 8081	7200	N/A	16	6.3	930	9.4	9.8	35	196	106	148	98	800	21	6.9
	DDE (Total)	µg/kg	EPA 8081	5100 ^b	N/A	106	30.6	3770	30.4	35.9	92	2010	553	894	499	1230	115.9	55.8
	DDT (Total)	µg/kg	EPA 8081	7000	430000	358	121	11200	170	256	237	4170	1820	2880	2650	12100	191	82
Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	0.044	N/A	0.012	0.008	0.17	0.0048	0.0069	0.0044	0.091	0.052	0.11	0.031	0.19	0.09	0.033

Group	Constituent	Units	Analytical Method	USEPA PRG's		SAMPLING LOCATION											
				Total for all Exposure Pathways		RBC-2-03	RBC-4-02	RBC-6-03	RBC-10-03	RBC-11-03	RBC-13-01	RB-1		RB-2		RB-3	
Date				Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1	3/19/2007	3/20/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	11/23/1998		11/23/1998		11/24/1998	
Max Depth (ft)						2.00	0.50	2.00	2.00	2.00	2.00	0.33	0.72	0.33	0.75	0.33	1.00
Sample Type						RB - discrete (deep)	Beach - discrete										
Pesticides	DDD (Total)	µg/kg	EPA 8081	7200	N/A	0.92	NS	0.96	44	220	1.46	66	360	100	360	84	75
	DDE (Total)	µg/kg	EPA 8081	5100 ^b	N/A	3.76	NS	13.76	262	380	6.73	73	310	130	310	150	110
	DDT (Total)	µg/kg	EPA 8081	7000	430000	16	NS	15.1	920	3270	29.8	320	1300	700	1300	2400	2000
Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	0.044	N/A	ND	NS	ND	ND	0.25	0.004	NS	NS	NS	NS	NS	NS

Group	Constituent	Units	Analytical Method	USEPA Industrial Soil PRG's		SAMPLING LOCATION									
				Total for all Exposure Pathways		RB-5		RB-6		RB-7	RB-8	RB-9	RB-10	RB-11	RB-12
Date				Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1	11/24/1998		11/24/1998		8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000
Max Depth (ft)						0.33	0.82	0.33	1.90	0.50	0.50	0.50	0.50	0.50	0.50
Sample Type						Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	RB - discrete					
Pesticides	DDD (Total)	µg/kg	EPA 8081	7200	N/A	10	10	26	28	94	1700	1100	530	500	770
	DDE (Total)	µg/kg	EPA 8081	5100 ^b	N/A	23	58	11	71	810	2400	1600	3500	2700	2900
	DDT (Total)	µg/kg	EPA 8081	7000	430000	34	64	64	360	2300	21000	95000	120000	52000	7100
Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	0.044	N/A	NS	NS	NS	NS	NS	NS	NS	NS	NS	

Notes:

a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
b - PRG shown is for p,p'-DDE (4,4'-DDE)
DEQ - Oregon Department of Environmental Quality
mg/kg - milligrams per kilogram
µg/kg - micrograms per kilogram
N/A - Not Applicable
ND - Not detected
NS - Analyte not sampled
RB - River bank

PAHs - Polycyclic Aromatic Hydrocarbons
PCBs - Polychlorinated Biphenyls
PEC - Probable Effects Concentration
SQV - Sediment Quality Value
PRG - US Environmental Protection Agency Region 9 Preliminary Remediation Goal for Industrial Soil, Sept. 2008
Bold - Analyte detected
Indicates screening value used for evaluation
Indicates concentration exceeds PRG

Table 6
US EPA Industrial PRG Exceedance Quotients
River Bank Erodible Soil Source Control Screening Evaluation
Arkema, Inc. - Portland Facility
December 2008

Group	Constituent	Units	Analytical Method	USEPA Industrial PRG's		SAMPLING LOCATION													
				Total for all Exposure Pathways		RBC-1	RBC-2	RBC-3	RBC-4	RBC-5	RBC-6	RBC-7 ^a	RBC-8	RBC-9	RBC-10	RBC-11	RBC-12	RBC-13	RBC-2-03
Date				Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1	3/19/2007	3/19/2007	3/20/2007	3/20/2007	3/20/2007	3/21/2007	3/21/2007	3/22/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	3/23/2007	3/19/2007
Max Depth (ft)						0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	2.00
Sample Type						RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - composite	RB - discrete (deep)
Pesticides	DDD (Total)	µg/kg	EPA 8081	7200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	DDE (Total)	µg/kg	EPA 8081	5100 ^b	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	DDT (Total)	µg/kg	EPA 8081	7000	430000	<1	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	2	<1	<1
Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	0.044	N/A	<1	<1	4	<1	<1	<1	2	1	3	<1	4	2	<1	<1

