



**STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY**

PO Box 47600, Olympia, WA 98504-7600 • 360-407-6000

December 20, 2022

Craig McKinney, Senior Environmental Engineer
Emerald Kalama Chemical, LLC
1296 NW 3rd Street
Kalama, WA 98625

Re: Notice of Periodic Review Conducted at the following Hazardous Waste Site:

Name: Emerald Kalama Chemical, LLC
Address: 1296 NW 3rd Street
Kalama, WA 98625
Facility/Site No.: 1082
Cleanup Site No.: 3686

Dear Craig McKinney,

Under the Model Toxics Control Act (MTCA), chapter 70A.305 RCW, which governs the cleanup of hazardous waste sites in Washington State, the Department of Ecology (Ecology) must conduct a periodic review of all sites with institutional controls and environmental covenants every five years. This letter serves to inform you that Ecology conducted a periodic review at the Emerald Kalama Chemical, LLC (Emerald) site. Ecology accepted comments on the periodic review from November 3, 2022 through December 5, 2022. Ecology received no comments.

The periodic review process included a review of any monitoring data collected since the cleanup was completed or since the last review was conducted and a site visit to confirm the institutional controls and conditions of environmental covenant are being followed.

This period review covers the cleanup activities related to the North Impacted Areas, Central Impacted Areas, and West Impacted Areas at the site. Based on the information collected during this periodic review, the Emerald site appears to meet the requirements of chapter 173-340 WAC, and the selected remedies continue to be protective of human health and the environment.

A periodic review will continue to be required every five years as long as institutional controls and/or environmental covenants are required to protect human health and the environment. The next periodic review will be due in December 2027.

Craig McKinney

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If you have any questions regarding this letter or if you would like additional information regarding the cleanup of hazardous waste sites, please contact me at (360) 819-6426 or greg.gould@ecy.wa.gov.

Thank you and Emerald's staff for your assistance during the review process.

Sincerely,

A handwritten signature in cursive script, appearing to read "Gregory Gould".

Gregory Gould, P.E.

Industrial Section

Solid Waste Management Program

Enclosure: Emerald 2022 Periodic Review

Cc: Chris Culp, Emerald
Rich Truax, RSEC



Periodic Review

Emerald Kalama Chemical LLC
1296 NW 3rd Street
Kalama, WA 98625

Facility Site ID#: 1082
Cleanup Site ID#: 3686

Prepared by:
Industrial Section
Solid Waste Management Program

October 2022

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1.0 INTRODUCTION

This document is a review by the Washington State Department of Ecology (Ecology) of post-cleanup Site conditions and monitoring data to assure human health and the environment are being protected at the Emerald Kalama Chemical LLC facility (Site) located in Kalama, Washington. Remedial action was undertaken at the Site under Consent Decree No. 082005152 (CD) between Ecology, Goodrich Corporation, and Emerald Kalama Chemical LLC. Cleanup at this Site was implemented under the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 Washington Administrative Code (WAC).

The CD between Ecology, Goodrich Corporation, and Emerald Kalama Chemical LLC was effective on March 17, 2008. The CD identifies Goodrich Corporation as the “performing party” until February 28, 2011, and then Emerald Kalama Chemical as the performing party starting March 1, 2011 to implement the Cleanup Action Plan (CAP) approved on October 11, 2004. The CAP called for the remediation of highly contaminated soil areas (former flare stack line and transfer sump) using soil vapor extraction in the Central Impacted Area (CIA) to remove a long-term source of groundwater impacts. The Waterloo Emitter System was installed as an effort to reduce contaminant mass migrating to the existing North Impacted Area (NIA) interception trench, which prevents impacted groundwater from migrating to the wetland and the Columbia River. The West Impacted Area (WIA) intermediate sand recovery well system was upgraded and continued operations of the WIA interception trench provided a reduction in contaminant mass and prevented impacted groundwater from reaching the Columbia River. The CD established cleanup levels for benzene, toluene, benzoic acid, diphenyl, bis(2-ethylhexyl)phthalate, diphenyl oxide, phenol, arsenic, and copper.

The MTCA cleanup levels for soil are established under WAC 173-340-740. The MTCA cleanup levels for groundwater are established under WAC 173-340-720. WAC 173-340-420(2) requires Ecology to conduct a periodic review of a Site every five years under the following conditions:

1. Whenever the department conducts a cleanup action
2. Whenever the department approves a cleanup action under an order, agreed order or consent decree
3. Or, as resources permit, whenever the department issues a no further action opinion,
4. and one of the following conditions exists at the site:
 - (a) Institutional controls or financial assurance are required as part of the cleanup;
 - (b) Where the cleanup level is based on a practical quantitation limit; or
 - (c) Where, in the department’s judgment, modifications to the default equations or assumptions using Site-specific information would significantly increase the concentration of hazardous substances remaining at the Site after cleanup or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors Ecology shall consider include [WAC 173-340-420(4)]:

- (a) The effectiveness of ongoing or completed cleanup actions, including the effectiveness of engineered controls and institutional controls in limiting exposure to hazardous substances remaining at the Site.
- (b) New scientific information for individual hazardous substances of mixtures present at the Site.
- (c) New applicable state and federal laws for hazardous substances present at the Site.
- (d) Current and projected Site use.
- (e) Availability and practicability of higher preference technologies; and
- (f) The availability of improved analytical techniques to evaluate compliance with cleanup levels.

Ecology shall publish a notice of all periodic reviews in the Site Register and provide an opportunity for public comment.

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site History

Emerald Kalama Chemical LLC (Emerald) is located at 1296 Third Street NW in Kalama, Washington, in Cowlitz County (Photo 1). Emerald owns approximately 165 acres of property located in the Columbia River Valley in southwestern Washington (Figure 1). The manufacturing plant occupies 40 acres and the remaining 125 acres is wetland. The facility is located on the east bank of the Columbia River, approximately 1 mile upstream from the confluence of the Columbia and Kalama Rivers. The Columbia River valley is relatively narrow near the site and is occupied by the Columbia River and surrounding flood plains. The flood plain is approximately 1.5 miles wide at the Site, with the river occupying approximately half of this width. The valley is surrounded by uplands with moderate to steep slopes.

Dow Chemical constructed the facility in 1962. Kalama Chemical, Inc. purchased the property from Dow Chemical in 1971 and wholly owned and operated it from 1971 to 1986. In 1986, BC Sugar Refinery Ltd. (BC Sugar) acquired less than 50 percent (50%) of Kalama Chemical, Inc. stock. By January 1990, BC Sugar acquired the remaining stock and Kalama Chemical, Inc. was a wholly owned subsidiary. In May 1994, BC Sugar sold all of its stock in Kalama Chemical, Inc. to Freedom Chemical. In March 1998, Kalama Chemical, Inc. was acquired by BF Goodrich and changed its name to BF Goodrich Kalama, Inc. (BFGK). Pursuant to an Asset Purchase Agreement dated November 2000, BF Goodrich sold its Performance Materials business, including BF Goodrich Kalama, Inc., and the Kalama facility subsequently changed its name to Noveon Kalama. In early 2004, Lubrizol acquired the Noveon Kalama facility. In May 2006, Sun Capital purchased several plants from Lubrizol and formed Emerald Performance Materials.

American Securities LLC purchased Emerald Performance Materials in 2014. LANXESS purchased Emerald Performance Materials in 2021. The facility is currently referred to as Emerald Kalama Chemical LLC.

The Emerald facility has historically used and continues to use toluene as the principal raw material to produce benzoic acid and a variety of other products that are derived from toluene. Emerald's products are used as flavorings and preservatives in foods and beverages and as additives in pharmaceuticals, fragrances, surfactants, plasticizers, and other consumer products.

Over the years of its operation, there have been a number of historical releases at the facility. The U.S. Environmental Protection Agency (EPA) and Ecology have conducted inspections of the facility including a Comprehensive Groundwater Monitoring Evaluation and a multimedia inspection. In 1991 BFGK and EPA entered into an Agreed Order pursuant to the Resource Conservation and Recovery Act (RCRA). The 1991 Order required the completion of a RCRA Facility Investigation (RFI), a corrective measures study (CMS), and an interim corrective measures evaluation (ICMA). The RFI work began in 1992 and EPA approved it on September 12, 1994. A subsequent Supplemental RFI (SRFI) to address specific data needs and to provide the basis for assessing final corrective measures was submitted to EPA on December 19, 1997.

In the RFI, the facility was divided into the NIA and the WIA based on distributions of chemicals of concern (COCs) and the direction of groundwater flow. As part of the SRFI, two additional areas were identified: the CIA and the East Area. The NIA, WIA and CIA are shown on Figure 1. Interim corrective measures (ICMs) were designed to address discharges of COCs from the NIA and WIA. The ICMs included an interceptor trench constructed in the NIA to control or reduce discharges from the upper sand aquifer to the wetland. In 1997, a soil vapor extraction (SVE) system, recovery well network, and a shallow interceptor trench were installed as ICMs in the WIA to control discharges to the Columbia River. With the exception of the SVE system and WIA shallow interceptor trench, the other ICMs continue to operate.

2.2 Site Investigations

On November 5, 1998, Ecology issued Agreed Order No. DE 98H-S327 with BFGK and Rogers Sugar Ltd. (Rogers), successor by amalgamation to BC Sugar, under the Model Toxics Control Act, and the 1991 RCRA Order with EPA was subsequently terminated on April 25, 1999. Under the Ecology Order, BFGK and Rogers conducted a Remedial Investigation and Feasibility Study (RI/FS) and prepared a CAP. Data gaps were identified and field investigations were performed to complete the remedial investigation.

Specific investigations were performed in the following areas: East Area, NIA, Wetland, CIA, and WIA. Tidal studies indicated a southward gradient from the NIA in the intermediate sand aquifer and a westward gradient toward the WIA in the intermediate and deep sand aquifers.

The East Area had low levels of benzene in groundwater that did not appear to be migrating towards the Columbia River or the wetland (Figure 2). Significant impacts were restricted to the upper sand aquifer in the NIA (Figure 3).

The CIA contained impacted soil in the upper sand soils and groundwater only. The CIA investigation indicated releases at the stack flare/stack line, above ground storage tanks, process tanks, loading dock, the API separator/process sewer system, the carbon absorption system, and former dry wells (Figure 4). The WIA investigation found releases from the west tank farm and the transfer pump, including releases of toluene and benzene (Figure 5).

The remedial investigation's soil analytical data from the CIA and WIA identified COCs in the soil, most prevalently benzene, toluene, biphenyl, bis(2-ethylhexyl)phthalate, and phenol.

Wetland studies, conducted from 1996-1998, concluded that the concentrations of metals in wetland surface water and wetland sediments were remaining constant or declining. All sediment samples were below the MTCA Method A and B values for soil, and surface water samples were below MTCA Method B concentrations. It was concluded that the NIA interception trench prevents impacted groundwater in the NIA from affecting the wetland, which in turn protects the Columbia River.

The distribution of COCs in groundwater were generally found in two contaminant plume areas: a contiguous area encompassing the northern part of the CIA and the central NIA and the western WIA.

2.3 Interim Corrective Measures

ICMs were taken to control or reduce impacts to the subsurface in the NIA and WIA. These measures included an NIA Interception Trench (Photo 2) operated from December 1995 to present; a WIA SVE System operated from May 1997 to October 1999; a WIA Shallow Interception Trench operated from November 1997 to November 2018; and WIA Intermediate Sand Recovery Wells operated from April 1997 to present.

Emerald installed the 1,500-foot long NIA interception trench to control and reduce the discharge of COCs from the upper sand aquifer to the wetland. Sampling results show reduced volatile organic compound (VOC) concentrations in the wetland surface water.

