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REVISED REMEDIAL INVESTIGATION REPORT

AGRI-TECH & YAKIMA STEEL FABRICATORS
6 AND 10 1/2 EAST WASHINGTON AVENUE
YAKIMA, WASHINGTON

Submitted by:
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Farallon PN: 765-001

For:
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June 10, 2004

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EXECUTIVE SUMMARY

This Revised Remedial Investigation (RI) Report has been prepared by Farallon Consulting, L.L.C. on behalf of Yakima Steel Fabricators (YSF) and Agri-Tech, Inc. (Agri-Tech) in general accordance with Agreed Order No. DE 97TC-C154 (Agreed Order) between YSF, Agri-Tech, and the Washington State Department of Ecology (Ecology). The Site, as defined in the Agreed Order, includes the YSF property (Tax Parcel No. 19133141009) and the Agri-Tech property (Tax Parcel No. 19133141409). The RI addresses the occurrence of constituents of potential concern (COPCs) that include halogenated and non-halogenated volatile organic compounds (VOCs), pesticides, herbicides, petroleum hydrocarbon-related compounds, polychlorinated biphenyls (PCBs), and heavy metals. The COPCs are associated with the former Site owner, Yakima Farmer Supply.

Yakima Farmer Supply operated an agricultural supply business and lime and sulfur pesticide formulation plant at the Site between 1952 and 1971. Another potential source of COPCs is the former Bay Chemical property located west of and adjacent to the Site. The Bay Chemical property has confirmed releases of heavy metals to soil and groundwater.

The technical scope of work was defined in the *Remedial Investigation Work Plan, Agri-Tech/Yakima Steel Fabricators*, prepared by Maxim Technologies, dated April 1997 with amendments dated May 9, 1997 and June 19, 1997 (RI Work Plan). Farallon prepared a *Revised Addendum to the Remedial Investigation Work Plan* (Revised Addendum) dated October 7, 2002 that included a technical scope of work for the supplemental field investigation activities necessary to complete the RI.

The objective of the RI was to collect and evaluate sufficient information regarding the Site to enable development of a scope of work for conducting a feasibility study (FS) in accordance with the Washington State Model Toxics Control Act (MTCA) Cleanup Regulation as specified in Chapter 173-340-350(8) of the Washington Administrative Code (WAC) and proceed toward selection of a cleanup action in accordance with Chapters 173-340-360 through 173-340-390 WAC.

SITE DESCRIPTION

Site features at the time of the RI on the YSF property included one, single-story, steel-framed, aluminum building used for steel fabrication. The areas immediately north, south, and west of the YSF building are asphalt paved and the remaining areas are unpaved. The areas east and south of the YSF building are used for storage of steel. The southern portion of the YSF property includes a pond that has been classified as a Type 3 wetland.

The Site features on the Agri-Tech property at the time of the RI included a 20,336 square foot, single-story, cinder block building which was constructed in 1982. The building appears to have a concrete slab on footings foundation and is surrounded by asphalt paving on all sides. Agri-Tech was a former sales and service business for fruit packing supplies and equipment. The Agri-Tech building was vacant in 1997 but has been leased to various tenants between 1997 and

2003. At the time of the additional site investigation work in November 2002, the building was vacant.

BACKGROUND

The former Yakima Farmer Supply operations included a shallow waste pit that received wash water and lime and sulfur residue from the formulation plant located where the Agri-Tech building is currently. Ecology identified the waste pit on aerial photographs and conducted the initial subsurface assessment in 1992. The assessment identified concentrations of COPCs in the waste pit area. One of the COPCs identified was tetrachloroethene (PCE) that resulted in the Site being named as a potentially liable party for a regional PCE plume referred to by Ecology as the Yakima Railroad Area (YRRA). The Site owners, Agri-Tech and YSF entered into the Agreed Order with Ecology in September 1997 to perform an RI at the Site. The RI was initiated by AGRA Earth and Environmental, Inc. in October 1997 and completed by Farallon in 2003.

DISTRIBUTION OF COPCs

The soil and groundwater analytical data were evaluated to determine the distribution of COPCs and potential presence or absence of dense nonaqueous phase liquid (DNAPL) as PCE. Modified MTCA Method B cleanup levels were used as preliminary screening levels to narrow the list of COPCs to preliminary indicator hazardous substances (IHSs). The IHSs are PCE, trichloroethene (TCE), cis 1,2-dichloroethene (cis-DCE), vinyl chloride, 4,4,-DDD, 4,4-DDE, dieldrin, endrin, heptachlor epoxide, alpha chlordane, cadmium, and mercury. Concentrations of cadmium and mercury were above the preliminary soil screening levels in the area along the western Site boundary, and the suspected source is the west adjacent Bay Chemical property. All other IHSs are located in the waste pit area and the suspected source is the former Yakima Farmer Supply operations. No other COPCs were detected at concentrations above the preliminary soil or groundwater screening levels in any area of the Site.

The lateral and vertical limits of contamination around the north end of the waste pit have not been confirmed but have been estimated using the existing soil analytical data. The highest concentration of PCE in soil was located beneath the Agri-Tech building. The lateral limits of soil contamination to the east of the central area of the waste pit are uncertain. Substantially lower concentrations of all COPCs were detected in the central and southern portions of the waste pit. The highest concentrations of 4,4-DDE, dieldrin, and endrin corresponded with the locations of the highest concentration of PCE.

The direction of groundwater flow and the gradient has been consistently to the southeast at an average hydraulic gradient of 0.003 to 0.004 foot per foot. The vertical gradient measured at well pair MW-7A and MW-7B is –0.018 feet per foot indicating that a slight downward vertical gradient exists. The seasonal low groundwater conditions occur in March, at a time when there is no regional irrigation being performed. The average seasonal flux in groundwater elevation is 3.21 feet.

The soil contamination in the waste pit appears to be contributing only a small quantity of PCE to the dissolved phase PCE plume. Concentrations of PCE in the upgradient monitoring well (MW-1) indicate that there is dissolved phase PCE entering the Site from an upgradient source at concentrations that are similar to the downgradient point of compliance wells (MW-3, MW-4, MW-5, MW-7A, and MW-7B). Groundwater samples collected from the monitoring well located in the waste pit have historically had the highest concentrations of PCE, other halogenated volatile organic compounds (HVOCs), and pesticides. These concentrations have been decreasing consistently since groundwater sampling was initiated in December 1997. The groundwater samples collected from monitoring wells immediately downgradient of the waste pit have exhibited occasional spikes of PCE and its daughter products, and only a single detection of the pesticide dieldrin between December 1997 and December 2002. Concentrations of the IHSs attributable to the waste pit area are below the preliminary groundwater screening levels at the point of compliance wells. Downgradient receptors are not at risk from historical releases of COPCs or IHSs identified at the Site.

Farallon also evaluated the potential for dense nonaqueous phase liquid (DNAPL) to be present in the waste pit. DNAPL was not present in the waste pit.

AFFECTED MEDIA AND POTENTIAL EXPOSURE PATHWAYS

The affected media have been confirmed to include soil and groundwater. Potential surface water receptors include the pond located in the Type 3 wetlands area on the southern portion of the YSF property, and a drainage ditch along the eastern Site boundary that drains to the wetlands area but does not contain water year-round. There is a potential for heavy metal contamination from the west adjacent Bay Chemical property to have affected the pond and wetlands area. The east drainage ditch may potentially be affected by the dissolved phase PCE plume but not the pond or wetlands area.

The air pathway was not specifically evaluated for the RI. However, evaluation of the soil analytical data beneath the Agri-Tech building indicates that there is a potential for HVOCs to affect indoor air quality inside the building. Additional sampling or modeling would be required to assess whether HVOCs are present in air inside the building at concentrations that would be harmful to human health.

The distribution and extent of the COPCs attributable to the waste pit could qualify the site for an exclusion from further evaluation of terrestrial ecologic risk evaluation if additional institutional controls are applied to ensure the buildings and pavement cap remain in-place. However, the potential for the metals associated with the Bay Chemical property to affect the Type 3 wetlands area at the YSF property may result in the need to further evaluate potential terrestrial ecologic risk at the Site. Ecology will need to be consulted to determine if further evaluation of terrestrial ecologic risk is required.

The potential exposure pathways for human health risk include the soil, groundwater, and vapor pathways. The Site is located in an industrial and commercial area. Therefore, potential exposure risk is associated with Site workers, construction/utility workers, and visitors. The buildings and pavement cap mitigate exposure to soil via the dermal and ingestion exposure routes. However, there is a potential vapor inhalation risk associated with indoor air quality in the Agri-Tech building. Institutional controls will likely be required to mitigate the potential for exposure to soil in the waste pit area.

The groundwater pathway is not expected to result in exposure via the dermal or ingestion exposure routes due to the absence of wells at or near the Site that are used for any purposes other than groundwater monitoring and sampling. The potential risk associated with the vapor inhalation exposure route is considered low in all areas but beneath the Agri-Tech building.

CONTAMINANT FATE AND TRANSPORT

The contaminant fate and transport characteristics were evaluated for the COPCs that may be selected for IHSs. The PCE in the waste pit appears to be undergoing reductive dechlorination. PCE and its degradation products, TCE, cis-DCE, and vinyl chloride have been observed in soil and/or groundwater in the waste pit. Slightly anaerobic, reducing conditions are present in the immediate vicinity of the waste pit whereas other areas of the Site exhibit aerobic, oxidizing conditions. The PCE in soil may continue to undergo reductive dechlorination. However, dissolved phase PCE appears to undergo this process only in the waste pit area. As the dissolved phase PCE and the degradation products exit the waste pit, the PCE and TCE are transported downgradient without further biodegradation under aerobic conditions. The cis-DCE and vinyl chloride appear to naturally attenuate aerobically as they are transported downgradient.

The pesticides present strongly sorb to soil particulate and do not readily leach into groundwater. These compounds are persistent in soil and do not readily biodegrade or attenuate in the subsurface with time. The presence of the pesticides in groundwater may indicate that the other volatile organic compounds present may be increasing the solubility of the pesticides present. The groundwater analytical data indicate that the dissolved phase concentrations are low and restricted to the waste pit area.

Any potential contamination from metals in soil, groundwater, or sediments will be persistent. Metals typically accumulate in shallow soils and remain unless physical processes such as wind, rain, erosion, or man-made disturbances result in transport of these contaminants. The presence of metals at the Site may have been a result of airborne deposition since the affected areas of the Bay Chemical property are unpaved. Leaching of the metals into groundwater is expected to be minimal based on the neutral pH and alkalinity of groundwater. However, total metals concentrations may be higher if the metals are in direct contact with groundwater.