Group	Constituent	Units	Analytical Method	USEPA Industrial PRG's		SAMPLING LOCATION												
				Total for all Exposure Pathways		RBC-4-02	RBC-6-03	RBC-10-03	RBC-11-03	RBC-13-01	RB-1	RB-2	RB-3	RB-4				
Date				Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1	3/20/2007	3/21/2007	3/22/2007	3/22/2007	3/23/2007	11/23/1998	11/23/1998	11/24/1998	11/24/1998				
Max Depth (ft)						0.50	2.00	2.00	2.00	2.00	0.33	0.72	0.33	0.75	0.33	1.00	0.33	1.10
Sample Type						RB - discrete (deep)	Beach - discrete											
Pesticides	DDD (Total)	µg/kg	EPA 8081	7200	N/A	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	DDE (Total)	µg/kg	EPA 8081	5100 ^b	N/A	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	DDT (Total)	µg/kg	EPA 8081	7000	430000	--	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	0.044	N/A	--	<1	<1	6	<1	--	--	--	--	--	--	--	--

Group	Constituent	Units	Analytical Method	USEPA Industrial PRG's		SAMPLING LOCATION										Maximum Exceedance Quotient	Minimum Exceedance Quotient
				Total for all Exposure Pathways		RB-5	RB-6	RB-7	RB-8	RB-9	RB-10	RB-11	RB-12				
Date				Carcinogenic Target Risk (TR) = 1E-06	Noncancer Hazard Index (HI) = 1	11/24/1998	11/24/1998	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000	8/3/2000				
Max Depth (ft)						0.33	0.82	0.33	1.90	0.50	0.50	0.50	0.50	0.50			
Sample Type						Beach - discrete	Beach - discrete	Beach - discrete	Beach - discrete	RB - discrete							
Pesticides	DDD (Total)	µg/kg	EPA 8081	7200	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1			
	DDE (Total)	µg/kg	EPA 8081	5100 ^b	N/A	<1	<1	<1	<1	<1	<1	<1	<1	<1			
	DDT (Total)	µg/kg	EPA 8081	7000	430000	<1	<1	<1	<1	<1	3	14	17	7			
Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	µg/kg	EPA 1613b	0.044	N/A	--	--	--	--	--	--	--	--	6	1		

Notes:

a - RBC-7 composite sample not analyzed for pesticides. Value shown is maximum reported for 5 discrete samples at RBC-7 location
b - PRG shown is for p,p'-DDE (4,4'-DDE)

DEQ = Oregon Department of Environmental Quality

mg/kg - milligrams per kilogram

µg/kg - micrograms per kilogram

N/A - Not Applicable

Bold = Analyte detected

ND = Not detected.

