Draft

Cleanup Action Plan

BURLINGTON ENVIRONMENTAL KENT FACILITY
20245 77th Avenue South
Kent, Washington

April 2025

Issued by
Washington State Department of Ecology
Hazardous Waste and Toxics Reduction Program
Northwest Region Office
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ACRONYMS AND ABBREVIATIONS

AOC .... Area of concern
ARAR .... Applicable or relevant and appropriate requirements
bgs .... Below ground surface
City .... City of Kent
CLARC .... Cleanup Levels and Risk Calculations
COC .... Constituent of concern
CPOC .... Conditional point of compliant
CSM .... Conceptual site model
CUL .... Cleanup level
dCAP .... Draft Cleanup Action Plan
DOF .... Dalton, Olmsted, and Fuglevand
Ecology .... Washington State Department of Ecology
EDR .... Engineering Design Report
EPA .... U.S. Environmental Protection Agency
FS .... Feasibility Study
FSWP .... Feasibility Study Work Plan
IC .... Institutional control
µg/L .... Micrograms per liter
mg/L .... Milligrams per liter
MNA .... Monitored Natural Attenuation
MTCA .... Model Toxics Control Act
POC .... Point of compliance
PQL .... Practical quantitation limit
RCRA .... Resource Conservation and Recovery Act
RCW .... Revised Code of Washington
RFA .... RCRA facility assessment
RI .... Remedial investigation
Site .... Burlington Environmental Kent Facility
SPOC .... Standard point of compliance
Stericycle .... Stericycle Environmental Solutions
TPH .... Total petroleum hydrocarbons
TPH-D .... Total petroleum hydrocarbons in the diesel range
TPH-G .... Total petroleum hydrocarbons in the gasoline range
UST .... Underground storage tank
VOC .... Volatile organic compound
WAC .... Washington Administrative Code

1.0 Introduction

This draft Cleanup Action Plan (dCAP) describes the cleanup action selected by the Washington State Department of Ecology (Ecology) for the Burlington Environmental Facility located in Kent, Washington (Site). The Site is located at 20245 77th Avenue South in Kent, Washington (Figure 1). This dCAP was developed using information presented in the Remedial Investigation (RI)/Feasibility Study (FS) for the Site, which was finalized by Dalton, Olmsted, and Fuglevand (DOF) in 2017 (DOF, 2017) on behalf of Burlington Environmental (formerly known as Stericycle Environmental Solutions) in accordance with their Resource Conservation and Recovery Act (RCRA) Part B permit No. WAD 991 281 767. A dCAP was prepared in 2018 to satisfy the RCRA corrective actions requirements of the RCRA Permit as well as Chapter 70A.305 of the Revised Code of Washington (RCW), administered by Ecology under the Model Toxics Control Act (MTCA) Cleanup Regulation, Washington Administrative Code (WAC) 173-340.

The purpose of the dCAP is to identify the proposed cleanup action for the Site and to provide an explanatory document for public review. More specifically, this plan:

- Describes the Site;
- Summarizes current Site conditions;
- Summarizes the cleanup action alternatives considered in the remedy selection process;
- Describes the selected cleanup action for the Site and the rational for selecting this alternative;
- Identifies Site-specific cleanup levels (CULs) and points of compliance for each hazardous substance and medium of concern for the proposed cleanup action;
- Identifies applicable state and federal laws for the proposed cleanup action;
- Identifies residual contamination remaining on the Site after cleanup and restrictions on future uses and activities at the Site to ensure continued protection of human health and the environment;
- Discusses compliance monitoring requirements; and
- Presents the schedule for implementing the dCAP.

1.1 Previous Studies

The U.S. Environmental Protection Agency (EPA) completed a RCRA facility assessment (RFA) between 1993 and 1996 in preparation for issuing the Hazardous and Solid Waste Amendments (HSWA) 3004 section of the RCRA Part B operating permit. In September 1998, EPA and Ecology jointly issued the RCRA Part B permit for the Site. Areas of concern (AOCs) were identified for the Site as part of the RFAs. Burlington Environmental (and its predecessors) have conducted corrective actions work under the RCRA Part B Permit in collaboration with Ecology since that time.

An RI report was prepared in 2007 (Geomatrix, 2007) and an FS Work Plan (FSWP) was prepared in 2015 (Amec, 2015). The FSWP presented updated contaminant distribution information and outlined the process that would be used to conduct the FS. A draft FS was submitted in April 2016 (Amec and DOF, 2016) and conditionally approved by Ecology in October 2016 (Ecology, 2016). This final RI/FS (DOF, 2017) included reissuing the 2007 RI and the Revised Final FS, including revisions and additional information requested by Ecology as part of the 2016 FS conditional approval. Ecology approved that report in a letter dated February 20, 2018 (Ecology, 2018).The RI/FS was approved by Ecology on March 20, 2018.

Five AOCs have been identified based on these previous studies. They are defined as the following:

- AOC-1: Former Underground Storage Tanks (USTs)
- AOC-2: Tank Farm Area
- AOC-3: Stabilization Area
- AOC-4: Stormwater Drainage System
- AOC-5: Process and Storage Area

The selected cleanup alternative for the Site addresses all of the AOCs listed above.

2.0 Site Description and Background

The site is located on a 6.25-acre parcel of land that can be divided into two areas: (1) the waste management facility on the eastern 3 acres of the Site, and (2) the 10-day hazardous waste transfer yard on the western 3.25 acres of the Site (Figure 2). The site is located in a heavily industrial area of the City of Kent (the City), in an area zoned M3 for general industrial land use by the City (DOF, 2017).

The properties surrounding the Site are other commercial and industrial facilities. The City's Comprehensive Plan adopted the implementation of zoning regulations under the Growth Management Act (Chapter 36.60A. RCW), which designated a manufacturing/industrial center and discourages and limits land uses other than manufacturing, high technology, and warehousing within the boundaries of the center. The Site is located with the City's designated manufacturing/industrial center.

