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December 5, 2023

Dan Irvin Flowserve Corporation 5215 N O'Connor Blvd, Irving, TX 75039

#### Re: Further Action at the following Site:

- Site Name: Flowserve Steam Supply
- Site Address: 2007 Stewart St, Tacoma, Pierce County, WA 98421
- Facility/Site ID: 8481432
- Cleanup Site ID: 2637
- VCP Project ID: SW0934

### Dear Dan Irvin:

On August 11, 2023, the Washington State Department of Ecology (Ecology) received your request for an opinion on the independent cleanup of the Flowserve Steam Supply (Site). This letter provides our opinion. We are providing this opinion under the authority of the Model Toxics Control Act (MTCA),<sup>1</sup> chapter 70.105D Revised Code of Washington (RCW).

## **Issue Presented and Opinion**

Ecology has determined that further remedial action is necessary to clean up contamination at the Site. This opinion is based on an analysis of whether the remedial action meets the substantive requirements of MTCA, chapter 70.105D RCW, and its implementing regulations, Washington Administrative Code (WAC) chapter 173-340 (collectively "substantive requirements of MTCA"). The analysis is provided below.

<sup>&</sup>lt;sup>1</sup> https://fortress.wa.gov/ecy/publications/SummaryPages/9406.html.

# **Description of the Site**

This opinion applies only to the Site described below. The Site is defined by the nature and extent of contamination associated with the following releases:

• Petroleum and petroleum constituents into the soil, groundwater, and air.

The parcel of real property associated with this Site is also located within the projected boundaries of the Asarco Tacoma Smelter facility (FSID 89267963). At this time, we have no information that the parcel is actually affected. This opinion does not apply to any contamination associated with the Asarco Tacoma Smelter facility.

# **Basis for the Opinion**

This opinion is based on the information contained in the following documents:

- 1. Conestoga-Rovers & Associates (CRA). 2005. Release Report, Flowserve Facility, Tacoma, WA. 29 June 2005.
- 2. CRA. 2006. Closure Report Automatic Transmission Fluid Release, Flowserve Facility, Tacoma, WA. 2 February 2006.
- 3. ERM-West, Inc. (ERM), Cleanup Action Progress Report (CAPR), January 2010. Flowserve Steam Supply, Tacoma, WA. Ecology Site ID: 8481432. January 2010
- 4. ERM, CAPR No. 2, September 2011. Flowserve Steam Supply, Tacoma, WA. Ecology Site ID: 8481432. September 2011.
- 5. ERM, *CAPR No. 3*, September 2014. Flowserve Steam Supply, 2007 Stewart Street, Tacoma, Washington. September 2014
- 6. ERM, Memorandum, December 2014.
- ERM, Memorandum, Project Update and Request for Opinion letter Regarding Site Characterization and Proposed Cleanup Levels, Flowserve Steam Supply, 2007 Stewart Street, Tacoma, Washington. 13 April 2015.
- 8. ERM, CAPR No. 4, Flowserve Steam Supply, 2007 Stewart Street, Tacoma, Washington. May 2018.
- 9. ERM, CAPR No. 5, Flowserve Steam Supply, 2007 Stewart Street, Tacoma, Washington. March 2019.
- 10. ERM, CAPR No. 6, Flowserve Steam Supply, 2007 Stewart Street, Tacoma, Washington. August 2020
- 11. ERM, CAPR No. 7, Flowserve Steam Supply, 2007 Stewart Street, Tacoma, Washington. August 2023.

Those documents are kept in the Central Files of the Southwest Regional Office of Ecology (SWRO) for review by appointment only. Information on obtaining those records can be found on Ecology's public records requests web page.<sup>2</sup> Some site documents may be available on Ecology's Cleanup Site Search web page.<sup>3</sup>

This opinion is void if any of the information contained in those documents is materially false or misleading.

# Analysis of the Cleanup

Ecology has concluded that further remedial action is necessary to clean up contamination at the Site. That conclusion is based on the following analysis:

## 1. Characterization of the Site.

The Site was occupied by Flowserve Steam Supply until 2005, when a diesel fuel release was discovered. During internal environmental facility audits in 2005, Flowserve discovered two petroleum releases which were reported to Ecology in the 29 June 2005 Release Report from Conestoga-Rovers & Associates (CRA). The first release was a diesel fuel leak from shallow underground piping that connected a boiler inside the former Flowserve facility to an aboveground storage tank located outside the north side of the facility. Additional information regarding the history of the hazardous substance release is provided in Cleanup Action Progress Report No. 3 dated September 2014. The second release was as an automatic transmission fluid leak from a compressor located in a shed outside the east corner of the building. Additional information regarding the investigation and cleanup of the automatic transmission fluid release are provided in the Conestoga-Rovers & Associates (CRA) Closure Report Automatic Transmission Fluid Release, Flowserve Facility, Tacoma, WA (CRA 2006).

