# DRAFT CLEANUP ACTION PLAN

SCHWERIN CONCAVES SITE
CSID 3956
FISD 11293827

Prepared by
Washington Department of Ecology
Eastern Regional Office
Toxics Cleanup Program
Spokane, WA

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# 1.0 INTRODUCTION

This Draft Cleanup Action Plan (DCAP) sets cleanup standards and selects a cleanup action that meets those cleanup standards for the Schwerin Concaves Site (Site). The Site is a former hard chromium electroplating facility located about four miles north of Highway 12 on Sapolil Road in Walla Walla County, Washington and is situated on a farm within a rural area (Figure 1). The cleanup action selected for the Site is based upon information contained in the Washington Department of Ecology's (Ecology) files, the remedial investigation (RI) completed by Ecology and the feasibility study (FS) completed by a consultant under contract to Ecology. The Site was formerly identified by Ecology's Toxics Cleanup Program as an orphan site. This means that at the time the Site was listed on Hazardous Sites List, the potentially liable person(s) (PLPs) were either financially unable or unavailable to conduct remedial action in an adequate or timely manner at this site. Since that time, the property has been transferred to a new owner, who has been named as a PLP.

Ecology is responsible for the cleanup action selection and the completion of the DCAP. The selected cleanup action is intended to fulfill the requirements of the Model Toxics Control Act (MTCA) RCW 70.105D. More specifically, the objectives of this document are to satisfy the MTCA requirements set forth in WAC 173-340-380(1) and will include the following:

- A brief Site history description;
- A description of the nature and extent of Site contamination summarized from the remedial investigation (RI);
- Establishment of cleanup standards for each contaminated medium that are protective of human health and the environment;
- Presentation of proposed remedial alternatives summarized from the feasibility study (FS); and
- Ecology's selected cleanup action.

## 1.2 APPLICABILITY

This DCAP is applicable only to the Schwerin Concaves Site in Walla Walla, Washington. The remedial actions to be taken at this Site were developed to meet the threshold requirements and other requirements of WAC 173-340-360. Cleanup standards have been developed and cleanup actions selected as an overall remediation process being conducted under Ecology oversight using MTCA authority. Ecology's decisions regarding these matters should not be considered as setting precedent for other sites.

## 1.3 ADMINISTRATIVE DOCUMENTATION

Documents used to develop this DCAP and the decisions contained herein are contained in Ecology's files. The administrative record for this Site is on file and available for public review by appointment at Ecology's Eastern Regional Office, located at 4601 N. Monroe, Spokane, Washington 99205-1295. Documents previously available for public comment are also available at the Walla Walla Public Library. The following documents were used to develop the proposed cleanup action:

- **Hahn and Associates, 1989. A Proposal to Characterize the Surface and Subsurface Soil Conditions at the Schwerin Chrome Concaves Facility.** February 1989.
- **Hart Crowser, 2007. Remedial Pilot Study Data Summary Report for Schwerin Concaves, Walla Walla, Washington. Prepared for the Washington Department of Ecology.** September 2007.
- **Hart Crowser, 2008. Focused Feasibility Study Schwerin Concaves, Walla Walla, Washington. Prepared for the Washington Department of Ecology.** June 2008.
- **Techno and Enviro Services Company, 1989. Preliminary Report on Schwerin Concaves and Hard Chrome Soil Sampling Results.** June 1989.
- **Techno and Enviro Services Company, 1989. Chromium Content in Soils at Schwerin Concaves and Hard Chrome.** October 1989.
- **Techno and Enviro Services Company, 1989. Clean-Up Plan for Schwerin Concaves, Inc.** March 1990.
- **Techno and Enviro Services Company, 1989. Progress Report on Schwerin Concaves Cleanup Plan.** May 1990.
- **Washington Department of Ecology, 2005. Schwerin Concaves Remedial Investigation Report.** November, 2005.
- **Washington Department of Ecology, 2001. Model Toxics Control Act, Chapter 173-340 WAC.** Publication No. 94-06.
- **Washington Department of Ecology, 2001. Cleanup Levels and Risk Calculations under the Model Toxics Control Act, Version 3.1.** Publication No. 94-145.

## 1.4 CLEANUP PROCESS

Cleanup conducted under the MTCA process requires specific documents to be completed and submitted for Ecology review. In the case of an orphan site, Ecology completes or contracts for completion of the remedial investigation and feasibility study. The DCAP and Public Participation Plan are documents completed by Ecology. These documents are used by Ecology to obtain more detailed information and determine the remedial actions to be conducted and the monitoring requirements prior to and following a cleanup action. These procedural tasks and resulting documents, along with the MTCA section that requires their completion, are listed below with a brief description of each task:

- Remedial Investigation and Feasibility Study - WAC 173-340-350
- Draft Cleanup Action Plan - WAC 173-340-380
- Engineering Design Report - WAC 173-340-400
- Construction Plans and Specifications - WAC 173-340-400
- Operation and Maintenance Plan(s) - WAC 173-340-400
- Cleanup Action Report - WAC 173-340-400
- Compliance Monitoring Plan - WAC 173-340-410
- Public Participation Plan - WAC 173-340-600

The Remedial Investigation and Feasibility Study (RI/FS) process documents the investigations and engineering evaluations conducted at the Site from the discovery phase to the final RI/FS. The investigations are designed to characterize the type and extent of contamination and the associated risks posed by the contamination to human health and the environment. The FS presents and evaluates different Site cleanup alternatives and proposes the preferred cleanup alternative. The Remedial Investigation Report and Feasibility Study Report were reviewed and made available for public review and comment, and then finalized.

The DCAP sets the cleanup standards for the Site and selects the cleanup actions intended to achieve the cleanup standards. After opportunity for public comment and any revisions made following public comment, the DCAP is finalized with an attached responsiveness summary and becomes the cleanup action plan (CAP).

The Engineering Design Report outlines the engineered system and design components of the CAP. Construction Plans and Specifications provide the technical drawings and specifications for design and implementation of the CAP.

The Operation and Maintenance (O&M) Plan(s) summarizes the requirements for inspection and maintenance as well as the regulatory and technical necessities to assure effective operations. The O&M Plan(s) outline the actions required to operate and maintain any equipment, structures, or other remedial facilities used in the cleanup action.

A Cleanup Action Report will be completed following implementation of the selected cleanup action. The report will detail the activities performed for the Site cleanup action and provide documentation of adherence to or variance from the CAP.

Compliance Monitoring Plans are designed to serve the following three purposes:

- Protection – Confirm human health and the environment are being protected during construction and O&M tasks for the cleanup action at the Site.
- Performance – Confirm the cleanup action has attained cleanup standards.
- Confirmational – Confirm the long-term effectiveness of the cleanup action after cleanup standards have been attained.

The Public Participation Plan is the framework to provide the public with information and give it the opportunity for participation in a site. This plan is tailored to the meet the public's needs and coordinate its effort in the MTCA process.

## 2.0 SITE HISTORY

The following paragraphs provide a brief summary of ownership, operational, and regulatory history of the Site. The information provided herein was provided in the Remedial Investigation reports completed by Hart Crowser, Hahn and Associates, Inc. Technico and Enviro Services Company, and Ecology.

Schwerin Concaves, Inc. (Schwerin) owned and operated a hard chromium electroplating facility on this property from the late 1970s to 2000. Ecology understands the facility was part of a wheat farming operation prior to its use as a plating facility. The farming operation continues to be present on other portions of the property. Schwerin electroplated internal farm combine components called concaves that remove husks from grain kernels. The concaves were brought to the facility and refurbished by a process that involved three main work areas: the cleaning station, plating station, and the wastewater treatment station.