2.1 Site History

Historical aerial photographs reviewed as part of the RI show that land use at the Site and in the surrounding area was primarily agricultural during the first half of the 20th century. By approximately 1980 the Site appears to have been cleared of all buildings and crops, and filled/graded prior to industrial facility construction. In 1980, Crosby and Overton, Inc., began developing the site as a commercial treatment and storage facility for oily wastewater. Hazardous waste management activities commenced in the 1980s and Chemical Processors, Inc. (a predecessor of Burlington Environmental) acquired the Site in 1989 (Geomatrix, 2007).

The Site currently consists of an office, a process containment building, container storage areas, a tank farm with aboveground storage tanks, and a treatment and solidification building. Container storage areas include the north and south container storage pads and the process containment building, which has storage areas for flammable waste, laboratory packs, and household waste. Existing facility operations include wastewater treatment (non-hazardous and RCRA/WA State dangerous waste), solidification, lab packing, and waste processing (e.g., consolidation, can crushing, shredding, baling, etc.). The 10-day RCRA hazardous waste transfer yard is located on the western 3.25 acres of the Site and was undeveloped until 2001 when the transfer yard was constructed. The transfer yard includes concrete pads and containment for transfer trailers and roll-off boxes, a fully lined stormwater retention pond, and a bio-filtration swale. The swale drains to a drainage ditch and culvert running along the northern edge of the Site.

Most operations that were regulated under Washington Dangerous Waste Code WAC 173-303 were halted in 2017. Remaining operations are mainly regulated under the Washington Solid Waste Code, which includes non-Federal Hazardous or State Dangerous wastes and Household Hazardous waste. However, TSCA-related waste management including mixed TSCA/Dangerous waste continues to occur on site under Permit in a room designated for that purpose. The Kent facility remains operating under a modified RCRA Part B Permit which was updated to reflect the change in operations.

2.2 Site Geology and Hydrogeology

The near-surface geology and hydrogeology at the Site is characterized by alternating sand and silty/clayey layers and is distinguished by the following eight units, listed in order of increasing depth:

- **Sandy Fill/Shallow Water-Bearing Unit.** Depth to the base of the fill is variable, but typically is found from ground surface to 5 to 7 feet bgs, hydraulically unconfined, becomes unsaturated during the period of low rainfall in summer and early fall.
- **Upper Silt and Clay Unit/Upper Aquitard**. Typically found between 5 to 17 feet bgs (varies) and up to 9 feet thick, partially unsaturated during the late summer and early fall. High in organic carbon content which combined with the low permeability of the silt and clay should make the upper aquitard a natural barrier to downward contaminant transport. Seasonally perched groundwater influences the oxidation-reduction potential favoring a tendency toward reducing conditions in shallower groundwater zones at the site.
- **Upper Silty Sand-Sand Unit/Intermediate Aquifer**. Fully saturated year-round. This unit has a silt layer present in the eastern and southeastern portions of the Site (up to 7 feet thick), but that silt is absent in the north and south central portions of the Site. Exact starting depths vary across the site (from 10 to 15 feet bgs) but a maximum depth of 25 feet bgs.
- **Lower Silt Unit/Lower Aquitard**. Thickness varies from about 2 to 10 feet and is typically encountered between 25 and 30 to 35 feet bgs.
- **Lower Sand Unit/Deep Aquifer**. Hydraulically confined year-round by the overlying lower aquitard. Groundwater flow direction is uniform, suggesting that lower aquitard is continuous, and directed to the west (typically encountered between 22 feet to 40 feet bgs).
- **Deep Silt Unit/Deep Aquitard**. Appears to be continuous across the site (typically at depths greater than 40 feet bgs).

Groundwater within the fill unit likely perches on the upper aquitard during wet months, and this water drains slowly into the upper portion of the intermediate aquifer. The intermediate aquifer is separated from the deep aquifer by a relatively thick silt and silty sand aquitard.

The fill unit and the upper aquitard represent important considerations in the hydrogeology and potential hydrogeochemistry of the Site. The upper aquitard represents the original ground surface prior to Site development, and the aquitard consists of silt and clay related to alluvial floodplain deposits of the Green River Valley. As a result, this aquitard is high in organic carbon content, which combined with the low permeability of the silt and clay should make the upper aquitard a natural barrier to downward contaminant transport. In addition, the seasonally perched groundwater affects the groundwater chemistry. In particular, the perched groundwater influences the oxidation-reduction potential favoring a tendency toward reducing conditions in the saturated portion of the fill and in Zone A of the intermediate aquifer.

2.2.1 Groundwater Flow

In the shallow water-bearing unit the groundwater flow is westerly when saturated in the spring, but by the fall most of the shallow zone wells have gone dry.

The groundwater flow directions in the intermediate aquifer are more complex. The groundwater flows towards an apparent low that centers around MW-124-I (Figure 2). This is an area where the silt layer within the intermediate aquifer is not present. Groundwater elevations in the intermediate aquifer in the spring are all lower than those in the overlying shallow water-bearing unit, indicating that groundwater will flow vertically from the shallow zone into the intermediate aquifer. In the fall, the same area mounds and groundwater flows away from this mound in several directions.

Groundwater flow direction in the deep aquifer is uniform and directed to the west.

The following list shows the horizontal groundwater seepage velocities calculated in the RI.

- Shallow water-bearing unit: 1.2 to 3.8 feet/day
- Intermediate aquifer: 0.008 to 0.25 foot/day
- Deep aquifer: 0.04 to 0.6 foot/day

2.3 Human Health and Environmental Concerns

The primary sources of contaminants of concern (COCs) at the Site are releases from tanks and piping and constituents spilled at the Site resulting in soil and groundwater impacts. A conceptual site model (CSM) was prepared as part of the RI/FS based on current and assumed future industrial land use at the Site and continued industrial and commercial land use in the surrounding area (Figure 3).

