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Corrective Action Plan (CAP)

Marysville Crown Pacific/Interfor Site

10 November 2011

Prepared for

City of Marysville
80 Columbia Avenue
Marysville, Washington 98270

K/J Project No. 1196004.00

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Section 1: Introduction

Kennedy/Jenks Consultants (Kennedy/Jenks) has prepared this Corrective Action Plan (CAP) to conduct remediation activities at the Marysville Brownfield Site (Site) located at 60 State Avenue in Marysville, Washington (Figure 1). Based on the completed Analysis of Brownfield Cleanup Alternatives (ABCA) (Kennedy/Jenks Consultants 2011b), the Washington State Department of Ecology (Ecology) has approved the recommended remedial action that consists of the excavation and offsite landfill disposal of petroleum hydrocarbon impacted soils. The ABCA recommended remedial action was approved by the Ecology in an opinion letter dated 19 September 2011 (Ecology 2011).

A Quality Assurance Project Plan (QAPP)/Sampling and Analysis Plan (SAP) and Health and Safety Plan (HASP) for the remediation and groundwater monitoring activities have been prepared under separate cover. This CAP is supplemented with technical specifications to support the City of Marysville's (City's) procurement process.

Cleanup of the site will be performed under Ecology's Model Toxics Control Act (MTCA) cleanup regulations (WAC 173-340). Cleanup standards selected for the site include MTCA Method A soil and groundwater cleanup levels for unrestricted land use (referred to herein as MTCA A).

Section 2: Background

This section provides a summary of the Site's history, environmental investigations and results, work completed under the Brownsfields Grant, and our understanding of Ecology's opinion letters.

2.1 History

The project site is located at 60 State Avenue in Marysville, Washington and is approximately 7 acres (Figure 1). The site is bounded by Ebey Slough to the south, a gas station and First Street to the north, City offices to the east, and a park and State Avenue to the west. The first known development of the site was in 1902 and its use prior to that time is unknown based on available records. The site has been used as a shingle mill, saw mill, log yard, and boat manufacturing facility. The City purchased the site in 2006 from Crown Pacific and now uses it for storage of vehicles and empty solid waste containers. Existing structures include a small office for City staff, a garage bay for solid waste truck parking, a former kiln, and a former maintenance shop.

2.2 Environmental Data

Environmental investigation activities have been conducted at the site from 1996 through 2011. Identified contaminants of concern (COCs) include gasoline, diesel, carcinogenic polynuclear aromatic hydrocarbons (cPAHs), methylene chloride, and arsenic. Six areas of concern have been identified on the site: north office building near a gasoline service station (Area 1), unknown underground storage tank (UST) area (Area 2), boat manufacturing facility (Area 3), log yards (Area 4), kiln area (Area 5), and general site surface soil (Area 6). Some remediation has occurred at a few of these areas, including Areas 1, 2, and 5. Area 3 was also recently remediated by the Washington State Department of Transportation (WSDOT) as part of its SR-529 Ebey Slough replacement project (see Section 2.3.1).

2.2.1 Century West Investigations and Remedial Actions (1996 to 2000)

Century West conducted site assessment and remediation activities from 1996 to 1998 (Century West 1996; Century West 2000). Twenty-three borings and test pits were advanced at the site for collection of soil and groundwater samples. Impacts to soil and/or groundwater from petroleum hydrocarbons were detected in four areas of the site (Area 1, Area 2, Area 3, and Area 5.

Area 1

- The source of the hydrocarbon impacts in this area was identified as originating from either a possible past spill or migration from the gas station adjacent to the north.
- Total petroleum hydrocarbons as diesel and oil (TPH-Dx) were detected above MTCA Method A cleanup levels in soil and groundwater samples.

- TPH as gasoline (TPH-Gx) and benzene, toluene, ethylbenzene, and xylenes (BTEX) were also detected but below MTCA Method A Cleanup Levels.

- In 1998, approximately 150 cubic yards of soil was excavated from this area and confirmation samples were all reported below cleanup levels.

- An interview was conducted with the onsite geologist at the time of the cleanup, and the geologist stated that all the contaminated soil was removed except the area around well MW-7, which was left in place (i.e., well MW-7 was not abandoned and excavation was completed in a manner not to compromise the integrity of the well). The geologist noted there appeared to be no visual evidence in the excavation of transport from the gas station to the north. This interview was conducted in 2011 (Saul 2011).

Area 2

- The source of COCs in this area was likely from a former UST removed in this vicinity.

- TPH-Gx was detected above MTCA Method A cleanup levels in soil. Benzene was detected in groundwater, but below cleanup levels.

- Approximately 60 cubic yards of contaminated soil was excavated and removed offsite. Clean confirmation soil samples were collected everywhere except along the south sidewall. This contamination could not be removed at the time due to a trailer being in the way.

Area 3

- The source of COCs in this area was likely due to the former boat manufacturing facility and the presence of a small gasoline UST.

- Soil samples in this vicinity did not exceed MTCA A cleanup levels for TPH-Gx or TPH-Dx.

- The concentrations of TPH-Gx and TPH-Dx in groundwater did not exceed MTCA Method A cleanup levels. The groundwater sample did exceed the MTCA Method A cleanup level for lead.

- No remediation occurred in this area.

Area 5

- The source of contamination in this area appeared to be from former USTs.

- Soil and groundwater samples exceeded MTCA Method A cleanup levels for TPH-Dx and oil.

- Approximately 80 cubic yards of contaminated soil was removed from the excavation and confirmation samples were all below MTCA Method A cleanup levels.

2.2.2 Century West and Parametrix Groundwater Monitoring and Treatment (1996-2004)

Century West installed 10 groundwater monitoring wells in Area 1 (MW-7, MW-8, and MW-9), Area 2 (MW-4, MW-5, and MW-6), and Area 5 (MW-1, MW-1r, MW-2, and MW-3) (Century West 2000) to monitor groundwater quality. The monitoring well locations are shown on Figure 2. By 2000, six of the wells were decommissioned due to four quarters or more of petroleum hydrocarbons concentration levels below MTCA Method A cleanup levels. Three wells were left onsite (MW-1r, MW-6, and MW-7), and only well MW-7 had concentrations above MTCA Method A cleanup levels (Parametrix 2002). Parametrix treated well MW-7 with an oxygen releasing compound (ORC®) in 2003 to improve groundwater quality (Parametrix 2004). Groundwater monitoring appears to have ended in 2004, and at that time, only well MW-7 was being monitored; however, concentrations of TPH-Dx were still above MTCA Method A cleanup levels.

2.2.3 Floyd and Snider Phase II ESA (2006)

Prior to purchase of the site in 2006, the City hired Floyd and Snider to conduct an extensive Phase II ESA of the entire property (Floyd and Snider 2006). Eleven Geoprobe borings and 10 test pits were completed in six areas on the site (Area 1, Area 2, Area 3, Area 4, Area 5, and Area 6).

Six borings were installed in Area 1 and a groundwater sample was collected from well MW-7. All samples were non-detect or below MTCA Method A cleanup levels, except one soil sample collected immediately adjacent to well MW-7 and the groundwater sample from well MW-7. The soil contamination appears to be limited in extent, and the sample from well MW-7 was just above MTCA Method A cleanup levels for TPH-Dx.

Three borings were installed in Area 2 and soil samples from two of the borings exceeded MTCA Method A for TPH-Gx. The groundwater sample collected from well MW-6 and was non-detect.

Five test pits were excavated in Area 3 and soil samples exceeded MTCA Method A cleanup levels for TPH-Gx, arsenic, methylene chloride, and polynuclear aromatic hydrocarbons (PAHs).

Two test pits were excavated in the log yard areas and one soil sample exceeded TPH as oil. The source of this contamination is unknown, but likely due to hydraulic drippings or waste oil.

One boring was drilled near Area 5 and the soil samples and the groundwater sample from well MW-1r were below MTCA Method A cleanup levels.

Two test pits were excavated in general areas of the site with one soil sample exceeding MTCA Method A cleanup levels for arsenic, methylene chloride, and PAHs.

2.3 Marysville EPA Brownfields Cleanup Grant (2009)

The site was entered into Ecology's Voluntary Cleanup Program (VCP) on 23 February 2010, and Ecology provided an opinion letter dated 14 October 2010 (Ecology 2010). Ecology

identified Area 1, Area 2, Area 3, and Area 5 as locations of environmental concern for gasoline, diesel, oil, and BTEX compounds in soil and groundwater.