Conestoga-Rovers & Associates (CRA) was retained by Flowserve in 2005 and conducted several cleanup actions and investigations from March 2005 to July 2008. The investigations included delineation of the magnitude and extent of TPH-D contamination to soil and groundwater, and subsequent removal, transport, and disposal of petroleum-contaminated soil (PCS). From May 6 to May 9, 2005, approximately 51 tons of PCS were removed from the area associated with the release along the northeastern corner of the former Flowserve facility building. Excavation activities were halted in the southerly direction due to presence of the building and the risk of compromising the integrity of its foundation. PCS (TPH-D/HO as a summed value) was determined to remain in excess of MTCA-A cleanup levels underneath the building's northeast corner, excavation sidewalls and in portions of the excavation bottom. Between June and September 2005, CRA conducted a remedial investigation and advanced a total of 12 soil borings. Benzene, toluene, ethylbenzene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs) were reportedly not detected above MTCA-A cleanup levels (CULs); however, TPH-D was detected above MTCA-A, and determined to be the

<sup>&</sup>lt;sup>2</sup> https://ecology.wa.gov/About-us/Accountability-transparency/Public-records-requests.

<sup>&</sup>lt;sup>3</sup> https://fortress.wa.gov/ecy/gsp/SiteSearchPage.aspx.

contaminant of concern (CoC) for the on-Site soil. Shallow groundwater was additionally determined to be impacted by TPH-D above the MTCA-A CUL and migrated outward from the excavation as a plume towards the southeast/south-southeast (ERM CAPR, 2010).

CRA initiated in-situ chemical oxidation (ISCO) treatments from September 2006 to April 2008 using Fenton's Reagent to degrade remnant PCS underneath the building and treat impacted groundwater through a series of injection wells and points. After ISCO treatment, general decreases of TPH-D/HO in groundwater were noted, but subsequent rebounds in CoC concentrations were observed. TPH-D/HO concentrations in soil remained above MTCA-A cleanup levels.

In 2008, ERM was retained by Flowserve and between 2008 and 2011, ERM investigated the magnitude and extent of PCS by installing four soil probes and three monitoring wells (MWs). An additional 815 tons of PCS were reportedly excavated, transported and disposed of off Site. ERM additionally amended PCS at the base of the excavation by adding ISCO compounds to enhance bioremediation and chemical oxidation. From March 1 to 4, 2010, ERM also performed ISCO injections at 15 locations near the former source area along the northeast corner of the Flowserve building. Confirmation samples collected from the excavation limits demonstrated the majority of PCS had been removed. The results of groundwater monitoring after ISCO amendments showed initial decreases in TPH-D/HO concentrations which subsequently rebounded. In general, the TPH-D/HO concentrations decreased yet remain above MTCA-A cleanup levels for groundwater, suggesting ISCO-driven attenuation of contaminants is minimal and ineffective.

Since December 2011, ERM advanced a total of 17 soil borings in an effort to further characterize the residual PCS located off the northeast corner of the former Flowserve building. An additional six soil borings were advanced in the vicinity of MW-8 (northern area of the delineated PCS).

ERM installed five additional MWs in December 2011 and November 2012 (MW-10 to MW-14). The MWs were installed to better characterize the western, southern, and eastern extents of the TPH-D/HO-impacted groundwater plume. According to recent groundwater monitoring data, the residual TPH-D/HO plume is centered around MW-3 and MW-10. According to recent groundwater monitoring data, the TPH-D/HO concentrations decreased since the last groundwater monitoring event on November 2012 at MW-3, MW-4, MW-8, MW-10, and MW-11. TPH-D/HO concentrations increased in MW-8 and MW-14. TPH-D/HO was not detected in MW-7, MW-9, and MW-12 (ERM Memorandum, December 2014, Enclosure B).

ERM advanced an additional 18 soil borings in January and February 2015. Recent characterization efforts in the northern areas ("hotspot" in the vicinity of MW-8 & SP-7) indicated residual PCS, which previously exceeded the MTCA-A cleanup levels, have been determined to be below MTCA-A cleanup levels. This "hotspot" appeared to have sufficiently degraded since the last soil investigation. As such, it was estimated that the areal extent of remnant PCS had decreased from approximately 920 square feet to approximately 500 square feet (ERM Memorandum, March 2015, Enclosure B).