DATA GAPS

The RI provided sufficient information to evaluate technically feasible remedial alternatives for a future feasibility study. However, there are remaining data gaps that should be evaluated during future Site work and prior to determining a final cleanup action, including:

- Additional site investigation should be conducted to refine the estimates of the lateral and vertical limits of contamination in the waste pit area.
- Collection of site-specific soil and aquifer characteristics in accordance with the revised MTCA to refine the calculations of Site-specific cleanup levels.
- The existing monitoring well network may also be supplemented to monitor groundwater quality near the waste pit area. The well network currently does not include monitoring wells immediately downgradient of the highest concentrations of IHSs identified beneath the Agri-Tech building.

- The potential affects of the Bay Chemical property on the western portion of the Site, specifically, the Type 3 wetland area should be further investigated.

1.0 INTRODUCTION

This Revised Remedial Investigation (RI) Report has been prepared by Farallon Consulting L.L.C. (Farallon) on behalf of Yakima Steel Fabricators (YSF) and Agri-Tech, Inc. (Agri-Tech). The RI involved collection of data necessary to characterize the source, nature, and extent of the constituents of concern (COPCs) in soil and groundwater at the YSF and Agri-Tech properties that are located at 6 and 10 1/2 East Washington Avenue, respectively, in Yakima, Washington (herein referred to as the Site, Figures 1 and 2). All work was performed in accordance with the requirements of the Washington Model Toxics Control Act (MTCA) cleanup regulation, Chapter 173-340 of the Washington Administrative Code (WAC).

1.1 REPORT ORGANIZATION

The format of this RI Report meets the requirements of Chapters 173-340-350 and 173-340–840 WAC for completion of remedial investigations and document submittals. Section 1 provides the purpose and framework of the RI including the regulatory history and parties to the Agreed Order. Section 2 provides background information on the Site and surrounding area including the environmental setting. Section 3 describes the technical elements and a summary of the scope of work of the RI. The results of the RI are presented in Section 4. Section 5 describes the conceptual site model developed for the Site. The conclusions of the RI are presented in Section 6. The references cited in the RI report are listed in Section 7. Section 8 presents the standard limitations for the RI as performed by Farallon.

1.2 REGULATORY HISTORY

Agri-Tech and YSF entered into an Agreed Order with the Washington State Department of Ecology (Ecology) in September 1997 to implement the scope of work defined in the *Remedial Investigation Work Plan, Agri-Tech/Yakima Steel Fabricators*, prepared by Maxim Technologies (Maxim), dated April 1997 with amendments dated May 9, 1997, and June 19, 1997 (RI Work Plan). In October 1997, AGRA Earth & Environmental, Inc. (AGRA) was contracted by Agri-Tech and YSF to conduct the technical scope of work for the RI defined in the RI Work Plan. After completion of the field investigation, AGRA prepared a Draft *Remedial Investigation Report* (Draft RI), dated June 29, 1998, which was submitted to Ecology for review and comment. AGRA also completed three additional quarterly groundwater monitoring and sampling events and summarized the results in *Groundwater Status Reports*, dated April 16, July 14, and October 14, 1998, which were also submitted to Ecology for review and comment.

Ecology provided comments dated November 9, 1998 on the Draft RI after completion of the quarterly groundwater monitoring and sampling events that were conducted between September 1997 and September 1998. The comments to the RI were not addressed and the Draft RI was not finalized.

Ecology contacted YSF in September 2001 regarding the completion of the requirements of the *Agreed Order*. Farallon understands that YSF agreed to proceed with completion of the RI without the participation of Agri-Tech. Ecology then provided additional comments on the Draft

RI in a letter dated April 10, 2002 for the purpose of focusing efforts on completing the RI. These comments included requirements necessary to complete the RI in accordance with the February 12, 2001 revisions to MTCA. YSF contracted Farallon in April 2002 to complete the RI.

Farallon prepared an *Addendum to the Remedial Investigation Work Plan* that included a technical scope of work for supplemental field investigation activities required to address Ecology's comments on the Draft RI and Ecology's comments dated April 10, 2002. Ecology's submitted comments on the *Addendum to the Remedial Investigation Work Plan* dated September 12, 2002. Farallon submitted a response to comments letter dated October 7, 2002 and a *Revised Addendum to the Remedial Investigation Work Plan* (Revised Addendum) also dated October 7, 2002. Following subsequent discussions between Farallon, counsel for YSF, and Ecology on September 23, 2002, the Revised Addendum was approved by Ecology. The scope of work presented in the Revised Addendum was completed in December 2002. All work performed by AGRA and Farallon was in general accordance with the Agreed Order No. DE 97TC-C154 (Agreed Order) between YSF, Agri-Tech, and Ecology. Any changes in the scope of work were approved by Ecology prior to proceeding.

1.3 PURPOSE

The objective of the RI was to collect, develop, and evaluate sufficient information regarding the Site to enable development of a scope of work for conducting a feasibility study (FS) in accordance with Chapter 173-340-350(8) WAC and proceed toward selection of a cleanup action in accordance with Chapters 173-340-360 through 173-340-390 WAC. The scope of work for the RI was intended to obtain sufficient data to develop a conceptual site model that identifies the suspected sources of contamination, the concentrations and distribution of the COPCs, the affected media, potential exposure pathways, contaminant fate and transport characteristics, and potential receptors. The development of the conceptual site model provides the information needed to perform a preliminary evaluation of technically feasible remedial alternatives and proceed toward development of a technical scope of work for an FS.

1.4 AGREED ORDER PARTIES

The first party to the Agreed Order is:

Mr. Merv Wark
Yakima Steel Fabricators
6 East Washington Avenue
Yakima, Washington 98903

YSF is represented by counsel:

Mr. Clark Davis
Davis, Roberts, and Johns Attorneys at Law
7525 Pioneer Way, Suite 202
Gig Harbor, Washington 98335

The second party to the Agreed Order is:

Mr. Robert Coffelt
Agri-Tech Incorporated
P.O. Box 448
Woodstock, Virginia 22664

Agri-Tech is represented by counsel:

Mr. Kevin Roy
Roy & Boutillier, P.L.L.C.
201 East D Street
Yakima, Washington 98907

The Ecology project manager is:

Mr. Brian Deeken, who replaced Mr. Rick Roeder in 2002
Department of Ecology, Central Regional Office
15 West Yakima Avenue, Suite 200
Yakima, Washington 98902-3452

The environmental consultant for the RI is:

Mr. Jeffrey Kaspar (formerly of AGRA Earth & Environmental, Inc.)
Farallon Consulting, L.L.C.
320 3rd Avenue N.E.
Issaquah, Washington 98027

2.0 BACKGROUND

This section presents Site and background information including the Site description, ownership and operation chronology, surrounding land use information, previous investigations, and the physical and environmental setting.

2.1 SITE DESCRIPTION

The Site, as defined in the Agreed Order, includes the YSF property (Tax Parcel No. 19133141009) and the Agri-Tech property (Tax Parcel No. 19133141409) and is depicted on Figure 2. The Site is located in the northeast corner of the southeast quarter of Section 31, Township 13 North, Range 19 East, Willamette Meridian. The approximate latitude and longitude of the Site is North 46 degrees, 34 minutes latitude, West 120 degrees, 29 minutes longitude, Willamette Meridian. The Site is located in an area of Yakima zoned for light industrial use, which is consistent with Site use since the 1940s.

Topography is relatively flat with less than 5 feet of relief across the 7.23 acres comprising the Site. The Site slopes very slightly to the southeast, following the regional trend of the Ahtanum Valley. The present Site grade is a result of fill and grading activities following the demolition of the former Yakima Farmers Supply improvements in the late 1970's.

Existing utilities at the Site include overhead power and telephone lines. An underground electric power line extends from an overhead power pole located between the YSF and Agri-Tech buildings to a meter at the northeast corner of the westernmost unit of the YSF building. Both YSF and Agri-Tech utilize a municipal water source and natural gas as a heating source. The main water line(s) and the natural gas line appear to run parallel to the fence located on the western Site boundary, separating the former Bay Chemical property from the Site. A clean out vault and pump station for the sanitary sewer is present in the approximate center of the former waste pit (Figure 3). The sanitary sewer line reportedly extends east from the vault along a visible asphalt-patched trench. It is uncertain where the line turns north towards the city main line located in East Washington Avenue. The YSF side sewer line extends from the westernmost portion of the building housing the offices of YSF and extends to the vault. The side sewer pipe for YSF is constructed of cast iron. The location of the Agri-Tech side sewer was not able to be ascertained during the RI. Stormwater controls include diversion of runoff to the unpaved areas.

2.1.1 Yakima Steel Fabricators Property Description

The YSF property comprises approximately 6.27 acres of land. The legal description as indicated by the Yakima County Tax Assessor office is as follows:

TH PT NE1/4 SE1/4 LY W OF W LN FORNEY

SUBD & E'LY OF E'LY R-W B.N.RY.CO.MAIN

LN & S'LY OF FOL DESC LN: BEG NW COR

LOT 1 FORNEY SUBD,TH S 0 D 21'E,AL W

LN 405 FT TO POB,TH W PAR WITH N LN

SUBD TO E'LY R-W LN B.N.RY.CO.MAIN LN

& TERM SD LN EX TH PT LY E OF E LN OF

W 990 FT NE1/4 SE1/4

Current features on the YSF property include one, single-story, steel-framed, aluminum-sided building measuring approximately 225 feet by 225 feet and subdivided into three areas. The western area is utilized for steel fabrication and houses the business offices. This area was the first portion of the YSF building constructed in the late 1970s. The central area of the building is used for steel fabrication and loading of finished product. The eastern area of the building is used for steel storage. The interior floors of the central and eastern areas are asphalt paved while the western area has a concrete slab. The areas immediately north, south, and west of the YSF building are asphalt paved. The remaining portions of the YSF property are unpaved. The areas east and south of the YSF building are used for storage of steel. The southern portion of the YSF property includes a pond and area surrounding it that has been classified as a Type 3 wetland according to the Yakima County Tax Assessor records.

2.1.2 Agri-Tech Property Description

The Agri-Tech property comprises approximately 1.00 acre of land. The legal description as indicated by the Yakima County Tax Assessor office is as follows:

SP 82-24: LOT 2

The current features on the Agri-Tech property include a 20,336 square foot, single-story, cinder block building (approximately 164 feet by 124 feet) which was constructed in 1982. The foundation appears to be a concrete slab on footings construction. The building was constructed by Team Research Engineering (a veterinary pharmaceutical supply company) that owned and operated the property prior to purchase by Agri-Tech in 1989.

2.2 OWNERSHIP AND OPERATION

A title search was not conducted for the RI; however, a limited ownership chronology was derived from information presented in the RI Work Plan. The Site was undeveloped until 1947. The Site was owned and operated from 1947 to 1971 by:

Yakima Farmer Supply Company

Co-op of local farmers (individual owners or board members not identified in available documentation)
10 East Washington Avenue
Yakima, Washington 98903

Yakima Farmer Supply filed for bankruptcy in 1971, and the receivership of the title and ownership information from 1971 to 1978 is currently unknown. The Site was owned and operated from 1978 to 1989 by:

Harvey M. Anderson and Luella M. Anderson
ANCO Industrial Park (ANCO)
Address not presented in available documentation

ANCO sold various parcels of the Site between 1978 and 1989 after removing all former improvements by Yakima Farmer Supply and grading the Site (Maxim, 1997).