COCs in groundwater at the Site may migrate and affect groundwater in offsite areas. Some of the more volatile constituents detected in soil and groundwater could potentially volatilize into soil gas, which could then migrate to indoor air of nearby buildings. Groundwater concentrations in the area of the existing building at the Site continue to be monitored and have been mostly non-detect for VOCs. Future buildings would be addressed as part of institutional controls, if warranted. It is assumed that concentrations of volatile compounds migrating from soil gas to outdoor air will be negligible due to rapid mixing and dilution in ambient air under normal working conditions. However, volatile compounds may migrate from soil gas to outdoor air in trenches during excavation activities. As the site is predominantly covered with buildings, concrete, or pavement, constituents detected in surface soil are unlikely to be mobilized in fugitive dust; and constituents detected in soil are also unlikely to leach to groundwater unless the industrial development is removed in the future. Constituents in groundwater may migrate to local surface water bodies via the drainage ditch along the northern border of the Site. This ditch could also be a source of recharge to the fill unit during the winter.

Since the Site is zoned industrial, groundwater in the shallow water-bearing unit and intermediate aquifer is not a current or future source of drinking water. The deep aquifer is also not a current or potential future source of drinking water, due to the confining clay layer beneath it. All public groundwater supply wells within 1 mile of the Site are deeper than the deep aquifer and are not a possible receptor of groundwater migrating from the Site.

- **Soil.** The RI identified a list of preliminary soil COCs which was narrowed as part of the FS based on concentration and preliminary CULs. Soil COCs considered in the FS included *volatile organic compounds (VOCs; benzene and vinyl chloride), polycyclic aromatic hydrocarbons (PAHs; benzo(a)pyrene, benzo(b)fluoranthene, and chrysene), total petroleum hydrocarbons (TPH), arsenic, and cyanide*. Soil data indicate that the tank farm may be the primary source for releases to the soil and groundwater. The lateral and vertical extent of these COCs appear to be limited, and primarily present in the area of AOC-2 (tank farm), and they do not appear to be migrating from the site at concentrations exceeding groundwater CULs.

- **Groundwater.** In groundwater, the COCs considered in the FS were vinyl chloride, arsenic, hexavalent chromium, cyanide, and iron.
    - ***Vinyl chloride***. Concentrations of vinyl chloride in groundwater have declined and evidence of biodegradation continues. Trends at the only well where vinyl chloride has been detected recently (MW-120-I1) indicate concentrations are nearing the CUL or non-detect (see Figure 6).
    - ***Arsenic.*** In contrast, arsenic concentrations in groundwater have not exhibited any significant increasing or decreasing trends over time. Arsenic levels may be related to seasonal variability in the geochemistry of groundwater, as evidenced by seasonally higher concentrations in the shallower groundwater zones.
    - ***Iron.*** Concentrations in groundwater at the site have not exhibited any significant increasing or decreasing trends over time. Historical releases of organic constituents could have contributed to reducing conditions and solubilization of iron, leading to higher concentrations of inorganic constituents.
    - Data for ***hexavalent chromium*** in groundwater prior to the FS were flagged for data quality issues since many reported hexavalent chromium results were higher than corresponding total chromium results. Burlington Environmental collected additional samples as part of the FS. Total/dissolved chromium has not been detected at any location above the preliminary CUL (for hexavalent chromium) and is consistently lower than the reported hexavalent chromium fraction. Therefore, hexavalent chromium is not a target compound for cleanup at the site.
    - ***Cyanide*** has been detected sporadically in groundwater at the site. As part of the FS, additional samples were analyzed for total, free, and weak acid dissociable cyanide to evaluate if the cyanide detected was in strong metal bound forms or if it was more biologically available. Results indicate that the cyanide present in groundwater at the site is not free cyanide and is not biologically available. Therefore, cyanide is not a target compound for cleanup at the site.

COCs in surface soil are unlikely to be mobilized in fugitive dust since the site is mostly developed; and constituents detected in soil are also unlikely to leach to groundwater unless the industrial development is removed in the future. COCs in groundwater at the Site may migrate and affect groundwater in offsite areas. Constituents in groundwater may migrate to local surface water bodies via a drainage ditch along the northern border of the Site. This ditch could also be a source of recharge to the fill unit during the winter.

The potential for exposure to contaminated soils or the migration of the COCs identified in soil and groundwater at concentrations exceeding CULs is unlikely under both current and future land use scenarios. The surface of the Site and most of the transfer yard is entirely covered with asphalt, concrete, or buildings. This surface cover effectively minimizes the leaching of soil COCs to groundwater, except where groundwater is in direct contact with COCs, which occurs only during the wettest periods of the year. As long as this low-permeability cover remains in place on most of the Site, leaching of COCs is assumed to be low. The only area on the Site where COCs in soil have also affected groundwater is in

AOC-2. However, the COCs in groundwater are a much smaller subset of those found in soil, the concentrations are generally very low, and the areal extent of groundwater impacts is limited.

3.0 Cleanup Standards

Establishment of cleanup standards requires specification of the CULs (chemical concentrations that are protective of human health and the environment) for each COC in each impacted media and the location on the site where the CULs must be attained, i.e., the point of compliance (POC). CULs for this dCAP were taken from those previously established in the FS and then updated to reflect current risk-based values presented in Ecology's Cleanup Levels and Risk Calculation (CLARC).

3.1 Soil Cleanup Levels

Soil CULs selected for the Site constitute MTCA Method C CULs under WAC 173- 340-745 and must be protective of human health and the environment. Soil CULs were developed by determining the lower value between the following:

- MTCA Method C Industrial Cleanup Level based on direct contact/ingestion obtained from the CLARC website (Ecology, 2020).
- MTCA Method A Soil Cleanup Levels for Industrial Land Use (MTCA Table 745-1) for constituents with no available Method C CULs.
- Soil CULs protective of preliminary groundwater CULs described in Section 3.2 (WAC 173-340-747[4]).