The City applied for an EPA Brownfields Cleanup Grant in 2008 and was awarded $200,000 on 15 September 2009. The EPA grant applied to cleanup of Area 1, Area 2, and Area 3. The proposed cleanup involved excavation and disposal of approximately 1,006 cubic yards of soil, amending excavation with ORC or similar material, and monitoring groundwater for 1 year (City of Marysville 2008).

The City hired Kennedy/Jenks Consultants on 9 March 2011, and a stakeholder kickoff meeting with the City, EPA, Ecology, and Kennedy/Jenks Consultants was held on 3 May 2011. During that meeting, information was provided to EPA and Ecology demonstrating Areas 3 and 5 may not require further action.

2.3.1 WSDOT Investigation, Cleanup, and Acquisition of Area 3

WSDOT acquired a portion of the site for its SR 529 bridge replacement project, which included Area 3. WSDOT conducted an ESA in 2009 and determined soil had been impacted with arsenic, lead, and PAHs and groundwater had been impacted with TPH-Dx (GeoEngineers 2009). Based on these results, WSDOT conducted a cleanup in 2010 and removed contaminated soil and demonstrated that impacted groundwater was limited in extent (GeoEngineers 2011). The area is now covered by approximately 10 feet of fill material as part of the bridge replacement project and further action does not appear warranted.

2.3.2 Pre-Remedial Design Investigation in Areas 1 and 2 (Kennedy/Jenks Consultants 2011)

A Pre-Remedial Design Investigation was performed to establish current groundwater quality, refine the extent of contamination in soil and groundwater, and evaluate shallow groundwater beneath the site (Kennedy/Jenks Consultants 2011a). As further action does not appear warranted in Area 3, the investigation was specifically conducted to delineate the lateral and vertical extent of impacted soils in Areas 1 and 2. A summary of investigation results include the following:

- The analytical results of groundwater samples collected from monitoring wells MW-1r, MW-6, and MW-7 were reported below detection limits for TPH-Gx, BTEX, and TPH as diesel and motor oil. The results of groundwater samples were above the MTCA Method A cleanup level for arsenic, but the reported concentrations were at the upper range of background levels for arsenic in Washington State (Thompson et al. 1997).

- The results of reconnaissance groundwater samples collected in Area 1 were reported below detection limits for TPH-Gx, BTEX, and TPH as diesel and motor oil. One of the reconnaissance groundwater samples (KJB7-RGW) collected in the Area 2 exceeded MTCA Method A cleanup levels for diesel, lead, and cPAHs. The reported arsenic concentration in sample KJB7-RGW was above MTCA Method A, but within the upper background range as discussed above.

- The soil sample results were below detection limits for TPH-Gx, BTEX, and NWTPH as diesel and motor oil, except for two samples (KJB5 and KJB7) collected in the southern portion of Area 2. A soil sample collected from KJB5 at 4 feet below ground surface (bgs) contained gasoline range hydrocarbons at 1,390 milligrams per kilogram (mg/kg), above the MTCA Method A cleanup level of 100 mg/kg. A soil sample collected from boring KJB7 at 3 feet bgs contained diesel range hydrocarbons at 10,900 mg/kg, above the MTCA Method A cleanup level of 2,000 mg/kg.

- Chromium was detected in two soil samples from Area 1 (KJB1-7 and KJB2-7) and two samples from Area 2 (KJB5-4 and KJB7-3) at concentrations just above the MTCA Method A cleanup level and likely represent background concentrations (Ecology 1994).

Soil and groundwater samples collected in Area 2 (North Office Area) as part of the Pre-Remedial Design Investigation did not contain chemical analytes at concentrations exceeding MTCA Method A cleanup standards. Based on these results, further remedial action in Area 1 is not warranted.

2.4 Ecology Opinion Letters (Ecology 2010 and 2011)

As stated above, Ecology rendered its first opinion letter on 14 October 2010 (Ecology 2010). Ecology identified Area 1, Area 2, Area 3, and Area 5 as locations of environmental concern for gasoline, diesel, oil, and BTEX compounds in soil and groundwater. The EPA Cleanup Grant (grant) originally identified three areas of contamination (Areas 1, 2, and 3), but since the grant was awarded, the WSDOT purchased and remediated the Boat Manufacturing Area (Area 3) to accommodate its State Route (SR 529) bridge replacement project (GeoEngineers 2011). As stated in Section 2.3.2, results from the Pre-Remedial Design Investigation indicated further remediation in Area 1 is not warranted. Therefore, further remediation efforts will be conducted in Area 2 only.

A second opinion letter was issued by Ecology (Ecology 2011) following review of the ABCA. The letters acknowledged the approval of the recommended remedial action that consists of the excavation and off-site landfill disposal of petroleum hydrocarbon impacted soils.

Section 3: Cleanup Goals and Removal Area/Volume

This section presents the remedial action objective, cleanup levels, and the volume of impacted soils requiring removal in the Unknown UST Area (Area 2).

3.1 Remedial Action Objective and Cleanup Levels

The remedial action objective is to remove petroleum hydrocarbon mass in soil, reducing the potential for dissolution and subsequently improving groundwater quality (i.e., an observed decrease in petroleum hydrocarbon concentrations in groundwater at that location). The COCs include TPH-Gx, BTEX, TPH-Dx, cPAH, and RCRA metals. The remediation standard for petroleum hydrocarbon-impacted soil is Ecology's MTCA Method A cleanup levels for unrestricted land use. For groundwater discharging to surface water, the cleanup standard is based on the MTCA Method B Surface Water Cleanup Levels. These cleanup standards are identified in Table 1.

3.2 Removal Area and Volume

In 1996, approximately 60 cubic yards of impacted soil was excavated from Area 2 to the approximate extent shown on Figure 1. The excavation was completed to depths between 4 and 7 feet bgs. During the soil excavation, a building (north) and pavement (east) were in place that prevented additional impacted soil from being removed. Confirmation soil samples were collected and submitted for TPH-Gx with detected concentrations below cleanup levels, except for sample UST-S16 (680 mg/kg). The impacted soil in the vicinity of UST-S16 extended under the asphalt paved area directly to east; therefore, the soil was left in place.

Following remediation activities, soil borings were completed in the vicinity of the exaction area. TPH-Gx was detected in borings GP-7 (3,600 mg/kg at 8.5 to 9 feet bgs) and GP-8 (100 mg/kg at 10 to 10.5 feet bgs) above the cleanup levels. Strong petroleum odors and elevated photoionization detector (PID) readings were detected in borings GP-7 and GP-8, between 2 and 11 feet bgs and 4 to 11 feet bgs, respectively.

Historical data and the results of the Pre-Remedial Design Investigation (see Section 2.3.2) were used to delineate the lateral and vertical extent of impacted soils in Area 2. The lateral extent of impacted soils requiring removal is shown on Figure 2 (i.e., two separate removal areas; designated as West Excavation and East Excavation). The lateral extent is based on soils exceeding the established cleanup level with consideration for field observations conducted during soil borings (petroleum odor and staining). For the purpose of the remedial action, the depth of excavation is estimated between 4 and 7 feet bgs. The area of impacted soil is estimated at approximately 2,400 square feet, equating to an estimated soil volume of up to 620 cubic yards (930 tons).

Section 4: Remedial Action Activities

This section presents a summary of remediation activities and is supplemented with technical specifications as presented in Appendix A. Confirmation soil sampling/chemical analyses and the groundwater monitoring program are presented in Sections 5 and 6, respectively.

4.1 Site Preparation Activities

4.1.1 Health and Safety Plan (HASP)

Kennedy/Jenks Consultants will prepare a site HASP for use by Kennedy/Jenks Consultants personnel (prepared under separate cover). The selected contractor and the City will also develop a HASP for their personnel. A copy of each HASP will be kept onsite at all times during field activities.

4.1.2 Permitting

The contractor (contracting directly with the City) will obtain necessary project permits, including, but not limited to, erosion control, grading, stormwater, and flood control (if applicable).

4.1.3 Utility Locating

The contractor will coordinate with a private utility locating service to locate underground utilities in the vicinity of the designated excavation areas. In addition, a minimum of 48 hours prior to conducting fieldwork, the Utility Notification Center will be contacted by the contractor to identify underground utilities.

4.1.4 Waste Characterization and Profiling

The contractor will be required to perform waste profiling for disposal of the excavated impacted soils and evacuated groundwater from the excavation areas. Kennedy/Jenks Consultants will provide available soil and water laboratory analytical results to the contractor for this purpose.

4.1.5 Site Security

The contractor will protect the working areas with temporary fencing.

4.1.6 Erosion Control

The contractor will be responsible for providing erosion control measures, including, but not limited to, gravel construction entrance, silt fencing, and catch basin protection.