6 East Washington Avenue has been owned from 1979 to present by:

Mr. Merv Wark
Yakima Steel Fabricators
6 East Washington Avenue
Yakima, Washington 98903

Mr. Wark constructed the YSF building between 1980 and 1982. YSF has been historically a steel fabrication facility. The available documentation (See References, Section 7.0) does not indicate that the historic steel fabrication operations used or stored the COPCs identified in soil and groundwater with the exception of diesel fuel. Diesel fuel has been stored on the YSF property in an aboveground storage tank and used for equipment such as the forklifts and cranes.

10 ½ East Washington Avenue was owned from 1980 to 1989 by:

Team Research Engineering Corp.
Harvey M. Anderson (President)
P.O. Box 3120
Yakima, Washington 98903

The available documentation indicates that Team Research Engineering Corporation constructed the existing building in 1982 and operated as a veterinary/pharmaceutical supply company.

10 ½ East Washington Avenue has been owned from 1989 to present by:

Mr. Robert and Lynda Coffelt
Agri-Tech Incorporated
P.O. Box 448
Woodstock, Virginia 22664

Agri-Tech operated a sales and service business for fruit packing supplies and equipment. The Agri-Tech building was vacant in 1997, but has been leased to various tenants from 1997 to

2003. At the time of the additional site investigation work in November 2002, the building was once again vacant. The available documentation does not indicate that the historical operations on the Agri-Tech property used or stored the COPCs identified in soil and groundwater during completion of the RI.

2.3 HISTORICAL SITE USE

Depositions of a former Yakima Farmer Supply plant manager, Mr. Fred Houck, had been taken by Roy & Boutillier, P.L.L.C. and the Attorney General of Washington in 1993 and 1994, respectively. The depositions were the primary source of the historical Site information presented in this section. Other sources of historic Site information were the RI Work Plan and *The Preliminary Assessment Report for Yakima Farmer Supply* (Preliminary Assessment) prepared by Ecology and the Environment, Inc. on behalf of the United States Environmental Protection Agency (USEPA) and dated June 24, 1988.

The available documentation indicates that Yakima Farmer Supply was a cooperative of farmers; however, the documentation does not indicate the names of the members of the cooperative. Yakima Farmer Supply purchased the Site in 1947. Yakima Farmer Supply owned and conducted business operations on what is today comprised of the following properties (Figure2): the YSF property (Tax Parcel No. 19133141009), the Agri-Tech property (Tax Parcel No. 19133141409), the Columbia Investment property (Tax Parcel No. 19133141011), the Keuler property (Tax Parcel No. 19133141408), the Isaak property (Tax Parcel No. 19133141005) and the Pauliin property (Tax Parcel No. 19133141003).

Yakima Farmer Supply constructed a 10,000 square foot warehouse on the parcels north and adjacent to the Agri-Tech property (presently the Isaak property) some time between 1947 and 1952. The warehouse was used for sales, storage, and display of the products offered by Yakima Farmer Supply. These products included farm equipment and supplies, including a variety of fertilizers, herbicides, pesticides, and carrier oils (dormant oils) obtained from both local manufacturers and national suppliers. Fertilizers were stored in the eastern end and pesticides were stored in the western end of the main warehouse. The main warehouse used a septic system and drainfield; however, the location of the drainfield was not indicated in the available documentation. The septic system received all water from sink drains and restrooms in the building.

Yakima Farmer Supply also constructed a warehouse building on what is now the Columbia Investment property that was leased to a local paper company for storage of fruit packing boxes. No other uses for the warehouse are reported during the period that Yakima Farmer Supply owned and operated that property.

The railroad spurs located on the south side of the main warehouse were used to unload materials. The railroad spurs appear to be part of an easement owned and operated by Burlington Northern Santa Fe Railway (BNSF). The northern spur was used to service the main warehouse building. The southern spur was used to unload bulk sulfur and packaged lime to the manufacturing plant south of the main warehouse, and discussed in detail below.

In 1960, a lime and sulfur formulating plant was constructed on what is currently the Agri-Tech property. The formulating plant consisted of two-story wood building with a concrete foundation and a basement. The formulating plant was used solely for the manufacturing of a liquid lime and sulfur mixture that was drummed and sold by Yakima Farmer Supply as a pesticide. The plant used a 5,500-gallon metal tank (cooker tank), located on the second floor, to mix bulk sulfur and packaged lime with hot water to formulate the final product mixture. According to Mr. Houck, no other pesticides, metals, oils, or other chemicals were added to the lime and sulfur mix. The final product was allowed to gravity drain from the cooker tank through a pipe that ran beneath the railroad spurs and to the south side of the main warehouse. The pipe outlet was near a scale that was used to weigh the product as it was placed into drums for storage and sale in the main warehouse. According to Mr. Houck, spills were minimal and contained by the scale platform. A diesel storage tank was located on the west side of the formulating plant that was used to fuel the cooker. The available documentation is unclear as to the size of the storage tank and as to whether it was an aboveground or underground storage tank (UST).

A waste pit that received residues and wash water from the cooker tank extended from the formulating plant south onto what are today the Agri-Tech and YSF properties. The available documentation contains no information on how the waste pit was constructed, such as dimensions and depth; however, based on aerial photographs (Appendix A), the waste pit appears to have been approximately 190 feet (north to south) by 60 feet (east to west). The waste pit received the residue and wash water from the cooker tank via a pipe that gravity drained into the pit. The waste pit also received wastewater from the lime and sulfur drumming area in the main warehouse via a second pipe that extended from the floor drain at the drumming area, beneath the railroad spurs and into the waste pit. According to Mr. Houck, steam cleaning with water was the only method used to clean drums and the cooker tank, no other chemicals or solvents were used in the cleaning or manufacturing processes.

According to the Preliminary Assessment, wastewater was generated by routine steam cleaning of the lime and sulfur product drums returned to Yakima Farmer Supply (a deposit on the drums was included in the product price). The Preliminary Assessment does not state where the drum cleaning was performed, but indicates that the wastewater and residues were temporarily stored in a 1,000-gallon, concrete UST. The location of the UST is not specified in any of the available documentation. The UST's contents were reported to be pumped out and transported to a municipal landfill. The source of this information was not identified in the Preliminary Assessment.

Yakima Farmer Supply filed for bankruptcy and the business was closed down in 1971. The available documentation was not clear as to whom receivership of the land title reverted to; however, in 1978 the Yakima Farmer Supply properties were purchased by ANCO. Aerial photographs indicate that the Yakima Farmer Supply formulating plant was demolished and the waste pit appeared to have been filled and graded during the period of time ANCO owned the former Yakima Farmer Supply properties. The available documentation does not indicate whether all Yakima Farmer Supply subsurface site improvements were removed. The main warehouse building and warehouse building to the southeast were not demolished. The individual parcels that comprised the former Yakima Farmer Supply appear to have been sold to various parties since acquisition by ANCO.

In 1979, Mr. Merv Wark, owner of YSF, purchased Tax Parcel No. 19133141009 and constructed these building in 1980. In 1982, Team Research Engineering purchased Tax Parcel No. 19133141409 which was then purchased by Agri-Tech in 1989. Team Research Engineering constructed a 20,336 square foot single-story warehouse building that is the same building present today. The available documentation does not indicate what type of materials were stored or used by Team Research Engineering during the seven years they owned and operated their business. The available documentation indicates that Agri-Tech was a sales and service business for fruit packing supplies and equipment. The available documentation does not indicate when Agri-Tech discontinued their business operations at the Site nor does it list the various lessees and their business practices during the last 14 years which Agri-Tech owned Tax Parcel No. 19133141409.

2.4 SURROUNDING PROPERTIES

The following sections described the properties and facilities surrounding the Site.

2.4.1 Former Yakima Farmer Supply Properties

A complete use history of the other parcels comprising the former Yakima Farmer Supply properties was not conducted for the RI. The available documentation indicates that the former main warehouse building (Isaak property, Tax Parcel No. 19133141005) was occupied by Printing Press, a printing company during completion of the RI. No information on other potential tenants was available.

The northwest adjacent parcel (Keuler property, Tax Parcel No. 19133141408) is asphalt-paved and includes a 7,222 square foot office building that fronts East Washington Avenue. The available documentation indicates that Agri-Tech owned this parcel but does not indicate when the property was transferred to Mrs. Keuler.

The Columbia Investment property (Tax Parcel No. 19133141011), which includes the location of the other former Yakima Farmer Supply warehouse structure was occupied by Pacific California, a trucking company, in 1997. During the supplementary RI work in November 2002, this property was occupied by Wilbert Precast, a company that manufacturers concrete septic tanks and vaults. Photographs taken by YSF prior to developing their property in 1979 depict two fuel dispensers and a rectangular concrete slab at the southwest corner of the warehouse building suggesting the presence of a UST. The available documentation does not indicate whether the fuel dispensers and UST were formerly part of the Yakima Farmer Supply facility or associated with the owner/operator in 1979. The photographs also depict the Yakima Farmer Supply formulating plant grading equipment, and evidence of grading, on Tax Parcel No. 19133141409 (Agri-Tech property). The paved road between the YSF and Agri-Tech property is also visible in the photographs. All improvements around the former formulating plant appeared to have been removed and the area around the building recently graded. No indications of the former waste pit were visible. Copies of the Site photographs have been included in Appendix A.

The Pauliin property (Tax Parcel No. 1913314003) is paved and does not appear to have been developed as a commercial or industrial business. At the time of the supplemental RI work in November 2002, the property use appeared unchanged as an unoccupied paved lot.

2.4.2 Bay Chemical Company and South Adjacent Property

The west adjacent property (Tax Parcel No. 19133141010, Figure 2) was previously owned by Northern Pacific Railroad, predecessor of BNSF. This property was leased to the Bay Chemical Company (Bay Chemical), a manufacturer of soil micronutrients, from 1963 to late 1975 or early 1976. The parcel is long and narrow, measuring about 200 feet (east to west) by 1,400 feet (north to south), and comprises approximately 16 acres. Bay Chemical used flue dust obtained from Bethlehem Steel which is located in Seattle, Washington. The flue dust was reacted with sulfuric acid to extract zinc and create a liquid zinc sulfate product that was sold for agricultural use. The residual sludge that contained other heavy metals was pumped to an unlined settling pond on the southern end of the property (Figure 3). The Bay Chemical Potentially Liable Parties (PLP) group has been working with Ecology under an Agreed Order (No. DE 94TC-CC110, March 1994) to complete an RI and an FS. The drafts of the RI and an FS became available to the public in April 2002. The *Remedial Investigation Report, Volume 1, Former Bay Chemical property,* dated March 1997 was prepared by Pacific Groundwater Group. The *Draft Focused Feasibility Study Report, Former Bay Chemical Property,* dated December 19, 1997 was prepared by Kennedy/Jenks Consultants.