NS - Analyte not sampled

RB - River bank

PAHs - Polycyclic Aromatic Hydrocarbons

-- - Analyte not sampled

PCBs - Polychlorinated Biphenyls

PRG - US Environmental Protection Agency

9 Preliminary Agency Remediation Goal

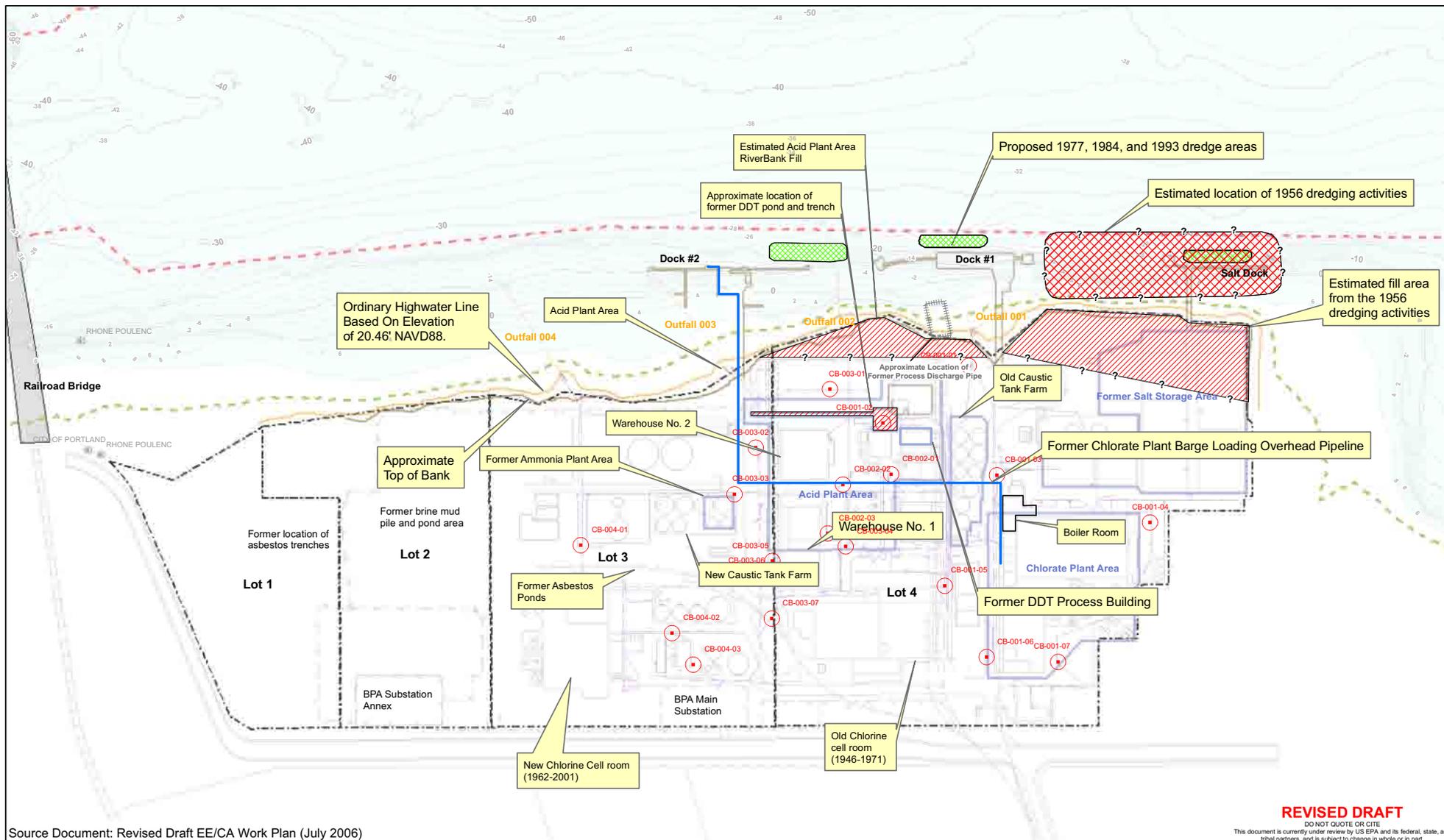
for Industrial Soil, Sept. 2008

Indicates screening value used for evaluation

Indicates result concentration exceeds PRG by a factor between 1 and 10

Indicates result concentration exceeds PRG by a factor between 10 and 100

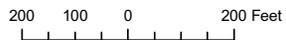
Appendix A
Current and Historical Upland
Contaminant Sources



REVISED DRAFT

DO NOT QUOTE OR CITE
 This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

Map Document: (C:\Projects\Arkema-Qty\MD\Arkema_Fig2-1_20080615.mxd) 6/13/2008 11:11:00 AM