Emerald designed the SVE system installed in 1997 in the WIA (Photo 3) as an ICM to remove contaminant mass from the west tank farm. Emerald removed approximately 50.32 pounds of benzene and 2,840 pounds of toluene using the SVE system from the vadose zone since beginning operation in 2009. Emerald shut down the SVE system in 2013 following Ecology approval.

Emerald installed a shallow interceptor trench in the WIA to collect contaminated groundwater to prevent it from discharging to the Columbia River.

A review of VOC concentrations in monitoring wells indicated a decrease in contaminant migration to the Columbia River. Emerald shut down the WIA shallow interceptor trench in November 2018 following Ecology approval, but the trench remains in-place and Emerald will restart the trench operations if Ecology requires Emerald to operate it to prevent contaminated groundwater from discharging to the Columbia River. The WIA Intermediate Sand Recovery Well (ISRW) System (Photo 4) consists of ten recovery wells that contain and reduce the mass of COCs in groundwater. The ISRW System continues to operate and has been effective in removing contaminant mass.

2.4 Cleanup Levels and Points of Compliance

Cleanup levels for this Site are presented in Section 3.3 of this document. The cleanup levels for groundwater were based on protection of surface water. The point of compliance for groundwater is from the uppermost level of the saturated zone extending vertically to the lowest most depth, which could potentially be affected by the site.

Soil cleanup levels that are protective of groundwater were exceeded for benzene, toluene benzoic acid, biphenyl, phenol and arsenic but were not exceeded for direct contact. The soil point of compliance for protection of groundwater is throughout the site.

Freshwater site-specific cleanup levels were chosen from the literature for benzoic acid, biphenyl, diphenyl oxide, phenol, and toluene. Freshwater cleanup levels for arsenic and copper were based on natural background concentrations in the area.

2.5 Remedial Actions

The CAP, approved on October 11, 2004, called for the remediation of highly contaminated soil areas (former flare stack line and transfer sump) using soil vapor extraction to remove a long-term source of groundwater impacts. Paving and other physical barriers were used to enhance the effectiveness of the technology and provide protection to terrestrial resources. The SVE system met the goal of providing source removal from impacted soils in the WIA and CIA and was shut down December 2013.

The Waterloo Emitter wells are an in-situ system (Photo 5) that utilizes diffusive tubing for the controlled and uniform release of oxygen. Oxygen diffused out of the tubing is intended to dissolve directly into the groundwater flowing past the emitter, with the goal of enhancing the aerobic biodegradation environment. Emerald operated the Waterloo Emitter wells between February 2009 and May 2017.

Continued operations of the NIA interception trench provided a reduction in contaminant mass and prevented impacted groundwater from migrating to the wetland and the Columbia River. The upgraded WIA intermediate sand recovery well system and continued operations of the WIA interception trench provided a reduction in contaminant mass and prevent impacted groundwater from reaching the Columbia River.

Emerald ceased operations of the WIA interception trench in November 2018 following Ecology's approval. Based on the review of annual groundwater flow and contamination, Ecology may require Emerald to restart the WIA interception trench operations in the future if necessary to prevent discharge of contaminated groundwater to the Columbia River. Ecology requested Emerald sample the WIA interception trench in 2023 to confirm that groundwater continues to be at low levels.

A compliance monitoring program was implemented and institutional controls were put in place to limit or prohibit activities that would interfere with the integrity of the remedy. Fencing and appropriate security was used to limit public access, and a restrictive covenant was recorded at the Cowlitz County Auditor's Office.

2.6 Environmental Covenant

Because contamination remains at the Site, a restrictive covenant (Covenant) was recorded on April 3, 2008 for the property to prohibit activities that may interfere with the cleanup action or monitoring, and to describe other measures necessary to assure the integrity of the cleanup action and continued protection of human health and the environment. The Covenant imposed the following limitations, among others:

1. Any activity on the Property that may interfere with the integrity of the Remedial Action and continued protection of human health and the environment is prohibited.
2. Unless authorized by the CAP or the Restrictive Covenant, any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or create a new exposure pathway for a hazardous substance that remains on the Property as part of the Remedial Action, is prohibited without prior written approval from Ecology.
3. Emerald must give thirty (30) day advance written notice to Ecology of the intent to convey any interest in the Property.
4. Emerald must restrict leases to uses and activities consistent with the Restrictive Covenant and notify all lessees of the restrictions on the use of the Property.
5. Emerald shall allow authorized representatives of Ecology the right to enter the Property at reasonable times and in compliance with applicable health and safety plans for the purpose of evaluating the Remedial Action; to take samples, to inspect Remedial Actions conducted at the Property, and to inspect records that are related to the Remedial Action.

6. Construction, maintenance, and related excavation activities shall be deemed consistent with and authorized by the terms of this Restrictive Covenant, and may occur on the Property without notice to or approval from Ecology, and without public notice and comment, provided that such construction, maintenance, and related excavation activities shall not involve any excavation of soil at depths greater than six feet below the existing ground surface.

The full Covenant is shown in Section 8.0.

3.0 PERIODIC REVIEW

3.1 Effectiveness of Completed Cleanup Actions

Cleanup actions for the WIA, NIA, and CIA were successfully implemented and several of them continue. Based on results from the 2021-2022 Remedial Action Report, the NIA trench system continues to maintain hydraulic control, preventing discharge of VOCs and semi-volatile organic compounds (SVOCs) from the upper sand aquifer to the wetland. Two COCs remain above cleanup levels in the NIA trench (East Sump and West Sump), benzene and diphenyl oxide (DPO) (Table 2). The NIA trench sumps pumped 29-million gallons of water in 2021-2022 resulting in the removal of approximately 0.2 pounds of benzene and 39 pounds of DPO. Emerald did not detect toluene in the NIA trench sumps in 2021-2022 resulting in a zero or near zero removal.

In the WIA and CIA, the SVE system operated until 2013. Influent concentrations and contaminant removal rates decreased by three to four orders of magnitude since startup, and then became asymptotic (trending toward zero and flat lining). The system effectively removed VOCs from the vadose zone soil for a time. When the SVE system was no longer extracting appreciable amounts of contaminants, Emerald shut down and decommissioned it with Ecology's approval. Although Ecology does not have specific evidence of a rebound in soil vapor contamination levels in the SVE system area, Ecology is evaluating whether to require Emerald to perform soil vapor sampling in the SVE system area. If Ecology decides to require Emerald to perform additional soil vapor sampling in the SVE system area, Ecology's will place the requirement in a letter responding to an annual remedial action report.

In the CIA, Emerald began operating the Waterloo Emitter system in 2009. Its intended use was to enhance bioremediation of DPO by increasing oxygen concentrations in the groundwater. In 2016, Emerald requested Ecology approval to test if the Waterloo Emitter system was still providing the intended benefit Emerald originally planned. The test included an initial sampling event, followed by shutdown of the emitter system, and a second sampling event after one month of shutdown. Emerald determined that the groundwater gradient near the Waterloo Emitter system was an order of magnitude lower than what was in the original 2006 engineering design report for the system. Emerald discovered that the groundwater flow direction was also different the original 2006 engineering design report for the system. Finally,

Emerald sampled three of the Waterloo Emitter wells for DPO at the beginning and end of the test. All three well results were non-detect at 0.95 micrograms per liter ($\mu\text{g/L}$) at the beginning and two of the wells at the end were also non-detect at 0.95 $\mu\text{g/L}$. Emerald detected one well at 1.2 $\mu\text{g/L}$, which Emerald said was within the expected error of the analytical method. As a result of the test, Emerald requested and received Ecology approval to cease operation of the system in May 2017 because it was not providing additional benefit towards mass removal of DPO.

According to the June 30, 2004 CAP (Exhibit B in the CD), the main two goals of the ISRW system are to 1) reduce the contaminant mass in the intermediate sand aquifer and 2) prevent impacted groundwater from reaching Columbia River.

Emerald operates the ISRW system to prevent contaminated groundwater from discharging into the Columbia River by keeping the groundwater level below the water level in the Columbia River, creating inward gradients within the ISRW system. This fulfills goal number two above. See Figure 6 for the locations of the ISRW system wells. Two COCs remain above cleanup levels in the ISRW system, benzene and toluene (Table 3). The ISRW system pumped approximately 1-million gallons of water in 2021-2022 resulting in the removal of approximately 0.4 pounds of benzene and 217 pounds of toluene. Since 1997, and according to the 2021-2022 Remedial Action Report, Emerald's ISRW system has removed approximately 109 pounds of benzene and 23,697 pounds of toluene from the groundwater.

Ecology evaluated the ISRW system with respect to goal number one above, reducing the contaminant mass in the intermediate sand aquifer. Ecology determined the overall contaminant mass in the intermediate sand aquifer is still quite large, with some wells showing no reduction in groundwater benzene and toluene concentrations since 2007. In addition, Ecology reviewed the CD, CAP, and the Final Feasibility Study to determine the restoration time frame for the WIA. Although Ecology found restoration time frames for the CIA and NIA, Ecology did not find restoration time frames for the WIA shallow and intermediate sand aquifers. In response to Emerald's 2021-2022 Remedial Action Report, Ecology has requested the following three tasks for Emerald to perform with results being submitted in the 2022-2023 Remedial Action Report:

- 1) Take one sample each from the North and South sumps of the WIA trenches in the spring sampling event for benzene, toluene, biphenyl, bis (2-ethylhexyl) phthalate, and DPO.
- 2) Evaluate whether the ISRW system adequately captures groundwater contamination with respect to river in-flow, specifically if well MW-243 is located such that if river in-flow allows groundwater contamination to extend beyond the ISRW system, groundwater sampling at well MW-243 would show the contamination moving beyond the ISRW system.

- 3) Evaluate whether the ISRW system adequately is reducing the contaminant mass in the intermediate sand aquifer, and provide restoration time frames for the WIA shallow and intermediate sand aquifers according to the procedures in WAC 173-340-360.

The Covenant for the Site was recorded and is in place. This Covenant prohibits activities that will result in the release of contaminants at the Site without Ecology's approval, and prohibits any use of the property that is inconsistent with the Covenant. This Covenant serves to ensure the long-term integrity of the remedy.

Based upon the Site visit conducted on April 1, 2022, the cleanup activities at the Site for the WIA, NIA, and CIA continue to eliminate exposure to contaminated soils and groundwater. The SVE system effectively removed contaminant mass. The interceptor trenches continue to maintain hydraulic control so contamination does not reach the wetland or the Columbia River. The Site is still operating as an organic chemical manufacturer. A photo log is available in Section 9.

3.2 New Scientific Information for Individual Hazardous Substances for Mixtures Present at the Site

There is no new scientific information for the contaminants related to the Site.

3.3 New Applicable State and Federal Laws for Hazardous Substances Present at the Site

The cleanup at the Site was governed by WAC 173-340-702(12)(c) [2001 ed.] and provides that,

"A release cleaned up under the cleanup levels determined in (a) or (b) of this subsection shall not be subject to further cleanup action due solely to subsequent amendments to the provision in this chapter on cleanup levels, unless the department determines, on a case-by-case basis, that the previous cleanup action is no longer sufficiently protective of human health and the environment."

Although cleanup levels in groundwater and soil have changed as a result of modifications to MTCA, contamination remains at the Site above the new MTCA Method A and B cleanup levels. Even so, the cleanup action is still protective of human health and the environment. Table 1 shows the cleanup levels from the CAP.