Historical remedial characterization for the Site was summarized in Ecology's June 9, 2015, Opinion. Subsequently, ERM submitted the May 2018 and March 2019 CAPR's 4 and 5 and requested Ecology review the March 2019 CAPR to evaluate the appropriateness of abandoning monitoring wells MW3,

> MW7, MW9, and MW12 at the Site. Ecology responded to that request in the July 8, 2019, Opinion. The July 8, 2019, opinion did not evaluate the independent remedial actions (IRMs) taken to clean up soil or groundwater contamination at the Site or determine how the IRM cleanups meet the substantial requirements of MTCA.

> ERM submitted CAPR No. 6 in August 2020, and which stated that the frequency and number of wells sampled as part of the post-construction groundwater monitoring program at the Site was reduced in 2019. Concentrations of TPH-D/HO in groundwater samples at monitoring wells MW-3, MW-4, MW-7, MW-9, and MW-11 through MW-14 were below the MTCA-A cleanup level of 500 micrograms per liter ( $\mu$ g/L); therefore, groundwater monitoring ceased at these wells. Groundwater monitoring continued in MW-8 and MW-10 to evaluate TPH-D/HO in groundwater, although the monitoring frequency in these wells was reduced from quarterly to semi-annual. ERM did not request an opinion for the CAPR No. 6.

ERM's CAPR No. 7 summarized the groundwater monitoring results from 2020 through 2022 and concluded that the contaminant plume was reducing in concentration via biodegradation. This was based on groundwater analytical results indicating that elevated concentrations of TPH-D/HO (without silica gel cleanup [SGC]) consisted primarily of metabolites from biodegradation processes. It was further concluded that the high concentrations of metabolites in Site groundwater suggested that biodegradation was occurring throughout the TPH-D/HO plume and that detections of TPH-D/HO at the downgradient end of the plume are the result of metabolites and not the migration of petroleum hydrocarbons. ERM further stated the contaminant plume is completely contained on the Site and was generally decreasing in both size and concentration.

ERM reviewed TPH-D/HO analytical data along with Ecology's Draft Guidance for Silica Gel Cleanup in Washington State (Ecology 2022), and Implementation Memorandum No. 23: Concentrations of Gasoline and Diesel Range Organics Predicted to be Protective of Aquatic Receptors in Surface Waters (Ecology 2021). The document review was conducted to support changing the Site groundwater cleanup level (CUL) from the MTCA Method A CUL of 500  $\mu$ g/L to the Protective Value Freshwater alternative CUL of 3,000  $\mu$ g/L. As a result, ERM suggests use of the higher CUL was appropriate due to the petroleum metabolite load in groundwater quantified by comparing TPH-D/HO concentrations with and without SGC and Site groundwater being designated as non-potable with the highest beneficial use of groundwater at the Site being discharge to surface water.

ERM and Flowserve seek an opinion letter supporting a no further action determination at the Site.

Ecology's Comments:

a. Ecology's Role in Independent Cleanups in the VCP: Ecology would like to reiterate and clarify our role in providing assistance with this project. Independent cleanups carried out under WAC 173-340-515 are carried out without Ecology oversight or approval.<sup>4</sup> Ecology's opinions normally

<sup>&</sup>lt;sup>4</sup> WAC 173-340-515(1).

provide informal technical assistance on how a cleanup may meet the substantive requirements of MTCA.<sup>5</sup> Such advice or assistance is advisory only and not binding on Ecology.<sup>6</sup> Persons conducting independent remedial actions do so at their own risk, and may be required to take additional remedial actions if the department determines such actions are necessary.<sup>7</sup>

**b. References:** Please provide the Conestoga-Rovers & Associates 2005 and 2006 Reports to Ecology, referenced as follows:

1. Conestoga-Rovers & Associates (CRA). 2005. Release Report, Flowserve Facility, Tacoma, WA. 29 June 2005.

2. CRA. 2006. Closure Report – Automatic Transmission Fluid Release, Flowserve Facility, Tacoma, WA. 2 February 2006.

Ecology does not currently have these reports in our files but needs to review them to complete our assessment of the activities.

c. Compliance Monitoring Plan: Ecology's July 8, 2019, opinion letter indicated that a Site compliance monitoring plan should be developed to evaluate whether a specific monitoring well or wells are needed for ongoing remedial performance monitoring. Unless otherwise directed by Ecology, a compliance monitoring plan shall be prepared for every MTCA cleanup.<sup>8</sup> To date, a compliance monitoring plan is not currently included in Ecology's Site record for this cleanup.