4.2 Excavation

The contractor will conduct the removal using an excavator to the neat line (approximate extent of COC concentrations exceeding the soil cleanup levels) as shown on Figure 2. The contractor will remove the existing asphalt pavement to the extent necessary to excavate impacted soils. The estimated depth of the excavation is estimated between 4 and 7 feet bgs.

4.3 Stockpiling

The contractor will segregate excavated material and temporarily stockpile in an approved location designated by the City. Segregation of clean and impacted soils will be conducted as follows (total of four separate stockpiles):

- Asphalt.
- Petroleum hydrocarbon impacted soil (West Excavation).
- Petroleum hydrocarbon impacted soil (East Excavation).
- Assumed clean soil excavated beyond the neat line (i.e., sidewalls sloped back to provide stability of the excavation).

Stockpiled material will be placed on and covered with plastic sheeting. Composite soil samples of impacted stockpiles will be collected for waste characterization and profiling. Composite soil samples of the clean stockpiles will be collected and analyzed to verify it is acceptable for replacement in the excavation as backfill material. Composite soil sample collection and analyses is presented in Section 5.1.

4.4 Transport and Disposal of Impacted Material

The contractor will transport and dispose the excavated impacted soil at a licensed Subtitle D landfill facility that is permitted to accept non-hazardous levels of petroleum impacted soil. Prior to leaving the site, each truck will be brushed and tarped to eliminate spillage. Landfill tipping receipts will be used to track the mass of impacted soil removed. The City will sign all waste disposal documentation, as required.

The contractor will transport the removed asphalt pavement for offsite disposal/recycling.

4.5 Dewatering/Management

The contractor will evacuate accumulated water within the excavations and temporarily stored in polyethylene or steel tank(s) for waste characterization and profiling. Accumulated water sample collection and chemical analyses are presented in Section 5.2.

4.6 Backfilling and Compaction

Upon completion of the excavation and confirmation sampling activities, the contractor will backfill the excavation with imported clean fill and stockpiled material that is deemed acceptable through confirmation soil sampling. The backfill will be compacted in uniform lifts to match the surrounding ground surface. The backfill placed within the smear zone may be amended with a biological supplement, as described in Section 4.7.

4.7 Backfill Amendment

Based on available budget, a portion of the imported backfill material may be amended with an oxygen releasing compound to promote biological degradation of petroleum residuals. The imported backfill material to be placed at the base of the excavation and within the smear zone would be amended with ORC Advanced®, as manufactured by Regenesis, at a rate of 0.3 percent (%) by weight of the soil matrix. ORC® installation instruction for excavation applications and material data safety sheet (MSDS) are included in Appendix B.

4.8 Site Restoration

The contractor will maintain the temporary chain-link fencing until the excavations are backfilled to grade and protected against erosion. The contractor will surface the excavation area with crushed rock to match existing conditions.

Section 5: Sampling and Chemical Analysis

Kennedy/Jenks Consultants personnel will collect and submit, for laboratory chemical analysis, discrete confirmation soil samples from the excavated areas and composite soils samples from stockpiles. The results of the confirmation soil samples will be compared to cleanup levels to evaluate the effectiveness of removal activities. Composite soil sampling results will be utilized for waste characterization/disposal (impacted soil stockpiles) and to determine applicability for re-use as backfill (assumed clean stockpiles). In addition, representative samples of accumulated water from the excavations will be collected for waste characterization and disposal.

A QAPP/SAP has been prepared for this project under separate cover. Please refer to the QAPP/SAP for additional information pertaining to soil and water sample collection and chemical analyses.

5.1 Soil Sample Collection and Chemical Analyses

5.1.1 Confirmation Soil Sampling

Discrete confirmation soil samples will be collected from the floor and sidewalls of the excavated areas. At a minimum, one sample will be collected from each of the four sidewalls, and up to two additional samples will be collected from the bottom of the excavation. Additional samples may be collected at the discretion of the field technician.

5.1.2 Stockpile Sampling

A minimum of one five-point composite sample for each stockpile of assumed clean or impacted material will be collected for chemical analysis. If more than 500 cubic yards of stockpiled material are generated, one five-point composite will be collected for every 500 cubic yards.

5.1.3 Chemical Analysis

The soil samples will be placed in a chilled ice chest for transport under chain-of-custody procedures to a licensed analytical laboratory. Each confirmation soil samples will be submitted for chemical analyses including the following:

- Diesel- and oil-range petroleum hydrocarbons by Ecology Method Northwest Total Petroleum Hydrocarbons as Diesel and Oil Extended (NWTPH-Dx).
- Gasoline-range petroleum hydrocarbons by Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline (NWTPH-Gx).
- BTEX by EPA Method 8260C (fixed base laboratory) or EPA Method 8021B (mobile laboratory).

Selected confirmational samples may also be analyzed for the following compounds:

- Total cPAHs using EPA Method 8270C.
- Metals (arsenic and lead) using EPA Method 6000 series.

Composite soil samples associated with the assumed clean stockpile will be submitted for the above-mentioned chemical analyses. Composite soil samples associated with the impacted soil stockpiles will be submitted for chemical analyses that are specific to the Subtitle D landfill facility accepting the waste (i.e., assumed to be Robanco/Allied Waste landfill facility in Seattle, Washington).

Note: Soil chemical analyses using a mobile laboratory may be conducted to assist with the soil removal process (i.e., rapid turnaround of chemical data will facilitate in-field decision-making on the lateral and vertical extent of impacted soils; permit prompt backfilling).

5.2 Water Sampling and Chemical Analyses

Water generated from the excavation area will be stored in a polyethylene or steel tank(s). A representative water sample(s) will be collected for waste characterization and profiling. The required chemical analyses will be specific to the treatment/disposal facility accepting the petroleum hydrocarbon liquid waste.

Section 6: Groundwater Monitoring

Following remediation activities, groundwater monitoring will be performed on a quarterly basis for one year to assess the treatment effectiveness of the remedial action. Groundwater monitoring will be performed for two newly installed wells in Area 2.

6.1 Monitoring Well Installation

Upon completion of remediation activities, monitoring wells will be strategically installed to assess groundwater quality/treatment performance. The proposed locations of the monitoring wells are shown on Figure 2 (MW-10 and MW-11). The monitoring wells will be drilled using hollow-stem auger drilling methods. The wells will be constructed using 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) blank casing and 0.010-inch slotted screen. The screen will be installed at the bottom of the well and span the groundwater fluctuation zone.

The new monitoring wells will be developed to provide relatively sediment free representative groundwater samples. The monitoring wells will be surveyed by a licensed surveyor for horizontal location and vertical elevation (to 0.01 foot) and tied into the other site monitoring wells.

6.2 Groundwater Monitoring and Chemical Analyses

Groundwater samples will be collected from the installed monitoring wells MW-10 and MW-11 and analyzed for the following:

- Diesel- and oil-range petroleum hydrocarbons by NWTPH-Dx.
- Gasoline-range petroleum hydrocarbons by NWTPH-Gx.
- BTEX by EPA Method 8260C.
- Natural Attenuation Parameters:
    - Nitrate and sulfate by EPA Method 300.0
    - Dissolved manganese and iron by EPA Method 6020.

6.3 Waste Management

Investigation-derived waste (IDW) will consist of drill cuttings, decontamination rinse water, and groundwater development and sampling purge water. IDW will be temporarily stored in 55-gallon steel drums pending waste characterization and disposal.

Section 7: Reporting

Following completion of the remediation activities and receipt of laboratory analytical data and disposal receipts, Kennedy/Jenks Consultants will prepare a Remedial Action Report (report). The report will include a summary of field activities, quantity of impacted soils removed and disposed, data summary tables and laboratory analytical reports, landfill disposal documentation, and a figure showing the excavated areas and locations of the confirmation samples.

Groundwater monitoring reports will be prepared for each of the quarterly groundwater sampling events.