Table 1 Cleanup Levels

Analyte	CD Soil ¹ Cleanup Levels (mg/kg ²)	CD Groundwater Cleanup Level (µg/L)
Benzene	0.00676	1.2
Toluene	14.5	2,000
Benzoic Acid	99	24,590
Biphenyl	5.9	230
Bis (2-ethylhexyl) phthalate	4.01	1.8
Diphenyl Oxide	15.2	410
Phenol	11.7	2,560
Arsenic	6	51
Copper	N/A ³	115

Footnotes for Table 1:

- 1 Soil cleanup levels are based on protection of groundwater (Method B).
- 2 mg/kg means milligrams per kilogram.
- 3 N/A means not applicable.

3.4 Current and Projected Site Use

The Site is currently used for industrial purposes. There have been no changes in current or projected future Site or resource uses.

3.5 Availability and Practicability of Higher Preference Technologies

The remedy implemented at this Site included removal and containment of hazardous substances, and it continues to be protective of human health and the environment. While higher preference cleanup technologies may be available, they are still not practicable at this Site.

3.6 Availability of Improved Analytical Methods and Techniques to Evaluate Compliance with Cleanup Levels

The analytical methods used at the time of the remedial action were capable of detection below selected Site cleanup levels. The presence of improved analytical techniques would not affect decisions or recommendations made for the Site.

4.0 CONCLUSIONS

The following conclusions have been made as a result of this periodic review:

- The cleanup actions completed at the Site still appear to be protective of human health and the environment.
- Cleanup actions for the WIA, NIA, and CIA continue to eliminate exposure to contaminated soils and groundwater. The SVE system effectively removed contaminant mass and the interceptor trenches continue to maintain hydraulic control so contamination does not reach the wetland or the Columbia River.
- The cleanup actions have been determined to comply with MTCA cleanup standards.
- Emerald monitors groundwater on a semi-annual basis at the NIA, CIA, and WIA for chemicals of concern. In annual remedial action reports, Emerald proposed changes to the groundwater monitoring schedule. Ecology authorized the following changes to the groundwater monitoring schedule based on a review of the site and groundwater data. If based on future data or if new information becomes available, Ecology may revoke any of the changes below. The year indicates when Ecology approved the changes.
 - Removed wells MW-201, MW-205, MW-238, and MW-255 from water quality analysis (2014).
 - Cease monitoring arsenic and copper in the CIA shallow aquifer; benzoic acid, biphenyl, phenol, and arsenic in the WIA shallow aquifer; and arsenic in the WIA intermediate sand aquifer (2014).
 - Cease monitoring benzene and toluene in WIA trench sumps; bis (2-ethylhexyl) phthalate in WIA shallow aquifer and trench sumps (2015).
 - Removed wells KC-13 and MW-249 from water quality analysis (2016).
 - Cease monitoring benzene in wells MW-232, MW-245, and MW-256; bis (2-ethylhexyl) phthalate in wells KC-9, MW-210, MW-230, MW-231, MW-232, and PDW-117; benzoic acid and phenol in wells KC-9, MW-210, MW-230, MW-231, PZ-104, PZ-107, and PDW-117 (2016).
 - Removed well KC-11 from water quality analysis (2017).
 - Removed wells MW-232 and MW-210 and WIA North Sump and South Sump from water quality analysis (2018).
 - Cease monitoring bis (2-ethylhexyl) phthalate in well MW-245; and biphenyl in NIA shallow aquifer wells (2018).
 - Removed well MW-244 from water quality analysis (2020).
 - Removed wells MW-230 and MW-231 from water quality analysis (2022).

-
- Reduced groundwater well monitoring in the NIA and WIA shallow aquifer from semi-annual to annual (2022).
 - Emerald began operating the Waterloo Emitter system in February 2009 as an effort to enhance bioremediation through oxygen diffusion to reduce DPO concentrations at the NIA Trench. Ecology determined that the system was not providing further benefit toward mass reduction of DPO and approved Emerald's request to cease operations and close the system in May 2017.
 - The Covenant recorded for the property in 2008 is in place and continues to be effective in protecting human health and the environment from exposure to hazardous substances and in protecting the integrity of the cleanup action.

Based on this periodic review, Ecology has determined that the requirements of the Covenant are being followed.

In response to Emerald's 2021-2022 Remedial Action Report, Ecology has requested the following three tasks for Emerald to perform with results being submitted in the 2022-2023 Remedial Action Report:

- 1) Take one sample each from the North and South sumps of the WIA trenches in the spring sampling event for benzene, toluene, biphenyl, bis (2-ethylhexyl) phthalate, and DPO.
- 2) Evaluate whether the ISRW system adequately captures groundwater contamination with respect to river in-flow, specifically if well MW-243 is located such that if river in-flow allows groundwater contamination to extend beyond the ISRW system, groundwater sampling at well MW-243 would show the contamination moving beyond the ISRW system.
- 3) Evaluate whether the ISRW system adequately is reducing the contaminant mass in the intermediate sand aquifer, and provide restoration time frames for the WIA shallow and intermediate sand aquifers according to the procedures in WAC 173-340-360.

It is the property owner's responsibility to continue implementation of the remedy and to inspect and monitor groundwater at the Site to assure that the integrity of the remedy is maintained.

4.1 Next Review

The next review for the Site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required at this Site, the next periodic review will be scheduled five years from the completion of those activities.

5.0 REFERENCES

Emerald Kalama Chemical LLC. Restrictive or *Environmental Covenant*. April 3, 2008.

ThermoRetec Consulting Corporation. Draft Remedial Investigation Revision 1. BF Goodrich Kalama Facility. October 16, 2000.

ThermoRetec Consulting Corporation. Draft Remedial Investigation Revision 2. BF Goodrich Kalama Facility. December 15, 2000.

The RETEC Group, Inc. Final Feasibility Study. Noveon Kalama. December 23, 2003.

The RETEC Group, Inc. Cleanup Action Plan. Noveon Kalama. June 30, 2004.

RSEC. 2020-2021 Annual Remedial Action Report. Emerald Kalama Chemical LLC. August 2021.

RSEC. 2021-2022 Annual Remedial Action Report. Emerald Kalama Chemical LLC. August 2022.

Ecology. *Site Visit*. April 1, 2022.

Agreed Order No. DE 98H-S327, November 2008.

Consent Decree No. 082005152, March 17, 2008.

6.0 FIGURES

Figure 1 Facility Location Map (Source: 2020 – 2021 Annual Remedial Action Report)



Figure 2 East Area Conceptual Model (Source: Remedial Investigation, December 2000)

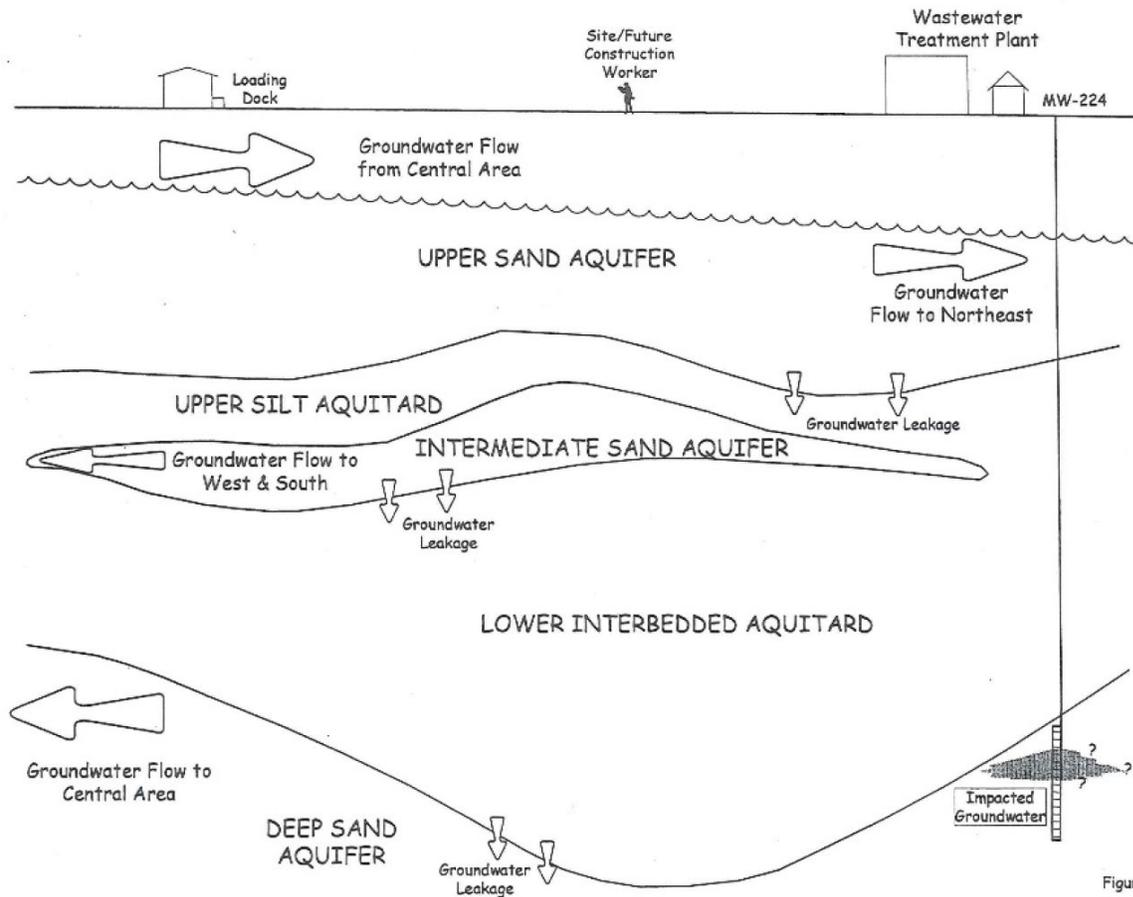


Figure 3 NIA Conceptual Model (Source: Remedial Investigation, December 2000)

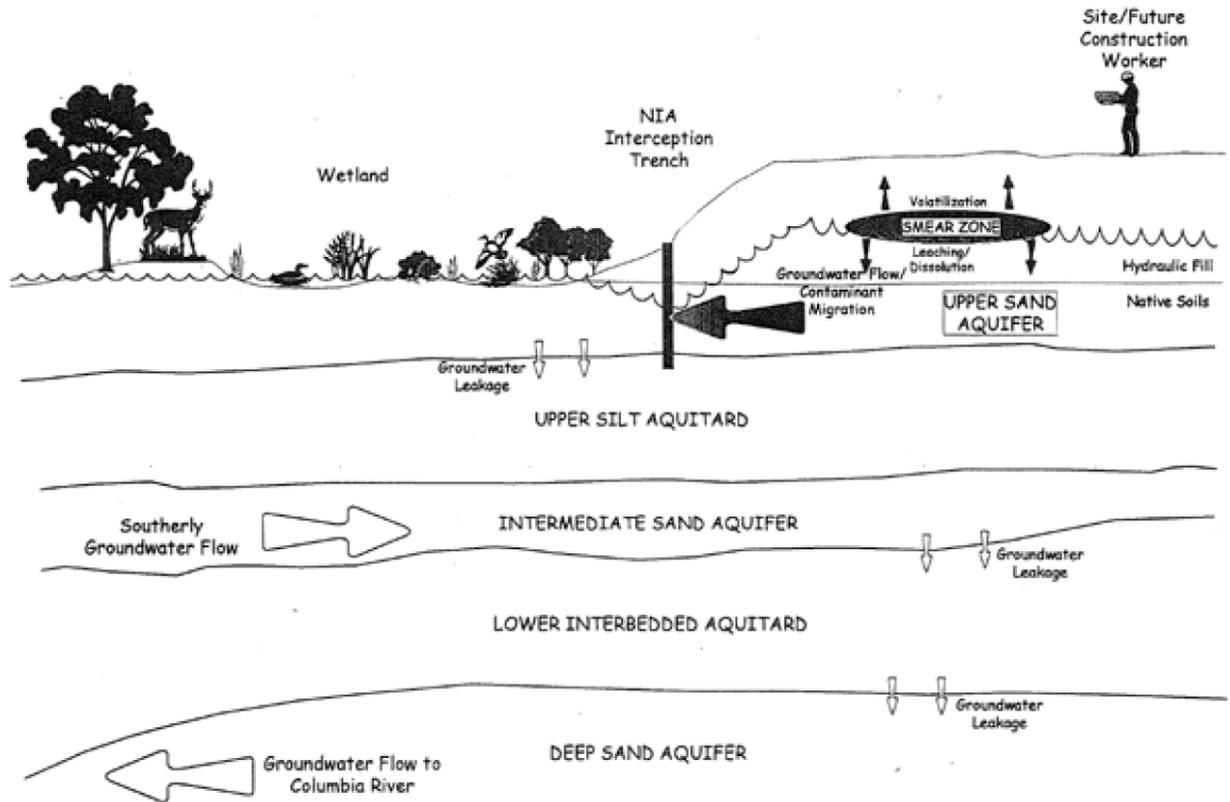


Figure not to scale.