A site's compliance monitoring plan is used to clarify how individual wells or groups of wells are used for compliance purposes for a cleanup. Sufficient performance monitoring shall be conducted at every Site to confirm that the interim action or cleanup action has attained cleanup standards.

Pending development of a Site compliance monitoring plan:

- Ecology suggests that it may be appropriate to temporarily discontinue regular monitoring at any Site monitoring well with more than four consecutive quarter-annual monitoring events reporting non-detect results for all hazardous substances found at the Site.
- Ecology suggests that pending Ecology's concurrence with a Site compliance monitoring plan, all Site monitoring wells should be maintained.
- Without reviewing the sufficiency of the Site cleanup as a whole, it will be difficult for Ecology to comment on the sufficiency of the compliance monitoring network. Ecology

<sup>&</sup>lt;sup>5</sup> WAC 173-340-515(5).

<sup>&</sup>lt;sup>6</sup> WAC 173-340-515(5).

<sup>&</sup>lt;sup>7</sup> WAC 173-340-515(3)(a).

<sup>&</sup>lt;sup>8</sup> WAC 173-340-410(2).

refers you to WAC 173-340-360 for the minimum requirements for a cleanup to comply with cleanup standards contained in WAC 173-340-700 through 760.

d. Current Data Gaps for Groundwater Monitoring Well Network: Remaining groundwater contaminant concentrations continue to be greatest at monitoring wells MW-8 and MW-10. Groundwater flow from MW-10 appears to be regularly depicted that groundwater flows from MW-10 to the south-southeast between monitoring wells MW-13 and MW-14.

Based on the reported directions of groundwater flow at the Site, Ecology suggests you obtain additional data, sufficient for Ecology to evaluate the following identified data gaps:

- For the two areas of the Site detailed below, Ecology suggests advancing a monitoring well or wells and including those wells with the regular monitoring events. Determine the hazardous substances detectable at these locations, ensuring that you obtain and report on the required analytes for unknown oil from WAC 173-340-900, Table 830-1.
  - Isocontours upgradient to the north-northwest of MW-8 are not adequately supported with data results. The extent of groundwater contamination to the north-northwest of MW-8 is not determined.
  - Isocontours downgradient to the south-southeast of MW-10, between MW-13 and MW-14 are not adequately supported with data results.
- The increase in TPH-D/HO concentrations at MW-10 observed in data obtained from September 2017 (1,300 µg/L) to September 2018 (6,600 µg/L) is not adequately explained in reporting. Further, TPH-D/HO concentrations in MW-10 were most elevated in December 2017 (7,500 µg/L) and 2019 (4,500 µg/L) which indicates that a greater saturated thickness of formation due to seasonal surface recharge likely impacted petroleum residues in the vadose zone. No correlative data was collected in December 2018 although we assume a similar relationship existed during that time. TPH concentrations at MW-10 in December 2020 and December 2021 decreased to 1,400 µg/L and 590 µg/L respectively, which may indicate dilution due to downgradient migration. In addition, well MW-14 exhibited increasing TPH concentrations at 750 µg/L during the last September 2018 monitoring event. Additional well network coverage as described above and sampling of both MW-13 and MW-14 is necessary to assess whether and to what degree contamination is currently moving downgradient in groundwater south-southeast (and potentially south-southwest) of MW-10.
- Please explain why monitoring wells MW-3, MW-4, MW-7, MW-8, and MW-13 have significant portions of their screened intervals completed in the organic-rich clay layer which is considered a confining layer. ERM is using SGC data to suggest that polar metabolites comprise a portion if not all of groundwater species which may likely exist at the downgradient edge of the plume and that are indicative of active biodegradation. Ecology is concerned that use of SGC obscures our understanding of anthropogenic metabolites and naturally occurring organic matter. Please discuss.

- Please provide the respective reports containing the monitoring well soil boring and construction logs.
- Please sample and analyze the existing well network for halogenated volatile organic compounds to assess past use and potential release of chlorinated solvents.
- e. Use of Silica Gel Cleanup: Additional information is needed for Ecology to concur with the use of silica gel cleanup for any analytical samples at this Site. With the data currently available, Ecology considers reported petroleum concentrations using silica gel cleanup at this Site to be minimum estimates of contamination present at those locations.

Ecology recognizes that there are situations where the use of silica gel treatment is appropriate at cleanup sites. An example is for sites with highly organic soils, such as peat, where very high concentrations of naturally occurring organic carbon impacts analytical results.