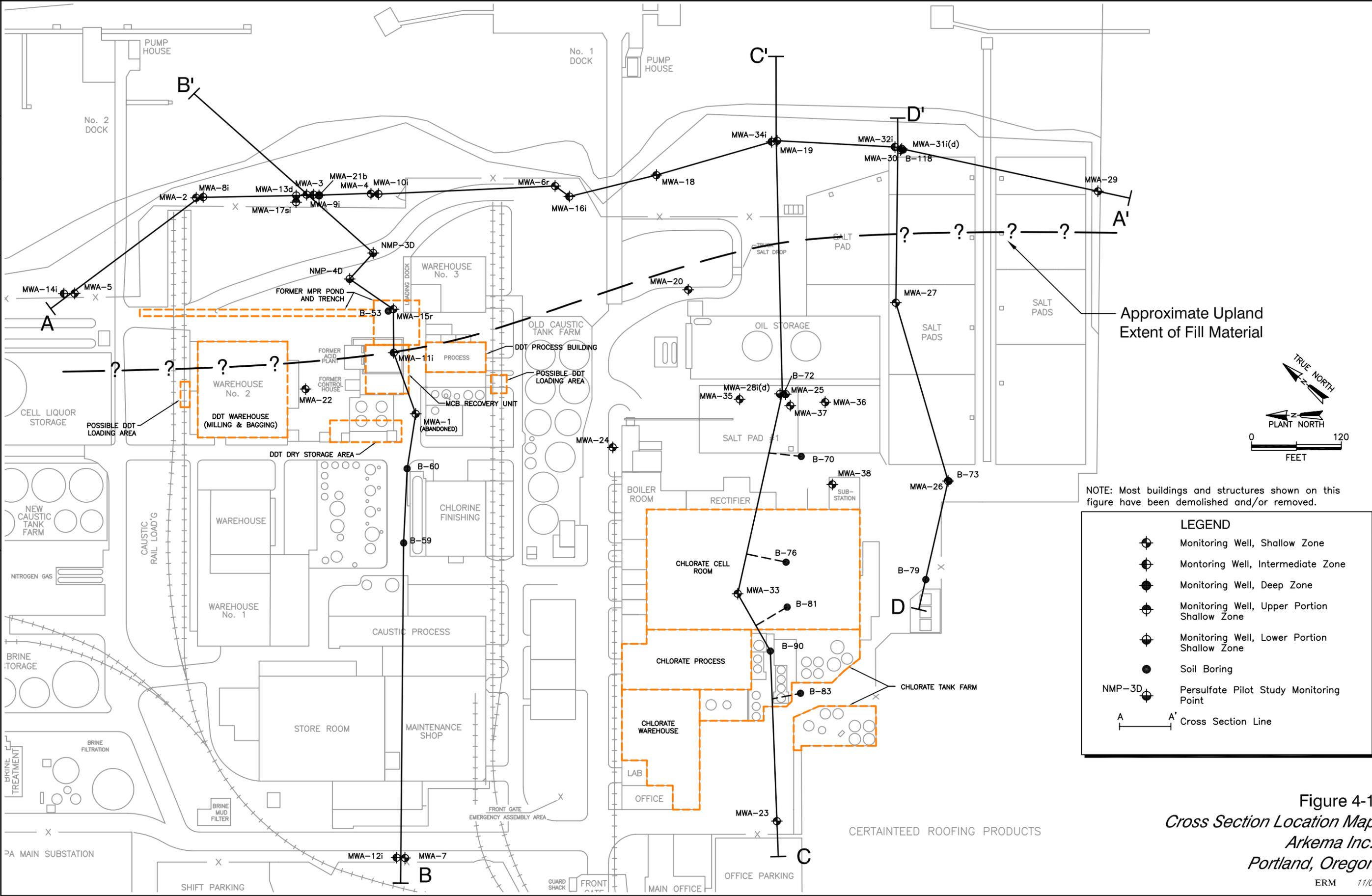


- Ordinary High Water
- Top of Bank
- - - E-Sewer-L
- - - Storm Drain
- - - 12ft Contour
- - - Navigation Channel
- ▭ Bridges
- - - Property Lines
- ⊙ Outfalls
- ⊙ Catch Basins
- ▨ Estimated Fill Area
- ▨ Proposed 1977, 1984, and 1993 dredge areas
- ▨ Estimated Dredged Area
- Overhead Pipeline

Figure 2
Current and Historic Upland Contaminant Sources

Appendix B
Geologic Cross-Sections

Project No. 0020423.10
 Date: 11/23/05
 Drawn By: R. Olson
 CAD File: g:\0020423\10\002042310-51.dwg



NOTE: Most buildings and structures shown on this figure have been demolished and/or removed.