The RI states that the primary COPCs at the Bay Chemical property are the metals antimony, arsenic, cadmium, chromium, copper, lead, manganese, mercury, and zinc. No investigation of organic contaminants has been required by Ecology. The results of the RI indicated that contamination in soil was generally limited to 1 to 1.5 feet below the ground surface (bgs) with lead being the primary COPC in soil. The lateral limits of contamination appear to include the entire property and the property to the south of YSF. Insufficient sampling was performed to determine the limits of contamination to the south and east of the Bay Chemical property; however, the photographs taken by YSF in 1979 prior to development of the YSF property (Appendix A) depict areas devoid of vegetation and with soil similar in appearance to the Bay Chemical property. These areas are particularly prevalent on the northwest portion of the YSF property, which was closer to the former Bay Chemical Company operations.

Six groundwater monitoring wells on the Bay Chemical property (Figure 4) were also sampled for the Bay Chemical property COPCs during the RI. The results indicated that cadmium, manganese, mercury, and zinc are the primary COPC for groundwater.

2.4.3 East Adjacent Properties

Three parcels are east and adjacent to the YSF property (Figure 2). These properties, from north to south are:

- The Reiland property (Tax Parcel No. 19133141406);

- The Lindeman property (Tax Parcel No. 19133232433); and
- The Gjs Investments LLC property (Tax Parcel No. 19133232408).

The Reiland property and YSF property are separated by the north to south trending drainage ditch that appears to flow to the south toward the pond. Aerial photographs (Appendix A) indicate that this ditch has been present since at least 1968 but it is not known whether this ditch was part of the regional irrigation system for the Yakima Basin. The Reiland property was being operated by Cascade Auto Recycling during the time of the RI. No additional investigation of the property's historic use has been performed.

The Lindeman and Gjs Investments LLC properties are developed with commercial businesses along South 1st Street. The western portions of these properties that abut the YSF property have never been developed and are covered with vegetation.

2.5 YAKIMA RAILROAD AREA SITES

SECOR International Incorporated (SECOR) conducted an RI (SECOR RI) for the Cameron Yakima Working Group that included an evaluation of the known historical sources of tetrachloroethene (PCE) and the distribution of PCE in the Yakima Railroad Area (YRRA). The RI involved installation of a regional monitoring well network and collection of soil and groundwater analytical data from monitoring wells located at 13 potential source locations (referenced as subfacilities). The SECOR RI was conducted between December 1997 and September 1998. The results of the SECOR RI provided the Cameron Yakima Working Group with a *Draft Remedial Investigation Report* dated July 29, 1999, which has not yet been finalized. The SECOR RI is the basis for the information presented in this section.

The YRRA, as defined by Ecology in the Consent Decree (CY-96-3196-WFN) dated May 5, 1997 with the Cameron Yakima Working Group, consists of approximately six square miles of primarily commercial and industrial properties that parallel the north to south trending railroad corridor that extends from the northern portion of Yakima, south to Union Gap (Figure 5). The YRRA includes 13 subfacilities that have been identified by Ecology as potential sources of releases of PCE. Although not each subfacility has been included in the YRRA Consent Decree, each potential PLP has been responsible for conducting site investigations to ascertain whether a release of PCE has occurred at their facility and whether that release is contributing to the regional PCE plume in the YRRA area.

The findings of the SECOR RI indicate that there are multiple subfacilities located upgradient of the Site that have concentrations of PCE in groundwater that are equal to or greater than the concentration of PCE detected in the upgradient monitoring well (MW-1) and crossgradient monitoring wells (MW-3 and MW-5) at the Site (Figure 4).

The Woods Industries/Crop King subfacility is the closest of the upgradient subfacilities, located approximately 2,600 feet north/northwest of the Site (Figure 5) at 1 East King Street. The subfacility is owned by BNSF, but was leased to Woods Industries/Crop King. This subfacility was a former pesticide manufacturing facility and has confirmed release(s) of PCE. Historically, this subfacility has documented concentrations of PCE in groundwater as high as 31 micrograms per liter (µg/l). More recently, the analytical results from groundwater sampling between 1997 and 2002 indicates that concentrations of PCE in groundwater samples from monitoring well MW-8 located at Woods Industries/Crop King and upgradient of the Site have ranged from 2.7 µg/l to 6.3 µg/l.

The SECOR RI and subsequent YRRA groundwater sampling conducted by Ecology through September 2003 included sampling YRRA monitoring wells located downgradient of the Site. The YRRA monitoring wells located directly downgradient of the Site include monitoring well pairs RI-7 through RI-11. These monitoring well pairs include shallow and deep wells screened at intervals ranging from 15 feet bgs up to 39 feet bgs for evaluation of the shallow water-bearing zone, and 95 feet bgs to 114 feet bgs for the deep water-bearing zone. All of these monitoring wells are located within 2,000 feet downgradient of the Site.

The analytical results for groundwater samples from the RI wells used to evaluate the shallow water-bearing zone (RI wells RI-7s to RI-11s) have been below the MTCA Method A cleanup level of 5.0 µg/l for PCE selected by Ecology as the action level for PCE in the YRRA. The concentrations of PCE have been below 5.0 µg/l since inception of the YRRA groundwater sampling program in December 1997. The highest concentration of PCE in any of these shallow monitoring wells has been 2.53 µg/l (RI-10s, June 1999). The analytical results for groundwater samples from the monitoring wells used to evaluate the deep water bearing zone (RI wells RI-7d to RI-11d) have also been below 5.0 µg/l since inception of the YRRA groundwater sampling program in December 1997. The highest concentration of PCE in these deep monitoring wells was 0.761 µg/l (RI-10d, September 1998).

2.6 PREVIOUS SITE INVESTIGATIONS

Previous investigations, conducted at the Site prior to the RI, have been documented in the following reports:

1. United States Environmental Protection Agency, Region 10, June 24, 1988, *Preliminary Assessment Report for Yakima Farmer Supply* (prepared by USEPA subcontractor Ecology and Environment, Inc.).
2. Washington State Department of Ecology, February 25, 1993, *Geotechnical Investigation of the Yakima Railroad Area.*
3. PLSA Engineering and Surveying, May 1993, *Site Sampling and Analysis Assessment for Yakima Steel Fabricators, Inc. and Agri-Tech, Inc.*
4. Maxim, 1996 through 1997, *Remedial Investigation Work Plan, Agri-Tech/Yakima Steel Fabricators and Addenda.* The RI Work Plan and Addenda did not include subsurface investigation activities, but did include a summary of the historical information for the Site and surrounding area.
5. AGRA, June 29, 1998, *Remedial Investigation Report, Agri-Tech/Yakima Steel Fabricators (DRAFT).* The results of AGRA's RI are incorporated into this Revised RI report.

6. AGRA, April 16, 1998; July 14, 1998; and October 14, 1998; Groundwater Status Reports documenting quarterly groundwater monitoring and sampling results in support of completion of the Draft RI. The results of these reports are incorporated into this Revised RI report.

The details of the previous investigations are presented in the sections that follow. The soil analytical data referenced in the following sections is provided in Tables 1 and 2 for volatile organic compounds (VOCs) and pesticides and herbicides, respectively; and Tables 8 and 9 for petroleum hydrocarbons and polychlorinated biphenyls (PCBs) and metals, respectively. The groundwater analytical data is presented in Tables 3 and 4 for VOCs and pesticides and herbicides, respectively. The soil and groundwater screening levels developed for use in the RI are provided in Tables 5 and 6, respectively; including comparative review of the regulatory alternatives evaluated based on MTCA protocols.

2.6.1 United States Environmental Protection Agency

The USEPA subcontracted Ecology and Environment, Inc. to complete the Preliminary Assessment in response to a citizen complaint from 1986 that indicated that Yakima Farmer Supply had a waste pit where the lime and sulfur pesticide residues were deposited. The waste pit was reported to have been filled and covered with gravel, but the Preliminary Assessment does not state what party performed the filling.

The Preliminary Assessment appears to have consisted of a Site visit and a review of available information pertinent to the former Yakima Farmer Supply operations but does not specify the source of these resources. The USEPA concluded that the Site represented a low potential to cause human health problems or adversely affect shallow groundwater or surface waters based on the assumption that the lime and sulfur pesticide residues and carrier oils were the only COPCs. No further action was recommended by the USEPA.

2.6.2 Ecology

The first subsurface investigation was performed by Ecology in 1992 as part of a regional investigation of the potential PLPs for the YRRA. This investigation included installation of one groundwater monitoring well, WDOE-6 (Figure 4) to a depth of approximately 17 feet bgs and drilling one soil boring, SB-2, to a depth of approximately 5 feet bgs. The analytical results of a soil sample collected at a depth of 10 feet bgs at monitoring well WDOE-6, and approximately 6 feet below the depth at which groundwater was encountered, indicated the presence of PCE at a concentration of 2.2 milligrams per kilogram (mg/kg). Concentrations of acetone, carbon disulfide, dichloroethene (DCE) isomers, methylene chloride, 1,2-dichloropropane, trichloroethene (TCE), ethylbenzene, xylenes, 4,4-DDD, 4,4-DDE, dieldrin, chlordane, and endosulfan sulfate were also detected in the soil sample (Tables 1 and 2). The analytical results of the groundwater sample collected from monitoring well WDOE-6 contained a concentration of PCE at 420 μg/l (Table 3). Concentrations of DCE isomers, TCE, ethylbenzene, dieldrin, DDE, DDD, and endrin were also detected in the groundwater sample (Tables 3 and 4).

2.6.3 PLSA Engineering and Surveying

The second subsurface investigation at the Site was performed by PLSA Engineering and Surveying (PLSA) in May 1993. PLSA was contracted by YSF and Agri-Tech to confirm the results of the 1992 Ecology investigation. Ecology was present during the investigation to observe and collect duplicate soil and groundwater samples. PLSA's investigation included excavation of four test pits (TP-1 through TP-4, Figure 6) to depths of 4.5 to 6 feet bgs. Two of the test pits were completed in the waste pit area, one test pit was located immediately north of the Agri-Tech building, and one test pit was excavated approximately 200 feet southeast of the waste pit, and approximately 100 feet east of the YSF building.