The precision and reliability of testing equipment most likely allowed chromium concentrations above zero to remain in the treated water. Prior to 1988, the wastewater was pumped to a 10,000-gallon holding tank. The tank was located north of the plating shop in secondary containment constructed with concrete masonry unit (CMU) blocks. The tank was partially below-ground and was covered with a portable roof. The treated wastewater was periodically pumped to an unlined settling pond in the self-propelled shed.

Ecology's Hazardous Waste Toxics Reduction Program completed several inspection and technical assistance visits to the facility between 1988 and 2000. Compliance investigations noted several hazardous waste management violations and practices resulting in site contamination. These violations included improper treatment of sludge and wastewater, chemical and sludge storage, and disposal practices. Based on waste handling practices and observed contamination, the Schwerin Concaves Site was placed on the Washington State Hazardous Sites List in August 2000. In addition, a site hazard assessment (SHA) was completed which resulted in a site ranking of 2. This site's ranking, on a scale of one to five with one being the highest, is relative to all other Washington State sites assessed at this time. This ranking indicates the site is considered to pose a very high assessed risk to human health and the environment from confirmed and suspected site contamination.

## 2.1 REGULATORY HISTORY

The first Ecology site inspection was conducted in June 1988. Nine areas of non-compliance were noted by the Ecology hazardous waste inspectors and a follow-up compliance letter was sent to correct the areas of general non-compliance. Another site inspection was conducted in April 1989, and six additional violations were noted during the visit. A letter was sent from Ecology to Schwerin in July 1989 to correct the non-compliance issues.
A consultant was hired by Schwerin to provide environmental services. The consultant completed a contaminant report identifying two areas of contamination and addressed other cleanup issues including RCRA closure (Technico and Enviro, 1989). Correspondence between Ecology and Schwerin continued regarding hazardous waste violations including a closure plan, worker training, waste water treatment, and sludge disposal.

In July 1991, EPA conducted a RCRA facility assessment at the Site. The EPA assessment identified ten solid waste management units (SWMUs) and violations at the site. A draft order was completed by EPA but never issued.

Ecology completed a site inspection in January 1992 and noted 13 violations. A letter and follow-up inspection was conducted in May 1993. Eight violations were observed in the May 1993 inspection. Six site inspections were conducted from 1994 through 1999 with continued violations noted. In March 2000, Ecology issued an Enforcement Order to Schwerin to conduct a study at the Site to define the extent of soil and groundwater contamination. Schwerin did not conduct the study prior to Ecology levying a $221,000 penalty for the continued violations observed throughout the years. Given the financial condition of the business, Ecology elected not to pursue collection of the fine.

In addition to the violations noted by Ecology, the EPA conducted a criminal investigation regarding improper handling and storage of hazardous waste at the Site. The investigation led to criminal charges and the plating shop was closed. As part of the criminal settlement, the plating shop interior and its contents were dismantled and disposed in accordance with state and federal regulations. Additional information on Hazardous Waste compliance can be found in the Hazardous Waste Toxics Reduction administrative file at Ecology's Eastern Regional Office.

## 3.0 PHYSICAL SETTING

The Schwerin Concaves Site is located about four miles north of Highway 12 on Sapolil Road in Walla Walla County, Washington. The property is located in Section 31, Township 8 North, Range 37 East, Willamette Meridian at 46$^{o}$ 04' 08" north latitude and 118$^{o}$ 21' 20" west longitude, and is situated on a farm within a rural area (Figure 1). Topographic map coverage of the Site and Site vicinity is provided by the Buroker Quadrangle, U.S. Geological Survey, 7.5 minute series dated 1966. The Site elevation is about 1220 feet above sea level using the National Geodetic Vertical Datum (NGVD) of 1929.

The Site is located along the north bank of Dry Creek, which is a tributary to the Walla Walla River. The immediate vicinity is rural and sparsely populated. Agricultural fields bound the Site on the north, west and east sides with Dry Creek forming the southern border. The Site is relatively flat with the topographic relief provided by the stream channel of Dry Creek. The topographic gradient is one percent or less from east to west across the Site. The elevation change ranges from 1224 feet at monitoring well MW-4 to 1218 feet at monitoring well MW-3 (Figure 2). The general land slope steepens to the north and south of the Site and drains across the Site and toward Dry Creek. The property is unpaved and surface water will pond in some areas and generally drains to the south toward the creek.

The plating operation was housed mainly in one large building with five auxiliary buildings used to store products and waste. A storage tank housed inside a subterranean covered shed was located to the north of the plating shop. The auxiliary buildings include an office/maintenance shop, self-propelled shed, long farm shed, a storage shed, and barn. A residence and garage are located west of the long farm shed (Figure 2).

## 3.1 REGIONAL GEOLOGY

As described above, the site is situated in the Walla Walla River Valley. Geologic materials in the area are described as alluvial and glacial deposits. Generally, the alluvial deposits consist of unconsolidated silt, sand, and gravel valley fill. The glacial deposits of Pleistocene age are lacustrine in nature and include fine-grained sand and silt with some gravel.

The oldest, thickest and most extensive valley fill unit of these deposits consists of the “old clay”, up to 500 feet or more in thickness, which partially fills the Walla Walla Basin. The “old clay” is interfingered with the “old gravel”. The “old gravel” is composed largely of well-rounded, pebble, cobble, and boulder gravel derived principally of basaltic material. The gravel is typically set in a matrix of sandy and silty material. In some cases considerable calcareous cement is present. The “old gravel” extends approximately from the foot of the Blue Mountains located east of the Site to Dry Creek near Buroker. It formed generally by the deposition of coalescent alluvial fans (Newcombe, 1965).

The upper portion of this alluvial surface was covered by later unconsolidated materials and forms the present physiographic surface in the upper part of the valley. Successively younger deposits of Pleistocene age, known as the Palouse Formation, Touchet Beds, and recent alluvium overlie the “old gravel” and “old clay” in some areas, as well as the basalt. The lower part of the valley is principally covered with glaciofluvial and recent alluvial deposits.

The aforementioned sequence of unconsolidated sediments overlie rocks of the Columbia River Basalt Supergroup. These basalt flows are grouped into different units. Each unit has varying thickness and depths throughout the Columbia Plateau and contains numerous individual flows. The basalt dips westward from the Blue Mountains, southward down the “Touchet Slope”, northward from the Horse Heaven ridge, and eastward from a divide ridge in the lower valley. These dips converge into a synclinal trough whose bedrock surface extends below sea level in at least two places west of Walla Walla. This trough defines a hydrologic sub basin of the Columbia Plateau known as the Walla Walla Basin.

The Columbia River Basalt Supergroup formations found in the area include the Saddle Mountains Basalt that overlies the Wanapum Basalt. The Wanapum overlies the Grande Ronde. Based on a review of well logs, a majority of the domestic and municipal supply wells in the area are completed in the Wanapum Basalt.

### *Site Geology*

The site geologic interpretation is made from split spoon samples and drill cuttings collected from the monitoring wells installed on-site, temporary well point samples, and excavation activities. The upper soil profile consists of light brown, dry medium dense, sandy silt. The sand is mostly fine-grained and the silt is non-plastic to slightly plastic. The sandy silt overlies sandy gravel with silt (5-15%) or gravelly sand. The gravel becomes sandier and less silty with depth. The site geology appears to correspond with the regional geology since the upper soil profile appears similar to loess of the Palouse Formation and the gravelly zone correlates to the "old gravel."

Bedrock was encountered in six of the thirteen monitoring well borings. The surface of the basalt bedrock was encountered 35 to 39 feet bgs and was closer to surface in wells MW-4 and MW-5, which are closest in proximity to Dry Creek. Basalt was encountered in MW-10 at approximately 80 feet bgs. Based on the drilling, the basalt appears to form a relatively flat surface that gently dips away from Dry Creek. The gently dipping surface appears to abruptly change in the plating shop area, dipping steeply between monitoring wells MW-6 and MW-9 at the plating shop's southern edge to monitoring well MW-10, north of the shop. This dramatic change in the bedrock profile is also supported by other boring logs and the geophysical survey.