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Table

Table 1: Risk Evaluation and Selection of Cleanup Levels

Media	Exposure Pathway	Cleanup Level Basis	TPH-Gx	TPH-Dx	Benzene	Toluene	Ethylbenzene	Xylenes	PAHs[a]	Arsenic	Lead
Soil	Terrestrial Ecological Receptors	Ecological Indicator Soil Concentrations for Protection of Wildlife (WAC 173-340-7490, Table 749-3)[b]	5,000 mg/kg	6,000 mg/kg	N/A	N/A	N/A	N/A	12 mg/kg	7 mg/kg[c]	118 mg/kg
	Protection of Sediments (Marine)	Ecology Sediment Management Standards (WAC 173-204, Table 2)[d]	N/A	N/A	N/A	N/A	N/A	N/A	99 mg/kg (organic carbon)	57 mg/kg	450 mg/kg
	Dermal	MTCA Method A Soil Cleanup Levels for Unrestricted Land Use	**30 mg/kg**	**2,000 mg/kg**	**0.03 mg/kg**	**7 mg/kg**	**6 mg/kg**	**9 mg/kg**	**0.1 mg/kg**	**20 mg/kg**	**250 mg/kg**
	Inhalation	MTCA Method B Soil Gas Screening Levels (Unrestricted Land Use)	N/A[e]	N/A	See note "f" below				N/A	N/A	N/A
Groundwater	Consumption of Water	Not a complete exposure pathway. No nearby wells. Surface water not used as a drinking water source.	See cleanup level basis.								
	Protection of Surface Water	See Surface Water	N/A	N/A	23 µg/L	19,000 µg/L	6,900 µg/L	N/A	0.03 µg/L	0.098 µg/L	N/A
	Inhalation	Not a complete exposure pathway from consumption of water or vapor intrusion into buildings.	See cleanup level basis.								
Surface Water	Consumption of Water	Not a complete exposure pathway. No nearby wells. Surface water not used as a drinking water source.	See cleanup level basis.								
	Consumption of Organisms in Surface Water	MTCA Method B Surface Water Cleanup Level and ARARs	N/A	N/A	**23 µg/L**	**19,000 µg/L**	**6,900 µg/L**	N/A	**0.03 µg/L**	**0.098 µg/L**	N/A
	Sediment Protection	MTCA Method B Surface Water Cleanup Level and ARARs	N/A	N/A	23 µg/L	19,000 µg/L	6,900 µg/L	N/A	0.03 µg/L	0.098 µg/L	N/A

Definitions:

mg/kg = milligrams per kilogram
N/A = Not Applicable
MTCA = Model Toxics Control Act
µg/L = micrograms per liter
ARARs = Applicable or Relevant and Appropriate Requirements

BOLD concentrations indicate proposed cleanup levels for the site.

Notes:

(a) = For carcinogenic PAHs, cleanup level is based on benzo(a)pyrene.
(b) = For industrial or commercial land uses, only the wildlife values need to be considered (WAC 173-340-7493).
(c) = Ecological indicator soil concentration for the protection of wildlife for arsenic III used for arsenic.
(d) = Marine sediment quality standards are reported on a dry weight basis.
(e) = Gasoline-range hydrocarbons evaluated as air phase hydrocarbon (APH) fractions.
(f) = To evaluate the vapor intrusion pathway for soil gas, follow the *Draft Guidance for Evaluating Soil Vapor Intrusion in Washington State: Investigation and Remedial Action,* Publication No. 09-09-047 (Ecology 2009).

Figures

LEGEND

- MW-6 — MONITORING WELL LOCATION
- GB-9 — SOIL BORING LOCATION (1996)
- GP-9 — SOIL CORING LOCATION (2006)
- B-9 — SOIL CORING LOCATION (2009)
- TP1 — TEST PIT LOCATION (1996)
- TP-8 — TEST PIT LOCATION (2006)
- MW-4 — ABANDONED MONITORING WELL LOCATION
- APPROXIMATE EXCAVATION LIMITS
- UST-S11 — EXCAVATION CONFIRMATION SOIL SAMPLE LOCATION
- APPROXIMATE PROPERTY BOUNDARY
- EXTENT OF EMBANKMENT
- STONE COLUMN AREA

GP-9		
DEPTH (FT)	E	TPHg(a)
4.5	6.6	3,600

SUBSURFACE SOIL DESIGNATION WITH DEPTH AND DETECTED VOCs, SVOCs, AND TPH ABOVE MTCA METHOD A CLEANUP LEVELS (mg/kg)

VOCs	VOLATILE ORGANIC COMPOUNDS
SVOCs	SEMIVOLATILE ORGANIC COMPOUNDS
TPH	TOTAL PETROLEUM HYDROCARBONS
E	ETHYLBENZENE
MC	METHYLENE CHLORIDE
TPHg	TPH REPORTED AS GASOLINE FRACTION
TPHd	TPH REPORTED AS DIESEL FRACTION
TPHo	TPH REPORTED AS HEAVY OIL FRACTION
cPAHs	TOTAL CARCONOGENIC PAHs
As	ARSENIC

NOTE:

(a) TPHg IDENTIFIED AS STODDARD SOLVENT.

(b) DATA PRESENTED FOR SOIL ONLY ABOVE MTCA METHOD A CLEANUP LEVELS.

N

0 50 100

APPROXIMATE SCALE IN FEET

Kennedy/Jenks Consultants

60 STATE AVENUE PROPERTY
CITY OF MARYSVILLE, WA

SUMMARY OF HISTORICAL ANALYTICAL DATA

1196004.00/CAP/FIG-01

10/11

FIGURE 1

P:\CAD\11\1196004.00 Marysville\CAP\FIG-01.dwg

LEGEND

MW-10	PROPOSED MONITORING WELL LOCATION
B1	SOIL CORING LOCATION (2011)
GP-8	SOIL CORING LOCATION (2006)
	AREAS OF REMEDIATED SOIL
	AREAS OF PROPOSED REMEDIATION
MW-6	EXISTING MONITORING WELL LOCATION
UNKNOWN UST	AREA OF CONCERN
	APPROXIMATE PROPERTY BOUNDARY

ESTIMATED VOLUMES FOR SOIL REMOVAL

AREA OF CONCERN	EPA GRANT ESTIMATED VOLUME	REVISED VOLUME BASED ON K/J RESEARCH AND GEOPROBE INVESTIGATION
NORTH OFFICE BLDG. AREA	467 TONS	0 TONS
UNKNOWN UST AREA	209 TONS	933 TONS
BOAT MANUFACTURING AREA	833 TONS	0 TONS
ESTIMATED TOTAL	1,509 TONS	933 TONS

N

0 50 100

APPROXIMATE SCALE IN FEET

Kennedy/Jenks Consultants

60 STATE AVENUE PROPERTY
CITY OF MARYSVILLE, WA

PROPOSED REMEDIATION AREAS (AREA 2)

1196004.00/CAP/FIG-02

10/11

FIGURE 2

P:\CAD\11\1196004.00 Marysville\CAP\FIG-02.dwg

Appendix A

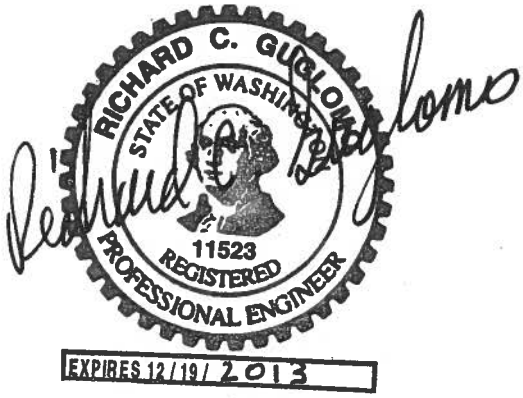
Technical Specifications

BID SPECIFICATION

DIVISION 2 SITE WORK

CITY OF MARYSVILLE
MARYSVILLE CROWN PACIFIC/INTERFOR SITE
REMEDIAL ACTION
MARYSVILLE, WASHINGTON

25 October 2011



Prepared by

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Federal Way, Washington 98001
253-835-6400
FAX: 253-952-3435

K/J 1196004.00

SECTION 02301

EARTHWORK
(CONTAMINATED SOIL REMOVAL AND RESTORATION)

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide the excavation and removal of approximately 620 (+/- 10 percent) cubic yards (neat line) of contaminated soil from the Marysville Crown Pacific/Interfor site located at 60 State Avenue in Marysville, Washington.

B. The impacted soils are designated as a non-hazardous waste. In consultation with the Engineer, conduct waste profiling with the licensed Subtitle D landfill facility.

C. Provide transport and disposal of contaminated soils to a licensed Subtitle D landfill facility.

D. Remove accumulated water from the excavation and temporarily store in an above-ground tank. In consultation with the Engineer, conduct waste profiling with a licensed treatment/disposal facility accepting petroleum hydrocarbon liquid waste.

E. Provide backfill and compaction of imported clean material to match surrounding grades.

F. Conduct restoration of disturbed areas.

G. Provide a secure working site for duration of excavation and restoration activities.

1.02 SAFETY RESPONSIBILITIES

A. All work shall be performed in strict accordance with applicable law, including local ordinances. All personnel shall be trained in OSHA safety standards. Contractor shall have a copy of OSHA standards on the work site at all times.