Figure 4 CIA Conceptual Model (Source: Remedial Investigation, December 2000)

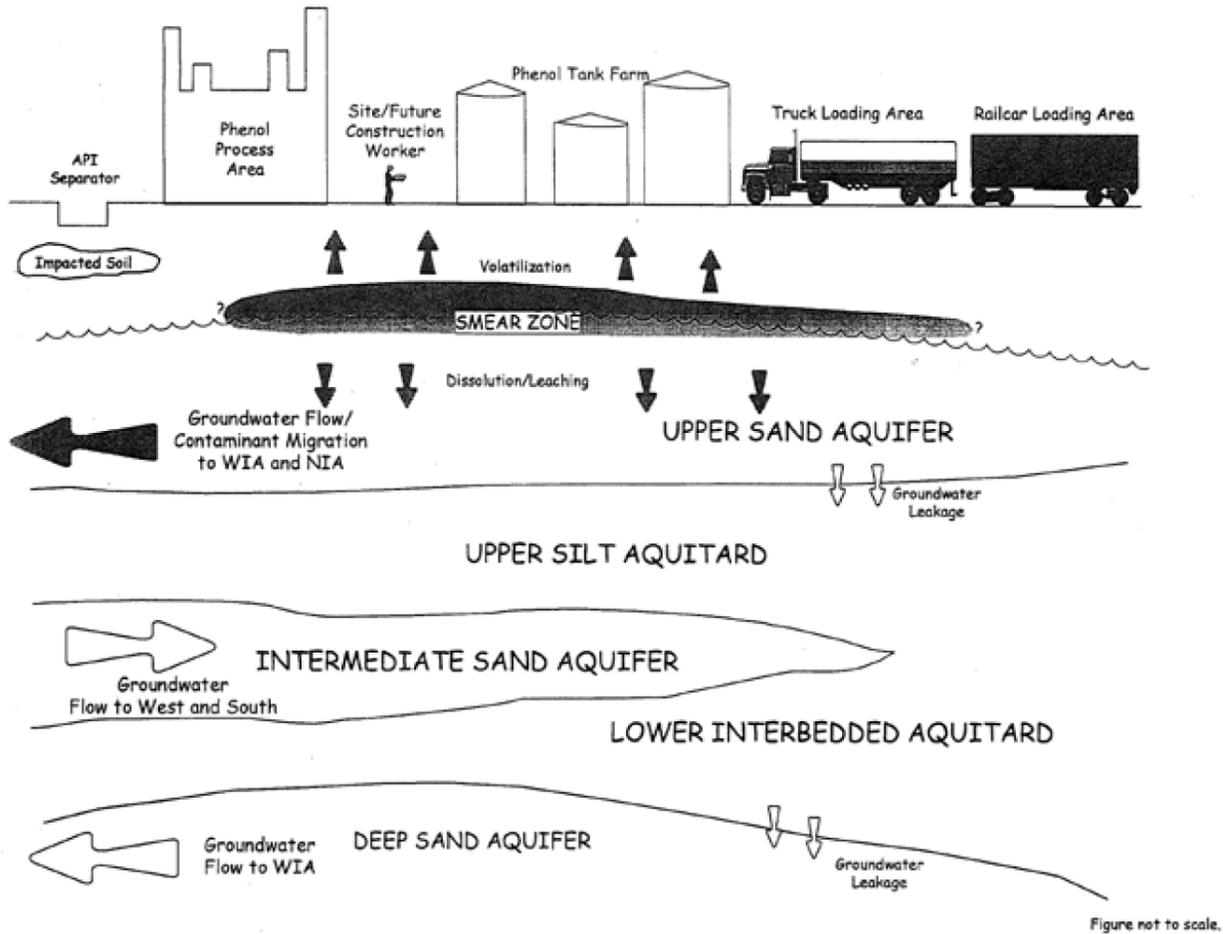


Figure 5 WIA Conceptual Model (Source: Remedial Investigation, December 2000)

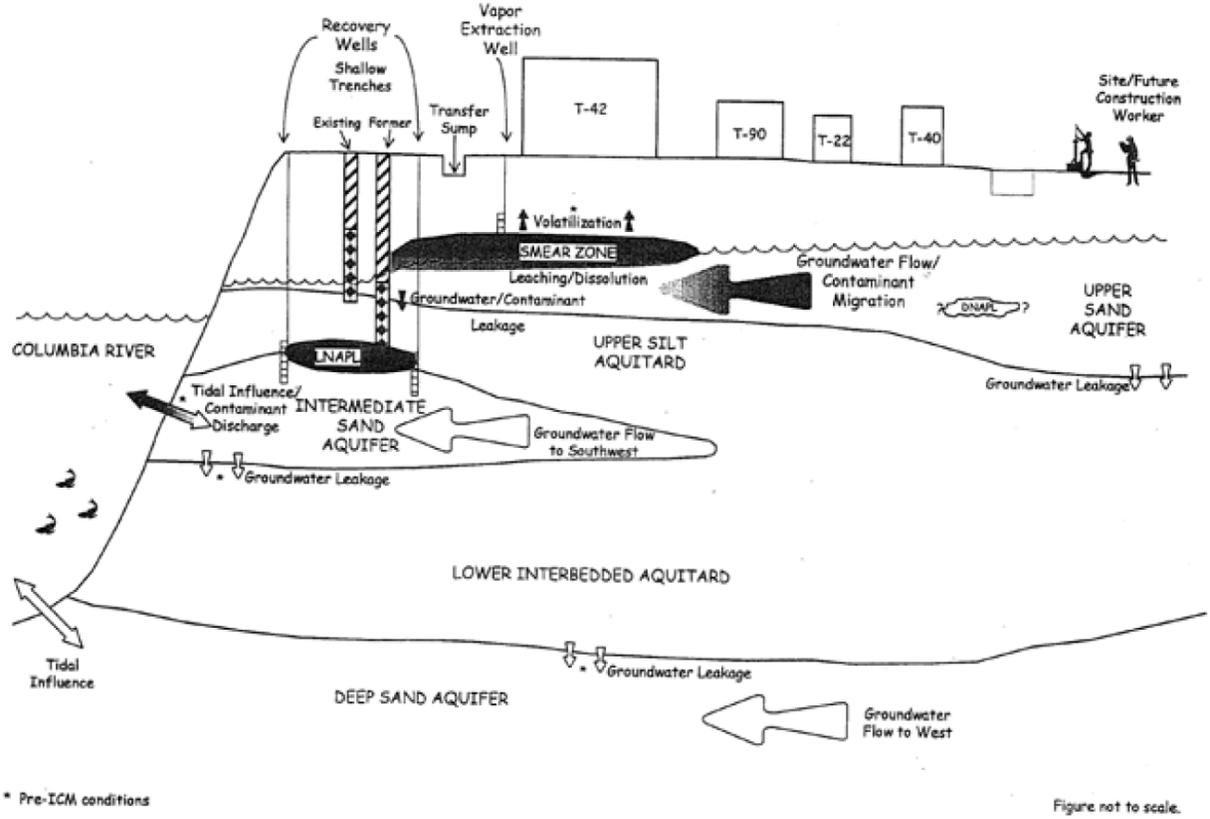
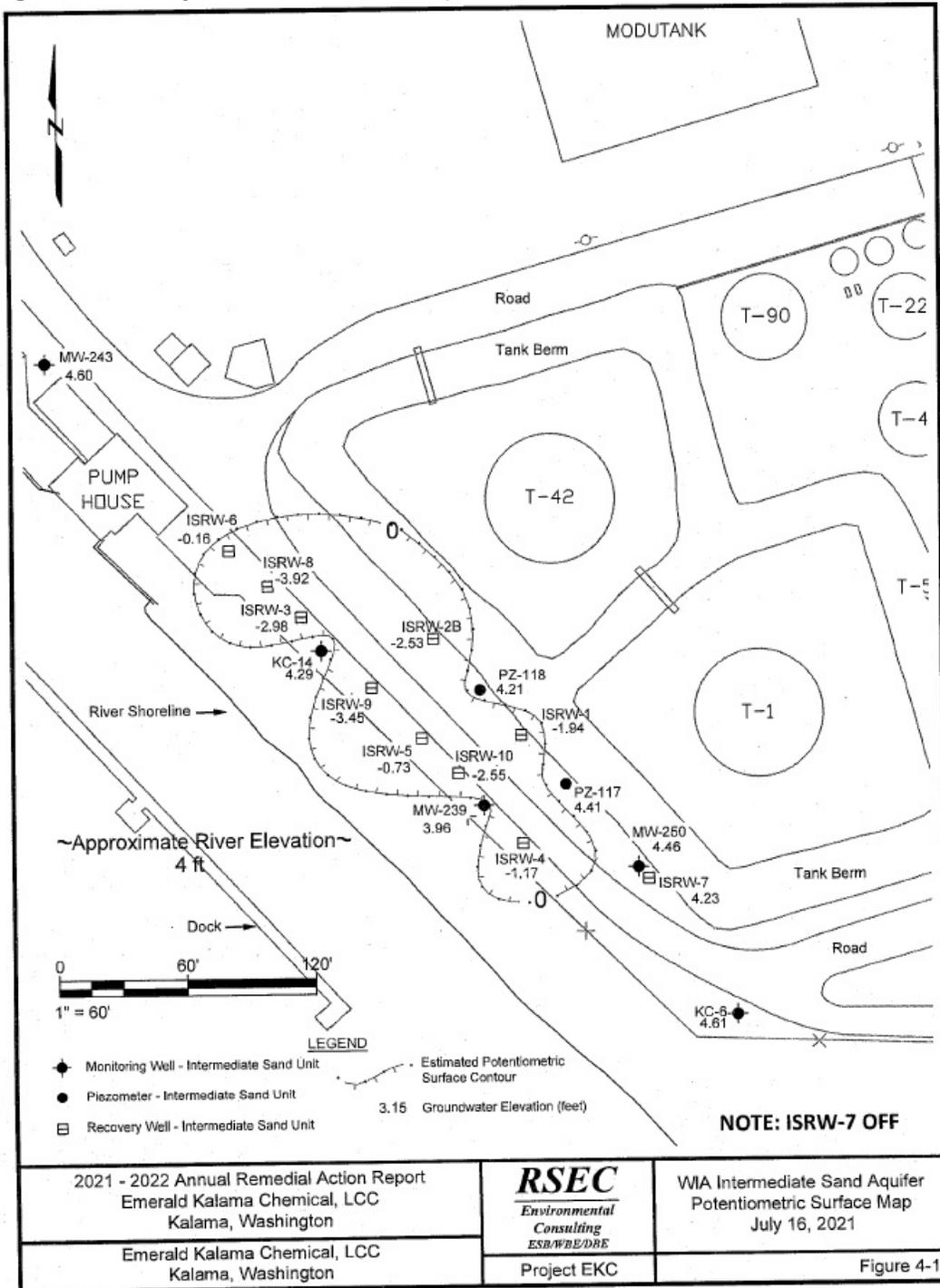