## 3.2 REGIONAL HYDROGEOLOGY

Groundwater occurrences in the Walla Walla Basin are developed in basalt bedrock, the "Old Gravels;" and the recent alluvium overlying the "old gravels," which includes loess soil and glaciofluvial sands and gravels. The majority of groundwater is used for irrigation with the remainder used for domestic and industrial purposes.

The regional groundwater flow direction in the gravel aquifer is west with a southern or northern flow component relative to the main stem of the Walla Walla River. The regional groundwater flow direction in the basalt aquifer is west with a southerly flow from the Touchet River toward the Walla Walla River and a northerly flow from Oregon toward the Walla Walla River.

Site Hydrogeology

The Site hydrogeology is based on the thirteen monitoring wells Ecology installed at the Site. Groundwater was encountered at varying depths based on the proximity to Dry Creek and the occurrence of bedrock. As shown in Figure 2, monitoring wells MW-1, MW-2, MW-3, and MW-7 encountered groundwater about 40 feet bgs. Monitoring wells MW-4, MW-5, MW-6, MW-8, and MW-9 encountered groundwater at approximately 30 feet bgs. Groundwater occurs in brown, gravelly sand or sandy gravel with silt.

Groundwater levels typically increased after well construction from the depth water was encountered during drilling. Static water levels after monitoring well construction range from 15 feet bgs in MW-13, located within the former plating shop, to 36 feet bgs in MW-12, the northernmost monitoring well. Based on water level elevations, bedrock appears to significantly control the water table surface. Groundwater flows away from the creek to the northeast where the bedrock is deeper and soil thickens. The water levels and flow direction appear to be directly influenced by Dry Creek and bedrock. Due to a thickening of the gravel aquifer, monitoring wells MW-1, MW-2, MW-3, MW-7, MW-10, MW-11, MW-12, and MW-13 did not encounter bedrock.

### 3.3 SURFACE WATER

Dry Creek forms the southern boundary of the Site. The creek flows west along the site and eventually flows into the Walla Walla River south of the town of Lowden. At the time of sampling, surface water samples collected near the Site from Dry Creek indicate the creek has not been affected by on-site contamination. Based on piezometers installed near the creek and groundwater monitoring wells, groundwater in the Site area flows away from the creek.

## 4.0 REMEDIAL INVESTIGATION

Ecology initiated drilling and field work at the Site in October 2000. Four soil borings were completed as monitoring wells. The boring locations were selected to provide an initial insight into groundwater quality near known and possible contaminant sources (Figure 2). The location for monitoring well MW-1 was selected to provide an assumed upgradient well for the Site. Monitoring well MW-2 was located in a perceived downgradient location of the plating shop. Monitoring well MW-3 was placed downgradient of the maintenance shop and MW-4 was located in a presumed downgradient location of the self-propelled shed. Monitoring well MW-4 was the only boring to encounter bedrock during this phase of investigation.

In 2001, Ecology completed a second phase of drilling and field work at the Site. The work was designed to further define the soil and groundwater contamination at the Site. Field work was initiated in December 2001. As shown on Figure 2, five additional monitoring wells were completed at the Site. Monitoring well locations were selected to augment conditions and further define the hydrogeologic regime. Monitoring well MW-5 was placed between MW-4 and Dry Creek in order to assess water quality near the creek. Monitoring well MW-8 was located east of the self-propelled shed to monitor groundwater conditions east of the shed as MW-4 does on the west side of the shed. Monitoring wells MW-6 and MW-9 were placed near the southwest and southeast corners of the plating shop to assess the presence of bedrock and groundwater conditions between the identified contamination sources. Monitoring well MW-7 was placed near the northeast corner of the plating shop in the proximity of the wastewater holding tank.

Of the five wells installed in 2001, four encountered bedrock during their completion. MW-7 did not encounter bedrock during drilling. The bedrock encountered suggested the basalt has a relatively flat profile with a gentle slope away from the creek.

Based on the information generated from the soil borings and the difficulty in soil sample retrieval, additional exploration was needed to further assess the subsurface. The subsurface exploration was designed to provide additional lithologic information as well as assist in developing a bedrock profile near the self-propelled shed. In October 2001, nine geoprobe borings were completed to varying depths across the site. In general depths ranged from 16 to 23 feet bgs and were terminated since the geoprobe could not be advanced beyond these depths.

## 4.1 SOIL CONTAMINATION

Soil contamination, while obvious at surface in two areas based on discoloration, was unknown at depth. During RI activities, the two suspected areas of contamination were confirmed. These areas, identified as the plating shop and the self-propelled shed, are believed to be the primary sources for groundwater contamination. As mentioned above, soil sample collection at depth using standard drilling and sampling techniques was proven very difficult. Samples were collected during monitoring well drilling and were retrieved near the soil/water interface. Results from limited soil samples indicated the presence of chromium. However, hexavalent chromium concentrations were much lower than the total chromium concentrations suggesting vadose conditions are conducive to partially reducing the hexavalent chromium to its trivalent form. Ecology conducted cleanup activities as an interim action because there was an immediate threat to human health and the environment in affected areas. The interim action was intended to provide rapid source control measures and limit groundwater contamination.

Prior to the interim action, two soil samples had been collected and analyzed from the self-propelled area to determine if the soil designated as dangerous waste. The soil did designate as dangerous waste by failure of the toxicity characteristics leaching procedure (TCLP) for chromium with concentrations of 30.7 and 160 parts per million (ppm) and thus was listed as D007 waste. Samples had not been retrieved from the plating shop area since the concrete apron entrance to the shop was needed for plating equipment removal. A portion of the soil in the plating shop area was assumed to designate as dangerous waste as well.

Self-Propelled Shed

The self-propelled shed dimensions were about 20 feet, west to east, by 30 feet, north to south. Prior to starting removal work, the structure was physically removed to allow access to the earthen floor and surrounding soils. Test pits were excavated to about four feet below ground surface (bgs) to assess the depth the soil no longer designated as dangerous waste. Samples were collected and submitted for chromium and lead analysis by TCLP methods. Sample results indicated the soil below four feet did not designate as dangerous waste and could be disposed at a subtitle D landfill.

The self-propelled shed excavation extended beyond the original footprint of 20 feet by 30 feet. The final excavation limits were about 46 feet, west to east, and 35 feet, north to south, to an overall depth of 12 feet. The excavation was expanded since contamination was observed beyond the original footprint. Approximately 750 tons of dangerous waste soils from the upper four feet of the self-propelled shed area were disposed at the Waste Management facility in Arlington, Oregon. Approximately 1,200 tons of contaminated soil not designated as dangerous waste were removed and transported to the Subtitle D Rabanco Regional Landfill in Roosevelt, Washington for disposal.

A grid was established in an effort to divide the excavation into similarly sized areas for sample collection. Soil samples were collected from the grid to assess and confirm the efficacy of the remediation. Soil sample results indicated the soil at the margins and bottom of the excavation were below Method B screening level for the site established at 240 milligrams per kilogram (mg/kg) for hexavalent chromium (Figure 3).

Plating Shop

The plating shop exterior consisted of a concrete slab apron and the partially buried polyurethane tank used for wastewater storage and treatment. The tank was situated inside a concrete masonry unit (CMU) secondary containment structure with a roof. The roof and tank were removed from the area by the owner prior to field work.

Initial soil samples collected from below the concrete pad suggested the soil did not designate as dangerous waste. However, samples beneath and adjacent to the buried tank were not collected in the initial screening. During the secondary containment demolition, the CMU and adjacent soil was observed to be stained and discolored. Soil sample results indicated the soil designated as dangerous waste based on chromium TCLP concentrations of 5.45 ppm. The soil and stained concrete were sent to Arlington, Oregon for disposal as dangerous waste. About 892 tons of dangerous waste soils were removed from the plating shop area.