B. The Contractor shall be responsible for the safety of his/her workers and shall comply with safety and health standards.

C. Personnel working onsite may be required to have received Hazardous Waste Operations and Emergency Response training in accordance with OSHA 29 CFR 1910.120 and be current in annual refresher training. For example, personnel performing excavations or earthwork, working in excavations, or in direct contact with contaminated soils while performing work. Constituents of concern (COCs) include total petroleum hydrocarbons (TPH) as gasoline, diesel, and heavy oil.

D. The Contractor is responsible for utility locating. The Contractor shall exercise care in avoiding damage to all utilities as the Contractor will be held responsible for their repair if damaged. Utilities in vicinity of work area are unknown.

E. The Contractor shall select, install and maintain shoring, sheeting, bracing, and sloping as necessary to maintain safe excavations. The Contractor shall be responsible for ensuring compliance with:
   1. Comply fully with 29 CFR Part 1926 OSHA Subpart P Excavations and Trenches requirements
   2. Provide necessary support to the sides of excavations
   3. Provide safe access to the Engineer's sampling and testing within the excavation
   4. Provide safe access for backfill, compaction, and compaction testing

5. Otherwise maintain excavations in a safe manner that shall not endanger property, life, health, or the project schedule.

F. Contractor is responsible for installing and maintaining temporary fencing during excavation and restoration activities.

G. Contractor is responsible for providing all necessary safety equipment including, but not limited to, respiratory equipment, protective clothing, and hand washing facilities.

H. Contractor shall conduct daily safety checks with construction personnel.

1.03 QUALITY CONTROL

A. The Contractor is responsible for obtaining and complying with all environmental permits required for the excavation, hauling, and disposal of the contaminated material.

B. The Contractor is responsible for obtaining and complying with all state and local permits required for the securing, hauling, and disposal of the contaminated material.

C. The Contractor is responsible for obtaining and complying with all state and local governing authority permits required for the work.

D. In case of a conflict or disagreement between codes, standards, laws, ordinances, rules, and regulations or within any document itself, the more stringent requirements, as determined by the Engineer, shall apply.

1.04 SUBMITTALS

A. Submit an Excavation, Disposal, and Restoration Plan, indicating methods and sequencing. Submit a project schedule for mobilization/demobilization, excavation, transportation, backfilling (including amendment), compaction, and restoration activities.

B. Submit a site Health and Safety Plan meeting the requirements of OSHA 29 CFR 1910.120.

C. Submit certification of Hazardous Waste Operations and Emergency Response training and/or annual refresher training meeting the requirements of OSHA 29 CFR 1910.120 to the Owner for all workers entering the project site and potentially exposed to environmental media containing regulated substances, including petroleum hydrocarbon impacted soil and groundwater.

D. Submit the following products/materials for review.
   1. Backfill materials, as described in the Materials section of this specification. Submit test results for import materials. Tests shall have been performed within 14 calendar days of the submission. All material furnished and all work performed shall be subject to rigid inspection, and no material shall be delivered to the site until it has been favorably reviewed by the Engineer, or used in the construction work until it has been inspected in the field by the Engineer.
   2. All imported materials shall consist of clean material, free of organic and inorganic contaminants (whether naturally occurring or not), including but not limited to the following list of contaminants:
      a. RCRA metals (Ag, As, Ba, Cd, Cr, Hg, Pb, Se); Test Method: EPA Method 6020.
      b. Volatile organic compounds (VOCs); Test Method: EPA Method 8260
      c. Semivolatile organic compounds (SVOCs); Test Method: EPA Method 8270

d. Polychlorinated biphenyls (PCBs); Test Method: EPA Method 8082
e. Organochlorine Pesticides; Test Method: EPA Method 8081
f. Herbicides; Test Method: EPA Method 8151
g. Petroleum hydrocarbons as gasoline and diesel; Test Method: NWTPH-Gx and Dx.

Collect and submit a representative sample of each import material to be used on the project to the Engineer for laboratory analysis to validate that each import material is in compliance with Quality Assurance requirements described herein. Furnish the samples with sufficient lead time for laboratory analysis prior to transport; typically 2 weeks. An Engineer's favorable review of the analytical results is required prior to transport of materials to the site.

3. Test Certificates: Submit test certificates to enable the Engineer to determine compliance with the specifications for imported materials for each proposed source of supplier.
   a. ASTM D1557.

E. Submit waste profiling and acceptance documentation from the selected landfill facility to the Engineer for concurrence. Upon completion of remediation activities, submit copies of the certification for the certified scale and disposal facility weigh master certificates to the Engineer for approval.

1.05 QUALITY ASSURANCE

A. Source Quality Control: Test import materials proposed for use to demonstrate that the materials conform to the specified requirements. Tests shall be performed by an independent testing laboratory.

B. Field Quality Control:
   1. The Engineer will:
      a. Review materials proposed for use.
      b. Observe limits of excavation.
      c. Observe placement and compaction of fill.
      d. Observe amendment of fill material with biological supplement.
      e. Observe restoration activities.

C. Soil Compaction Tests:
   1. ASTM D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3)) .
      a. Sample tests will be representative of materials to be placed.
      b. Determine and provide optimum moisture-density curve for each type of material encountered or utilized.
   2. TM D4253 - Test for Relative Density of Cohesionless Soils.
   3. Test results will be the basis for Field Quality Control.

D. Relative Compaction: In-place density divided by the maximum dry density laboratory compaction expressed as percentage

PART 2 - PRODUCTS

2.01 MATERIALS

A. Imported Crushed Gravel: Crushed surfacing top course (CSTC) per Section 9-03.9(3) of the Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (2010). For the top 8 inches.

B. Imported Backfill (Pit Run). Select borrow per Section 9-03.14(3) of the Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (2010). For backfill up to 8 inches below finish grade.

C. Biological Amendment: Oxygen release compound (ORC Advanced™) as manufactured by Regenesis of San Clemente, California. Material Safety Data Sheets (MSDS) for materials provided as attached. Biological Amendment to be provided by Owner.

D. Plastic Sheeting and Tarps: Shall meet or exceed Washington State Department of Transportation for licensed hazardous waste transporters.

2.02 VEHICLES

A. General: Shall meet all applicable state and federal requirements for vehicles hauling contaminated soils and debris. All required permits shall be current.

B. Vehicles for Onsite Hauling: Suitable to haul contaminated materials from point of loading to stockpile area and/or to off-site hauling vehicles. Equip as necessary with liners, seals or otherwise configure so as to prevent spillage, leakage, and losses.

C. Vehicles for Offsite Hauling: Highway transport vehicles, typically consisting of a tractor with and end-dump trailer. Payload capacities between 20 to 25 tons; however, trucks and pup trailers can be used. Licensed to transport waste. Equip as necessary with liners, seals or otherwise configure so as to prevent all such spillage, leakage, and losses.

2.03 COMPACTION EQUIPMENT

A. Rollers: Use rollers or compaction equipment so designed that the effective weight can be increased as required to obtain specified compaction.

PART 3 - EXECUTION

3.01 GENERAL CONSTRUCTION REQUIREMENTS

A. Site Access: Access to the site will be over public and private roads. Exercise care in the use of such roads and repair at own expense any damage caused by Contractor's operations. Such repair shall be to the satisfaction of the Owner or agency having jurisdiction over the road. Take whatever means are necessary to prevent tracking of mud onto existing roads and keep roads free of debris. Impacted materials shall be fully contained during transport over public and private roads.

B. The Contractor is responsible for providing any temporary surfacing as required for equipment staging or any other work described in this Specification.

C. Barriers shall be placed at all excavations and at such places along excavations as may be necessary to warn all pedestrian and vehicular traffic of such excavations.

D. Erect and maintain temporary fencing to secure site.

E. Dust Control: Take proper and efficient steps to control dust.

F. Erosion Control: The contractor shall comply with WSDOT 2010 Standard Specifications for Erosion Control. Prevent sediments from entering streams or other water bodies by employing methods are necessary, including aggregate construction site entrance, silt fence, biobags, etc.

G. Do not excavate or backfill in the presence of rain, snow, or any other precipitation at the discretion of the Engineer.

3.02 EXCAVATION

A. Excavate only in the presence of the Engineer or as otherwise directed.

B. Excavate to limits generally shown in Drawings and as field staked by the Engineer.

C. Excavation tolerances shall be plus or minus 0.1 foot except where dimensions or grades are specified as minimum or maximum.