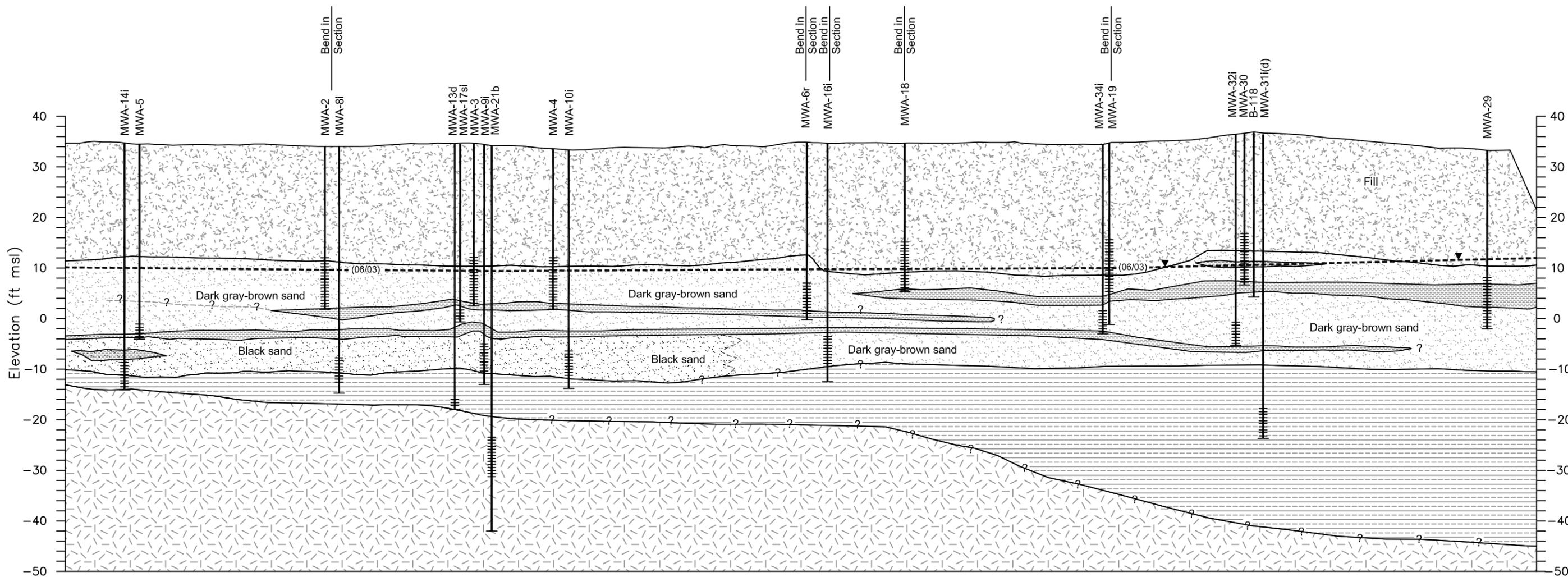
LEGEND

- Monitoring Well, Shallow Zone
- Monitoring Well, Intermediate Zone
- Monitoring Well, Deep Zone
- Monitoring Well, Upper Portion Shallow Zone
- Monitoring Well, Lower Portion Shallow Zone
- Soil Boring
- Persulfate Pilot Study Monitoring Point
- Cross Section Line

Figure 4-1
Cross Section Location Map
 Arkema Inc.
 Portland, Oregon

A (Plant North)

A' (Plant South)



LEGEND

- | | | | |
|--|--|--|--|
| | Fill | | B-59 — Geoprobe® boring number |
| | Sand with varying amounts of silt | | MWA-1 — Well number |
| | Silt with varying amounts of fine sand | | — Cased interval |
| | Silt with some clay and fine sand | | — Screen interval |
| | Basalt | | - - - - - Shallow-zone groundwater surface (approximate);
June 2003 |
| | | | - - - - - Inferred soil or geologic contact (queried where uncertain) |

(Vertical Exaggeration = 5X)