The visibly discolored soil in the plating shop area dictated the original configuration be expanded. The grid was expanded to include the concrete apron and shop entrance. The final dimensions for the plating shop excavation were 42 feet, west to east, and 28 feet, north to south. The excavation depth varied from six feet deep along the western and northern portions and up to 19 feet below ground surface near the building (Figure 4).

Soil samples were collected from the grid to assess and confirm the efficacy of the remediation. Sample results indicated the excavation soils were below Method B removal screening levels for the site.

## 4.2 GROUNDWATER CONTAMINATION

Site groundwater is contaminated with chromium, predominantly in the hexavalent form. Groundwater chromium concentrations have generally decreased since the interim action in 2002. The previously identified source areas, the self-propelled shed and plating shop, retain residual groundwater contamination in both areas. Monitoring well MW-4 represents the highest groundwater chromium concentrations in the self-propelled shed area while monitoring well MW-7 has the highest chromium concentrations near the plating shop.

For the first level of screening, a Method B cleanup level for groundwater contaminants was used. Of the elevated groundwater contaminants, chromium is the only contaminant continuously exceeding a MTCA cleanup level. Arsenic, cadmium, iron, lead, zinc, nitrate, and sulfate have been detected in groundwater at concentrations that exceed the screening levels. The Method B groundwater cleanup level for chromium with the hexavalent form present is 48 parts per billion (ppb). Of the remaining contaminants of concern (COCs): iron, nitrate, and sulfate have not been analyzed for frequently and were collected as part of a pilot treatment study. Their presence appears to be associated with the pilot treatment study injections. Arsenic, cadmium, lead, and zinc are more commonly associated with the plating processes. The Method B screening level concentrations for arsenic, cadmium, and zinc are 4.8 ppb, 8 ppb, and 4,800 ppb respectively. Lead does not have a Method B cleanup level, but the Washington State maximum contaminant level (MCL) is 15 ppb.

## 4.4 PILOT TREATMENT STUDY

A pilot treatment study was performed at the Site from October 2006 through June 2007. The study is discussed in "Remedial Pilot Study Data Summary Report" dated September 14, 2007. The pilot study purpose was to determine the effectiveness of in situ treatment of hexavalent chromium in groundwater. The groundwater recirculation pilot system began operating in November 2006 and operated through May 2007. The system withdrew groundwater from four-inch diameter, monitoring well, MW-11. Due to limited production from MW-11, an additional two- inch monitoring well, MW-10, was added as a pumping well. Groundwater pumped from the downgradient extraction wells was temporarily stored in a polycarbonate tank and amended with dextrose/nutrient mixture before being re-injected in monitoring wells MW-9 and MW-13. Due to poor groundwater circulation at the Site, use of the recirculation system was discontinued. Based on the sample results and field parameters, an anaerobic environment was established in the injection wells, but did not appear to disperse to the other monitoring wells. Within the injection wells, hexavalent chromium concentrations decreased from 0.116 to 0.0120 mg/L in MW-9 and from 0.0200 to less than 0.005 mg/L in MW-13, respectively. Hexavalent chromium concentrations decreased slightly in nearby monitoring wells MW-1 and MW-6, while they were relatively unchanged in the remaining wells.

Following cessation of the recirculation system, the dextrose/nutrient amendment was injected into specific site wells to confirm that native microbes could successfully reduce hexavalent chromium to trivalent chromium. Slug injections were performed during June, July, and December 2007. August 2007 analytical results from slug-injected wells MW-2, MW-6, MW-7, MW-9, MW-11, and MW-13 showed substantial reductions in hexavalent chromium concentrations. Hexavalent chromium levels were below detection limits for the slug injected wells with the exception of monitoring well MW-7. Well MW-7 concentrations of hexavalent chromium decreased from 77.5 ppm in June 2007 to 19.2 ppm during the August 2007 sampling event. The observed hexavalent chromium reductions are also supported by decreases in nitrate and sulfate (electron acceptors) concentrations in wells MW-2, MW-6, MW-9, and MW-13. The pilot study and slug-injections confirmed that microbes could be stimulated to reduce hexavalent chromium to trivalent chromium.

Prior to initiation of the pilot study, arsenic was detected below screening levels. Since the pilot study has encouraged reductive processes at the Site, arsenic has been periodically detected in the pilot study wells. Under oxidative aquifer conditions, arsenic is stable and readily forms insoluble salts. However, under reductive conditions like those created by the in-situ treatment, arsenic is reduced to trivalent arsenic (arsenic III) and becomes mobile. Ecology believes the presence of arsenic in groundwater samples is a result of the pilot study.

## 5.0 CLEANUP STANDARDS

The cleanup standard development process is used to determine which hazardous substances contribute to an overall threat to human health and the environment at a site. Once these substances are identified, an evaluation is made to determine at what concentrations these substances are considered to be protective of human health and the environment. A point of compliance is then established on the Site, which is a point or points where these cleanup levels must be attained (WAC 173-340-200). Cleanup standards include both cleanup levels and points of compliance for those cleanup levels.

MTCA provides three main methods for establishing cleanup levels at a site. These are Method A, B, and C. Method A provides cleanup levels for routine cleanup actions or sites with relatively few hazardous substances. Methods B and C cleanup concentrations are calculated from applicable or relevant and appropriate requirements (ARARs) and by using the formulas provided in WAC 173-340-720 through WAC 173-340-760. Method B is the standard method for establishing cleanup levels and is applicable to all sites. Method C is a conditional method for use at sites subject to specified uses.

Following establishment of cleanup levels, media having concentrations above cleanup levels must be addressed using one or more technologies selected as part of the remedy. Criteria for remedy selection are outlined in WAC 173-340-360.

Human health and terrestrial ecological conditions are evaluated in order to establish cleanup standards. Two exposure pathways have been considered in establishing cleanup standards for this Site. These pathways are direct contact with contaminated soil and the protection of groundwater. Even though the Site is a commercial facility, it is located in a rural agricultural are; therefore, Ecology considers the Site to have an unrestricted land use. The most reasonable exposure scenarios for human health and ecological receptors are ingestion and direct contact with the contaminated soil and ingestion.

Groundwater exposure is only evaluated for human health exposures. As stated previously, the highest beneficial use of Site groundwater is as a current and future drinking water source. Ecology has determined the reasonable maximum exposure expected is through ingestion of drinking water and other domestic uses (WAC 173-340-720 (1) (a)). A Method B cleanup standard will be used for establishing cleanup levels in soil and groundwater at the Site.

Chromium and lead are the indicator substances identified for groundwater (Table 1) and chromium for soil. The metal contamination is a direct result of releases of plating fluids and solids. The same suite of analytes previously used to monitor the Site will continue to be used to monitor the Site.

## 5.1 TERRESTRIAL ECOLOGICAL EVALUATION

A site is required under WAC 173-340-7490 to perform a terrestrial ecological evaluation (TEE) to determine whether a release of hazardous substances to soil may pose a threat to ecological receptors. A site may be excluded from a TEE if any of the following conditions are met:

- All contaminated soil is or will be located below the point of compliance;
- All contaminated soil is or will be covered by physical barriers such as buildings or pavement;
- The site meets certain requirements related to the nature of on-site and surrounding undeveloped land; or
- Concentrations of hazardous substances in soil do not exceed natural background levels.

This Site does not meet any of the exclusionary criteria, but it does qualify for a simplified TEE which was conducted at the Site. As previously discussed, the Site has an unrestricted land use. Therefore, plants and animals are considered as potential receptors.