The final values were compared to Puget Sound natural background levels as calculated by Ecology (1994) and adjusted upward if that value was higher as is the case with arsenic. The soil CULs are presented in Table 1.

3.2 Groundwater Cleanup Levels

Groundwater CULs were developed to be protective of drinking water, surface water, and indoor air by determining the lower of the value between the following:

- MTCA groundwater table values obtained from the CLARC website (Ecology, 2020):
  - MTCA Method A levels for constituents that do not have a Method B level available
  - MTCA standard Method B levels based on drinking water beneficial use, which include Federal maximum contaminant levels
- Surface water applicable or relevant and appropriate regulations (ARARs):
  - Water Quality Standards for Surface Waters of the State of Washington (WAC 173-201A) – Acute and Chronic effects, Aquatic Life, Freshwater
  - National Recommended Water Quality Criteria (Clean Water Act §304) – Freshwater, Acute and Chronic effects, Aquatic Life and for the Protection of Human Health, Consumption of Water and Organisms and Consumption of Organisms Only
  - National Toxics Rule (40 Code of Federal Regulations 131) – Freshwater, Acute and Chronic effects, Aquatic Life, and Human Health, Consumption of Water and Organisms
- MTCA Method B Surface Water levels, calculated using CLARC tables if a federal or local surface water value is not found in the ARARs (Ecology, 2020)

- MTCA groundwater values protective of indoor air obtained from the CLARC website (Ecology, 2020).

The determined values were compared to the laboratory screening levels and were adjusted upward in accordance with WAC 173-340-707 if they were below the PQL.

Area background levels were also considered in developing CULs consistent with the requirements of WAC 173-340-709. Area background calculations were conducted as part of the FS for COCs that were sporadically detected within the groundwater data set and for which a historical source of contamination was not identified. This assessment was applicable only to arsenic and iron, and was done to distinguish site-related concentrations from non-site-related concentrations. Consistent with WAC 173-340-706(1)(a)(i) the CULs for the COCs arsenic and iron were set to the MTCA C values because the calculated background values were greater than the MTCA C values. The groundwater CULs are presented in Table 2.

3.3 Point of Compliance

As defined in the MTCA regulations, the POC is the point or points at which CULs must be attained and may be a standard POC (SPOC) or a conditional POC (CPOC). A SPOC requires attaining cleanup levels throughout the site. The relevant regulatory provisions for establishing a CPOC for affected groundwater at the site are presented in WAC 173-340-720(8). For groundwater, a CPOC is proposed near the site boundary as shown on Figure 4. Under MTCA (WAC 173-340-720[8][c]), a CPOC for groundwater is permissible when:

1. It is not practicable to attain the SPOC within a reasonable restoration timeframe,
2. The CPOC is as close as practicable to the source of the release, and
3. All practicable methods of treatment are used in the site cleanup.

Highly disruptive remediation technologies would likely be the only way to completely remove COCs to allow for an SPOC within a short restoration time frame. However, highly disruptive remediation technologies (i.e., excavation) beneath AOC-2, the tank farm area, would likely fail a cost/benefit analysis because (1) the site is an active waste handling facility, (2) the extent of the source area is small, and (3) effects on groundwater are limited. Since other remedial technologies exist that would allow industrial activities to continue, highly disruptive remediation costs would be disproportionately high relative to the potential incremental benefit.

For soil, the POC is established under WAC 173-340-740(6) and generally requires establishment of a POC for soils throughout the site to a depth of 15 feet below ground surface (bgs). However, for cleanup actions that involve containment of contamination, WAC 173-340-740(6)(f) establishes the following provisions for the cleanup to comply with the cleanup standards:

> *"…for those cleanup actions selected under this chapter that involve containment of hazardous substances, the soil cleanup levels will typically not be met at the points of compliance specified in (b) through (e) of this subsection. In these cases, the cleanup action may be determined to comply with cleanup standards, provided:*
>
> *(i) The selected remedy is permanent to the maximum extent practicable…*
>
> *(ii) The cleanup is protective of human health…*

(iii) *The cleanup action is demonstrated to be protective of terrestrial ecological receptors…*

(iv) *Institutional controls are put in place…that prohibit or limit activities that could interfere with the long-term integrity of the containment system;*

(v) *Compliance monitoring…and periodic reviews…are designed to ensure the long-term integrity of the containment system; and*

(vi) *The types, levels and amounts of hazardous substances remaining on-site and the measures that will be used to prevent migration and contact with those substances are specified in the draft cleanup action plan."*

Based on the site conditions presented in the RI/FS soil CULs would not expected to be met at the SPOC and the provisions of WAC 173-340-740(6)(f) apply to the site. It is not practicable to attain the CULs at the SPOC for soil because buildings and the tank farm on the site limit access to some portions of the subsurface, and the presence of shallow groundwater limits the practicable depth at which many remediation technologies could be employed.

Burlington Environmental will comply with the requirements for soil cleanup standards in WAC 173-340-740(6)(f) as follows:

(i) Using practicable, permanent treatment methods to remove the source area. Treatment methods that may be applicable were described and evaluated as part of the FS and adhere to the requirements specified under WAC 173-340-360.

(ii) Meeting CULs that have been established to protect human health; in those locations where CULs will not be achieved, the receptor pathways are evaluated and suitable institutional controls (ICs) will be included in the final remedy to protect human health.

(iii, iv) Implementing ICs that maintain the integrity of the containment system and protect plants and wildlife from being exposed to any residual contamination are part of the selected final remedy.

(v) Conducting compliance monitoring and implementing long-term controls necessary for the remedy will be defined in the design of the final remedy.

3.4 Contaminant Distribution

This section summarizes the distribution of COCs present at the site, organized by the defined AOCs.