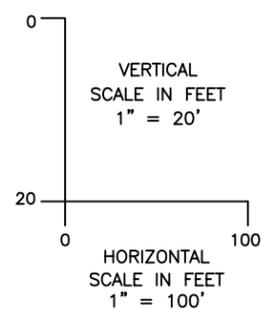
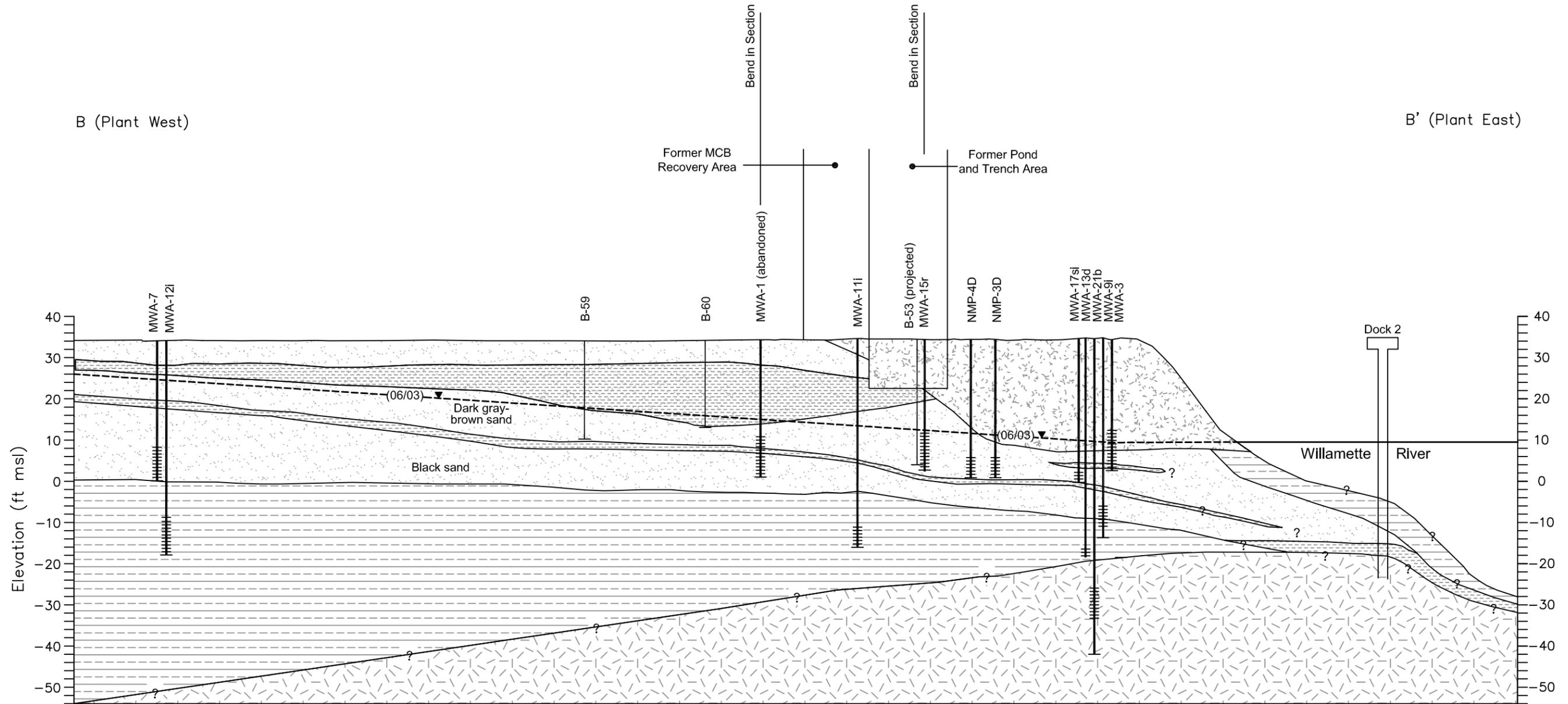


Figure 4-2
 Cross Section A-A'
 Arkema Inc.
 Portland, Oregon



LEGEND

- | | | | |
|--|--|-------|--|
| | Fill | B-59 | — Geoprobe® boring number |
| | Sand with varying amounts of silt | MWA-1 | — Well number |
| | Silt with varying amounts of fine sand | | Cased interval |
| | Silt with some clay and fine sand | | Screen interval |
| | Basalt | | Shallow-zone groundwater surface (approximate);
June 2003; Based on monitoring well data only |
| | | | Inferred soil or geologic contact (queried where uncertain) |
- Stratigraphy Beneath River Provided by Exponent

(Vertical Exaggeration = 4X)