## 5.2 INDICATOR SUBSTANCES

Indicator substances as defined by WAC 173-340-200 are a subset of hazardous substances present at a site selected under WAC 173-340-708 for monitoring and analysis. Metals have been identified as the chemicals of concern at the Site. Indicator substances are selected from the list of chemicals of concern. The criteria found in WAC 173-340-708 (2) are used to screen the list of chemicals. Following the selection of indicator substances, cleanup levels are developed for the list of substances used to calculate the total site risk. Protection of groundwater is considered in conjunction with exposure scenarios. For non-carcinogenic substances, the summation of risk for each toxic endpoint of all media must not exceed a hazard index of one. For establishing cleanup levels of carcinogenic substances, the total cancer risk from all chemicals in the affected media must not be greater than one in one hundred thousand or $1x10^{-5}$.

Soil Indicator Substances

Confirmation soil sample results from the excavations showed the contaminated soil had been removed during the interim action. Soil contamination may remain beneath the plating shop building floor and at the water table. Based on the samples collected from the near-surface and at-depth soil borings, chromium was the only contaminant identified above Method B screening levels. The most stringent chromium soil cleanup level is 42 parts per million and is set for ecological protection.

Groundwater Indicator Substances

The highest beneficial use of Site groundwater is as a current and future drinking water source. Groundwater production is low and the yield is limited. Exposure through ingestion and other domestic uses is the main potential groundwater pathway. Chromium and lead are indicator substances for groundwater. The chromium contamination is mostly in the hexavalent form. Metals contamination at this Site is associated with the former plating operations. Groundwater indicator substance screening results are presented as Table 1.

## 5.3 CLEANUP STANDARD DEVELOPMENT

The indicator substance screening resulted in the selection of (1) soil and (2) groundwater contaminants to be carried forward for cleanup standard development. Groundwater cleanup levels will be set to be protective of human health via ingestion and other domestic uses. A cleanup standard combines the establishment of a cleanup level at a point of compliance. A point of compliance (WAC 173-340-200) is the point or points where cleanup levels established in accordance with WAC 173-340-720 through 173-340-760 shall be attained. Once those cleanup levels have been attained at that point, a site is no longer considered a threat to human health and the environment. If a conditional point of compliance is established, institutional controls must remain in place to prevent exposure where hazardous substances remain on-site above cleanup levels.

The standard soil point of compliance for cleanup levels established to be protective of human health via direct contact is upper fifteen feet of the soil profile. Where hazardous substances remain on-site as part of the cleanup action, institutional controls will be required. Since the soil cleanup levels were established for protection of terrestrial receptors, a conditional point of compliance may be used with institutional controls. The conditional point of compliance may be set at the biologically active zone, which is assumed to extend to six feet below ground surface. Ecology may approve a site-specific depth based on a demonstration an alternative is appropriate for the site.

### *5.3.1 Soil Cleanup Levels*

Soil cleanup concentrations set under Method B shall be at least as stringent as the criteria in WAC 173-340-740(3)(b), which includes the following:

- Concentrations established under applicable state and federal laws.
- No significant adverse effects on the protection and propagation of terrestrial ecological receptors established using the procedures specified in WAC 173-340-7490 through 173-340-7494.
- For hazardous substances for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health as determined by the equations presented in WAC 173-340-740(3)(iii)(A) and (B).

Soil cleanup levels were developed for chromium. The soil cleanup level was established using the terrestrial ecological evaluation table values.

### *5.3.2 Groundwater Cleanup Levels*

Groundwater levels set under Method B for groundwater must be at least as stringent as the criteria in WAC 173-340-720(4)(b), which includes the following:

i) Concentrations established under applicable state and federal laws, including the requirements in WAC 173-340-720(3)(b)(ii):

ii) For protection of surface water beneficial uses.

iii) For hazardous substances for which sufficiently protective, health-based criteria or standards have not been established under applicable state and federal laws, those concentrations which protect human health as determined by the equations presented in WAC 173-340-720 (3)(iii)(A) and (B).

To develop cleanup levels for the Site, Ecology evaluated existing Site groundwater data and compared these data to Method B cleanup levels. Table 1 presents the Method B cleanup levels for indicator substances chromium and lead in groundwater. Based on potentiometric surface maps, groundwater at the Site does not discharge to Dry Creek and flows away from the creek. Groundwater cleanup levels must be set to be protective of drinking water.

Hexavalent chromium has a cleanup level of 48 ug/L, which is the Method B calculated concentration. The Method B trivalent chromium cleanup level is 24,000 ug/L. The lead cleanup level of 15 ug/L is based on the federal and state maximum contaminant level (MCL) of the Primary Drinking Water Standards (40 CFR 141 and WAC 248-54).

A point of compliance (WAC 173-340-200) is the point or points where cleanup levels established in accordance with WAC 173-340-720 through 173-340-760 shall be attained. Once those cleanup levels have been attained, a site is no longer considered a threat to human health and the environment. If a conditional point of compliance is established (see below), institutional controls must remain in place to prevent exposure where hazardous substances remain on-site above cleanup levels.

Under MTCA, the standard groundwater point of compliance is throughout a site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the Site (WAC 173-340-720(8)(b)).

Where hazardous substances remain on-site as part of the cleanup action, a groundwater conditional point of compliance may be used, which shall be as close as practicable to the source of hazardous substances not to exceed the property boundary. If a conditional point of compliance is used, the proponent shall demonstrate all practicable methods of treatment are utilized in the cleanup action (WAC 173-340-720(8)(c)). A standard point of compliance has been selected for use at the Site, as explained in Section 7.1 below.

## 5.4 OVERALL SITE RISK

The identified indicator substances are not considered carcinogenic. The hazard index for the Site is one. This is derived from the risk associated with chromium in groundwater. Since an oral reference dose is not available for lead, a hazard quotient could not be calculated. Although it does not have a toxic endpoint, the highest calculated hazard index of one is for chromium. Table 2 presents the cleanup levels and associated hazard quotients.

# 6.0 REMEDIAL ALTERNATIVES

Ecology contracted with Hart Crowser to complete the focused feasibility study (FFS). The FFS supplied Ecology with an evaluation of technologies that could be used to remediate contamination at the Schwerin Concaves Site. Since the FFS was submitted near the end of the contract period, Ecology accepted the FFS as final. The FFS identified five alternatives for addressing groundwater contamination. Each alternative will require institutional controls since contaminated groundwater and in some cases, soil contamination will remain. Each proposed alternative includes building decontamination and demolition. In order to address groundwater contamination, two alternatives involve groundwater and soil treatment. A third alternative involves partial source removal coupled with source area treatment. The alternatives are as follows:

- Building Decontamination and Demolition
- Limited In-Situ Soil and Groundwater Treatment and Building Decon and Demo
- Aggressive In-Situ Soil and Groundwater Treatment and Building Decon and Demo
- Source Removal and Monitoring
- Source Removal and In Situ Source Area Treatment

The alternatives were developed to comply with MTCA including other applicable or relevant and appropriate requirements (ARARs), and to provide protection of human health and the environment. Each alternative is summarized directly from the FFS and presented below.

## 6.1 ALTERNATIVE 1 – BUILDING DECONTAMINATION, DEMOLITION & MONITORING

In Alternative 1, the former Plating Shop would be decontaminated and demolished to reduce direct human health and ecological risks at the Site. This alternative would also include continuing groundwater monitoring to ensure contaminants do not pose unacceptable risk to potential receptors. The decontamination would include removing any remaining plating wastes along with decontaminating obviously stained building materials to minimize disposal costs. A comparison of Alternative 1 against applicable MTCA criteria is provided below.

## 6.2 ALTERNATIVE 2 – LIMITED IN-SITU SOIL, GROUNDWATER TREATMENT AND BUILDING DECON & DEMO

This alternative would introduce an electron donor through slug injections to convert the bulk of chromium VI to chromium III, and monitor groundwater for 10 years. Slug injections would be performed in several stages and custom-tailored to address the approximate contaminant mass in each area of the Site. The goal of the injections would be to reduce all COC concentrations to achieve CULs for most areas south of the MW 10/MW-12 well alignment.