3.4.1 Soil

AOC-1: Former USTs. No COCs have been detected at concentrations exceeding CULs in this area.

AOC-2: Tank Farm Area. Historical data indicate that the tank farm may be the primary source for releases to the soil and groundwater. Compounds that have been detected in soil from the tank farm area at concentrations exceeding the soil CULs include benzene, benzo(b)fluoranthene, chrysene, arsenic, cyanide, and TPH in the gasoline range (TPH-G), diesel range (TPH-D), and lube oil range (TPH-

O). Higher concentrations of petroleum constituents have been detected in near-surface soil than in deeper soil in petroleum-impacted areas, suggesting a surficial release.

AOC-3: Stabilization Area. Benzene, vinyl chloride, arsenic, and TPH-G have been detected in soil at concentrations exceeding the CULs.

AOC-4: Stormwater Drainage System. Benzene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, TPH-G, TPH-D, and arsenic have been detected in soil at concentrations exceeding the CULs.

AOC-5: Process and Storage Area. No COCs have been detected at concentrations exceeding CULs in this area.

10-Day RCRA Hazardous Waste Transfer Yard. Arsenic was detected in soil samples from this area at concentrations exceeding CULs; however statistical assessment performed during the FS indicated a 95 percent upper confidence limit value below the CUL and does not warrant cleanup. Arsenic detections may be associated with fill material used across the site during construction.

3.4.2 Groundwater

Biodegradation appears to be reducing the concentrations of chlorinated ethenes in groundwater. Vinyl chloride has only been detected in groundwater samples above the CUL at a few wells in recent years, all located in AOC-2 and AOC-3. Given the current trend in groundwater concentrations at the historically highest concentration well (MW-120-I1), vinyl chloride would be anticipated to be less than the CUL by around 2020 (Figure 6) and has been non-detect for the first time during the most recent 2018 sampling round.

Historically, the highest concentrations of arsenic have been associated with the shallow water-bearing unit in AOC-2, and are likely associated with soil concentrations in this area combined with reducing conditions in groundwater in the same area. Recent results continue to show the highest arsenic concentrations in AOC-2, with the highest detected concentration at well MW-123-S (60 micrograms per liter [µg/L] in April 2018). Concentrations at wells MW-102-I, MW-117-I2, and MW-126-I also consistently show detections above 20 µg/L. The concentrations of arsenic detected in groundwater throughout the remainder of the site appear to represent background conditions in the area (Appendix A). An upward trend in arsenic at well MW-117-I2 has recently been detected (Appendix A-2). This well is at the far southern end of the Site. This pattern will continue to be monitored and evaluated as part of regular groundwater monitoring and progress reporting.

The highest concentrations of iron appear to be limited to AOC-2; the concentrations detected throughout the remainder of the site appear to represent area background conditions, with wells MW-102-I-1 and MW-123-I showing concentrations of 94.5 milligrams per liter (mg/L) and 109 mg/L, respectively, in 2015 – the most recent sampling round that included iron.

4.0 Cleanup Action Selection

4.1 Cleanup Action Alternatives

Cleanup alternatives to meet these remedial action objectives are evaluated as part of the FS. The FS evaluated multiple alternatives for addressing all contaminated media at the Site. The following five alternatives are based on the proposals made by the PLPs in their Feasibility Study. Note that Alternatives 3, 4, and 5 all include the use of one or more engineered cover systems. The Feasibility Study specified that several types of engineered cover systems could possibly be constructed. To comply with applicable ARARs and public input that Ecology received during the public review of the RI and FS reports, Ecology will complete its alternative analysis with the assumption that any cover system will, at a minimum, meet the requirements of the Limited Purpose Landfill Regulations, WAC 173-350-400.

4.1.1 Alternative 1 - Monitored Natural Attenuation

This alternative relies on eventual contaminated soil remediation, maintenance of surface cover over remaining source soils, and monitored natural attenuation to address affected site soil and groundwater. The following elements are included in Alternative 1:

- Remediation of contaminated soils in AOC-2 and AOC-3 when the areas become accessible;
- Assessing and repairing the existing surface cover, as necessary, in remaining source soil areas in AOCs 2 and 3;
- Long-term monitoring and maintenance of the cover over remaining soil source areas in AOC 2 and 3;
- Monitored natural attenuation of groundwater downgradient of source areas;
- Long term groundwater monitoring; and

ICs, including a deed restriction

4.1.2 Alternative 2 - Permeable Reactive Barriers and Monitored Natural Attenuation

This alternative supplements the source material soil remediation, surface cover, and natural attenuation processes that would occur under Alternative 1 with the installation of Permeable Reactive Barriers (PRBs) to prevent off-site migration of affected groundwater from all three aquifer zones to protect downgradient receptors. The configuration and layout of the PRBs includes:

- Both shallow and intermediate PRBs along the north and northwest side of AOC-2 and the east side of AOC-3 to prevent off-site migration of COC-affected groundwater;
- An intermediate aquifer PRB in the vicinity of the South Gate to prevent off-site migration of arsenic-affected groundwater near MW-117; and
- A deep aquifer PRB to prevent off-site migration of cyanide-affected groundwater downgradient of MW-24D and MW-117D.

4.1.3 Alternative 3 - In Situ Chemical Reduction and In Situ Bioremediation

This alternative supplements the source material soil remediation, surface cover, and natural attenuation processes that would occur under Alternative 1 with in situ chemical reduction (ISCR) and in situ bioremediation (ISB), which consists of the injection of a in situ chemical reductant and substrate to promote anaerobic degradation and bio-mediated precipitation of ferrous iron and sulfide. Direct push injections allow for distribution of ISCR and ISB solutions across target depth intervals. Injections would be timed and strategically placed to make use of the seasonal changes in groundwater flow. The following elements are included in this alternative:

- Remediation of contaminated soils from AOC-2 and AOC-3 when the areas become accessible;
- Assessing and repairing the existing surface cover, as necessary, in remaining source soil areas in AOCs 2 and 3;
- Long-term monitoring and maintenance of the cover over remaining soil source areas in AOC 2 and 3;
- Seasonal injections of a chemical reductant and a substrate to facilitate in situ biological remediation;
- Monitored natural attenuation of groundwater from other known or suspected source areas;
- Long term groundwater monitoring; and
- ICs, including a deed restriction.