An example of data that may be useful for Ecology to support the use of silica gel cleanup is very high carbon fractions measured in both impacted areas and upgradient of the Site, in adjacent unimpacted areas. Delineation of total and dissolved organic carbon (T/DOC) in samples obtained at the Site and upgradient may provide support for use of silica gel cleanup. Demonstration of the impact of silica gel cleanup on upgradient unimpacted samples may provide another line of evidence. Despite being previously suggested by Ecology in our 2019 Opinion, no T/DOC data has been submitted to date.

Given the draft nature of the SGC guidance, if you choose to use silica gel cleanup on any samples used for either delineation of the plume in soil or groundwater, or for MTCA compliance, Ecology needs you to provide all the following supporting information for our review/concurrence:

- Tabulated and laboratory reporting of both pre- and post-silica gel treatment results at all sampling locations (completed).
- Chromatograms, calculations, and numerical estimations of variability or laboratory measurements based on laboratory QA/QC and supporting evidence and criteria for use of the method at each sample location (not completed).
- Sample results for this remedial investigation reported with and without the use of silica gel cleanup in plain view and geologic cross section concentration isopleth maps (completed).
- Evaluation of the impact of silica gel cleanup in both contaminated and upgradient, uncontaminated areas. Information of silica gel cleanup's impact on samples obtained from upgradient areas, and organic carbon measurements from unimpacted areas will be especially important to understand the biogenic influence of organic matter at the Site (not completed).

- Justify and calculate the risk of polar breakdown metabolites as part of the site-specific cumulative risk (not completed).<sup>9</sup>
- Organic carbon concentrations from the Site and upgradient of the Site (not completed).
- Analysis showing a statistically significant reduction in petroleum concentration using silica gel cleanup on the organic carbon signal in upgradient, unimpacted areas of the Site (not completed).

If a statistically significant difference is detected between upgradient samples with and without silica gel treatment, it may be appropriate to then subtract that amount from sample results from the Site not analyzed with silica gel, determined by other means to be impacted by the release.

If this approach is appropriate, be sure to carefully address how the Site was delineated, how the specific background samples were selected, and how the results were determined to be statistically significant. Ensure that you also report on organic carbon fractions in all samples.

f. Terrestrial Ecological Evaluation: Ecology suggests you consider recompleting the terrestrial ecological evaluation using an unrestricted land use scenario. In the conclusions contained in CAPR No. 3, you indicate that your goal is to seek no further action at the Site without institutional controls managed by an environmental covenant. Ecology respects that goal, and points out that in CAPR No. 3, Section 4.3, you conducted the simplified terrestrial ecological evaluation using commercial/industrial evaluation levels.

Use of commercial/industrial evaluation levels for a terrestrial ecological evaluation will result in the need to establish an environmental covenant in perpetuity to maintain that Site use. Ecology suggests you reevaluate your terrestrial ecological evaluation with respect to the stated goal.

**g. Groundwater Potability Determination:** Ecology concurs with the conclusion that groundwater in the area is not potable, that no beneficial uses exist now or likely in the future, that human health groundwater cleanup levels are not appropriate for this Site, and that the highest groundwater beneficial use is discharge to marine surface water. Ecology suggests obtaining salinity and chloride to the analytical suite to better understand the classification of the receiving waters.

<sup>&</sup>lt;sup>9</sup> For example: Petroleum Metabolites Literature Review and Assessment Framework Technical Resource Document, San Francisco Bay Regional Water Quality Control Board, June 27, 2016, accessed February 4, 2019 at https://www.waterboards.ca.gov/sanfranciscobay/publications\_forms/documents/SF\_WB\_Petroleum\_Metabolites .pdf.

### 2. Cleanup Standards

Under MTCA, cleanup standards consist of three primary components; (a) points of compliance,<sup>10</sup> (b) cleanup levels,<sup>11</sup> and (c) applicable local, state, and federal laws.<sup>12</sup> Cleanup standards must be demonstrated as likely to be met within a reasonable restoration timeframe.<sup>13</sup> Ecology suggests reviewing the following information to determine how the cleanup levels and points of compliance you established for the Site meet the substantive requirements of MTCA.

**a. Points of Compliance:** Ecology provides the following list of points of compliance applicable to the Site.

Media	Points of Compliance
Soil-Direct Contact	Based on human exposure via direct contact, the standard point of compliance is throughout the Site from ground surface to fifteen feet below the ground surface. <sup>14</sup>
Soil- Protection of Groundwater	Based on the protection of groundwater, the standard point of compliance is throughout the Site. <sup>15</sup>
Soil-Protection of Plants, Animals, and Soil Biota	Based on ecological protection, the standard point of compliance is throughout the Site from ground surface to fifteen feet below the ground surface. <sup>16</sup>
Groundwater	Based on the protection of groundwater quality, the standard point of compliance is throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site. <sup>17</sup>
Groundwater-Surface Water Protection	Based on the protection of surface water, the standard point of compliance is all locations where hazardous substances are released to surface water. <sup>18</sup>
Air Quality	Based on the protection of air quality, the point of compliance is indoor and ambient air throughout the Site. <sup>19</sup>
Sediment	Based on the protection of sediment quality, compliance with the requirements of 173-204 WAC. <sup>20</sup>

<sup>&</sup>lt;sup>10</sup> WAC 173-340-200 "Point of Compliance."