The soil encountered in the test pits on the YSF property consisted of an initial 2 to 7.5 foot mixture of silt, sand and gravel. A black, organic-rich soil horizon was encountered in test pits TP-1 through TP-3 at approximately 4.5 to 5 feet bgs. The organic-rich horizon may represent a former vegetated ground surface elevation. A 2 to 3 foot layer of the lime and sulfur residue was encountered below the silt, sand and gravel layer in test pits TP-2 and TP-3, located in the waste pit. The lime and sulfur residue was described as gray to greenish, semi-solid, with a hydrogen sulfide-like odor. A soil layer described as cemented layer of gravel and cobbles was encountered below the layer of lime and sulfur at a depth of approximately 7 feet bgs, in test pit TP-2 but not in test pit TP-3, located approximately 35 feet to the south of test pit TP-2. No details were presented as to the possible cementing agent; however, since this layer was at the base of the waste pit materials, the cementing agent was likely comprised of the mixture of materials deposited into the pit by Yakima Farmer Supply. Native silt, sand and gravel was encountered between 5 to 7 feet bgs in the test pits. Groundwater was encountered at a depth of 7.5 to 8 feet bgs in all four test pits.

Soil samples YSF-1 through YSF-6 were collected from the test pits at depths ranging from 4 to 8 feet bgs. Soil sample YSF-4, collected from test pit TP-2 located in the waste pit, contained a concentration of PCE at 0.013 mg/kg. However, PLSA noted that this sample was cross-contaminated with groundwater that had risen up in the test pit and saturated the layer of soil sampled. PLSA noted that Ecology requested the soil sample be collected despite the obvious cross-contamination with groundwater. All other soil samples were collected above the water table and did not contain concentrations of PCE above the laboratory practical quantitation limit (PQL). Concentrations of acetone, carbon disulfide, DCE isomers, methylene chloride, 1,2-dichloropropane, TCE, ethylbenzene, toluene, xylenes, 4,4-DDD, 4,4-DDE, dieldrin, heptachlor epoxide, and endrin were also detected in soil sample YSF-4, collected from the waste pit. The PLSA soil and groundwater analytical data are presented in Tables 1 through 4.

Groundwater samples were also collected from water pooling at the base of the four test pits. The groundwater samples from the two test pits completed in the waste pit contained the highest concentrations of PCE up to 220 μg/l. The groundwater sample collected from the upgradient test pit (test pit TP-4), located immediately north of the Agri-Tech building contained a concentration of PCE of 6.7 μg/l. The groundwater sample from the downgradient test pit (test pit TP-1), located east of the YSF building, contained a concentration of PCE at 7.2 μg/l.

PLSA concluded that the cemented layer of gravel and cobbles in the waste pit may act as a barrier, separating the overlying soil and lime and sulfur residue mixture from the groundwater below. PLSA also concluded that the combination of the absence of soil containing PCE above the water table and the presence of PCE in all groundwater samples from the four test pits indicated that the PCE source was from groundwater upgradient of the Site and not historical Site operations. There was no information in the available documentation regarding Ecology's response to the PLSA investigation.

2.6.4 Maxim Technologies, Inc.

Following the preliminary subsurface investigation work by Ecology and PLSA, Maxim was contracted by YSF and Agri-Tech to prepare the RI Work Plan as part of the Agreed Order. Maxim performed an evaluation of the available Site history information, including the previous Site investigations, researched surrounding property use, and performed a limited preliminary sensitive receptor survey during preparation of the RI Work Plan. Maxim used this information to develop a scope of work for the RI. The RI Work Plan also included:

- A Site health and safety plan;
- A sampling and analysis plan;
- A quality assurance project plan; and
- A pre-investigation cleanup action alternatives report.

The RI Work Plan defined the COPCs as based on historical Site operations and the results of the previous investigations. The COPCs were defined as volatile organic compounds, including PCE, organochlorine pesticides, petroleum hydrocarbons, and polychlorinated biphenyls (PCBs). Maxim indicated that Ecology indicated that the PCBs were detected at the Bay Chemical property and were retained as a Site COPC to determine whether the Site had been affected by the contamination present at the Bay Chemical property. Farallon understands that the metals detected at the Bay Chemical property were later added to the list of COPCs at the recommendation of Ecology. Ecology also recommended including organophosphorous pesticides and chlorinated herbicides in the list of COPCs until their presence or absence in the waste pit materials could be confirmed.

The RI Work Plan defined the soil and groundwater cleanup standards for consideration during the RI. The soil cleanup level was defined as the MTCA Method B cleanup levels protective of groundwater under the 1991 version of the MTCA regulation (Chapter 173-340 WAC). Farallon understands that Ecology later requested that site-specific MTCA Method B soil cleanup levels also be evaluated using fraction organic carbon (foc) data that were collected during the RI. The soil and groundwater cleanup levels for petroleum hydrocarbons were defined as the MTCA Method A cleanup levels. However, there was no indication whether residential or industrial MTCA Method A cleanup levels were appropriate. The cleanup level for PCE in groundwater was specified as the USEPA drinking water standard of 5.0 µg/l that is the same as the MTCA Method A groundwater cleanup level. The point of compliance was defined in the RI Work Plan as the property boundaries of the Site.

Based on the comments to the Draft RI presented by Ecology, the selection of cleanup levels for soil and groundwater was subsequently revised to meet the requirements of the revisions to MTCA in 2001. Farallon evaluated standard and modified MTCA Method A, B, and C cleanup levels and selected preliminary screening levels for soil and groundwater in accordance with the revisions to MTCA. Details of this evaluation are presented in Section 3, and are summarized in Tables 5 and 6.

A pre-investigation cleanup action alternatives section was included in the RI Work Plan. This was intended to provide a preliminary evaluation of technically feasible remedial alternatives for Site soil based on the data presented in the prior Site investigation reports. Maxim indicated that this preliminary evaluation process was intended to focus the scope of work for the RI on collecting data to support the evaluation of the technically feasible remedial alternatives. The preliminary evaluation was not intended to address groundwater since only one monitoring well (WDOE-6) existed at the time that the RI Work Plan was prepared. Maxim indicated that the following remedial alternatives should be considered for future evaluation during completion of an FS:

- No further action for soil if the RI results indicated that the selected soil cleanup levels were met at the Site;
- Application of institutional controls if concentrations of COPCs in soil exceeded the selected cleanup levels but were not affecting other media;
- Paving the waste pit and surrounding Site;
- Excavation and removal of all affected soil to a "special waste landfill";
- Excavation and removal of all affected soil to a hazardous waste landfill;
- Excavation and incineration of affected soil;
- Excavation and removal to a special waste landfill, "hot spots" only;
- Excavation and removal to a hazardous waste landfill, "hot spots" only;
- Excavation and removal to an incineration facility, "hot spots" only; and
- Soil washing for soil outside the waste pit where the percentage of sand and gravel exceeded 80% of the total soil volume.

The available documentation does not indicate whether Ecology agreed with the preliminary evaluation of the technically feasible remedial alternatives. The available documentation confirms that all parties to the Agreed Order agreed that a FS would be completed independent of the scope of work presented in the RI Work Plan.

The RI Work Plan divided the Site into three areas of concern that required investigation:

- Area 1- Area 1 includes the former Yakima Farmer Supply lime and sulfur processing plant and the area of the former waste pit.
- Area 2 – Area 2 is located on the central and eastern portion of the YSF property between the YSF building and the east adjacent automobile recycling facility. This area is

suspected to have included stockpiles of bulk lime and sulfur, based on the 1968 aerial photograph reviewed by Ecology (Appendix A).

- Area 3 – Area 3 includes a small area located southwest of the YSF building. Ecology indicated that they suspected a release of petroleum hydrocarbons in this area based on a 1990 aerial photograph and site observations during previous investigations that indicated black-stained soil was present on the ground surface in the unpaved area. Mr. Merv Wark, owner and operator of YSF indicated that a small wood structure had been burnt in this area leaving the soil discolored. This area was covered with sand and gravel and no surface discoloration was observed at the time of the RI.

The boundaries/limits of these areas were not defined for the purpose of the RI Work Plan but were intended to be assessed during the RI. The scope of work presented in the RI Work Plan included soil and groundwater investigation activities intended to assess the lateral and vertical distribution of the COPCs.

2.6.5 AGRA Earth & Environmental Inc.

AGRA was contracted by YSF and Agri-Tech in October 1997 to implement the RI Work Plan. AGRA completed the scope of work in 1998 and submitted the Draft RI Report dated June 29, 1998 for Ecology review and comment. AGRA also completed one year of quarterly groundwater monitoring and sampling in accordance with the RI Work Plan and submitted the results to Ecology in three supplemental groundwater status reports dated April 16, 1998, July 14, 1998, and October 14, 1998. Ecology provided comments (November 9, 1998) on the Draft RI after completion of the quarterly groundwater monitoring and sampling events that were conducted between September 1997 and September 1998. The draft RI was not revised to address Ecology's comments. The results of AGRA's work have been incorporated into this revision to the RI.

2.7 PHYSICAL AND ENVIRONMENTAL SETTING

This section presents information on the general physical and environmental setting in the Site area. The information presented includes regional geography, geology, hydrogeology, and climate data. Farallon has also included site-specific information pertaining to the potential terrestrial ecologic risk evaluation under Chapters 173-340-7490 through 173-340–7493 WAC.

2.7.1 Geography and Geology

The following information was derived from the documents listed in Section 7.0. The Site is located in the southern portion of the city of Yakima, and immediately north of the city of Union Gap in an area of Yakima zoned for light industrial use. The land use for the Site appears to be consistent with land use since the 1940s. Surrounding properties are all currently used for similar commercial and light industrial use.

The cities of Yakima and Union Gap are located in the Yakima River Valley in the Ahtanum-Moxee Subbasin. The Yakima River Valley is a major agricultural area of south-central Washington.

The near surface soils in the vicinity of the Site are classified by the National Resource Conservation Service as the Weirman fine sandy loam. These soils are described as grayish brown gravelly fine sandy loam up to approximately 5 feet in thickness. Significant modifications and development in the Yakima River Valley have affected the upper soil profile.

The Site is underlain by approximately 1,000 to 1,500 feet of unconsolidated to semi-consolidated soil and alluvial sediments that overlie the Tertiary-age Columbia River Basalt flows. The Ahtanum-Moxee Subbasin lies within a broad syncline bounded by the east-west trending Yakima and Ahtanum/Rattlesnake Ridges to the north and south, respectively. The Columbia River Basalts are exposed along the ridges and dip beneath the valley where they are overlain by soil and alluvial sediments.

The sediments consist of Holocene-age alluvial deposits, denoted as the Yakima Valley Alluvium. The Yakima Valley Alluvium consists of unconsolidated fine to coarse sands and gravel to boulder-sized rock, with interbedded silt lenses. The Yakima Valley Alluvium is approximately 30 feet in thickness near the Site. These deposits are highly permeable and acts as an unconfined shallow water-bearing zone, recharged by both local precipitation and irrigation.

The Yakima Valley Terrace Deposits underlie the Yakima Valley Alluvium and consist of alluvial gravels with some clay, silt, and sand deposited during the Pleistocene glacial retreats and advances. The deposits may be consolidated in areas and include stratified conglomerates and caliche. The permeability of these deposits varies locally depending on the types of sediments present and degree of consolidation/stratification. The deposits may range from 200 to 300 feet in thickness. The Yakima Valley Terrace Deposits act as an unconfined water-bearing zone used for domestic, public, irrigation, and industrial supply wells. Recharge is by precipitation, irrigation, and upward leakage from the underlying Ellensburg Formation.