For this alternative, two long-lasting (i.e., up to 5 years) amendments were evaluated on paper. These include the Remediation and Natural Attenuation product Newman Zone®, which is comprised of emulsified soybean oil and sodium lactate, and Adventus' EHC® product, which is comprised of processed cellulose and zero-valent iron.

Based on this evaluation, the amount of electron donor, and number of injection locations, the emulsified oil was evaluated further for this alternative, and the information gathered from the EHC® evaluation was used in a subsequent alternative. Institutional controls would also likely be necessary to restrict use of contaminated soils and groundwater at the Site. This alternative also includes the Plating Shop decontamination and demolition.

## 6.3 ALTERNATIVE 3 – AGGRESSIVE IN-SITU SOIL, GROUNDWATER TREATMENT AND BUILDING DECON & DEMO

This alternative would employ a combination of Plating Shop decontamination, demolition, and disposed at an appropriate waste facility. Aggressive electron donor amendment slug injections would be used to biologically remediate contaminated groundwater across much of the Site. This aggressive remedial approach would also target contamination present from near Dry Creek to the northern extent along MW-10/MW-12.

Following decontamination and/or demolition, the second phase of this alternative would be slug injections of low-mobility EHC® placed around the former Plating Shop and the former self-propelled shed source areas. Additional slug injections would be used to install a permeable reactive barrier approximately 50 feet south of the MW-10/MW-12 alignment as an additional treatment contingency.

Institutional controls would also likely be necessary to restrict access and use of contaminated soils and groundwater at the Site.

## 6.4 ALTERNATIVE 4 – SOURCE REMOVAL, MONITORING AND BUILDING DECON & DEMO

For this alternative, the Plating Shop would be decontaminated, demolished, and disposed at an appropriate waste facility. Contaminated soil underneath the former plating vaults would be removed for disposal. Long-term groundwater sampling and analysis would be performed to determine risk to potential receptors and institutional controls would be put in place to protect against future exposure.

## 6.5 ALTERNATIVE 5 – SOURCE REMOVAL, IN SITU SOURCE AREA TREATMENT AND BUILDING DECON & DEMO

The Plating Shop would be decontaminated, demolished, and disposed at an appropriate facility. A reduced volume of source area soils would be removed in comparison to Alternative 4 and disposed off-site. The remaining source area soils and groundwater will be addressed with in situ bioremediation.

To enhance contaminant control, MW-13 would be converted to an extraction well to create a vertical recirculation cell. Infiltrating and re-circulating electron donor in the highest concentration source area would mitigate residual contamination above and below the water table.

Institutional controls would also likely be necessary to restrict access and use of contaminated soils and groundwater at the Site

## 6.6 CLEANUP ACTION EVALUATION CRITERIA

The criteria used to evaluate cleanup actions are presented in WAC 173-340-360. All cleanup actions must meet the following four threshold requirements:

- Protect human health and the environment
- Comply with cleanup standards set forth in WAC 173-340-700 through 760
- Comply with applicable state and federal laws
- Provide for compliance monitoring

Other requirements for cleanup actions meeting threshold criteria include the following:

- Use permanent solutions to the maximum extent practicable
- Provide for reasonable restoration time frame
- Consider public concerns raised during the public comment period on DCAP

WAC 173-340-360(3)(b) describes the specific requirements and procedures for determining whether a cleanup action uses permanent solutions to the maximum extent practicable. A permanent solution is defined as one where cleanup levels can be met without further action being required at a site, other than the disposal of residue from the treatment of hazardous substances. To determine whether a cleanup action uses permanent solutions to the maximum extent practicable, a disproportionate cost analysis is conducted. This analysis compares the costs and benefits of the cleanup action alternatives and involves the consideration of several factors, including:

- Protectiveness;
- Permanent reduction of toxicity, mobility and volume;
- Cost;
- Long-term effectiveness;
- Management of short-term risks;
- Implementability; and
- Consideration of public concerns.

The comparison of benefits and costs may be quantitative, but will often be qualitative and require the use of best professional judgment.

WAC 173-340-360(4) describes the specific requirements and procedures for determining whether a cleanup action provides for a reasonable restoration time frame.

Groundwater Cleanup Action Requirements

At sites with contaminated groundwater, WAC 173-340-360(2)(c) requires the cleanup action meet certain additional requirements. For non-permanent groundwater cleanup actions, the regulation requires the following two requirements be met:

1) Treatment or removal of the source of the release shall be conducted for liquid wastes, areas of high contamination, areas of highly mobile contaminants, or substances that can’t be reliably contained; and
2) Groundwater containment (such as barriers) or control (such as pumping) shall be implemented to the maximum extent practicable.

Cleanup Action Expectations

WAC 173-340-370 sets forth the following expectations for the development of cleanup action alternatives and the selection of cleanup actions. These expectations represent the types of cleanup actions Ecology considers likely as a result of the remedy selection process; however, Ecology recognizes there may be some sites where cleanup actions conforming to these expectations are not appropriate:

- Treatment technologies will be emphasized at sites with liquid wastes, areas with high concentrations of hazardous substances, or with highly mobile and/or highly treatable contaminants;
- To minimize the need for long-term management of contaminated materials, hazardous substances will be destroyed, detoxified, and/or removed to concentrations below cleanup levels throughout sites with small volumes of hazardous substances;
- Engineering controls, such as containment, may need to be used at sites with large volumes of materials with relatively low levels of hazardous substances where treatment is impracticable;
- To minimize the potential for migration of hazardous substances, active measures will be taken to prevent precipitation and runoff from coming into contact with contaminated soils or waste materials;
- When hazardous substances remain on-site at concentrations which exceed cleanup levels, they will be consolidated to the maximum extent practicable where needed to minimize the potential for direct contact and migration of hazardous substances;
- For sites adjacent to surface water, active measures will be taken to prevent/minimize releases to that water; dilution will not be the sole method for demonstrating compliance;
- Natural attenuation of hazardous substances may be appropriate at sites under certain specified conditions (see WAC 173-340-370(7)); and
- Cleanup actions will not result in a significantly greater overall threat to human health and the environment than other alternatives.

## 6.7 EVALUATION OF PROPOSED REMEDIAL ALTERNATIVES

The remedial alternatives proposed in the feasibility study were evaluated according to the criteria set forth in WAC 173-340-360 and discussed in Section 6.6. The five alternatives meet the threshold requirements to varying degrees. The alternatives will be listed with high, moderate or low ranking for protectiveness of human health and the environment.

Three of the five alternatives proposed to address groundwater contamination utilize in-situ groundwater treatment. The remaining two alternatives use contaminated soil removal and treatment coupled with groundwater monitoring to manage groundwater contamination. The soil and groundwater will be treated with the same amendments. Each alternative is considered protective of human health and the environment since each takes actions to remove the direct contact pathway and addresses groundwater to meet established Site cleanup levels at the applicable point of compliance. Each alternative is compliant with applicable federal and state requirements and provides for compliance monitoring. Therefore, each alternative meets the threshold criteria set forth in WAC 173-340-360(2)(a). Table 4 presents the ranking scores for each alternative.

The second component used to evaluate alternatives is WAC 173-340-360 (2)(b) ("Other Requirements"), which includes requirements that remedies use permanent solutions to the maximum extent practicable, reflect the consideration of public concerns, and provide for a reasonable restoration time frame. Since groundwater contamination will remain for a while after implementation of the remedy, the proposed alternatives are not considered permanent solutions. For the purpose of evaluation, Alternative 3 is considered the remedy exhibiting the highest degree of permanence since it aggressively remediates groundwater and soil. Ecology has not identified any potential issues associated with the alternatives. For this reason and for evaluation purposes, Ecology considers the public concern for each alternative to be equivalent and will rely on actual public input to gauge public concern. In addition, each alternative provides for compliance monitoring and restrictive covenants.