<sup>&</sup>lt;sup>11</sup> WAC 173-340-200 "Cleanup level."

<sup>&</sup>lt;sup>12</sup> WAC 173-340-200 "Applicable state and federal laws," WAC 173-340-700(3)(c).

<sup>&</sup>lt;sup>13</sup> WAC 173-340-700(7), WAC 173-340-360.

<sup>&</sup>lt;sup>14</sup> WAC 173-340-740 (6)(d).

<sup>&</sup>lt;sup>15</sup> WAC 173-340-747.

<sup>&</sup>lt;sup>16</sup> WAC 173-340-7490(4)(b).

<sup>&</sup>lt;sup>17</sup> WAC 173-340-720(8)(b).

<sup>&</sup>lt;sup>18</sup> WAC 173-340-730(6).

<sup>&</sup>lt;sup>19</sup> WAC 173-340-750(6).

<sup>&</sup>lt;sup>20</sup> WAC 173-340-760.

- b. Cleanup Levels: For each media and point of compliance above that you determine applicable to the Site, ensure you determine and apply appropriate cleanup levels for each hazardous substance detected at the Site. Apply the proposed cleanup levels at the appropriate points of compliance.
  - Soil: MTCA Method-A cleanup levels for both soils and groundwater have been established under the industrial land use scenario. The Site is zoned Port Maritime & Industrial, and the City of Tacoma has identified the area for future Port and Maritime industrial use (ERM CAPR No. 3).

During previous investigations, BTEX and PAHs were not identified as CoCs for the Site. However, TPH-D and TPH-HO were identified as the CoCs for the Site in both soil and groundwater. The TPH-D and TPH-HO sample results were combined for each sample that span both the TPH-D and TPH-HO ranges, inclusive of a heavily weathered diesel product. This was done in accordance with an Ecology Memorandum, *Determining Compliance with Method-A Cleanup Levels for Diesel and Heavy Oil*, Ecology, June 17, 2004.

Cleanup levels for soil were adopted after evaluating the protection of several receptors, including human health direct contact with soil, terrestrial wildlife direct contact with soil, protection of groundwater resources leaching from soil, and protection of indoor air from soil vapor intrusion (ERM CAPR No. 3). This resulted in a cleanup level of 2,000 mg/Kg (MTCA-A cleanup level for industrial land use).

- Groundwater Cleanup Levels Based on Discharge to Surface Water: Ecology concurs with the highest beneficial use of groundwater at this Site as discharge to marine surface water. Accordingly, and as specified in Table 1 of Ecology's Implementation Memorandum No. 23: Concentrations of Gasoline and Diesel Range Organics Predicted to be Protective of Aquatic Receptors in Surface Waters (2021), Ecology recommends using the Protective Value Marine Waters of 2,000 micrograms per liter for weathered diesel-range organics.
- Applicable Laws and Regulations: In addition to establishing minimum requirements for cleanup standards, applicable local, state, and federal laws may also impose certain technical and procedural requirements for performing cleanup actions. These requirements are described in WAC 173-340-710 and are similar to the "ARAR" (applicable, relevant, and appropriate requirements) approach of the federal superfund law.
- All cleanup actions conducted under MTCA shall comply with applicable local, state, and federal laws.<sup>21</sup>
- The person conducting a cleanup action shall identify all applicable local, state, and federal laws. The department shall make the final interpretation on whether these

<sup>&</sup>lt;sup>21</sup> WAC 173-340-710(1)

requirements have been correctly identified and are legally applicable or relevant and appropriate.<sup>22</sup>

- There are three general groups of applicable local, state, and federal laws for you to identify:
  - Chemical-Specific: Examples of chemical-specific laws include promulgated concentrations from another rule that result in adjusting proposed cleanup levels. Method A is inclusive of these laws. For Methods B or C, additional evaluation of chemical-specific applicable state and federal laws is required.
  - Action-Specific: Examples of action-specific laws include requirements for obtaining local permits to excavate and/or dispose of contaminated soil, stormwater construction permits, or the requirement to notify in case human remains are discovered during excavation. All MTCA cleanups require evaluation of action-specific applicable state and federal laws.
  - Location-Specific: Examples of location-specific laws include specific requirements for working near wetlands or archeologically important areas. All MTCA cleanups require evaluation of location-specific applicable state and federal laws.