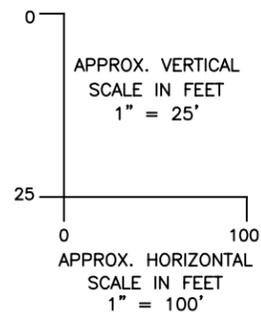
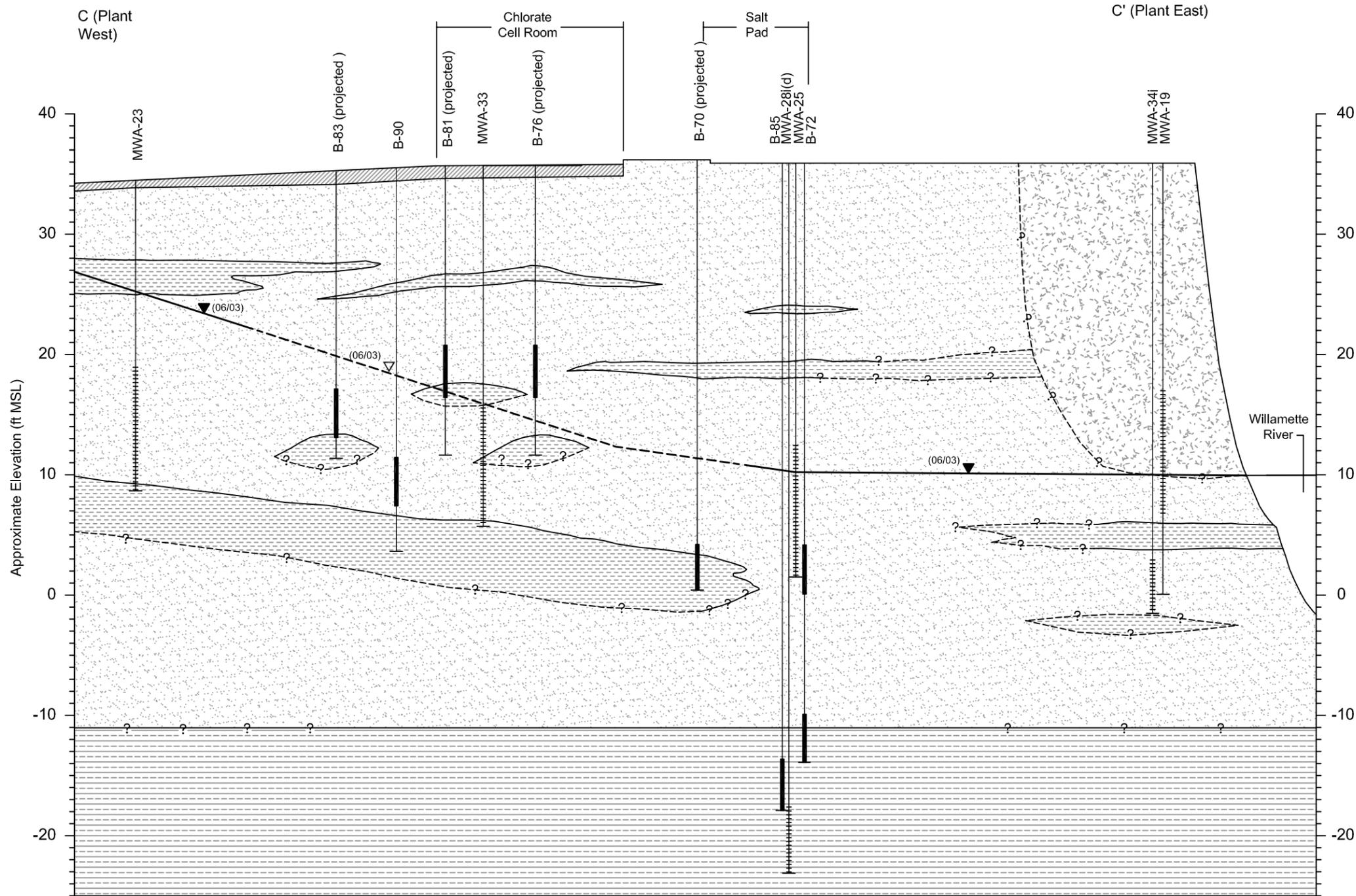


Figure 4-3
Cross Section B-B'
 Arkema Inc.
 Portland, Oregon



LEGEND

- Concrete or asphalt
- Fill
- Sand with varying amounts of silt
- Silt with varying amounts of fine sand
- Silt with some clay and fine sand
- MWA-30, B-74 Well or boring I.D. number
- Soil Boring with groundwater sample interval
- Monitoring well with screen casing
- Inferred soil contact (queried where uncertain)
- Shallow-zone groundwater surface (June 2003); dashed and open symbol where approximate; based on monitoring well data only

Stratigraphy Beneath River Provided by Exponent, Inc.