### *6.7.1 Alternative 1*

Alternative 1 will reduce direct human health and ecological risks at the Site by decontaminating the Plating Shop's interior prior to demolishing the building. The decontamination would include removing any remaining plating wastes along with decontaminating obviously stained building materials to minimize disposal costs. Groundwater monitoring and institutional controls make up the remainder of the alternative. This alternative has been given a low degree of permanence since it will not treat groundwater or soil. A longer restoration time frame would be needed since no source removal will be conducted or groundwater treatment. The alternative utilizes standard construction techniques giving it a high level of implementability. The long-term effectiveness of this alternative is low since a limited amount of contamination is removed and soil and groundwater contamination is not treated. The short-term risks are workers may be exposed to chromium contamination during demolition. The remainder of the installation has typical construction related risks that can readily be addressed with proper safety precautions.

### *6.7.2 Alternative 2*

Similar to Alternative 1, Alternative 2 involves decontamination and demolition of the Plating Shop. In addition, this alternative would treat groundwater by injecting reactive media into the subsurface that converts the hexavalent chromium to trivalent chromium. Groundwater monitoring for ten years is included as part of the alternative. Slug injections would be performed in several stages and custom-tailored to address the approximate contaminant mass in each area of the Site. The alternative is given a medium degree of permanence since it does not address soil contamination. The restoration time frame is reduced compared to Alternative 1 since groundwater treatment is utilized. The alternative utilizes standard construction techniques giving it a high level of implement ability. The long-term effectiveness of this alternative is medium since building contamination is removed and groundwater contamination is treated. The short-term risks are workers may be exposed to chromium contamination during demolition. The remainder of the installation has typical construction related risks that can readily be addressed with proper safety precautions.

### *6.7.3 Alternative 3*

This alternative is similar to Alternative 2, since it would employ a combination of Plating Shop decontamination and/or demolition, and aggressive electron donor amendment slug injections to biologically remediate contaminated groundwater across much of the Site. This aggressive remedial approach would target an area larger than described in Alternative 2 and address contamination from near Dry Creek to the northern monitoring wells. Alternative 3 has a medium-high degree of permanence since it more aggressively addresses groundwater contamination. The restoration time frame is reduced in comparison to Alternative 2 since a larger area of groundwater is treated and additional slug injections would be used to install a permeable reactive barrier approximately 50 feet south of the MW 10/MW-12 alignment. The alternative utilizes standard construction techniques giving it a high level of implement ability. The long-term effectiveness of this alternative is medium since building contamination is removed and groundwater contamination is treated. The short-term risks are workers may be exposed to chromium contamination during demolition. The remainder of the installation has typical construction related risks that can readily be addressed with proper safety precautions.

### *6.7.4 Alternative 4*

Alternative 4 will decontaminate the Plating Shop prior to demolition and wastes would be disposed of at an appropriate waste facility. Contaminated soil underneath the former plating vaults would be removed for disposal. This alternative has been given a low-medium degree of permanence since it will not directly treat groundwater. A longer restoration time frame would be needed since no groundwater treatment will be conducted. The alternative would utilize standard demolition and construction techniques giving it a high level of implement ability. The long-term effectiveness of this alternative is medium since building and soil contamination is removed. The short-term risks are workers may be exposed to chromium contamination during construction. The project remainder has typical construction related risks that can readily be addressed with proper safety precautions.

### *6.7.5 Alternative 5*

For this alternative, the Plating Shop would be decontaminated and demolished. A reduced volume of source area soils would be removed and disposed off-site. The remaining source area soils and groundwater will be addressed with in situ bioremediation. The alternative is given a high degree of permanence since it removes contaminated wastes, demolishes the plating shop, and treats the remaining soil contamination and groundwater with in-situ bioremediation.

The restoration time frame may be lengthened by using in-situ soil treatment instead of excavation and removal proposed in Alternative 4. However, a longer period of time may be used for the restoration time frame if the cleanup action selected has a greater degree of long-term effectiveness than on-site or off-site disposal, isolation, or containment options (173-340-360(4)(c)). The alternative would utilize standard demolition and construction techniques giving it a high level of implement ability. The long-term effectiveness of this alternative is medium since building and soil contamination is removed. The short-term risks are workers may be exposed to chromium contamination during construction. The project remainder has typical construction related risks that can readily be addressed with proper safety precautions.

# 7.0 SELECTED CLEANUP ACTION

Ecology is selecting a combination of technologies presented in the FS for the cleanup action. The selected remedial action will address potential soil and groundwater contamination by in-situ treatment. A reactive media will be utilized to transform the hexavalent chromium to the more stable trivalent state. The technology was proven to be effective during the pilot test. An electron donor source will be utilized that does not require continual replenishment and is readily available. The reactive media will be used to treat potentially contaminated soil in the same fashion as the groundwater. If soil contamination areas are not identified, the best locations for reactive media placement will be determined. The remedial design will determine the most efficient distribution methodology of the reactive media into the subsurface.

Wastes in the plating shop interior will be removed from the building for disposal at an appropriate facility. Residual materials not in containers and other detritus will be removed from the building. Contaminated building materials will be identified and confirmed by analytical testing prior to building demolition. The building will be demolished in stages. The uncontaminated building materials will be segregated and disposed as solid waste. The contaminated building materials will be disposed at an appropriate facility. The concrete floor slab will be decontaminated and remain in place after building demolition. The concrete floor provides both containment and a barrier to potential subsurface contamination. The building demolition will also provide access to areas of the site previously not available to heavy equipment.

The cleanup action addresses Site soil and groundwater contamination, meets the threshold requirements, and is protective of human health and the environment. Potential soil and groundwater contamination from the former plating operations continues to be present at the Site. The pilot study demonstrated in-situ bioremediation can effectively transform hexavalent chromium to the more stable trivalent state. This transformation is effective in soil and groundwater. While the previously designed closed loop recirculation system did not adequately distribute the reactive media, direct injections of the reactive media demonstrated the effectiveness of transforming hexavalent chromium to the trivalent state. A more efficient delivery system and longer lasting reactive media will be selected for the site.

The efficacy of the treatment system will require performance monitoring. In order to monitor the treatment system, specific analytical parameters such as total organic carbon (TOC), sulfate, nitrate, phosphate, sulfide, and total metals will need to be analyzed. Based on sample results, groundwater samples may be collected on a quarterly basis until cleanup levels are met consistently or results indicate concentrations are asymptotic.

## 7.1 POINT OF COMPLIANCE

A standard soil point of compliance is 15 feet below ground surface. A conditional point of compliance may be set for a soil remedy developed to be protective of ecological receptors. The soil beneath the Plating Shop is believed to be potentially contaminated. Ecological cleanup levels will be used to assess soil conditions beneath the Plating Shop. For a site with institutional controls a conditional point of compliance may be set at the biologically active soil zone. The biologically active zone is assumed to extend to a depth of six feet. Ecology may approve a site-specific depth based on a demonstration an alternative depth is more appropriate for the site.

A conditional point of compliance was selected for soil in order to address ecological concerns. The conditional point of compliance is set to address the contaminated soil beneath the plating shop. The contaminated Site soil has been removed to below cleanup levels outside the Plating Shop and in the former self-propelled shed. The concrete slab floor serves as a barrier to the biologically active zone and allows for the use of the conditional point of compliance.

The standard groundwater point of compliance is established throughout the site from the uppermost level of the saturated zone extended vertically to the lowest most depth which is potentially affected by the Site. A standard point of compliance will be used for the Site. Monitoring will be used to establish compliance with the point of compliance.