The Ellensburg Formation consists of semi-consolidated, volcanic-derived, sand, silt, and gravel deposits with some volcanic mudflow and ash deposits. The thickness of this formation may be as much as 1,000 feet. The Ellensburg Formation acts as a confined water-bearing zone and is recharged by lateral and upward flow of groundwater from the Yakima Basalt Group.

The Pomona Basalt underlies the Ellensburg formation and is the youngest member of the Columbia River Basalts that comprise the Yakima Basalt Group. The basalts may be up to 5,000 feet thick in areas. This formation is not used as a groundwater source in the Yakima Valley. The basalts are recharged where they are exposed along the ridges by precipitation, surface waters, and local irrigation.

2.7.2 Hydrogeology

The regional hydrogeology of the Yakima Valley consists of three aquifer systems (SECOR, 1999). The uppermost aquifer is located in the Yakima Valley Alluvium and Yakima Valley Terrace Deposits and is commonly referred to as the Yakima Gravels. The intermediate aquifer is located in the coarser-grained deposits of the Ellensburg Formation. The lowermost aquifer is located in the Pomona Basalts.

The Yakima Gravels in the vicinity of the Site are very permeable and capable of yielding groundwater at hundreds of gallons per minute (SECOR, 1999). Groundwater is typically encountered between 5 to 30 feet bgs, depending on local topography, seasonal groundwater fluctuations, and seasonal irrigation practices. The seasonal groundwater flux can be as much as 12 feet in this aquifer system (SECOR, 1999). The seasonal low groundwater conditions are typically between winter and early spring (February through March) and increase with regional irrigation between early spring and late fall (April through November). Regional groundwater flow in this aquifer system is typically from the upland areas toward the Yakima River. Closer to the Yakima River, groundwater flow is subparallel to the southerly flow of the river.

The SECOR RI included assessment of the characteristics of the Yakima Gravels aquifer. The SECOR RI divided the Yakima Gravels aquifer into a shallow and deep water-bearing zone for discussion purposes. The shallow water-bearing zone consisted of groundwater present less than 50 feet bgs. The deeper water-bearing zone consisted of groundwater greater than 50 feet bgs up to the maximum depth of the monitoring wells completed for the RI at 130 feet bgs. The SECOR RI indicates that there is a slight downward vertical gradient between the shallow water-bearing zone and the deeper water-bearing zone. The two zones are not separated by an aquitard with the exception of some areas in the northern portion of the YRRA. The SECOR RI indicated the following specific details:

- The hydraulic conductivity at three locations in the YRRA was evaluated. The locations included monitoring well pairs RI-4, RI-13, and the Cameron Yakima facility (Figure 5). The ranges of hydraulic conductivity at monitoring well pairs RI-4, RI-13 were estimated based on published values for the soil types encountered; however, the range of hydraulic conductivity for the Cameron Yakima facility was based on aquifer testing performed by others. The published values ranged from 566 feet per day (ft/day) to 2,835 ft/day (173 meters per day (m/day) to 864 m/day). The Cameron Yakima facility, ranged from 57 ft/day to 567 ft/day (17 m/day to 173 m/day).
- The shallow water-bearing zone is unconfined but the deeper water-bearing zone is semi-confined in the northern portion of the YRRA where layers of caliche were encountered.
- The hydraulic gradient is to the southeast regionally and near the Site. The horizontal gradient in the southern portion of the YRRA, which includes the Site, is 0.005 foot per foot (ft/ft) on average.
- The direction of regional groundwater flow is not affected by seasonal irrigation.
- The effective porosity based on published values for the region range from 2 to 3 percent.
- The groundwater seepage velocity for the shallow water-bearing zone was stated as being highly variable, ranging on the order of several hundred to several thousand feet per year.

The groundwater seepage velocity for the YRRA was estimated but was not specifically calculated. Farallon estimates that the groundwater seepage velocity could range from 3,449 to 1,724,625 feet per year based on the following equation:

$$v = \frac{K\iota}{\eta} \times 365$$

Where:

v = groundwater velocity (feet per year)
K = hydraulic conductivity of 56.69 to 2,835 (feet/day)
ι = hydraulic gradient of 0.05 (feet/foot)
η = effective porosity of 3.0 (percent)
365 = days per year

2.7.3 Surface Waters and Critical Areas

Surface waters on the Site include a pond on the southern end of the Site where water collects year-round and a drainage ditch along the eastern Site boundary. The area around the pond is classified as a Type 3 wetland by the City of Yakima. However, there was no information to indicate a formal wetland survey has ever been conducted to confirm this classification. A Type 3 wetland is defined by Ecology as vernal pools that are isolated or wetlands with a moderate level of function that generally have been disturbed in some ways, and are often smaller, less diverse and/or more isolated in landscape. Type 3 wetlands are not typically protected to the degree of Type 1 and 2 wetlands. The Type 3 wetland at the Site is not known to be a critical habitat for any endangered or threatened species.

The Yakima River located approximately 1 mile east of the Site. This is the only major surface water body in the vicinity of the Site.

The closest off-site critical area is another Type 3 wetland located to the southeast on the Reiland property (Tax Parcel No. 19133141406). The Reiland property and YSF property are separated by a north to south trending drainage ditch (Figure 3). Aerial photographs (Appendix A) indicate that this ditch dates back to at least 1968 but it is not clear whether it was part of the regional irrigation system for the Yakima Basin.

2.7.4 Sensitive Receptors

The sensitive receptors that may be affected by the release(s) of COPCs identified at the Site have been evaluated for selection of appropriate soil and groundwater screening levels and for future consideration of long-term cleanup actions. Sensitive receptors that may potentially be affected by the historic release(s) of COPCs are:

- **Human populations**. These include Site workers, visitors, and nearby off-site populations. Potential pathways of exposure include direct contact, via dermal and ingestion pathways, and to a lesser extent vapor inhalation pathway. The potential risk to this receptor group is estimated to be minimal based on the locations, characteristics, and concentrations of the COPCs in the areas most frequented by humans. Site workers conducting subsurface work such as utility repairs are at highest risk of exposure.
- **Groundwater receptors.** Groundwater receptors include drinking water wells and other wells screened within the upper 50 feet of the Yakima Gravels aquifer system. According to a letter to Ecology dated May 6, 1997 from Maxim Technologies, Inc., the

nearest drinking water wells are approximately 2,460 feet downgradient (south) of the Site and include the municipal water supply well field for the city of Union Gap located in Township 12 North, Range 19 East, Section 6 (Appendix B). However, the analytical results for PCE in the groundwater samples from YRRA RI well pairs RI-7 to RI-11, located less than 2,000 feet downgradient of the Site, have been below the USEPA drinking water standard of 5.0 µg/l since inception of the YRRA groundwater sampling program in December 1997. In addition, the municipal water supply wells extract water from depths of 400 feet bgs or greater (SECOR, 1999), which is deeper than the extent of PCE in the YRRA. Additional information on water wells proximal to the Site has been included in Appendix B.

- **Surface water receptors**. The Type 3 wetland on the southern portion of the YSF property is considered the only potential surface water receptor. The eastern drainage ditch is not considered a potential receptor because surface water is present in the ditch for only a small portion of the year and this water ultimately discharges into the Type 3 wetland. The Yakima River is not considered a potential receptor due to its location hydraulically crossgradient to the Site (Figure 1) based on the YRRA groundwater monitoring data cited above.

- **Terrestrial ecologic receptors.** The terrestrial ecologic receptors are defined as native plants and animals that live primarily or entirely on land. Although a site-specific terrestrial ecologic risk evaluation has not been completed, the COPCs present in the waste pit are not expected to affect the plants or animals present on the undeveloped portions of the Site based on the locations and concentrations of COPCs present. The COPCs at the unpaved, west adjacent Bay Chemical property may have affected these receptors and may require further evaluation, however.

2.7.5 Climate

The Yakima River Valley is located in an arid to semi-arid region characterized by warm, dry summers, and cold, moist winters. According to the Western Regional Climate Center, the average annual precipitation in the Yakima area is 8.21 inches. The high monthly average temperature is 87.3°Farenheit and occurs in July, and the low monthly average temperature is 20.3°Farenheit and occurs in January. Additional regional climate data are presented in Table 7.

3.0 REMEDIAL INVESTIGATION

This section summarizes the technical elements, scope of work, and results of the RI. The work was performed in accordance with the RI Work Plan, Revised Addendum, and Agreed Order. Modifications to the scope of work in the RI Work Plan or Revised Addendum were approved by Ecology. Both the RI Work Plan and Revised Addendum included Sampling and Analysis Plans, Quality Assurance Project Plans, and Health and Safety Plans that detailed the protocols used to complete the scope of work for each phase of the RI. These documents should be referenced for specific details not presented in this report.

3.1 TECHNICAL ELEMENTS

The technical elements applicable to the RI include identification of the media of concern and COPCs, and defining the preliminary screening levels for each COPC. Other technical elements, such as identification of the points of compliance and ARARs, will be addressed separately in a feasibility study.

3.1.1 Media of Concern

Soil and groundwater were the only media of concern that required investigation under the Agreed Order or that were identified in the RI Work Plan. Other potential media of concern that were identified by Farallon that did not require investigation during the RI include surface water and air. Although no sampling of these media was required under the Agreed Order, discussions of the potential for these media to have been affected by Site and surrounding area activities are addressed below for completeness of the RI.

The transport mechanism for COPCs associated with the waste pit to reach surface water (the pond) is via the groundwater pathway. Concentrations of COPCs would not be transported directly to surface water via overland flow from the waste pit due to the presence of the asphalt cap and buildings over the contaminated soil in this area. The potential for transport of hazardous substances to reach the pond from the unpaved, west adjacent Bay Chemical property include both the surface water and groundwater pathways.

Air is considered a potential media of concern because portions of the waste pit are present beneath both the YSF and Agri-Tech buildings. COPCs present in shallow soil and groundwater may potentially be transported via the vapor pathway and affect indoor air quality within these structures.