D. Continuously monitor excavation for a variation in the soil group being excavated. Notify the Engineer immediately if any variation is suspected.

E. Continuously monitor excavation for a variation in the groundwater level. Notify the Engineer immediately if any variation is suspected.

F. Extra Excavation
   1. Cut back to a stable slope as applicable.
   2. Excavation sides that are not cut back to a stable slope as necessary, to prevent sliding or caving to protect workers and the Work.

3.03 TEMPORARY STOCKPILING OF CONTAMINATED MATERIAL

A. Stockpiling shall be completed in an orderly manner and kept a sufficient distance from banks, open trenches, or excavations to avoid overloading and to prevent slides or cave-ins.

B. Place stockpiled material onto thick plastic sheeting. Do not let the excavated material come into contact with the bare ground surface.

C. Cover stockpile with 6-mil plastic sheeting.

D. Do not stockpile near storm drains or watercourses.

E. Treat all sheeting as contaminated material, and dispose of accordingly.

3.04 WASTE PROFILING, MANIFESTING, LOADING, TRANSPORT, AND DISPOSAL OF CONTAMINATED MATERIAL

A. The Contract shall conduct waste profiling with the selected licensed Subtitle D landfill facility. Immediately following completion of soil stockpiling, the Engineer will collect composite soil samples from the stockpiles and submit for chemical analyses on a rapid turnaround basis. The Engineer will provide the laboratory analytical reports and associated summary tables to the Contractor within 2 days.

B. The Contractor shall coordinate applicable manifesting for transportation and disposal of the loaded waste material. The Contractor shall prepare all required manifests.

C. Transport and dispose of contaminated materials in accordance with the rules and regulations of the following agencies: WSDOT, USEPA, Washington Department of Ecology, WS-OSHA and local regulatory agencies.

D. The Contractor will provide the necessary trucking for transportation of the wastes to be disposed of offsite to the licensed Subtitle D landfill facility, and coordinate with the Engineer.

E. Conduct work to minimize spillage of waste during loading operations. Load trucks systematically, avoiding spillage onto the ground. Remove spilled waste material at

the end of each day of loading operations. Remove contaminated materials from exterior of vehicles and place into transport vehicles.

F. Construct working pads with gravel or ballast in waste loading areas as needed to facilitate the work at no additional cost to the Owner. The Contractor shall designate and prepare a loading area near the area of stockpile or excavation. Following the work, the Contractor shall remove and properly dispose of the working pad materials.

G. If required, the Contractor shall provide and install truck liners at no additional cost to the owner. The plastic sheeting or pre-fabricated liner shall be approved by the Engineer prior to use. Lining may be required either to prevent leakage, keep the interior of the transport clean, or both.

H. Load trucks to between 90% and 100% of the allowable gross vehicle weight. Do not load trucks in excess of the allowable gross vehicle weight. Costs to rectify overloading will be the responsibility of the Contractor.

I. Dry decontaminate (scraping and brushing, do not use water) the exterior of each loaded and covered truck before releasing from the site.

J. Verify that each load is covered before leaving the work area.

K. Conduct all operations in a safe and efficient manner and prevent damage to trucks during all loading operations.

3.05 BACKFILL AND COMPACTION

A. Backfill excavation back to original grade.

B. Do not place any backfill material until the Engineer has inspected, tested (confirmation soil sampling) to his satisfaction, and favorably reviewed the prepared excavation site.

C. Spread and compact materials in uniform lifts not exceeding 12 inches in uncompacted thickness. Compact to a minimum 90 percent of maximum density, in accordance with ASTM D-1557 unless directed otherwise by the Engineer.

D. Add water to the backfill material or dry the material as necessary to obtain moisture content within 3% of optimum. Employ such means as may be necessary to secure a uniform moisture content throughout the material of each layer being compacted.

E. After the material has been moisture conditioned, compact it with compaction equipment appropriate for the use to achieve specified compaction.

F. If the backfill material becomes saturated from rains or any other source because it was not compacted to the specified density or was not backfilled and compacted to surface grade, through negligence or otherwise, remove the faulty material and replace it with suitable material compacted to the specified density. No additional payment will be made for doing such work or removal and replacement.

G. Compaction of backfill materials by flooding, ponding, or jetting is not permitted.

H. When densities of compacted materials do not meet the requirements, remove and/or recompact the material until the requirements are met at no additional cost to the Owner.

I. Testing Frequency: One test for each 3 feet of fill. Successful compaction shall result in a non-yielding condition.

J. Final compacted lift shall be level to surrounding grades.

3.06 BACKFILL AMENDMENT

A. Amend the imported backfill in accordance with Regenesis Oxygen Release Compound (ORC®) Installation Instructions (Excavation Applications). Apply pure ORC at a rate of 0.3 percent (%) by weight of the soil matrix. Place amended backfill at the base of the excavation and within the smear zone, as directed by the Engineer.

3.07 DEWATERING/MANAGEMENT

A. Remove accumulated water from the excavation and temporarily store in an above-ground polyethylene or steel tank(s).

B. In consultation with the Engineer, conduct waste profiling with a licensed treatment/disposal facility accepting petroleum hydrocarbon liquid waste. The Engineer will collect representative water sample(s) of the accumulate water within the storage tank(s) and submit for chemical analyses on a rapid turnaround basis. The Engineer will provide the laboratory analytical reports and associated summary tables to the Contractor within 2 days.

C. Transport and dispose of petroleum impacted water at a licensed treatment/disposal facility accepting petroleum hydrocarbon liquid waste.

3.08 RESTORATION

A. Restore the excavation area with an 8-inch thick surface layer of crushed surfacing top course (CSTC).

B. Restore surfaces to preconstruction condition if damaged during construction.

C. Remove all debris and construction activity from the site. The Engineer/Owner will perform a final walkthrough for approval of compliance with the final site condition.

END OF SECTION

Appendix B

Oxygen Release Compound (ORC®) Installation Instructions (Excavation Applications) and Material Safety Data Sheet (MSDS)

REGENESIS

Oxygen Release Compound (ORC®) Installation Instructions

(Excavation Applications)

SAFETY:

Pure ORC is shipped to you as a fine powder, which is rated at -325 mesh (passes through a 44 micron screen). It is considered to be a mild oxidizer and as such should be handled with care while in the field. Field personnel should take precautions while applying the pure ORC. Typically, the operator should work up wind of the product as well as use appropriate safety equipment. These would include eye, respiratory protection and gloves as deemed appropriate by exposure duration and field conditions.

Although two options are discussed, application of ORC should never be applied by personnel within the tank excavation, unless proper shoring or sidewall cutback is in place.

GENERAL GUIDELINES:

ORC can be applied in a dry powder form or as a slurry. Field conditions dictate which form of ORC can be used most effectively.

Installation of ORC should be within the tank excavation floor and/or in an adequate backfill section thickness to account for the anticipated groundwater "smear zone".

Maximum treatment effect is obtained when ORC is mixed as thoroughly as possible within the backfill material. The more dispersed the ORC slurry/powder within the excavation backfill, the more effective the treatment.

The quantity of ORC to be used is generally calculated prior to moving into the field for installation. Generally it is applied at a rate of between 0.1% and 1.0% by weight of the soil matrix. The following illustrates a dilute application rate calculation:

> Use a weight/weight percent of ORC/backfill material to ensure distribution of the ORC into the desired aquifer section. For example: a 0.15% weight of ORC to weight of backfill for the standard ORC weight (30 pounds) per container calculates as follows: 30 lb. ORC/0.15% = 20,000 lbs. of soil matrix. Thus, to achieve a 0.15% mixture of ORC in the backfill material, 30 lb. of pure ORC should be mixed into 10 tons (20,000 lbs. ÷2,000 lbs./ton) of backfill, or approximately 7 - 10 cubic yards of soil depending on field conditions. Professional judgment should be used to select the appropriate soil mass per cubic yard for designing each site treatment.

CHOOSING THE FORM OF INSTALLATION:

Pure ORC is shipped to you in a powder form. Weather conditions (especially wind) may have a direct effect on the application of ORC as a tank backfill amendment.

Application of the dry powder may be difficult in windy conditions. To counter the effects of wind (and the subsequent potential loss of ORC), Regenesis recommends that a water source or a spray tank be on-site to wet down the ORC and the backfill material as ORC is applied.

Application of ORC in a slurry format is a very effective method and eliminates the wind issue.