Figure 6 ISRW System Well Locations (Source: 2021 – 2022 Annual Remedial Action Report)



7.0 TABLES

Table 2 NIA Trench Sumps Groundwater Results (Source: 2021 – 2022 Annual Remedial Action Report)

Well	Date	VOCs (µg/L) (EPA Method 8021B/8260)		SVOCs (µg/L) (EPA Method 8270C SIM)				
		Benzene	Toluene	Benzoic Acid	Biphenyl	Bis (2-ethylhexyl) phthalate	Diphenyl Oxide	Phenol
	Cleanup Level	1.2	2,000	24,590	230	1.8	410	2,560
East Sump	7/25/2007	7.5	30	< 9.5 U	29	<0.95 U	910 D	8
	10/24/2007	6	16	< 9.0 UJ	13	<0.96	960	11
	1/17/2008	9.7 D	160 D	< 9.5 U	13	<0.95 U	650 D	8.1
	4/15/2008	12	710	< 9.5 UJ	19	<0.95	730	27
	7/28/2008	5.6	69	< 9.6	21	<0.96	600	5.6
	10/24/2008	7.9	57	NA	17	<0.97	1,200	14
	1/30/2009	2.3	< 1	< 9.5	13	<0.95	580	6.2
	4/20/2009	4.3	79	< 9.6 J	7.6	<0.96	590	3.6
	10/21/2009	2.4	< 1.0	< 11 J	3.4	< 1.1	500	15
	4/22/2010	1.9	< 1.0	< 10 J	4.4	< 1.0	330	4.4
	10/21/2010	14	< 1.0	< 10	6.7	< 1.0	760	18
	10/10/2011	9.7	< 1.0	<9.5	3.3 J	<0.95	310 J	5.1 J
	4/19/2012	1.9	< 1.0	<9.5	4.4	<2.4	280	<1.9
	11/7/2012	<1.0	< 1.0	<9.5 UJ	2.4	<0.95	220	2.4
	4/10/2013	<1.0	< 1.0	<9.5	2.0	<0.95	200	2.8
	10/16/2013	<1.0	< 1.0	<9.5 UJ	1.8	<0.95	260	2.8
	4/14/2014	< 1.0	< 1.0	<9.5	1.6	<0.95	190	<1.9
	10/21/2014	< 0.06	< 0.11	NA	NA	NA	200	NA
	4/20/2015	< 0.42	1.2 J	NA	NA	NA	150	NA
	10/20/2015	< 1.0	< 1.0	NA	NA	NA	<0.95	NA
	4/13/2016	< 1.0	< 1.0	NA	NA	NA	260 D	NA
	10/27/2016	< 1.0	< 1.0	NA	NA	NA	53	NA
	4/10/2017	< 1.0	< 1.0	NA	NA	NA	170	NA
	10/4/2017	< 0.50	< 1.0	NA	NA	NA	360 D	NA
	4/23/2018	< 1.0	< 1.0	NA	NA	NA	140	NA
	10/2/2018	< 0.3	< 1.0	NA	NA	NA	92 D	NA
	4/12/2019	< 0.3	< 1.0	NA	< 0.644	NA	112	NA
	10/15/2019	<0.300	<1.00	NA	<0.473	NA	266	NA
	4/7/2020	<0.300	<1.00	NA	<0.475	NA	80.5 D	NA
	10/19/2020	54.5	<1.00	NA	<0.481	NA	216 D	NA
	10/19/2020 Dup	55.1	<1.00	NA	<0.483	NA	278	NA
	1/15/2021	5.98	<1.00	NA	NA	NA	NA	NA
	4/8/2021	15.5	<1.00	NA	<0.479	NA	117 D	NA
7/16/21 ALS 8260	2.0	<0.50 U	NA	NA	NA	NA	NA	
7/16/21 Spcity 802	2.19	1.15	NA	NA	NA	NA	NA	
10/1/2021 Spcity 8	<0.300	<1.00	NA	<0.473	NA	104 H (lab)	NA	
10/1/2021 DUF	<0.300	<1.00	NA	<0.474	NA	NA	NA	
4/14/2022 ALS	<0.50 U	<0.50 U	NA	<0.94	NA	99	NA	
4/14/2022 DUF	<0.50 U	<0.50 U	NA	<0.94	NA	99	NA	
7/25/2007	270 D	1,900 D	12	180 D	<0.95 U	1,600 D	9.5	
7/25/2007 Dup	270 D	1,500 D	11	160 D	2.5	1,600 D	14	
10/24/2007	270 J	1,300 J	32 J	190	<0.96	2,200	22 J	
10/24/2007 Dup	450 J	2,000 J	20 J	210	<0.95	2,100	16 J	
1/17/2008	410 D	8,300 D	9.8	45	<0.96 U	620 D	62 D	
1/17/2008 Dup	400 D	7,900 D	< 9.7 U	42	<0.97 U	600 D	55 D	
4/15/2008	79	820	< 9.5 UJ	160	1.1	1,200	8.7	
4/15/2008 Dup	83	780	< 9.5 UJ	160	<0.95	1,200	8.4	
7/28/2008	200	740	< 9.5	140	<0.95	1,300	18	
7/28/2008 Dup	200	740	< 9.5	140	<0.95	1,200	21	

(Continued on next page)

West Sump	10/24/2008	140	1,700	26 J-	110	<0.95	1,000	15
	1/30/2009	160	1,400	26	78	<0.95	880	2.5
	1/30/2009 Dup	150	1,300	< 9.5	110	<0.95	870	17
	4/20/2009	26	78	< 9.6 J	150	<0.96	1,100	5.7
	4/20/2009 Dup	27	78	< 9.6 J	130	<0.96	1,000	5.3
	10/20/2009	100	1,100	< 9.5 J	5.0 J	<0.95	570 J	31
	10/21/2009 Dup	100	1,100	< 9.5 J	59 J	<0.95	970 J	28
	4/22/2010	56	77	< 9.0 J	46	<0.95	490	5
	4/22/2010 Dup	59	85	< 9.0 J	45	<0.99	490	6.8
	10/21/2010	42	69	< 9.8	15	< 0.98	470	100
	10/10/2011	33	210	<9.5	45 J	<0.95	730 J	8.7 J
	10/10/2011 Dup	33	210	<9.3	23 J	<0.93	560 J	20 J
	4/19/2012	71	230	<9.5	27	< 2.4	320	4.2
	4/19/2012 Dup	71	230	<9.5	27	< 2.4	310	4.3
	11/7/2012	52	109	<9.5 UJ	49	<0.95	760	6.1
	11/7/2012 Dup	48	101	<9.5 UJ	46	<0.95	750	6.1
	4/10/2013	34	23	12	42	<0.95	410	5.0
	4/10/2013 Dup	34	22	9.8	42	<0.95	430	5.3
	10/16/2013	33	18	<9.5	45	<0.95	770	4.6
	10/16/2013 Dup	33	19	<9.5	42	<0.95	750	5.1
	4/14/2014	67	120	<9.5 UJ	47	<0.95	520	7.4
	4/14/2014 Dup	72	120	<9.5 UJ	46	<0.95	520	8.4
	10/21/2014	4.4	0.91	NA	NA	NA	830	NA
	10/21/2014 Dup	4.4	0.85	NA	NA	NA	980	NA
	4/20/2015	56	60	NA	NA	NA	550	NA
	10/20/2015	4.4	< 1.0	NA	NA	NA	200	NA
	10/20/2015 Dup	4.5	< 1.0	NA	NA	NA	200	NA
	4/13/2016	74	51	NA	NA	NA	180	NA
	4/13/2016 Dup	71	50	NA	NA	NA	190	NA
	10/27/2016	5.0	5.5	NA	NA	NA	1,100 D	NA
	10/27/2016 Dup	6.1	7.1	NA	NA	NA	1,100 D	NA
	4/10/2017	65 D	40 D	NA	NA	NA	100	NA
4/10/2017 Dup	68 D	42 D	NA	NA	NA	100	NA	
10/4/2017	2.7	3.7	NA	NA	NA	790 D	NA	
10/4/2017 Dup	2.8	3.4	NA	NA	NA	770 D	NA	
4/23/2018	21	8.6	NA	NA	NA	300 D	NA	
4/23/2018 Dup	21	8.6	NA	NA	NA	300 D	NA	
10/2/2018	3.3	< 1.0	NA	NA	NA	844 D	NA	
10/2/2018 Dup	2.9	< 1.0	NA	NA	NA	595 D	NA	
4/12/2019	18.2	11.8	NA	37.8	NA	898 D	NA	
4/12/2019 Dup	18.6	12.4	NA	37.8	NA	962 D	NA	
10/15/2019	1.11	<1.00	NA	22.1	NA	996 D	NA	
10/15/2019 Dup	1.16	<1.00	NA	24.1	NA	1020 D	NA	
4/7/2020	9.57	11.8	NA	11.9	NA	532 D	NA	
4/7/2020 Dup	9.69	10.7	NA	12.9	NA	603 D	NA	
10/19/2020	0.970	<1.00	NA	13.1	NA	874 D	NA	
1/15/2021	15.2	2.45	NA	NA	NA	NA	NA	
4/8/2021	4.51	1.86	NA	8.82	NA	690 D	NA	
10/1/2021	0.500	<1.00	NA	<0.474	NA	119 H (lab)	NA	
4/14/2022	2.7	<0.50 U	NA	5.4	NA	400 D	NA	

Notes:

< - Result is non-detected above the laboratory detection limit.

< - Detection limit above cleanup level.

Bold indicates detection.

Dup - Field Duplicate Sample.

NA - Not analyzed per Ecology approval.

J - Estimated concentration.

UJ - Not detected, estimate concentration.

Bold and shaded Detection above cleanup level.