After you have selected appropriate applicable local, state, and federal laws, justify in reporting the applicable local, state, and federal laws selections you made and how those laws and regulations impact proposed cleanup levels, points of compliance, or the cleanup, if at all. Provide all permits obtained for the cleanup action.<sup>23</sup>

**c. Reasonable Restoration Timeframe:** To determine whether a cleanup action provides for a reasonable restoration time frame, the factors of WAC 173-340-360(4)(b), as appropriate, need to be considered.

## 3. Selection of Cleanup Action.

In Ecology's June 9, 2015, opinion for the Site, Ecology determined that the cleanup action you selected for the Site meets the substantive requirements of MTCA. For that opinion, ERM proposed the excavation, transportation, and off-Site disposal of residual PCS located underneath and in the vicinity of the northeast comer of the former Flowserve building. ERM proposed natural attenuation and in-situ treatment as the remedial action to address groundwater. In that opinion, Ecology requested you demonstrate that the cleanup you conducted meets the substantive requirements of MTCA by collecting:

• Sufficient soil samples from the proposed excavation sidewalls and bottom demonstrating compliance with cleanup standards.

<sup>&</sup>lt;sup>22</sup> WAC 173-340-710(2).

<sup>&</sup>lt;sup>23</sup> WAC 173-340-710(9)(a).

• Four consecutive quarters of groundwater sampling with results below MTCA cleanup levels demonstrating compliance with cleanup standards.

#### 4. Cleanup.

The following interim actions have been completed at the Site:

- CRA May 6-9, 2005, IRM. Approximately 51 tons of PCS were removed from the area associated with the release along the northeastern corner of the former Flowserve facility building. Excavation activities were halted in the southerly direction due to presence of the building and the risk of compromising the integrity of its foundation. PCS (TPH-D/HO) was determined to remain in excess of MTCA-A cleanup levels underneath the building's northeast corner/sidewalls and in portions of the excavation bottom. Between June and September 2005, CRA conducted a remedial investigation and advanced a total of 12 soil borings. Benzene, toluene, ethylbenzene and xylenes (BTEX) and polycyclic aromatic hydrocarbons (PAHs) were reportedly not detected above MTCA-A cleanup levels (CULs); however, TPH-D was detected above MTCA-A and determined to be the contaminant of concern (CoC) for the on-Site soil. Shallow groundwater was additionally determined to be impacted by TPH-D above the MTCA-A CUL and migrated outward from the excavation as a plume towards the southeast/south-southeast (ERM CAPR, 2010).
- CRA September 2006 April 2008 IRM. In-situ chemical oxidation (ISCO) treatments using Fenton's Reagent were implemented through a series of injection wells and points in an effort to naturally attenuate the remaining PCS pocket underneath the former Flowserve building and impacted groundwater. After the ISCO remedial treatments, general decreases in TPH-D/HO in groundwater were noted, but subsequent rebounds in contaminant concentrations transpired. TPH-D/HO concentrations in soil remained above MTCA-A cleanup levels.
- ERM 2008 2011 IRM. An additional 815 tons of PCS from north of the former Flowserve building and from the Morgan Trucking driveway northeast of the building were reportedly excavated, transported, and disposed of off Site. ERM additionally amended PCS at the base of the excavation by adding ISCO compounds to enhance bioremediation and chemical oxidation. From March 1 to 4, 2010, ERM also performed ISCO injections at 15 locations near the former source area along the northeast corner of the Flowserve building. Confirmation sample data collected from the excavation limits exhibited the majority of PCS had been removed. The results of groundwater monitoring after ISCO amendments showed initial decreases in TPH-D/HO concentrations with subsequent rebound. In general, the TPH-D/HO concentrations decreased, yet remain above MTCA-A cleanup levels for groundwater, suggesting natural attenuation of contaminants was minimal and ineffective.
- ERM March-April 2017 IRM (ERM CAPR No. 4; May 2018). Removed PCS from beneath and adjacent to the northeast corner of the former Flowserve building using a drill rig equipped with a large (2-foot)-diameter auger (LDA) and advancing overlapping boreholes. A total of 42 LDA borings were advanced to a depth of 16 feet below ground surface (bgs) and backfilled

with a controlled low strength material (CLSM). Soils were removed from beneath and adjacent to the building walls via 9 slot trenches and conventional excavation methods to depths ranging from 12 feet bgs on the east side of the building to 15 feet bgs on the north side of the building. Four of the slot trenches on the east side of the building and the two slot trenches on the north side of the building were backfilled with CLSM. A bioremediation amendment, BOS200<sup>®</sup>, was placed at the bottom of the remaining slot trenches and the conventional excavation areas prior to ERM backfilling those areas with quarry spalls and 2-inch minus quarry product. A total of 732 tons of petroleum-impacted soil was removed from the Site and transported to Pierce County Recycling, Composting, and Disposal, LLC (dba LRI) in Puyallup, Washington, for disposal in March and April 2017.