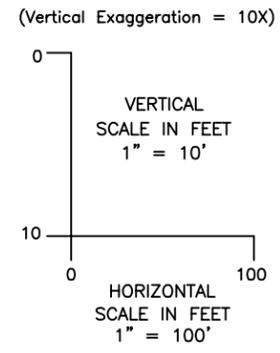


Figure 4-4
 Cross Section C-C'
 Arkema Inc.
 Portland, Oregon

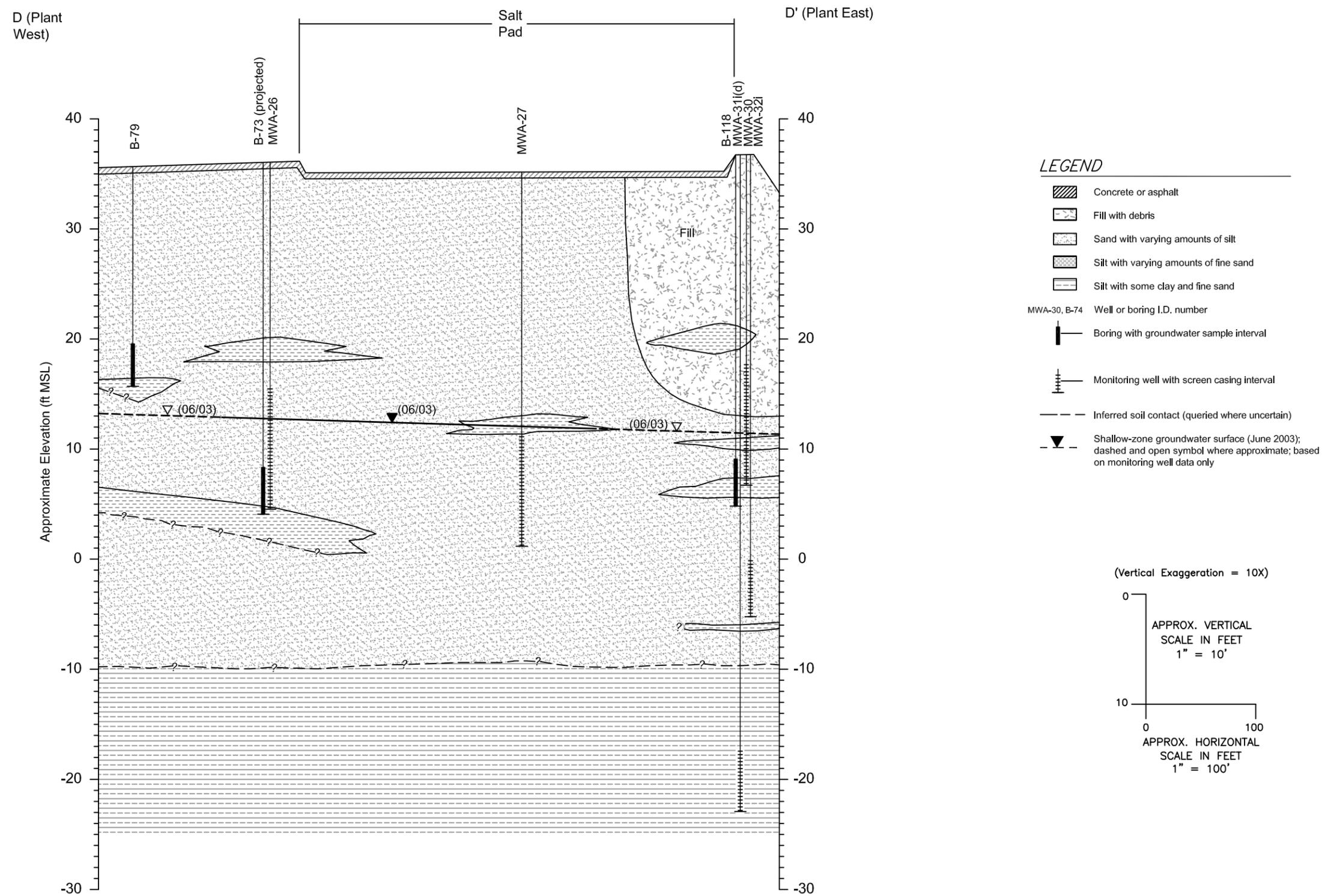


Figure 4-5
 Cross Section D-D'
 Arkema Inc.
 Portland, Oregon