3.1.2 Constituents of Potential Concern

The RI Work Plan identified COPCs based on evaluation of historic Site operations and the previous Site investigation soil and groundwater analytical data. Further, if a compound was detected in soil and/or groundwater, it was included for consideration for the RI until additional data are collected to eliminate it as a defined COPC or indicator hazardous substance (Chapter 173-340-703 WAC). Using these criteria, the following are considered COPCs:

Volatile organic compounds

- Total xylenes
- Toluene
- Ethylbenzene
- 1,2-dichloropropane
- n-propylbenzene
- 1,3,5-trimethylbenzene
- 1,2,4-trimethylbenzene
- 4-isopropyltoluene
- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- 1,1-dichloroethene (1,1-DCE)
- cis-1,2-dichloroethene (cis-DCE)
- trans-1,2-dichloroethene (trans-DCE)
- Vinyl chloride
- Acetone
- Carbon disulfide
- 2-Butanone/methyl ethyl ketone (MEK)
- Chloroform
- Chloromethane
- 1,1,1-trichloroethane (1,1,1-TCA)
- 1,1-dichloroethane (1,1-DCA)

Pesticides and herbicides

- 4,4-DDT
- 4,4-DDE
- 4,4-DDD
- Dieldrin
- Endrin
- Heptachlor epoxide
- Endosulfan I and II/endosulfan sulfate

- Aldrin
- Alpha-chlordane (chlordane derivative)
- Organophosphorous pesticides (general category)
- Chlorinated herbicides (general category)

Heavy metals

- Cadmium
- Chromium III
- Copper
- Lead
- Nickel
- Silver
- Zinc
- Antimony
- Arsenic
- Thallium
- Mercury

Other hazardous substances

- PCBs
- Total petroleum hydrocarbons (TPH) as diesel range organics (DRO) and oil range organics (ORO)
- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs)

Consideration of the pesticides and herbicides is based on the former Yakima Farmer Supply operations. The volatile organic compounds are associated with the former Yakima Farmer Supply operations based on identification of these compounds in the waste pit at the facility by Ecology (Ecology, 1992). The origin of the heavy metals and PCBs was the former activities at the west adjacent Bay Chemical property according to information provided by Ecology. The analysis of metals and PCBs was recommended by Ecology to begin documenting potential impacts to the Site by Bay Chemical. DRO and cPAHs were identified as potential COPCs only in Area 3 of the Site, located southwest of the existing YSF building (refer to Figure 3). The identification of these COPCs was based on Ecology's review of an aerial photograph, and observations at the Site that indicated this area had stained surficial soil that Ecology believed could have resulted from a limited petroleum release associated with YSF operations.

3.1.3 Evaluation of Preliminary Screening Levels for COPCs

Ecology has indicated that the MTCA Method B soil and groundwater cleanup levels shall be evaluated as the selected preliminary screening levels for the identified COPCs. Ecology has further indicated that comparison of the standard MTCA Method B and modified MTCA Method B soil and groundwater cleanup levels be performed using site-specific soil data.

Modified Method B soil and groundwater cleanup levels have been calculated using Ecology's *Worksheet for Calculating Soil Cleanup Levels for Unrestricted and Industrial Land Use* (Ecology, 2001). An average site-specific fraction organic carbon (foc) value of 0.004 was obtained but not used. The locations of the soil samples used to derive the foc value were not consistent with the requirements in the 2001 revision of MTCA (Chapter 173-340-747[5]).

The default foc value of 0.001 was used for calculation of the cleanup levels. All values used for the cleanup level calculations were based on default values presented in the worksheet and in Ecology's Cleanup Levels and Risk Calculations (CLARC) guidance. The modified MTCA Method B/C soil and groundwater cleanup levels have been calculated and evaluated for applicability for long-term cleanup actions at the Site. The comparisons of potential soil and groundwater cleanup levels for the COPCs are presented in Tables 5 and 6. Copies of the COPC-specific *Worksheet for Calculating Soil Cleanup Levels for Unrestricted and Industrial Land Use* are included in Appendix C.

The target cleanup level for PCE throughout the YRRA has been established by Ecology based on the MTCA Method A cleanup level USEPA drinking water standard of 5.0 µg/l. Dissolved phase PCE concentrations detected across the Site have been compared to this standard for determination of whether additional cleanup actions for groundwater are warranted.

Standard Method B and C soil and groundwater cleanup levels for DRO and ORO are not provided under CLARC, but can be calculated based on the composition of the petroleum mixture present. However, for preliminary screening purposes, the MTCA Method A cleanup levels for DRO and ORO were used to assess whether further risk-based analyses to derive the MTCA Method B and C soil and groundwater cleanup levels are warranted.

The concentrations of lead have also been compared to the MTCA Method A cleanup level for preliminary screening purposes because standard MTCA Method B or C cleanup levels have not been established. The standard MTCA Method A and B soil cleanup levels for unrestricted land use were used for comparative interpretation of the remaining heavy metal, soil, and groundwater data. This approach was considered a reasonable scenario for preliminary screening purposes, based on the Bay Chemical RI results that indicate that direct contact via the dermal and ingestion exposure pathways is the maximum reasonable exposure scenario.

Development of preliminary soil and groundwater screening levels was also based on a comparison of the standard and modified MTCA Method B cleanup levels including consideration of surface water cleanup levels due to the presence of the Type 3 wetlands area. Following review of the information derived from the screening level comparison, the most stringent values were selected for each COPC and media of concern. The preliminary cleanup level of 5.0 µg/l was retained for PCE in groundwater based on the consistent use of this value throughout the YRRA. MTCA Method A values for unrestricted land use were also selected for lead, DRO, and ORO.

3.1.3.1 Preliminary Soil Screening Level Selection and Calculations

Ecology requested that MTCA Method B soil cleanup levels that would be protective of a potable groundwater resource (Chapter 173-340-747 WAC) be utilized as the preliminary screening levels for interpretation of the soil analytical results. This request assumes that the maximum reasonable exposure would occur from the COPCs leaching into groundwater and being transported to a downgradient potable water source rather than via direct contact with the affected soil. The requested comparison to MTCA Method B soil cleanup levels assumes a reasonable maximum exposure based on residential rather than industrial land use conditions. The current and future Site and surrounding area land uses are anticipated to remain industrial. Therefore, MTCA Method C soil cleanup levels may be more appropriate due to the commercial and industrial nature of the Site and surrounding area. As a result, the standard and modified MTCA Method C soil cleanup levels are also presented in Table 2 for comparison purposes, and for future consideration during development of a final cleanup action plan.

At the time of the Draft RI preparation (AGRA 1998), CLARC included soil cleanup levels considered protective of potable groundwater based on values that were 100 times the groundwater cleanup level (i.e., 100X rule). The revised MTCA has eliminated the 100X rule and has provided methods for calculating site-specific MTCA Method B soil cleanup levels for the soil to groundwater leaching pathway and other exposure pathways. Ecology's *Worksheet for Calculating Soil Cleanup Levels for Unrestricted and Industrial Land Use* was used to calculate the Method B and Method C cleanup levels for soil that are considered protective of potable groundwater.

The average foc value of 0.001 for the YRRA was used for calculation of Site-specific cleanup levels for COPCs in soil. The average concentrations of the COPCs detected in soil were used for input of the measured soil concentrations. Where concentrations of the COPCs were below the laboratory reporting limits, a concentration of one-half the laboratory reporting limit was used to determine the average measured concentration.

The calculated cleanup levels do not include adjustments for cumulative risk or other potentially applicable adjustments that may require consideration under the 2001 revisions to MTCA. The final selection of soil cleanup levels and any adjustments that may be required will be negotiated with Ecology prior to determining an appropriate long-term cleanup action. The standard and modified MTCA Method B soil cleanup levels for the soil to groundwater leaching pathway were compared and the most stringent of the two values was selected as the preliminary screening level for interpretation of the soil analytical results. The standard MTCA Method A and B soil cleanup levels for unrestricted land use were used for interpretation of the heavy metal concentrations as noted previously. The MTCA Method A soil cleanup levels for unrestricted land use were selected as the preliminary screening levels for interpretation of the DRO and ORO analyses as noted previously. The cleanup level evaluation is presented in Table 5, and the associated screening level calculations are provided in Appendix C.

3.1.3.2 Preliminary Groundwater Screening Level Selection and Calculations

The target cleanup level for PCE throughout the YRRA has been established by Ecology as 5.0 µg/l. This standard was selected as the preliminary screening level for interpretation of the PCE analytical results. Similarly, MTCA Method A groundwater cleanup levels have been selected as the preliminary screening levels for interpretation of the DRO and ORO groundwater analytical data.

Analyses for heavy metals in groundwater were not required under the Agreed Order and were not performed. Therefore, evaluation of preliminary screening levels for heavy metals in groundwater was not performed. However, the standard MTCA Method A, B, and C cleanup levels have been included in Table 6 for future consideration.

The standard MTCA Method B/modified Method B and the standard MTCA Method C/modified Method C groundwater cleanup levels for COPCs have been included in Table 6 for comparison purposes, and for future evaluation of the appropriate groundwater cleanup levels. Ecology's *Worksheet for Calculating Cleanup Levels for Potable Groundwater* was used to calculate site-specific Method B and Method C cleanup levels for groundwater. The calculated cleanup levels do not include adjustments for cumulative risk or other potentially applicable adjustments that may require consideration under the 2001 revisions to MTCA. The final selection of groundwater cleanup levels and any adjustments that may be required will be negotiated with Ecology prior to determining an appropriate long-term cleanup action. The cleanup levels for MTCA Method B and Method C cleanup levels for surface water have also been presented for comparison due to the potential for COPCs to reach the Type 3 wetlands area in the southern portion of the Site.

3.2 SCOPE OF WORK

The initial scope of fieldwork defined in the RI Work Plan was completed between October 1997 and September 1998 by AGRA. Farallon recommended a supplementary scope of work, described in the Revised Addendum, to address data gaps from the initial phase of the RI and to provide sufficient data to proceed toward completion of the FS. The scope of work described in the Revised Addendum was performed between November and December 2002.

3.2.1 Soil Investigation

The investigation of soil conditions was conducted by AGRA during October 1997. The soil investigation focused on three potential source areas (designated as Areas 1, 2, and 3; Figure 3) at the Site. The areal extent of the COPCs in soil in Area 1, the location of the former waste pit, was characterized by installing borings SP-1 through SP-22 using direct-push drilling methods (Figure 6). The borings were advanced to depths ranging from 5 to 11 feet bgs. One soil sample collected from each soil boring was submitted for laboratory analysis for select COPCs. Two soil samples were also submitted for analysis of total organic carbon (TOC) content to support the evaluation of site-specific soil and groundwater cleanup levels. Two soil samples were also collected at depths of 5 and 10 feet bgs from the boring completed for the installation of monitoring well MW-1, located upgradient of the former lime and sulfur mixing plant/waste pit.

Characterization of the vertical distribution of COPCs in soil at Area 1 was performed by installing borings B-1 and B-2 using hollow-stem auger drilling methods to collect soil samples at a greater depth (Figure 6). The borings were located near the center of the former waste pit on the north and south sides of the sanitary sewer vault. Borings B-1 and B-2 were advanced to depths of 31.5 feet and 27 feet bgs, respectively. Two soil samples from each boring were submitted for laboratory analysis of select COPCs.

The characterization of soil conditions within Area 2, where the suspected lime and sulfur stockpiles were located, was performed by advancing borings SP-26, SP-27, and SP-28 using direct-push drilling methods (Figure 6). The borings were advanced to depths of 6.5 to 7.5 feet bgs. One soil sample was submitted from each boring for analysis for select COPCs.