## 7.2 INSTITUTIONAL CONTROLS

Institutional controls are measures undertaken to limit or prohibit activities that may interfere with the cleanup action or result in the exposure to hazardous substances at a site. Institutional controls are required where cleanup actions result in residual concentrations of hazardous substances exceeding cleanup levels established for a site. These controls may not be used as a substitute for a cleanup that is technically possible. Since soil and groundwater bioremediation will not be realized immediately, institutional controls will be required.

The institutional control requirements are set forth in WAC 173-340-440. The following institutional controls that prohibit and/or limit groundwater use within the groundwater contamination plume will be required, as incorporated into a restrictive covenant to be filed with the office of the Walla Walla County Auditor:

1) No groundwater may be taken from the parcel, except for purposes related to the Remedial Action, such as groundwater monitoring.
2) Ecology will provide for operation of the soil and groundwater remediation system until such time system operation is no longer required. This will occur when monitoring data show cleanup levels have been met in soil and groundwater.
3) The owner will restrict Site use that limits exposure to contamination or that may interfere with the cleanup action.

## 7.3 PERIODIC REVIEW

WAC 173-340-420 states 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. Since the waste materials may remain on-site and institutional controls will be required, periodic reviews shall take place at this Site. Monitoring data shall be reviewed to continue to assess the effectiveness of the groundwater contamination treatment. If data do not indicate the treatment has the capacity to treat contaminant concentrations to meet cleanup levels, then additional remedial action may be required.

# 8.0 EVALUATION OF THE CLEANUP ACTION USING MTCA CRITERIA

The selected remedy is evaluated using the MTCA criteria set forth in WAC 173-340-360, as follows:

## 8.1 PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Soil and groundwater is the contaminated media and focus of treatment at the Site. The exposure routes identified at the Site are via direct contact and ingestion of contaminated soil and groundwater. The building demolition and interior decontamination will eliminate direct exposure routes. The in-situ treatment of contamination will reduce contaminant concentrations and the associated risk from direct contact and ingestion of the contaminated media. Institutional controls will limit exposure via ingestion and dermal contact.

## 8.2 COMPLIANCE WITH CLEANUP STANDARDS

Contaminated groundwater will be treated by an in-situ technology involving the injection of reactive media to provide an environment for transformation of hexavalent chrome to its more stable trivalent form in the subsurface. The groundwater will be treated to meet cleanup levels at a point of compliance for groundwater cleanup levels pursuant to WAC 173-340-720(4). Institutional controls will be part of this cleanup action since soil and groundwater bioremediation will not be realized immediately.

## 8.3 COMPLIANCE WITH APPLICABLE STATE AND FEDERAL LAWS

The cleanup action for this Site complies with applicable state and federal laws. The applicable state and federal laws for the implementation of the cleanup action are identified in Table 3. Local laws, which can be more stringent, will govern actions when they are applicable.

## 8.4 COMPLIANCE MONITORING

Compliance monitoring is divided into three categories: protection, performance, and confirmational (WAC 173-340-410). Protection monitoring is designed to protect human health and the environment during construction and the operation and maintenance tasks for the cleanup action. Performance monitoring confirms the cleanup action has attained cleanup and/or performance standards. Confirmational monitoring confirms the long-term effectiveness of the cleanup action once cleanup standards have been achieved or other performance standards have been attained. Compliance monitoring will be conducted in accordance with a Compliance Monitoring Plan, which will be developed by Ecology.

## 8.5 USE PERMANENT SOLUTIONS TO THE MAXIMUM EXTENT PRACTICABLE

A permanent solution is one in which cleanup standards can be met without further action being required. Ecology believes a combination of technologies described in the alternatives will provide a remedial action that displays the highest degree of permanence for the Site.

### *8.5.1 Protection of Human Health and the Environment*

The remedy selected for soil and groundwater is considered protective of human health and the environment. The remedy is considered protective since it will treat contaminated soil and groundwater. Cleanup levels will be met at the applicable points of compliance for soil and groundwater.

Institutional controls will prohibit activities that will provide direct contact with contaminated soil or residues. The withdrawal and use of the contaminated groundwater at the Site will be prohibited. Achieving soil and groundwater cleanup standards will be assessed as part of the review process up to the five-year review required under WAC 173-340-420. If groundwater cleanup levels have not been met at their respective points of compliance, additional cleanup action may be required. Performance monitoring will be completed according to the schedules established pursuant to Section 8.4 above.

### *8.5.2 Long-Term Effectiveness*

The long-term effectiveness of the soil and groundwater remedy will be assessed as in-situ biodegradation reduces the amount of groundwater requiring treatment. The in-situ groundwater treatment system is expected to transform hexavalent chromium to trivalent chromium and meet cleanup standards.

### *8.5.3 Short-Term Effectiveness*

Risks associated with the cleanup action in the short term are the potential exposure of workers to the contaminated groundwater during injection of the reactive media into the groundwater. Institutional controls to prevent contact with contaminated groundwater will minimize the short-term risks while the groundwater remedy is implemented. Worker health and safety will be addressed as part of the Health and Safety Plan to comply with the appropriate regulations and to satisfy the protection monitoring requirements.

### *8.5.4 Permanent Reduction of Toxicity, Mobility, and Volume*

The groundwater treatment will transform hexavalent chromium to the more stable and less toxic trivalent state. Groundwater treatment will reduce the contaminants in groundwater to meet cleanup levels at the point of compliance for groundwater cleanup levels pursuant to WAC 173-340-720(4).

### *8.5.5 Implementability*

The selected cleanup action can be readily implemented since it involves the use of conventional remediation technologies and innovative technologies that have been demonstrated at the Site. The conceptual design may be modified for final implementation if field conditions dictate necessary changes in the remedial design.

### *8.5.6 Cost*

The cost provided in the FS for the alternatives range from $649,911 to $1,176,381. The projected annual operation and maintenance (O&M) costs for the groundwater treatment and monitoring is $327,470 for 10 years and $481,400 for 20 years.

| ALTERNATIVE | COST | MONITORING | TOTAL |
|---|---|---|---|
| 1 | $848,911 | $327,470 | $1,176,381 |
| 2 | $433,356 | $327,470 | $760,826 |
| 3 | $515,311 | $382,190 | $897,501 |
| 4 | $509,261 | $481,400 | $990,661 |
| 5 | $168,511 | $481,400 | $649,911 |

Alternatives 1 and 2 assume the site will be sampled on a quarterly basis for five years and then annually for the next five years. Like Alternatives 1 and 2, Alternative 3 calls for sampling the Site quarterly for the first five years; however, the next five years the Site will be sampled bi-annually. Monitoring costs associated with Alternatives 4 and 5 include collecting samples annually for twenty years. A three percent annual rate of inflation was used to calculate costs.

## 8.6 PROVIDE REASONABLE RESTORATION TIME FRAME

Alternatives 1 through 3 provide for a 10-year restoration time frame while Alternatives 4 and 5 suggest a 20-year time frame will be needed. The proposed cleanup action will provide source control measures by treating in-situ contaminated soil and groundwater. As a result, it will reduce the amount of contamination generated. Based on the pilot test, restoration to meet cleanup levels at the groundwater point of compliance should occur once the cleanup action is fully implemented. The proposed cleanup action is most similar to Alternative 2, and therefore, a 10-year restoration time frame is estimated for the Site. Details of the monitoring program, including parameters and frequency, will be specified in the Compliance Monitoring Plan.

Groundwater monitoring and periodic review will provide an assessment tool for the cleanup action. Monitoring wells will serve as the points of compliance and the number and location of the wells will be discussed in the Compliance Monitoring Plan

## 8.7 PUBLIC PARTICIPATION AND COMMUNITY ACCEPTANCE

A public comment period will be held to allow the public and parties affected by the cleanup action an opportunity to provide comment on this document. Public comments and concerns will be addressed in a responsiveness summary and incorporated as appropriate in the final cleanup action plan.