4.2 Regulatory Requirements

The overall objective of selecting a remedy is to reduce the risks to human health and the environment resulting from COCs in soil and groundwater at the site to acceptable levels. All remedial alternatives considered in the FS addressed the CSM and the site migration and exposure pathways of concern. The remediation considerations and remediation objectives established for the site provided the framework for development of remedial alternatives.

The MTCA regulations (WAC 173-340-360) present the general requirements for selecting cleanup actions for a contaminated site. The minimum requirements applicable to all cleanup actions include specific threshold requirements and other requirements that must be met by all cleanup actions.

The threshold requirements specify that the cleanup action should:

- Protect human health and the environment;
- Comply with cleanup standards specified in WAC 173-340-700 through WAC 173-340- 760;
- Comply with applicable state and federal laws and local requirements; and
- Provide for compliance monitoring.

The other requirements cited in the MTCA regulations specify that the cleanup action should:

- Use permanent solutions to the maximum extent practicable, as determined by the requirements of WAC 173-340-173-340-360(3);
- Provide for a reasonable restoration time, as determined by the requirements of WAC 173-340-360(4); and
- Consider public concerns.

A variety of remedial technologies were screened as part of the FS. Table 3 summarizes the alternatives screened during that process. These alternatives took into account site conditions and the remedial action objectives described below.

- Prevent direct contact with surface or subsurface soil and inhalation of dust from surface soil affected with COCs at concentrations that exceed industrial CULs or reduce the risks associated with these exposure pathways to acceptable levels.
- Reduce, as practicable, COC mass in soil and groundwater within a reasonable timeframe (including subsurface VOC concentrations).
- Protect human and ecological receptors by reducing COC concentrations in affected groundwater at the CPOC within a reasonable time frame.
- Support current and future industrial use of the property.
- Comply with applicable state and federal regulations for site cleanup, health and safety, and waste management.

Several in situ technologies (chemical oxidation, chemical reduction, caps/covers) and ex situ technologies (excavation/treatment) were considered for remediation of soil. Technologies considered for groundwater included enhanced anaerobic biodegradation, bioaugmentation, monitored natural attenuation (MNA), chemical reduction, chemical oxidation, and permeable reactive barriers.

5.0 Description of Selected Remedy

5.1 Description of Cleanup Action

The highest ranking and recommended remedial alternative defined in the FS was "Alternative 1" which is MNA relying on eventual contaminated soil remediation in AOC-2 and AOC-3 when the areas become accessible, maintenance of surface cover over remaining source soils, and MNA to address affected site soil and groundwater.

The preferred remedy includes:

- Active treatment of remaining source soils in active areas of the Site as they become accessible or at Site closure;
- Pavement or concrete surface cover;
- Treatment of arsenic in groundwater by treatment/removal of anthropogenic sources of carbon where those sources have exacerbated the existing arsenic concentrations;
- Long-term compliance monitoring; and
- ICs.

5.2 Basis for Selecting Alternative 1

The MTCA requirements for sites where natural attenuation may be an appropriate aspect of a remedy were considered as part of the FS. These considerations included those specifically cited in WAC 173-340-370(7)(a) through (d), as follows.

a. ***Source control has been conducted to the maximum extent practicable.*** Sources of contamination that remain at the Site are confined to the areas underneath the active portion of the operational facility, and covered by pavement and/or buildings and tanks controlling access and risk of contact with this material. Groundwater and surface water sampling do not show a concern for offsite migration due to remaining sources at the Site.

b. ***Leaving contaminants on site during the restoration time frame does not pose an unacceptable threat to human health or the environment.*** ICs will be included in the remedy to prevent risks of contact with contaminated media at the site and ongoing monitoring will continue to assess risk of offsite migration, which is currently not expected to occur.

c. ***There is evidence that natural biodegradation or chemical degradation is occurring and will continue to occur at a reasonable rate at the site.*** The groundwater data trends presented in the FS showed large reductions in the contaminants of potential concern (COPCs) identified in the RI, and continued degradation of remaining organic COCs at the Site. Inorganic COCs will continue to be monitored for evidence of reduction as geochemical conditions change and the remaining organic COCs attenuate. Current and historical data trends for inorganic COCs support the hypothesis that groundwater concentrations are stable for those compounds, and not increasing, as recommended under Ecology's natural attenuation related guidance (Ecology, 2005).

d. ***Appropriate monitoring requirements are conducted to ensure that the natural attenuation process is taking place and that human health and the environment are protected.*** The remedy will include ongoing groundwater monitoring.

The proposed action received a higher score than the other alternatives for technical and administrative implementability and cost, and would fully attain remediation objectives as well as:

- Prevent direct contact with soils and inhalation of dust at the site and be protective of industrial workers;
- Address groundwater COCs above CULs including chlorinated VOCs and inorganic COCs caused by anthropogenic releases of carbon sources;
- Reduce risks due to inhalation of vapors or dust by incorporating ICs;
- Protect human and ecological receptors in Mill Creek by natural degradation of groundwater COCs and limiting the further release of COCs by remediation of site soils; and
- Support current and future industrial use of the site.

The proposed action would control potential exposures related to affected soil, groundwater, and soil gas, achieving the environmental indicator goals for the Site. Details of the proposed action are described in the following subsections.