EPA = U.S. Environmental Protection Agency; µg/L micrograms per liter; mg/L = milligrams per liter; NIA = North Impacted Area;

Table 3 ISRW Groundwater Results (Source: 2021 – 2022 Annual Remedial Action Report)

Well	Date	VOCs (µg/L) (EPA Method 8021B/8260)	
		Benzene	Toluene
	Cleanup Level	1.2	2,000
ISRW-1	7/25/2007	290 D	35,000 D
	7/25/2007 Dup	310 D	34,000 D
	10/23/2007	380	61,000
	10/23/2007 Dup	370	59,000
	1/17/2008	390 D	65,000 D
	1/17/2008 Dup	390 D	69,000 D
	4/15/2008	350	55,000
	4/15/2008 Dup	360	54,000
	7/28/2008	550	56,000
	7/28/2008 Dup	570	63,000
	10/23/2008	250	27,000
	10/23/2008 Dup	240	29,000
	1/30/2009	360	35,000
	1/30/2009 Dup	340	35,000
	4/20/2009	100	26,000 J
	4/20/2009 Dup	110	45,000 J
	10/21/2009	400	58,000
	10/21/2009 Dup	410	58,000
	4/21/2010	430	47,000
	4/21/2010 Dup	440	49,000
	10/19/2010	190	23,000
	10/11/2011	250	49,000
	10/11/2011 Dup	260	49,000
	4/19/2012	200	36,000
	4/19/2012 Dup	200	35,000
	11/6/2012	153	40,600
	11/6/2012 Dup	170	45,700
	4/9/2013	230	66,000
	4/9/2013 Dup	230	66,000
	10/16/2013	160	49,000
	10/16/2013 Dup	150	47,000
	4/14/2014	240	55,000
	4/14/2014 Dup	240	55,000
	10/21/2014	< 600	68,000
	4/20/2015	170	46,000
	10/19/2015	110 D	33,000 D
	4/11/2016	200 D	61,000 D
	10/24/2016	120 D	48,000 D
	4/10/2017	240 D	63,000 D
	10/4/2017	160 D	48,000 D
	4/23/2018 all on	200 D	72,000 D
	4/26/2018 5-10off	270 D	110,000 D
	5/16/2018 HiRV/R	280 D	110,000 D
	8/6/2018 Smr1/4	107	35,800 D
	10/2/2018	99 D	43,100 D
	1/16/2019	87	51,800 D
4/12/2019	166	92,500	
7/30/2019	45.0	12,300 D	
10/15/2019	30.3	11,100 D	
1/7/2020	91.2	45,800 D	
4/7/2020 VOA#1(4/15)	37.3	4,140 D	
4/7/2020 VOA#3(4/24)	NA	21,100 H	
7/28/2020	89.8	19,700 D	
10/19/2020	39.0	16,100 D	
10/19/2020 Dup	36.0	11,400 D	
1/15/2021	68.6	51,400 D	
1/15/2021 Dup	86.6	50,600 D	
4/8/2021	23.8 D	13,600 D	
7/16/2021(ALS 8260)	34	26,000	
7/16/2021(Spolty 8021)	34.2 D	21,900 D	
10/1/2021(Spolty 8260)	<300 DQ	1,720 D	
10/1/2021 Dup Spolty	6.8 D	1,870 D	
1/18/2022 (ALS)	<50 U,D	30,000 D	
1/18/2022 Dup ALS (11)	<50 U,D	32,000 D	
4/14/2022	<25 U,D	11,000 D	

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Well	Date	VOCs (µg/L) (EPA Method 8021B/8260)	
		Benzene	Toluene
	Cleanup Level	1.2	2,000
ISRW-2B	7/25/2007	14 D	8,500 D
	10/23/2007	7.6	3,000
	1/17/2008	45 D	22,000 D
	4/15/2008	60	20,000
	7/28/2008	150	36,000
	10/23/2008	130	31,000
	1/30/2009	77	33,000
	4/20/2009	230	150,000
	10/21/2009	330	260,000
	4/21/2010	470	720,000
	10/11/2011	95	83,000
	4/19/2012	300	23,000
	11/6/2012	71	53,900
	4/9/2013	130	61,000
	10/16/2013	97	68,000
	4/14/2014	94	72,000
	10/21/2014	< 600	75,000
	4/20/2015	94 J	72,000
	10/19/2015	47 D	18,000 D
	4/11/2016	160 D	110,000 D
	10/24/2016	< 20	11,000 D
	4/10/2017	110 D	92,000 D
	10/4/2017	130 D	74,000 D
	4/23/2018 all on	54 D	9,800 D
	4/26/2018 5-10off	130 D	89,000 D
	8/6/2018 Smr1/4	58	23,600 D
	10/2/2018	59 D	43,200 D
	1/16/2019	96	77,200 D
	4/12/2019	75	52,900
	7/30/2019	42.6	16,600 D
	10/15/2019	62.8	18,500 D
	1/7/2020	56.1	32,500 D
	4/7/2020 VOA#1(4/15)	100	5,760 D
4/7/2020 VOA#3(4/24)	NA	50,700 H	
7/28/2020	53.3	18,400 D	
10/19/2020	33.1	8,090 D	
1/15/2021	45.9	54,200 D	
4/8/2021	57.6	20,200 D	
7/16/2021	68.4 D	32,500 D	
10/1/2021 Spclty	96.0 D	17,000 D	
1/18/2022 ALS	69 D	37,000 D	
4/14/2022 ALS	27 D	8,600 D	
ISRW-3	7/25/2007	150 D	110,000 D
	10/23/2007	110	82,000
	1/17/2008	210 D	130,000 D
	4/15/2008	150	100,000
	7/28/2008	150	110,000
	10/23/2008	< 500	140,000
	1/30/2009	98	97,000
	4/20/2009	13	14,000
	10/21/2009	9.4	25,000 J
	4/21/2010	17,000	980,000
	10/19/2010	13	34,000
	10/11/2011	20	47,000
	4/19/2012	70	65,000
	11/6/2012	25	45,000
	4/9/2013	50	58,000
	10/16/2013	16	22,000
	4/14/2014	23	33,000
	10/21/2014	< 600	47,000
	4/20/2015	56 J	51,000
	10/19/2015	55 D	71,000 D
	4/11/2016	120 D	150,000 D
	10/24/2016	290 D	200,000 D
	4/10/2017	< 50 U	74,000 D
	10/4/2017	140 D	100,000 D
	4/23/2018 all on	< 50 U	19,000 D
	4/26/2018 5-10off	< 100 U	67,000 D
	8/6/2018 Smr1/4	54	23,700 D
	10/2/2018	54 D	30,800 D
1/16/2019	129	93,000 D	
4/12/2019	337	172,000	
7/30/2019	97.4	63,400 D	
10/15/2019	80.4	51,900 D	

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Well	Date	VOCs (µg/L) (EPA Method 8021B/8260)	
		Benzene	Toluene
	Cleanup Level	1.2	2,000
ISRW-3	1/7/2020	204 D	142,000 D
	4/7/2020 VOA#1(4/15)	117	17,200 D
	4/7/2020 VOA#3(4/24)	NA	61,400 H
	7/28/2020	157	44,300 D
	10/19/2020	92.4	56,400 D
	1/15/2021	206 D	204,000 D
	4/8/2021	92.5 D	61,400 D
	4/8/2021 Dup	106 D	72,500 D
	7/16/2021	243 D	133,000 D
	10/1/2021	58.0 D	17,800 D
	1/18/2022 (ALS)	150 D	100,000 D
4/14/2022 ALS	120 D	73,000 D	
ISRW-4	7/25/2007	35 D	20,000 D
	10/23/2007	350	65,000
	1/17/2008	130 D	34,000 D
	4/15/2008	430	77,000
	7/28/2008	48	24,000
	10/23/2008	130	55,000
	1/30/2009	120	59,000
	4/20/2009	28	10,000
	10/21/2009	3.1	4,700
	4/21/2010	3.7	7,300
	10/19/2010	7.8	3,200
	10/11/2011	20	14,000
	4/19/2012	< 1.0	650
	11/6/2012	< 0.5	29
	4/9/2013	0.57	200
	10/16/2013	< 1.0	59
	4/14/2014	< 1.0	35
	10/21/2014	< 600	32,000
	4/20/2015	15	6,400
	10/19/2015	6.8 D	29,000 D
	4/11/2016	2.1	1,000 D
	10/24/2016	14	3,100 D
	4/10/2017	< 0.50 U	< 1.0 U
	10/4/2017	< 50 U	9,000 D
	4/23/2018 all on	< 25 U	18,000 D
	4/26/2018 5-10off	< 50 U	15,000 D
	8/6/2018 Smr1/4	6	526 D
	10/2/2018	34 D	6,280 D
	1/16/2019	167 D	34,600 D
	4/12/2019	140	27,800
	7/30/2019	62.2 D	1,440 D
	10/15/2019	41.2	261
	1/7/2020	94.5 D	10,000 D
4/7/2020 VOA#1(4/15)	30.6	2,200 D	
4/7/2020 VOA#3(4/24)	NA	5,640 H	
7/28/2020	6.03	1,250 D	
10/19/2020	96.9	25,100 D	
1/15/2021	0.918	40	
4/8/2021	6.76 D	296 D	
7/16/2021	25.8 D	6,080 D	
10/1/2021	7.30	78.8	
1/18/2022 (ALS)	10 D	3,800 D	
4/14/2022 ALS	11 D	690 D	
ISRW-5	7/25/2007	110 D	37,000 D
	10/23/2007	110	45,000
	1/17/2008	170 D	62,000 D
	4/15/2008	140	68,000
	7/28/2008	360	110,000
	10/23/2008	130	47,000
	1/30/2009	100	33,000
	4/22/2009	79	52,000
	10/21/2009	40	20,000
	4/21/2010	7.5	2,400
	10/19/2010	26	7,900
	10/11/2011	36	15,000
	4/19/2012	30	12,000
	11/6/2012	402	48,500
	4/9/2013	94	46,000
	10/16/2013	160	92,000
	4/14/2014	37	16,000
	10/21/2014	< 600	19,000
	4/20/2015	76 J	25,000
	10/19/2015	84 D	17,000 D
	4/11/2016	< 100	31,000 D
	10/24/2016	120 D	130,000 D
	4/10/2017	50 D	46,000 D

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Well	Date	VOCs (µg/L) (EPA Method 8021B/8260)	
		Benzene	Toluene
	Cleanup Level	1.2	2,000
ISRW-5	10/4/2017	80 D	53,000 D
	4/23/2018	190 D	110,000 D
	8/6/2018 Smr1/4	88	59,700 D
	10/2/2018	72 D	106,000 D
	1/16/2019	79	60,300 D
	4/12/2019	106	90,200
	7/30/2019	72.5	56,000 D
	10/15/2019	20.9	15,900 D
	1/7/2020	58.6	71,900 D
	4/7/2020 VOA#1(4/15)	42.2	11,000 D
	4/7/2020 VOA#3(4/24)	NA	93,800 H
	5/12/20 VOA#1	66.9	74,700 D
	5/12/20 VOA #3	68.4	74,300 D
	7/28/2020	110	45,400 D
	10/19/2020	47.2	28,900 D
	1/15/2021	256 D	158,000 D
	4/8/2021	25.4 D	46,400 D
7/16/21 ALS 8260	31	38,000	
7/16/21 Spcity 8021	27.6 D	36,300 D	
10/1/2021 Spcity 8260	<30.0 D	21,300 D	
1/18/2022 ALS	<100 U,D	78,000 D	
4/14/2022 ALS	<100 U,D	34,000 D	
ISRW-6	7/25/2007	150 D	59,000 D
	10/23/2007	120	47,000
	1/17/2008	150 D	58,000 D
	4/15/2008	190	69,000
	7/28/2008	140	53,000
	10/23/2008	< 200	62,000
	1/30/2009	140	61,000
	4/20/2009	15	16,000
	10/21/2009	1.4	270
	4/21/2010	56	22,000
	10/19/2010	49	42,000
	10/11/2011	4.3	1,000
	4/19/2012	18	14,000
	1/17/2012	2.0	1,420
	4/9/2013	8.6	6,900
	10/16/2013	1.1	1,200
	4/14/2014	6.1	8,100
	10/21/2014	1.3 J	890
	4/20/2015	0.73 J	790
	10/19/2015	1.7	270 D
	4/11/2016	3.7 D	2,300 D
	10/24/2016	140 D	57,000 D
	4/12/2017	< 0.50 U	< 1.0 U
	10/4/2017	< 50 U	10,000 D
	4/23/2018	1.8	1,400 D
	5/16/2018 HIRvr	1.1	1,400 D
	8/6/2018 Smr1/4	0.6	377 D
	10/2/2018	2.7	2,220 D
	1/16/2019	34 D	10,100 D
	4/12/2019	32.6	5,940
	7/30/2019	45.4	2,470 D
	10/15/2019	33.2	1,860 D
	1/7/2020	7.90 D	341 D
4/7/2020 VOA#1(4/15)	1.35	120 D	
4/7/2020 VOA#3(4/24)	NA	630 H	
7/28/2020	0.750	1,340 D	
10/19/2020	0.710	365 D	
1/15/2021	< 3.00 D	3,120 D	
4/8/2021	3.94 D	2,990 D	
7/16/2021	57.5 D	16,900 D	
10/1/2021	54.0 D	7,520 D	
1/18/2022 ALS	46 D	18,000 D	
4/14/2022 ALS	140 D	31,000 D	
ISRW-7	7/25/2007	1,100	24,000 D
	10/23/2007	350	9,400
	1/17/2008	540 D	19,000 D
	4/15/2008	200	11,000
	7/28/2008	520	32,000
	10/23/2008	280	14,000
	1/30/2009	120	9,100
	4/20/2009	83	5,900
	10/21/2009	3,400	45,000
	4/21/2010	2,700	30,000
	10/19/2010	17,000	18,000
	10/11/2011	4,000	27,000