Confirmation soil sampling was performed by ERM prior to and during soil removal activities to confirm complete removal of soil contaminated with TPH-D/HO at concentrations exceeding soil cleanup levels. Confirmation soil samples were collected prior to initiating LDA soil removal activities because the LDA borings would be backfilled with CSLM immediately after removing impacted soil. Confirmation soil samples were collected from soil borings advanced via direct-push drilling methods within and at the limits of the interior soil removal area. A total of six soil borings were advanced in March 2017 at the direction of ERM with soil confirmation samples collected from the sidewalls and base of the exterior soil removal area and analyzed for TPH-D/HO. A total of 13 confirmation soil samples were collected from the exterior soil removal area. The aggregate confirmation soil sample results indicated that both interior and exterior TPH-D/HO concentrations at the proposed limits of the excavation area are below the Site soil cleanup level (CUL) of 2,000 mg/kg.

To address residual groundwater contamination and concentrations of TPH-D/HO below cleanup levels remaining in the saturated soils after completing the soil removal, a slurry of BOS 200<sup>®</sup> and a concentrated bacteria mixture was added to the bottom of the excavation areas that had not been backfilled with CLSM. BOS 200<sup>®</sup> is an activated carbon product that traps petroleum compounds and enhances sustained biodegradation under both aerobic and anaerobic conditions. BOS 200<sup>®</sup> was placed as a slurry in three slot trenches and conventional excavation areas. The slurry consisted of the BOS 200<sup>®</sup> product, a concentrated bacteria mixture, and clean water and was mixed in a backhoe bucket and placed on top of a 2-foot layer of clean backfill previously added to the bottom of the excavation areas. The slurry was allowed to settle into the backfill before adding additional backfill. A total of 200 pounds of BOS 200<sup>®</sup> and 5 gallons of bacteria concentrate were placed in the excavation.

Ecology supports the IRMs taken to reduce contaminant concentrations at the Site.

# Limitations of the Opinion

#### 1. Opinion Does Not Settle Liability with the State.

Liable persons are strictly liable, jointly and severally, for all remedial action costs and for all natural resource damages resulting from the release or releases of hazardous substances at the Site. This opinion **does not**:

- Resolve or alter a person's liability to the state.
- Protect liable persons from contribution claims by third parties.

To settle liability with the state and obtain protection from contribution claims, a person must enter into a consent decree with Ecology under RCW 70.105D.040(4).

### 2. Opinion Does Not Constitute a Determination of Substantial Equivalence.

To recover remedial action costs from other liable persons under MTCA, one must demonstrate that the action is the substantial equivalent of an Ecology-conducted or Ecology-supervised action. This opinion does not determine whether the action you performed is substantially equivalent. Courts make that determination. See RCW 70.105D.080 and WAC 173-340-545.

**3. State is** Immune from Liability.

The state, Ecology, and its officers and employees are immune from all liability, and no cause of action of any nature may arise from any act or omission in providing this opinion. *See* RCW 70.105D.030(1)(i).

### **Contact Information**

Thank you for choosing to clean up the Site under the Voluntary Cleanup Program (VCP). After you have addressed our concerns, you may request another review of your cleanup. Please do not hesitate to request additional services as your cleanup progresses. We look forward to working with you.

For more information about the VCP and the cleanup process, please visit our Voluntary Cleanup Program web site.<sup>24</sup> If you have any questions about this opinion, please contact me at (360) 489-5347 or joe.hunt@ecy.wa.gov.

Sincerely,

Joseph B. Hunt, LHG Toxics Cleanup Program Southwest Regional Office

JH:at

cc: Bob Bernstein, <u>Bob@LocateHere.com</u>, Site Owner Mike Mendes, <u>mike.mendes@erm.com</u>, ERM Jerome Lambiotte, CPG, Ecology <u>Jerome.Lambiotte@ecy.wa.gov</u> Ecology Site File

<sup>&</sup>lt;sup>24</sup> https://ecy.wa.gov/vcp.