Four somewhat different installation conditions can be encountered in the field:

- ORC in a pea gravel back-fill. ("Type 1")
- ORC in a soil back-fill. ("Type 2")
- ORC mixed in native soil in the bottom of a tank pit. ("Type 3")
- ORC installed in soil under standing water in the bottom of a tank pit. ("Type 4")

A single tank pit excavation can include more than one of these conditions, depending on the site and extent of treatment. Instructions for each condition are discussed separately in the following sections. After the installation instructions are detailed instructions for mixing the slurry, if that is the option chosen.

INSTALLATION INSTRUCTIONS:

"Type 1," ORC in a Pea Gravel Back-fill

The easiest method for installing ORC in pea gravel back-fill is to mix the ORC in the material in a backhoe or skiploader bucket before placing it in the excavation.

- **Dry Powder method**

Into each scoop of back-fill material add the appropriate portion of ORC being installed. Generally, it is advisable to moisten the material in the bucket to reduce wind blown ORC loss. Excessive winds make this method not feasible.

After mixing the dry powder in the bucket, it is dumped into the bottom of the excavation. The backhoe bucket can be used for further mixing in the excavation.

- **Slurry method**

Mix a 63% solids slurry of ORC and water (see "Steps to make ORC slurry). This relatively thick slurry is used to help keep the ORC dispersed through the pea gravel, even when it contacts water in the bottom of the excavation during installation. It is generally desirable to avoid having the ORC run down through the pea gravel and collect in the bottom of the excavation. The thick slurry addresses this issue.

In each scoop of back-fill material, add the appropriate amount of ORC slurry. Pre-mix the materials in the backhoe bucket After mixing, dump the slurry and back-fill into the bottom of the excavation. The backhoe bucket can be used for further mixing in the

excavation.

If the slurry method is being used, observe the physical behavior of the ORC in the fill material. If the ORC collects at the bottom of the back-fill material, increase the percent solids content by reducing the amount of water being used to make the slurry.

"Type 2," ORC in a Soil Back-fill

Follow the instructions for the pea gravel back-fill method, except:

If the slurry method is being used, the solids content should be reduced. Typically a 50% solids is appropriate, although soil conditions sometimes dictate lower solids contents (see "Steps to make ORC slurry").

" Type 3," ORC Mixed in Native Soil in the Bottom of the Tank Pit

When ORC is added to the bottom of a tank pit it may be done by backhoe or injection.
CAUTION: Personnel should never work within the tank excavation, unless proper shoring or sidewall cutback is in place.

- **Backhoe method**

A skilled backhoe operator can distribute the ORC around the bottom of the tank excavation and, using the bucket, mix it thoroughly. If there are no winds, it may be possible to:

1. Put the dry ORC powder in the backhoe bucket,
2. Lower it to the bottom of the pit,
3. Gently deposit the ORC evenly on the remaining soil,
4. Use the bucket to mix the powder into the soil,
5. To mitigate dusting, if necessary, spray water into the excavation during the process.

An alternative backhoe method is to use a 50% (or less) solids ORC slurry (see "Steps to make ORC slurry) in place of the dry powder. This eliminates the dusting problem, and in some cases enhances the even distribution of ORC into the soil. Observe the slurry mixing behavior in the bottom of the excavation, and adjust the water content of the slurry to optimize mixing, if necessary.

- **Injection method**

If available, a pump and root feeder may be used to inject an ORC slurry into the excavation floor. This may require a more dilute slurry mix, and care should be taken to assure that the solids do not settle out of the slurry prior to injection.

" Type 4." ORC installed in standing water in the bottom of a tank pit

Application of ORC into tank excavations with standing water requires the operator apply ORC in a slurry form. ORC powder application in this scenario is not advised because a portion of the ORC particle fraction is not likely to pass through the surface tension of the standing water. Caution: Personnel should never work within the tank excavation, unless proper shoring or sidewall cutback is in place.

- **Backhoe method**

A skilled backhoe operator can distribute the ORC slurry within the excavation, and mix it into the soil underlying the standing water with the bucket. Steps for installation:

1. Mix a high solids content ORC slurry (63% solids). See ("Steps to make ORC slurry").
2. Pour slurry into the backhoe bucket.
3. Lower the bucket to the standing water level in the excavation, and deposit the slurry as evenly as possible across the excavation floor. The dense slurry (63%solids is 1.6 grams per ml) will tend to make the majority of the slurry sink quickly to the bottom of the water layer.
4. Use the bucket to mix the slurry into the soil.
5. Water in the vicinity of the ORC slurry will often turn white and milky, since some of the ORC is dispersed within the standing water. This provides additional dispersion within the standing water and back-fill material as it is added to the excavation.

- **Injection method**

If available, a pump and root feeder may be used to inject an ORC slurry into the soil in an excavation. This may require a more dilute slurry mix, and care should be taken to assure that the solids do not settle out of the slurry prior to injection.

MIXING ORC SLURRY:

ORC powder is shipped to you in pre-measured batches. Each batch is contained in a plastic bag which is shipped in a 5-gallon bucket.

Remove the pre-measured ORC bag from the 5-gallon bucket and open
Measure and pour the appropriate amount of water from the following table into the 5 gallon bucket

Slurry Solids Content (%)	Pounds of ORC	Gallons of Water
63%	30 lbs.	2.1 gal. (2 gal. + 2 cups)
50%	30 lbs.	3.6 gal. (3 gal + 2 1/2 qts.)

Add the entire ORC pre-measured bag to the water (30 pounds). If the slurry solids contents of less than 50% are desired, the quantity of ORC per batch mixed in the bucket must be reduced. For example, a bucket containing four gallons of water would require 22.4 pounds of ORC to make a 40% solids slurry, and 16.6 pounds of ORC to make a 33% slurry.

Use an appropriate mixing device to thoroughly mix ORC and water. Regenesis

recommends use of a 0.5 Horsepower (minimum) hand held drill with a “jiffy mixer” or stucco mixer. A common paint paddle can be used to scrape the bottom and sides of the container to ensure thorough mixing. Standard environmental slurry mixers may also be used.

After mixing, small amounts of water can be added to adjust the consistency of the slurry.

When slurries are used, the early batches should be observed in the process of mixing with the soil. Each site can vary, due to soil type and moisture content. Based on professional judgment, additional water can be added to subsequent slurry batches.

ORC slurry should be used ASAP; if the ORC slurry has been standing more than 15 minutes, it should be remixed immediately before using. Do not let stand more than 30 minutes without stirring. Otherwise, the slurry will begin to harden into a weak cement.

For direct assistance or answers to any questions you may have regarding these instructions, contact Regenesis Technical Services at 949-366-8000.

Oxygen Release Compound – Advanced (ORC *Advanced*™)
MATERIAL SAFETY DATA SHEET (MSDS)

Last Revised: March 13, 2007

Section 1 - Material Identification

Supplier:

REGENESIS

1011 Calle Sombra
San Clemente, CA 92673

Phone: **949.366.8000**

Fax: **949.366.8090**

E-mail: **info@regenesis.com**

Chemical Description:	A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
Chemical Family:	Inorganic Chemical
Trade Name:	Advanced Formula Oxygen Release Compound (ORC *Advanced*™)
Chemical Synonyms	Calcium Hydroxide Oxide; Calcium Oxide Peroxide
Product Use:	Used to remediate contaminated soil and groundwater (environmental applications)

Section 2 – Composition

CAS No.	Chemical
682334-66-3	**Calcium Hydroxide Oxide [$CaO(OH)_2$]**
1305-62-0	**Calcium Hydroxide [$Ca(OH)_2$]**
7758-11-4	**Dipotassium Phosphate (HK_2O_4P)**
7778-77-0	**Monopotassium Phosphate (H_2KO_4P)**

Section 3 – Physical Data

Form:	Powder
Color:	White to Pale Yellow
Odor:	Odorless
Melting Point:	527 °F (275 °C) – Decomposes
Boiling Point:	Not Applicable (NA)
Flammability/Flash Point:	NA
Auto- Flammability:	NA
Vapor Pressure:	NA
Self-Ignition Temperature:	NA
Thermal Decomposition:	527 °F (275 °C) – Decomposes
Bulk Density:	0.5 – 0.65 g/ml (Loose Method)
Solubility:	1.65 g/L @ 68° F (20° C) for calcium hydroxide.
Viscosity:	NA
pH:	11-13 (saturated solution)
Explosion Limits % by Volume:	Non-explosive
Hazardous Decomposition Products:	Oxygen, Hydrogen Peroxide, Steam, and Heat
Hazardous Reactions:	None

Section 4 – Reactivity Data

Stability:	Stable under certain conditions (see below).
Conditions to Avoid:	Heat and moisture.
Incompatibility:	Acids, bases, salts of heavy metals, reducing agents, and flammable substances.
Hazardous Polymerization:	Does not occur.