(Continued on next page)

Well	Date	VOCs (µg/L) (EPA Method 8021B/8260)		
		Benzene	Toluene	
		1.2	2,000	
	Cleanup Level			
ISRW-7	4/19/2012	1,100	18,000	
	11/6/2012	1,220	18,700	
	4/9/2013	180	9,900	
	10/16/2013	380	6,600	
	4/14/2014	900	14,000	
	10/21/2014	530	1,800	
	4/20/2015	12	2,100	
	10/19/2015	170 D	1,700 D	
	4/11/2016	54 D	4,300 D	
	10/24/2016	92 D	1,600 D	
	4/10/2017	190 D	10,000 D	
	10/4/2017	180 D	2,800 D	
	4/23/2018	72 D	330 D	
	5/16/2018	HIRvr	270 D	1,700 D
	8/6/2018	Smr1/4	8	46
	10/2/2018		1.1	< 1.0
	1/16/2019		0.6	< 1.00
	4/12/2019		< 0.300	< 1.00
	7/30/2019		0.500	3.24
	10/15/2019		< 0.300	19.7
	1/7/2020		7.27	730 D
	4/7/2020	VOA#1(4/15)	4.51	124 D
	4/7/2020	VOA#3(4/24)	NA	372 H
	7/28/2020		0.32	123 D
	10/19/2020		< 0.300	28.7
1/15/2021		< 0.300	0.515	
4/8/2021		< 0.300	< 0.500	
7/16/2021		< 0.300	1.31	
10/1/2021		< 0.300	< 1.00	
1/18/2022	ALS	< 0.50	0.66	
4/14/2022	ALS	< 0.50	< 0.50	
ISRW-8	4/20/2009	90	66,000	
	10/21/2009	45	50,000	
	4/21/2010	71	57,000	
	10/19/2010	31	72,000	
	10/11/2011	52	54,000	
	4/19/2012	53	40,000	
	11/6/2012	69	51,200	
	4/9/2013	58	33,000	
	10/16/2013	64	39,000	
	4/14/2014	61	40,000	
	10/21/2014	< 600	36,000	
	4/20/2015	84 J	51,000	
	10/19/2015	58 D	39,000 D	
	4/11/2016	< 100	79,000 D	
	10/24/2016	140 D	74,000 D	
	4/10/2017	17 D	20,000 D	
	10/4/2017	140 D	84,000 D	
	4/23/2018	< 100 U	44,000 D	
	4/26/2018	5-10off	< 100 U	69,000 D
	8/6/2018	Smr1/4	127	49,500 D
	10/2/2018		170	61,800 D
	1/16/2019		148	67,400 D
	4/12/2019		164	107,000
	7/30/2019		102	49,100 D
	10/15/2019		130	34,800
	1/7/2020		107	69,700 D
	4/7/2020	VOA#1(4/15)	115	7,240 D
	4/7/2020	VOA#3(4/24)	NA	62,700 H
7/28/2020		111	33,200 D	
10/19/2020		115	31,700 D	
1/15/2021		81.6	43,400 D	
4/8/2021		64.0 D	45,800 D	
7/16/2021	ALS 8260	70	52,000	
7/16/21	Spclty 8021	71.8 D	44,000 D	
10/1/2021		60.0 D	17,000 D	
1/18/2022	ALS	77 D	45,000 D	
4/14/2022	ALS	56 D	39,000 D	
ISRW-9	4/20/2009	120	62,000	
	10/21/2009	71	36,000	
	4/21/2010	81	42,000	
	10/19/2010	71	55,000	
	10/11/2011	4.1	920	
	4/19/2012	22	16,000	
	11/6/2012	40	20,100	
	4/9/2013	47	35,000	
	10/16/2013	83	73,000	

(Continued on next page)

Well	Date	VOCs (µg/L) (EPA Method 8021B/8260)	
		Benzene	Toluene
		Cleanup Level	2,000
ISRW-9	4/14/2014	39	35,000
	10/21/2014	< 600	30,000
	4/20/2015	79 J	64,000
	10/19/2015	55 D	44,000 D
	4/11/2016	< 100	53,000 D
	10/24/2016	77 D	95,000 D
	4/10/2017	19 D	19,000 D
	10/4/2017	< 50 U	22,000 D
	4/23/2018	< 100 U	83,000 D
	5/16/2018	HIRvt < 200 U	59,000 D
	8/6/2018	Smr1/4 27	11,500 D
	10/2/2018	36	12,600 D
	1/16/2019	28	25,300 D
	4/12/2019	81.3	77,900
	7/30/2019	20.3	8,570 D
	10/15/2019	58.5	45,800 D
	1/7/2020	64.4	71,700 D
	4/7/2020	VOA#1(4/15) 45.7	3,440 D
	4/7/2020	VOA#3(4/24) NA	33,300 H
	7/28/2020	31.2	18,600 D
	10/19/2020	26.3	14,200 D
	1/15/2021	42.0	48,800 D
	4/8/2021	60.8 D	40,900 D
	7/16/2021	9.98 D	7,430 D
	10/1/2021	Spclty < 15.0 D	4,360 D
	1/18/2022	ALS < 25 U,D	17,000 D
4/14/2022	ALS 36 D	8,700 D	
ISRW-10	4/20/2009	180	38,000
	10/21/2009	3.8	1,400
	4/21/2010	2	380
	10/19/2010	< 1.0	63
	10/11/2011	16	1,100
	4/19/2012	85	15,000
	11/6/2012	< 1.0	2.5
	4/9/2013	34	3,300
	10/16/2013	96	8,300
	4/14/2014	< 1.0	7.7
	10/21/2014	3.9	140
	4/20/2015	< 0.42	13
	10/19/2015	52 D	3,800 D
	4/11/2016	49 D	4,700 D
	10/24/2016	190 D	29,000 D
	4/10/2017	29	4,300 D
	10/4/2017	110 D	43,000 D
	4/23/2018	220 D	30,000 D
	8/6/2018	36	2,900 D
	10/2/2018	151	18,800 D
	1/16/2019	204 D	78,300 D
	4/12/2019	385	113,000
	7/30/2019	160 D	43,900 D
	10/15/2019	82.9	22,600 D
	1/7/2020	243 D	80,200 D
	4/7/2020	VOA#1(4/15) 72.5	4,300 D
	4/7/2020	VOA#3(4/24) NA	29,300 H
	7/28/2020	319	34,900 D
	10/19/2020	135 D	328,000 D
	1/15/2021	145	50,200 D
	4/8/2021	53.8 D	20,600 D
	7/16/2021	ALS 8260 150	74,000
7/16/2021	Spclty 8021 148 D	61,600 D	
10/1/2021	127 D	35,900 D	
1/18/2022	ALS 110 D	47,000 D	
4/14/2022	ALS 63 D	45,000 D	

Notes:

(1) - ISRW pump wells sampled by peristaltic pump October 2015 & April 2016
 < - Result is non-detected above the laboratory reporting limit.

< - Detection limit above cleanup level.

Bold indicates detection.

Dup - Field Duplicate Sample.

D - Laboratory analytical dilution

J - Estimated concentration.

Bold and shaded Detection above cleanup level.

EPA - U.S. Environmental Protection Agency; µg/L micrograms per liter;

VOC - volatile organic compound; WIA - West Impacted Area

8.0 ENVIRONMENTAL COVENANT

After Recording Return to:
Ha Tran
Department of Ecology
Industrial Section
Solid Waste & Financial Assistance Program
300 Desmond Drive
Lacey, WA 98504-7600

3363502
84/03/2008 10:23:02 AM
Covenants: EMERALD KALAMA CHEMICAL 49.00
Cowlitz County Washington
Pages: 8

Facility: Emerald	
Year of Last Right	
AS	Corr
Water	Reports
NPDES	Permit
WET/Tox	Enf
DW/RCRA	Eng
Clean Up	Sub
SW	
HWP2	

RECEIVED

APR 08 2008

EXHIBIT D

Ecology - SWFA - Ind

RESTRICTIVE (ENVIRONMENTAL) COVENANT EMERALD KALAMA CHEMICAL LLC

Grantor: Emerald Kalama Chemical LLC
Grantee: State of Washington, Department of Ecology
Legal: See Exhibit A to Consent Decree for full legal description
Tax Parcel Nos.: 61335, 62816002

Grantor, Emerald Kalama Chemical LLC (hereafter "Emerald Kalama Chemical"), hereby binds Grantor, its successors and assigns to the land use restrictions identified herein and grants such other rights under this environmental covenant (hereafter "Covenant" or "Restrictive Covenant") made this 2nd day of April, 2008, in favor of the State of Washington, Department of Ecology (hereafter "Ecology"). Ecology shall have full right of enforcement of the rights conveyed under this Covenant pursuant to the Model Toxics Control Act, RCW 70.105D.030(g), and the Uniform Environmental Covenants Act, Chapter 64.70 RCW.

This Declaration of Restrictive Covenant is made pursuant to RCW 70.105D.030(1)(f) and (g) and WAC 173-340-440 by Emerald Kalama Chemical LLC (hereafter "Emerald Kalama Chemical"), its successors and assigns, and Ecology, its successors and assigns.

A remedial action (hereafter "Remedial Action") is occurring at the property that is the subject of this Restrictive Covenant. The Remedial Action conducted at the property is described in the following documents, among others:

- 1) Consent Decree, dated March 17, 2008.
- 2) Cleanup Action Plan (CAP), dated June 2004.

These documents are on file at Ecology's Industrial Section Central Files.

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EXHIBIT D
Restrictive Covenant

EXHIBIT D

EXHIBIT D

1

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
(360) 586-6770

This Restrictive Covenant is required because the Remedial Action will result in residual concentrations of contaminants of concern (COCs) identified in the CAP (including toluene, benzene, and diphenyl oxide) that exceed the Model Toxics Control Act (MTCA) cleanup levels for groundwater specified in the CAP.

This Restrictive Covenant is required as long as hazardous substances remain at the site in concentrations that exceed MTCA cleanup levels specified in the CAP. Upon demonstration that residual concentrations of the COCs do not persist on the Property after completion of the Remedial Action specified in the Consent Decree and CAP, the owner of the Property may proceed under Section 7 of this covenant, pending Ecology's written concurrence.

The undersigned, Emerald Kalama Chemical, is the fee owner of real property in the County of Cowlitz, State of Washington, a portion of which is subject to this Restrictive Covenant (hereafter "Property"). The legal description of the Property subject to this Restrictive Covenant is contained in Exhibit A to the Consent Decree.

Emerald Kalama Chemical (hereafter "Owner") makes the following declaration as to limitations, restrictions, and uses to which the Property may be put and specifies that such declarations shall constitute covenants to run with the land, as provided by law and shall be binding on all parties and all persons claiming under them, including all current and future owners of any portion of or interest in the Property.

Section 1. Any activity on the Property that may interfere with the integrity of the Remedial Action and continued protection of human health and the environment is prohibited.