4.1.1 Institutional Controls

ICs, as described in WAC 173-340-360(2)(e), are not a remediation technology and do not result in site cleanup; rather, they are commonly used as a component of remedial alternatives to address residual soil and/or groundwater contamination. In addition, ICs may be used to protect human health and the environment during implementation of a remediation program that may require longer time frames to achieve remediation objectives. ICs typically consist of administrative controls, such as deed restrictions, and controls that prohibit actions that may result in the exposure of individuals to soil or groundwater contaminants. They also may include engineering controls that limit exposure to individuals and the environment (e.g., soil cover, hydraulic control, site fencing, etc.).

The proposed action would likely result in the attainment of groundwater CULs within approximately five to ten years after source removal.

5.3 Selected Remedial Action Components

5.3.1 Active Treatment of Source Material in Soils

The majority of elevated concentration COCs were detected in samples from AOC-2 and a few locations farther south in AOC-3. It is currently impracticable to remediate source material beneath the active areas of the Site, especially in AOC-2 and in AOC-3, without severely affecting Site operations. Remediation would require demolition or temporary removal of existing tanks, structures, and/or breaches to existing containment features that are currently necessary to minimize the risk of releases to the subsurface from Site operations.

Remediation of the soils above CULs beneath the tank farm in AOC-2 would result in severe impacts to active site operations and would require decommissioning, removing, and replacing/restoring waste storage tanks that are currently in use. Remediation of soils above CULs in AOC-3 southeast of the Treatment Stabilization Building would also severely impact operations. Sample results for arsenic in one area of AOC-3 (5307-SB-1) showed a concentration that is more than two times the CUL of 7.4 milligrams per kilogram (mg/kg). This sample is from approximately 6 to 11 feet bgs, below the shallow silt layer and underneath a vault. In order to design treatment, additional pre-design sampling and characterization would be necessary which is currently impracticable with the active operations in these areas.

Contamination remaining in soil for the majority of the active areas of the Site could be evaluated and remediated at Site closure, as maintenance on the tanks/structures is needed, and/or as redevelopment activities allow. Since many of the soil sample results are now 15 to 30 years old and for several COCs that are naturally degradable, resampling prior to remediation of these areas is warranted to specifically determine depths and extents of treatment or excavation zones.

Based on the existing data, an area encompassing the highest density of samples that showed concentrations above CULs in Site soil is assumed for future assessment and remediation during Site closure via excavation or other active measures. The areas to be assessed for further remediation at Site closure are shown on Figure 5 and include approximately 9,000 square feet within the central area of AOC-2 under the tank farm (Source Area 1) and two smaller source areas—an approximately 1,000 square foot area in the northwest corner of AOC-2 (Source Area 2) near sample location S-1, and an approximately 500 square foot area on the east side of the Treatment Stabilization Building in AOC-3 (Source Area 3).

Burlington Environmental must provide a detailed pre-design prior to remediation of soils in order to better delineate the extent of remediation that will be required. Under the July 2015 RCRA Closure Plan (included in the permit), Burlington Environmental is already required to conduct soil sampling in Source Area 1 and 3 upon Site closure, which will aid in determining design of active remediation of soils in that area. Burlington Environmental must also perform pre-remediation sampling in Source Area 2 to aid design of treatment for that remaining soil source area. ICs will be used to prevent worker exposure and any excavation work performed in known or suspected contaminated areas will be coordinated with Ecology.

5.3.2 Pavement or Concrete Surface Cover

Surface cover and containment are crucial in support of ongoing Site operations. Maintaining pavement and concrete is necessary for both ongoing operations and to prevent worker exposure to subsurface contaminants. Burlington Environmental will assess pavement in remaining source soil areas in AOCs 2 and 3 and repair pavement, as necessary. Maintaining this existing pavement and concrete surface cover/containment is a component of the proposed cleanup (Figure 5).

5.3.3 Treatment of Arsenic in Groundwater

Treatment of arsenic in groundwater will be limited to MNA to destroy anthropogenic sources of carbon in areas where anthropogenic sources of carbon have exacerbated the existing arsenic concentrations (Figure 5). The primary areas for treatment are under and around AOC-2, as well as near MW-117-I2. Since several sources of anthropogenic carbon will likely remain for some time under the tank farm in AOC-2, declines in arsenic concentrations are unlikely to occur in the near future. Once the anthropogenic contaminants are treated, the previously existing geochemistry should return and arsenic concentrations should return to levels consistent with the natural total organic carbon and iron oxide interactions in the aquifer.

Although no carbon-based groundwater COCs are currently above screening levels at MW-117-12, arsenic levels are substantially elevated when compared to the majority of the wells on site (Appendix A). Low-level detections of some chlorinated VOCs (*cis*-1,2-dichloroethene, vinyl chloride) have been reported in semiannual progress reports since 2010, indicating the presence of anthropogenic carbon, which may explain the higher arsenic concentrations.

5.3.4 Long-Term Compliance Monitoring

Compliance monitoring required under WAC 173-340-410 consists of the following.

- **Protection Monitoring.** Confirms human health and the environment are adequately protected during construction and operations of cleanup. This will be addressed in a site-specific health and safety plan.
- **Performance Monitoring**. Confirms the cleanup action attains cleanup or other performance standards.
- **Confirmational Monitoring**. Confirms the long-term effectiveness of the cleanup action.

Performance and confirmational monitoring will be addressed by a groundwater monitoring program employing the existing monitoring well network to verify that natural attenuation and degradation of COCs continue to occur, and that COC concentrations are trending toward CULs at the CPOC over time. There are currently 27 wells actively being monitored under the existing monitoring plan (Appendix B). Three new monitoring wells are proposed as part of cleanup implementation (Figure 5). Monitoring will consist of regularly scheduled groundwater sampling and analysis for COCs from a network of wells on the Site. These data will be used to document and evaluate remedy effectiveness and progress on anticipated remediation timelines to meet CULs.