Section 5 – Regulations

TSCA Inventory List:	Listed

CERCLA Hazardous Substance (40 CFR Part 302)

Listed Substance:	No
Unlisted Substance:	Yes
Reportable Quantity (RQ):	100 pounds
Characteristic(s):	Ignitibility
RCRA Waste Number:	D001

SARA, Title III, Sections 302/303 (40 CFR Part 355 – Emergency Planning and Notification)

Extremely Hazardous Substance:	No

SARA, Title III, Sections 311/312 (40 CFR Part 370 – Hazardous Chemical Reporting: Community Right-To-Know

Hazard Category:	Immediate Health Hazard Fire Hazard
Threshold Planning Quantity:	10,000 pounds

Section 5 – Regulations (cont)

SARA, Title III, Section 313 (40 CFR Part 372 – Toxic Chemical Release Reporting: Community Right-To-Know

Extremely Hazardous Substance:	No	
WHMIS Classification:	C	Oxidizing Material Poisonous and Infectious Material
	D	Material Causing Other Toxic Effects – Eye and Skin Irritant
Canadian Domestic Substance List:	Not Listed	

Section 6 – Protective Measures, Storage and Handling

Technical Protective Measures

Storage:	Keep in tightly closed container. Store in dry area, protected from heat sources and direct sunlight.
Handling:	Clean and dry processing pipes and equipment before operation. Never return unused product to the storage container. Keep away from incompatible products. Containers and equipment used to handle this product should be used exclusively for this material. Avoid contact with water or humidity.

Section 6 – Protective Measures, Storage and Handling (cont)

Personal Protective Equipment (PPE)

Engineering Controls:	Calcium Hydroxide ACGIH® TLV® (2000) 5 mg/m^3 TWA OSHA PEL Total dust–15 mg/m^3 TWA Respirable fraction– 5 mg/m^3 TWA NIOSH REL (1994) 5 mg/m^3
Respiratory Protection:	For many conditions, no respiratory protection may be needed; however, in dusty or unknown atmospheres use a NIOSH approved dust respirator.
Hand Protection:	Impervious protective gloves made of nitrile, natural rubbber or neoprene.
Eye Protection:	Use chemical safety goggles (dust proof).
Skin Protection:	For brief contact, few precautions other than clean clothing are needed. Full body clothing impervious to this material should be used during prolonged exposure.
Other:	Safety shower and eyewash stations should be present. Consultation with an industrial hygienist or safety manager for the selection of PPE suitable for working conditions is suggested.
Industrial Hygiene:	Avoid contact with skin and eyes.
Protection Against Fire & Explosion:	NA

Section 7 – Hazards Identification

Emergency Overview:	Oxidizer – Contact with combustibles may cause a fire. This material decomposes and releases oxygen in a fire. The additional oxygen may intensify the fire.
Potential Health Effects:	Irritating to the mucous membrane and eyes. If the product splashes in ones face and eyes, treat the eyes first. Do not dry soiled clothing close to an open flame or heat source. Any

	clothing that has been contaminated with this product should be submerged in water prior to drying.
Inhalation:	High concentrations may cause slight nose and throat irritation with a cough. There is risk of sore throat and nose bleeds if one is exposed to this material for an extended period of time.
Eye Contact:	Severe eye irritation with watering and redness. There is also the risk of serious and/or permanent eye lesions.
Skin Contact:	Irritation may occur if one is exposed to this material for extended periods.
Ingestion:	Irritation of the mouth and throat with nausea and vomiting.

Section 8 – Measures in Case of Accidents and Fire

After Spillage/Leakage/Gas Leakage:	Collect in suitable containers. Wash remainder with copious quantities of water.
Extinguishing Media:	See next.
Suitable:	Large quantities of water or water spray. In case of fire in close proximity, all means of extinguishing are acceptable.
Further Information:	Self contained breathing apparatus or approved gas mask should be worn due to small particle size. Use extinguishing media appropriate for surrounding fire. Apply cooling water to sides of transport or storage vessels that are exposed to flames until the fire is extinguished. Do not approach hot vessels that contain this product.
First Aid:	After contact with skin, wash immediately with plenty of water and soap. In case of contact with eyes, rinse immediately with plenty of water and seek medical attention. Consult an opthalmologist in all cases.

Section 8 – Measures in Case of Accidents and Fire

Eye Contact:	Flush eyes with running water for 15 minutes, while keeping the eyelids wide open. Consult with an ophthalmologist in all cases.
Inhalation:	Remove subject from dusty environment. Consult with a physician in case of respiratory symptoms.

Ingestion:	If the victim is conscious, rinse mouth and admnister fresh water. DO NOT induce vomiting. Consult a physician in all cases.
Skin Contact:	Wash affected skin with running water. Remove and clean clothing. Consult with a physician in case of persistent pain or redness.
Special Precautions:	Evacuate all non-essential personnel. Intervention should only be done by capable personnel that are trained and aware of the hazards associated with this product. When it is safe, unaffected product should be moved to safe area.
Specific Hazards:	Oxidizing substance. Oxygen released on exothermic decomposition may support combustion. Confined spaces and/or containers may be subject to increased pressure. If product comes into contact with flammables, fire or explosion may occur.

Section 9 – Accidental Release Measures

Precautions:	Observe the protection methods cited in Section 3. Avoid materials and products that are incompatible with product. Immediately notify the appropriate authorities in case of reportable discharge (> 100 lbs).
Cleanup Methods:	Collect the product with a suitable means of avoiding dust formation. All receiving equipment should be clean, vented, dry, labeled and made of material that this product is compatible with. Because of the contamination risk, the collected material should be kept in a safe isolated place. Use large quantities of water to clean the impacted area. See Section 12 for disposal methods.

Section 10 – Information on Toxicology

Toxicity Data

Acute Toxicity:	Oral Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Dermal Route, LD_{50}, rat, > 2,000 mg/kg (powder 50%) Inhalation, LD_{50}, rat, > 5,000 mg/m^3 (powder 35%)
Irritation:	Rabbit (eyes), severe irritant

Sensitization:	No data
Chronic Toxicity:	In vitro, no mutagenic effect (Powder 50%)
Target Organ Effects:	Eyes and respiratory passages.

Section 11 – Information on Ecology

Ecology Data	
	10 mg $Ca(OH)_2$/L: pH = 9.0 100 mg $Ca(OH)_2$/L: pH = 10.6
Acute Exotoxicity:	Fishes, Cyprinus carpio, LC_{50}, 48 hrs, 160 mg/L Crustaceans, Daphnia sp., EC_{50}, 24 hours, 25.6 mg/L (Powder 16%)
Mobility:	Low Solubility and Mobility
Abiotic Degradation:	Water – Slow Hydrolysis. Degradation Products: Calcium Hydroxide Water/soil – complexation/precipitation. Carbonates/sulfates present at environmental concentrations. Degradation products: carbonates/sulfates sparingly soluble
Biotic Degradation:	NA (inorganic compound)
Potential for Bioaccumulation:	NA (ionizable inorganic compound)

Section 11 – Information on Ecology (cont)

Comments:	Observed effects are related to alkaline properties of the product. Hazard for the environment is limited due to the product properties of: • No bioaccumulation • Weak solubility and precipatation as carbonate or sulfate in an aquatic environment. Diluted product is rapidly neutralized at environmental pH.
Further Information:	NA

Section 12 – Disposal Considerations

Waste Disposal Method:	Consult current federal, state and local regulations regarding the proper disposal of this material and its emptied containers.

Section 13 – Shipping/Transport Information

D.O.T Shipping Name:	Oxidizing Solid, N.O.S [A mixture of Calcium OxyHydroxide [$CaO(OH)_2$] and Calcium Hydroxide [$Ca(OH)_2$].
UN Number:	1479
Hazard Class:	5.1
Label(s):	5.1 (Oxidizer)
Packaging Group:	II
STCC Number:	4918717

Section 14 – Other Information

HMIS® Rating	Health – 2 Flammability – 0	Reactivity – 1 PPE - Required

HMIS® is a registered trademark of the National Painting and Coating Association.

NFPA® Rating	Health – 2 Flammability – 0	Reactivity – 1 OX

NFPA® is a registered trademark of the National Fire Protection Association.

Reason for Issue: Update toxicological and ecological data

Section 15 – Further Information

The information contained in this document is the best available to the supplier at the time of writing, but is provided without warranty of any kind. Some possible hazards have been determined by analogy to similar classes of material. The items in this document are subject to change and clarification as more information become available.