Section 2. Unless authorized by the CAP or this Restrictive Covenant, any activity on the Property that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or create a new exposure pathway for a hazardous substance that remains on the Property as part of the Remedial Action, is prohibited without prior written approval from Ecology in accordance with Section 5 of this Restrictive Covenant, which approval shall not be unreasonably withheld. Such activities include, but are not limited to, the withdrawal of groundwater for domestic uses. Activities performed in accordance with Section 8 herein shall be deemed to be authorized by this Restrictive Covenant and, therefore, shall not require notification to or approval from Ecology and shall not be subject to public notice and comment under Section 5 herein.

Section 3. Except as otherwise specified herein, the Owner of the Property must give thirty (30) day advance written notice to Ecology of the Owner's intent to convey any interest in the Property. Where it is not possible for the Owner to notify Ecology of such transfer at least thirty (30) days in advance due to the timing of the transfer, the Owner must provide written notice to Ecology as soon as it becomes aware of the impending transfer. No conveyance of title, easement, lease, or other interest in the Property shall be consummated by the Owner without adequate and complete provision for continued monitoring, operation, and maintenance of the Remedial Action. This Section 3 shall not be construed as granting any exemption from,

or any waiver of, any other requirements that may require notice of such conveyance of interest under applicable laws, rules and regulations.

Section 4. The Owner must restrict leases to uses and activities consistent with the Restrictive Covenant and notify all lessees of the restrictions on the use of the Property.

Section 5. The Owner must notify and obtain written approval from Ecology prior to conducting any activity on the Property that is not authorized by the CAP or by this Restrictive Covenant that may result in the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or create a new exposure pathway for a hazardous substance that remains on the Property as part of the Remedial Action. Ecology may approve any such use only after public notice and comment. Approval by Ecology pursuant to Section 5 shall not be unreasonably withheld. Activities performed in accordance with Section 8 herein shall be deemed to be authorized by this Restrictive Covenant and, therefore, shall not require notification to or approval from Ecology and shall not require public notice and comment under this Section.

Section 6. The Owner shall allow authorized representatives of Ecology the right to enter the Property at reasonable times and in compliance with applicable health and safety plans for the purpose of evaluating the Remedial Action; to take samples, to inspect Remedial Actions conducted at the Property, and to inspect records that are related to the Remedial Action.

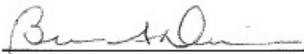
Section 7. The Owner of the Property reserves the right under WAC 173-340-440 to record an instrument that provides that this Restrictive Covenant shall no longer limit use of the Property or be of any further force or effect. However, such an instrument may be recorded only if Ecology, after public notice and opportunity for comment, concurs, which concurrence shall not be unreasonably withheld.

Section 8. Notwithstanding any other provision in this Restrictive Covenant, construction and maintenance and related excavation activities shall be deemed consistent with and authorized by the terms of this Restrictive Covenant, and may occur on the Property without notice to or approval from Ecology, and without public notice and comment, provided that such construction and maintenance and related excavation activities shall not involve any excavation of soil at depths greater than six feet below the existing ground surface, and provided further that following such activities, physical barriers required by the CAP or by this Restrictive Covenant shall be restored or created to prevent the release or exposure to the environment of a hazardous substance that remains on the Property as part of the Remedial Action, or to prevent a new exposure pathway for a hazardous substance that remains on the Property as part of the Remedial Action. Notification will be made to Ecology for approval, without the public notice and comment, if the disturbed barriers are not restored or created within 30 days after the completion of such activities. Any construction and maintenance and related excavation activities at depths greater than six feet below the existing ground surface shall not occur on the Property without prior written approval from Ecology in accordance with Section 5, which approval shall not be unreasonably withheld. This Section 8 shall not be construed as granting any exemption from, or any waiver of, any permitting or other requirements that may apply to such uses and activities

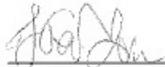
under applicable laws, rules and regulations, including requirements related to worker safety and waste management involving contaminated media.

EMERALD KALAMA CHEMICAL LLC

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY



Brian Denison
Vice President, Health, Safety
Environmental, Technology & Logistics



Ha Tran
Industrial Section, Solid Waste & Financial
Assistance Program

Dated: 2 APRIL 2008

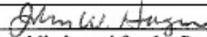
Dated: 3/31/08

STATE OF WASHINGTON)
) ss.
COUNTY OF COWLITZ)

I certify that I know or have satisfactory evidence that Brian Denison is the person who appeared before me, and said person acknowledged that he/she was authorized to execute the instrument and acknowledged it to be the free and voluntary act and deed of such party for the uses and purposes mentioned in this instrument.

DATED this 2 day of April, 2008



By: 

Notary public in and for the State of Washington,
residing at Cowlitz County
My appointment expires 3/13/2011

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EXHIBIT A
Site Diagram and Legal Description

EXHIBIT A

1

ATTORNEY GENERAL OF WASHINGTON
Ecology Division
PO Box 40117
Olympia, WA 98504-0117
(360) 586-6770

AUG-30-'94 11:07 ID:COWLITZ CO TITLE TEL NO:4258010 H292 P02



LIMITED LIABILITY CERTIFICATE

DATE: August 25, 1994 at 8:00 a.m.

Order No.	:102712
Charge	:\$250.00
Tax	: 18.75
Total	:\$268.75

This is a report as of August 8, 1994, covering the property hereinafter described. The information contained herein is made solely for the purpose of determining the status of the property described herein, is restricted to the use of the addressee, and is not to be used as a basis for closing any transaction affecting title to said property. Liability is limited to the charge made for this certificate.

LEGAL DESCRIPTION:

A PARCEL OF LAND IN SECTIONS 1 AND 12, TOWNSHIP 6 NORTH, RANGE 2 WEST OF THE W.M., AND SECTIONS 6 AND 7, TOWNSHIP 8 NORTH, RANGE 1 WEST OF THE W.M., COWLITZ COUNTY, WASHINGTON;

BEGINNING AT A POINT 915.0 FEET NORTH AND 610.9 FEET WEST OF THE SOUTHWEST CORNER OF SMITH M. HENSIL D.L.C. NO. 39, COWLITZ COUNTY, WASHINGTON;
THENCE RUNNING DUE WEST 479.63 FEET TO THE INTERSECTION OF THE GOVERNMENT MEANDER LINE ON THE EAST BANK OF THE COLUMBIA RIVER;
THENCE NORTHERLY ALONG SAID MEANDER LINE NORTH 52° 38' WEST 187.52 FEET, NORTH 38° 52' WEST 708.1 FEET, NORTH 49° 07' WEST 781.7 FEET, NORTH 4° 39' WEST 76.2 FEET, NORTH 22° 22' WEST 123.8 FEET, NORTH 71° 08' WEST 121.3 FEET, NORTH 45° 07' WEST 58.6 FEET, NORTH 31° 08' WEST 260.6 FEET, NORTH 22° 53' WEST 43.0 FEET;
THENCE RUNNING NORTH 57° 30' 00" EAST 2597.14 FEET TO A POINT ON THE WEST LINE OF SAID JAMES ROCKEY D.L.C. NO. 38;
THENCE SOUTH 34° 44' 50" EAST 1763.67 FEET TO THE INTERSECTION OF THE WEST LINE OF SAID JAMES ROCKEY D.L.C. WITH A LINE 60 FEET WEST AND PARALLEL TO THE WEST RIGHT OF WAY LINE OF THE GREAT NORTHERN, NORTHERN PACIFIC AND UNION PACIFIC RAILROADS;
THENCE SOUTH 17° 37' EAST 1738.32 FEET;
THENCE DUE WEST 1896.08 FEET TO THE POINT OF BEGINNING.

ALSO:

A PARCEL OF LAND LYING IN SECTION 6, TOWNSHIP 6 NORTH, RANGE 1 WEST OF THE W.M., BEING A PORTION OF THE JAMES ROCKEY D.L.C. NO. 38, DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT IN THE INTERSECTION OF THE WEST LINE OF THE JAMES ROCKEY D.L.C. NO. 38 AND A LINE 60 FEET WEST OF AND PARALLEL WITH THE GREAT NORTHERN, NORTHERN PACIFIC AND UNION PACIFIC RAILROADS WEST RIGHT OF WAY LINE;
THENCE NORTH 34° 44' 50" WEST 1763.67 FEET ALONG THE WEST LINE OF SAID D.L.C.;
THENCE NORTH 57° 30' EAST 537.55 FEET TO A POINT 60 FEET WEST OF THE WEST RIGHT OF WAY OF THE GREAT NORTHERN, NORTHERN PACIFIC AND UNION PACIFIC RAILROADS;
THENCE SOUTH 17° 37' EAST 1823.49 FEET TO THE POINT OF BEGINNING.

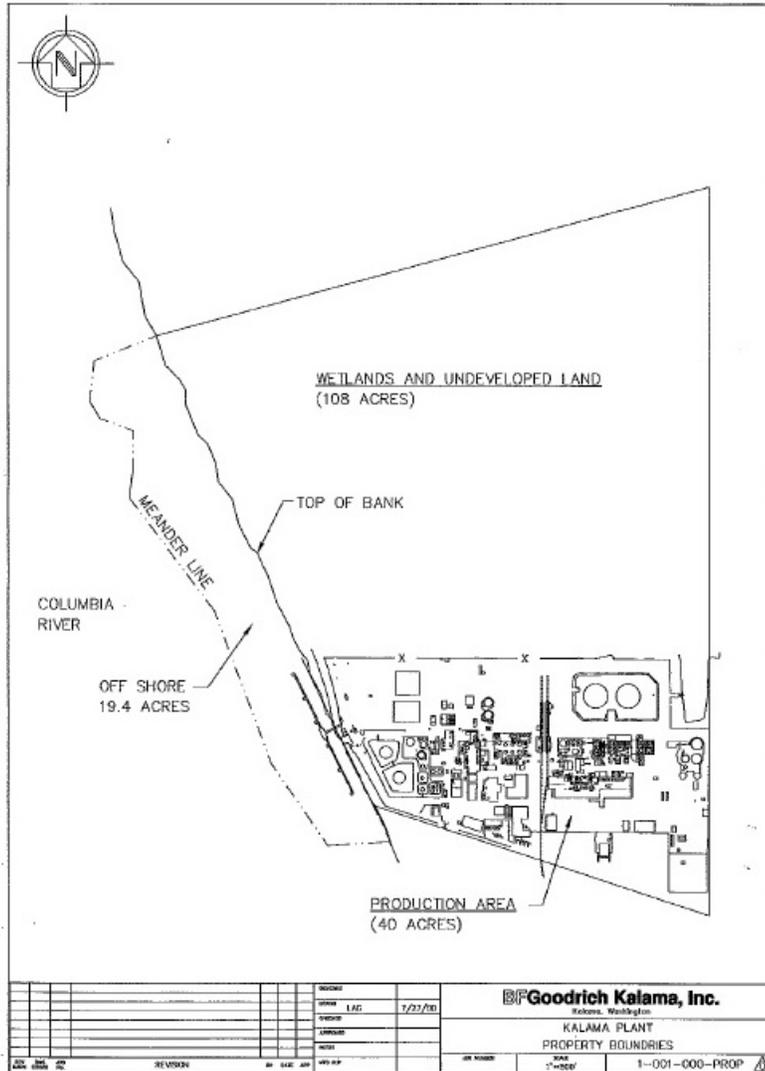
SITUATE IN COWLITZ COUNTY, STATE OF WASHINGTON
1145 14th Avenue ■ Longview, Washington 98632

Phone: (206) 423-5330

Fax: (206) 423-5932

Night Owl Line: (206) 423-9916

"Service is the Difference"



9.0 PHOTO LOG

Photo 1 Emerald Main Office



Photo 2 NIA Interception Trench Pump



Photo 3 SVE System Shed



Photo 4 ISRW Area



Photo 5 Waterloo Emitter wells