5.3.5 Institutional Controls

ICs are included in the proposed cleanup so that the cover is maintained, and to restrict future land use and groundwater use at the site. Since potential exposure to COCs above CULs would remain, a deed restriction limiting the site to industrial use would be implemented. The deed restriction would also clearly identify the location of known soil and groundwater contamination. Additional ICs to limit recovery and use of groundwater beneath the site and strict health and safety requirements for conducting subsurface work in impacted areas would also be required. Formal pavement inspections would be performed during groundwater monitoring events. Facility operators would be expected to repair damage or settling in the pavement.

Deed restrictions protect the health and safety of people who may come in contact with the site in the future. Such restrictions could include preventing or limiting site excavation work and assessing potential vapor exposure pathways prior to ground disturbing activities, requirements to notify future construction workers of the presence and location of affected site soil or groundwater, or precluding future use or redevelopment of the site for certain uses, such as residential, schools, day care centers, or hospitals. Additional ICs can be established to maintain remediation technologies put in place at a site.

Administrative controls also can be non-enforceable restrictions that provide information, notification, or site security. These controls may include warning signs that inform users of the potential site hazards and access requirements. On-site security and containment fencing may be employed in addition to warning signs to prevent unauthorized individuals from entering the Site. On an industrial facility operation like this Site, administrative controls can be built into site safety plans and in employee and visitor hazard communications.

5.4 Applicable or Relevant and Appropriate Requirements

Cleanup actions conducted under MTCA must comply with applicable state and federal laws. The term "applicable state and federal laws" includes legally applicable requirements and those requirements that Ecology determines to be relevant and appropriate as described in WAC 173-340-710. Typical ARARs include location-specific, action-specific, and contaminant-specific ARARs.

The facility RCRA Part B permit specifically required that the FS comply with RCW Chapter 70A.300 (Hazardous Waste Management), Chapter 173-303 (Dangerous Waste Regulations), and Chapter 173-340 (MTCA Cleanup Regulations). Additionally, the Site is covered under RCRA as an interim status facility for the purpose of corrective action, requiring compliance with federal RCRA regulations (40 Code of Federal Regulations 240-299). Any remedial action taken at the site must comply with other applicable laws and regulations (42 United States Code Ch. 6901 et seq.). The applicable requirements under the Dangerous Waste Regulations and RCRA pertain primarily to management of remediation wastes and general compliance with the interim status RCRA permit. Corrective action requirements under RCRA and the dangerous waste rules are addressed under the RCRA permit and the MTCA regulations.

Location-specific ARARs include those based on the location of the site, such as:

- Permits from local municipalities as required for activities at the site;
- Shoreline, wetlands, and critical areas criteria; and
- Tribal and cultural protections (archaeological resources).

Action-specific ARARs include those based on acceptable management practices. They include:

- Minimum Standards for Construction and Maintenance of Wells;

- General Occupation Health Standards and Safety Standards for Construction Work; and
- State Environmental Policy Act.

Additional ARARs may apply and will be defined as part of the design for implementation. Standard industry practices often address many ARARs, such as construction of wells being performed by a Washington-licensed driller and construction work being conducted under site-specific health and safety plans compliant with federal and local safety regulations.

5.0 Implementation of the Proposed Cleanup Action

The following sections describe the activities that Burlington Environment is required to take to implement the cleanup. Specific details of the cleanup action will be provided in the EDR.

5.1 Implementation Schedule

Burlington Environmental will prepare an EDR once the dCAP is finalized, which will include the following:

- Construction Work Plan for surface cover inspection and repair and installation of new groundwater monitoring wells
- Description of the administrative approach for addressing future assessment and remediation of source material beneath the active areas of the Site
- Long-Term Groundwater Monitoring Plan for MNA
- Health and Safety Plans
- Draft Long-Term Controls Plan including a draft environmental covenant consistent with the ICs proposed for the site

Following implementation, Burlington Environmental will prepare and submit to Ecology a cleanup action construction report, consistent with WAC 173-340-400(b).

5.2 Financial Assurance

Financial assurance for corrective action is required by WAC 173-303-64620. Ecology's Financial Assurance Officer shall determine when Burlington Environmental's actions and submissions meet the requirements of WAC 173-303-64620..

In addition, Burlington Environmental's Permit (Sections 2.6.4.5 and 2.6.4.8) specifies that a written cost estimate will be submitted to the Ecology within 30 days from the effective date of an Agreed Order or Consent Decree and/or within 30 days of Ecology's notice of selection of a final remedy (i.e. the CAP). Burlington Environmental must establish financial assurance within 30 days of Ecology approving the cost estimate.

5.3 Periodic Review

As long as groundwater cleanup levels have not been achieved, WAC 173-340-420 states that at sites where a cleanup action requires an institutional control, a periodic review shall be completed no less frequently than every five years after the initiation of a cleanup action.

Additionally, periodic reviews are required at sites that rely on institutional controls as part of the cleanup action. Periodic reviews will be required at this Site.

6.0 Conclusions

Although the time frame to meet CULs in groundwater is longer for the proposed action than for using more active remediation technologies, the COCs in soil are not a threat to workers on site and the COC concentrations in groundwater are very low and are unlikely to reach potential receptors.

The Site currently poses no known or suspected risk to human health or the environment. ICs would be needed for the Site over the long term to protect human health and the environment and meet the criteria under MTCA for sites utilizing MTCA Method C CULs.

The proposed cleanup action meets the threshold requirements established in WAC 173-340-360(2)(a). The action would provide short-term protection of human health and the environment through risk reduction (ICs and surface cover), and long-term protection through the permanent destruction, transformation, or immobilization of hazardous chemicals through natural attenuation processes and contaminated soil remediation. This action is in compliance with state and federal laws, and provides for long-term compliance monitoring.

7.0 References

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Ecology, 2020, CLARC database, located at: https://fortress.wa.gov/ecy/clarc/CLARCHome.aspx.

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