Soil conditions within Area 3, where the suspected petroleum release was located, were characterized by advancing three borings, SP-23, SP-24, and SP-25 (Figure 6), using direct-push drilling methods. The borings were advanced to depths of 7.5 to 8 feet bgs. One soil sample from each boring was submitted for analysis for select COPCs. This was the only area where the RI Work Plan indicated that soil samples would be analyzed for petroleum hydrocarbons and heavy metals. The analyses for heavy metals were performed to evaluate the potential for contamination of on-Site soil from former operations at the west adjacent Bay Chemical property.

Mr. Rick Roeder of Ecology's Central Regional Office assisted in selecting the boring locations for the investigation of soil conditions. Ecology collected duplicate soil samples at some locations at their discretion for analysis for select COPCs.

The locations of the soil borings were surveyed by a licensed surveyor. The boring logs prepared by AGRA are included as Appendix D.

3.2.1.1 Soil Sampling and Analysis

A total of 35 samples collected from the 38 borings (28 direct-push borings, eight monitoring well borings, and two hollow-stem auger borings) were submitted for laboratory analysis. Soil samples were selected for analyses based on field screening results and field observations of soil conditions. Soil sample numbers were designated by the type of boring (i.e., SP = direct-push boring, B = hollow-stem auger boring, MW = monitoring well boring) and the boring/monitoring well number followed by the approximate depth that the sample was collected.

The analytical testing approach was described in the RI Work Plan. Selected soil samples were analyzed using the following methods:

- VOCs by USEPA Method 5030B/8260B;
- Organochlorine pesticides and PCBs by USEPA Method 8081;

- Organophosphorous pesticides by USEPA Method 8141A;
- Chlorinated herbicides by USEPA Method 8151;
- DRO and ORO by Ecology Method NWTPH D Extended;
- cPAHs by USEPA Method 3545/8270C;
- Heavy metals by USEPA 6000/7000 Series Methods; and
- TOC by USEPA Method 9060-Modified.

3.2.2 Groundwater Investigation

The monitoring wells installed to investigate groundwater conditions for the RI included three shallow monitoring wells (MW-2, MW-6, and MW-7A) and five deeper monitoring wells (MW-1, MW-3, MW-4, MW-5, and MW-7B). The shallow wells had a maximum well screen depth of 15 feet bgs and the deeper monitoring wells had a maximum well screen depth of 30 feet bgs. The rationale for the monitoring well locations and construction details are presented in Sections 3.2.2.1 and 3.2.2.2 below.

Monitoring wells MW-1 through MW-6 were installed by AGRA in 1997 and were sampled for four consecutive quarters between December 1997 and September 1998. Monitoring wells MW-7A/7B were installed by Farallon in November 2002. All of the monitoring wells were sampled again in December 2002. Ecology's monitoring well WDOE-6, located near the center of the waste pit, was also utilized between 1998 and 2002 to assess groundwater conditions. The groundwater monitoring event frequency and scope of analytical testing are presented in Section 3.2.2.3.

3.2.2.1 Monitoring Well Locations

The approximate locations of monitoring wells MW-1 through MW-5 were identified in the RI Work Plan and the final locations were confirmed in the field with Ecology representatives. Monitoring well MW-6 was a supplemental monitoring well that was added based on field observations during the soil investigation. Monitoring wells MW-7A and MW-7B were located immediately north of the pond in accordance with the Revised Addendum. The monitoring well locations are shown on Figure 4. The rationale for the monitoring well locations were as follows:

- Monitoring well MW-1 was installed north (upgradient) of the former lime and sulfur formulating plant and waste pit to evaluate background groundwater conditions.
- Monitoring well MW-2 was installed on the southern edge of the waste pit to assess shallow groundwater quality immediately downgradient of the waste pit.
- Monitoring wells MW-3 and MW-4 were installed near the eastern Site boundary, downgradient of the waste pit and/or Area 2, and were intended to monitor downgradient groundwater quality and to potentially serve as future points of compliance.
- Monitoring well MW-5 was installed near the western Site boundary proximal to Area 3. Monitoring well MW-5 was utilized to assess the impact of the suspected release of petroleum hydrocarbons within Area 3 and the potential former drainage area (1968 aerial photograph) that was inferred by Ecology to represent a

preferential transport pathway for overflow from the waste pit. Monitoring well MW-5 may be utilized as a future point of compliance to assess the potential impact to groundwater quality due to releases at the west adjacent Bay Chemical property.

- Monitoring well MW-6 was installed downgradient of the waste pit and approximately 80 feet south of monitoring well MW-2. This monitoring well was installed to further characterize shallow groundwater quality immediately downgradient of the waste pit.
- Monitoring wells MW-7A and MW-7B were installed approximately 20 feet north of the Type 3 wetland. Monitoring well MW-7A is a shallow monitoring well screened in the same portion of the aquifer as monitoring wells MW-2 and MW-6. Monitoring well MW-7B is a deeper monitoring well screened in the same portion (or at similar elevation) of the aquifer as monitoring wells MW-1, and MW-3 through MW-5. The deeper monitoring well, MW-7B was utilized to assess deeper groundwater quality that is affected by a regional PCE plume emanating from off-Site sources within the YRRA. These monitoring wells were utilized to assess potential impacts to the surface water in the Type 3 wetlands, to provide future downgradient point of compliance monitoring wells, and to assess potential groundwater quality impacts from releases at the west adjacent Bay Chemical property in the future.

Ecology monitoring well WDOE-6 is within the boundaries of the waste pit. Groundwater samples from this well are used to characterize groundwater quality at this source area.

All of the monitoring wells were located and surveyed by a licensed surveyor. The top of the monitoring well casings were surveyed to the nearest 0.01 foot based on the NAVD 29 datum point for the City of Yakima with elevations relative to mean sea level.

3.2.2.2 Monitoring Well Construction

The specific monitoring well construction details for each monitoring well are presented in Table 10 and Appendix E. Shallow monitoring wells MW-2, MW-6, and MW-7A were screened to monitor concentrations of COPCs in groundwater in direct contact with the waste pit materials.

Deep monitoring wells MW-1, MW-3, MW-4, and MW-5, were constructed consistent with other off-Site monitoring wells in the YRRA area that are used to monitor the shallow water-bearing zone of the Yakima Gravels. These monitoring wells have a 20-foot section of well screen set between approximately 10 and 30 feet bgs. A 20-foot length of well screen is greater than is typical for the assessment of halogenated volatile organic compound (HVOC) plumes. However, this length was requested by Ecology for consistency with other monitoring wells within the YRRA. Deep monitoring well MW-7B was constructed with a 5-foot section of well screen set at 25 to 30 feet bgs to provide data on the vertical distribution of HVOCs in the downgradient portion of the Site.

Ecology monitoring well WDOE-6 was reported by Ecology to have been completed to a depth of 23.5 feet bgs. However, subsequent measurement of the monitoring well by AGRA following redevelopment indicated that the bottom of the well was at approximately 17 feet bgs. The well was constructed with a 5-foot section of stainless steel well screen, which means the screened interval in the well is approximately 12 to 17 feet bgs and not 18.5 to 23.5 feet bgs as indicated in the Ecology well log (Appendix E). The well screen is set in the sand and gravel deposits below the limits of the waste pit and provides information on groundwater quality in the waste pit area.

The range of well screen depths and distribution of the monitoring wells provide sufficient data to assess potential impacts to groundwater associated with the waste pit and other suspected on-Site sources, and the concentrations of PCE migrating onto the Site from off-Site sources in the YRRA. The monitoring well network also provides sufficient data to estimate the direction of groundwater flow and hydraulic gradient across the Site.

3.2.2.3 Groundwater Sampling and Analysis

Groundwater sampling at monitoring wells MW-1 through MW-6 and WDOE-6 was performed in December 1997; and in March, June , and September 1998. The December 1997 sampling event excluded monitoring well WDOE-6 pending confirmation that the surface seal was not compromised. Another groundwater sampling event was performed in December 2002 following the installation of monitoring wells MW-7A and MW-7B. Groundwater monitoring and sampling was performed in December 2002 using the low-flow groundwater sampling protocols developed and approved by the USEPA. Prior groundwater sampling was performed by bailing a minimum of three saturated well casing volumes from the monitoring wells prior to sampling.

The analytical testing approach described in the RI Work Plan included analysis of select groundwater samples for the following:

- Volatile organic compounds (VOCs) by USEPA Method 5030B/8260B;
- Organochlorine pesticides and/or PCBs by Method 8081;
- Organophosphorous pesticides by USEPA Method 8141A;
- Chlorinated herbicides by USEPA Method 8151;
- DRO and ORO by Ecology Method WTPH-D Extended; and
- cPAHs by USEPA Method 3545/8270C

The December 2002 groundwater sampling event included analysis of VOCs in all monitoring wells, and organochlorine pesticide analyses at monitoring wells MW-2 and WDOE-6. In addition to the analyses for the COPCs, the following parameters were measured in the field during sampling:

- pH;
- Temperature;
- Conductivity;
- Dissolved oxygen; and

- Oxidation-reduction potential (ORP).

Groundwater samples collected from monitoring wells MW-1, MW-2, MW-4, MW-5, MW-6, MW-7A, and WDOE-6 during the December 2002 groundwater sampling event were submitted for analyses for the following water quality parameters:

- Alkalinity;
- Sulfate;
- Sulfide;
- Nitrogen as nitrate;
- Total organic carbon;
- Chloride;
- Ferrous iron;
- Methane, ethane, and ethene; and
- Total phosphorus.

These supplementary measurements and analytical results were used to assess geochemical conditions within and outside the waste pit area, and to assess the contaminant fate and transport characteristics of the dissolved phase plume(s). These data will also be used to evaluate whether monitored natural attenuation may be an appropriate remedial alternative for the Site.

3.2.3 Reporting

AGRA prepared the following reports pertaining to the RI as required by the Agreed Order:

- Remedial Investigation Report, Agri-Tech/Yakima Steel Fabricators (DRAFT) dated June 29, 1998.
- Groundwater Status Report (March 3, 1998), dated April 16, 1998.
- Groundwater Status Report (June 3, 1998), dated July 14, 1998.
- Groundwater Status Report (September 2, 1998), dated October 14, 1998.

These reports documented the scope of work conducted under the RI Work Plan and required under the Agreed Order. Ecology reviewed these documents and provided comments in the *Response to Remedial Investigation Report, Agri-Tech/Yakima Steel Fabricators* letter dated November 9, 1998. The Draft RI was not finalized following receipt of comments, and a response to Ecology's comments was not prepared. Copies of these reports are available in Ecology's files.

The scope of work and results of the investigations performed by AGRA and Farallon have been incorporated into this Revised RI Report. The revision to the original RI considers the revisions to MTCA and Ecology's comments on the Draft RI.

4.0 RI RESULTS

This section presents the results of the RI including the soil and groundwater investigation results, an evaluation of the potential for DNAPL, potential effects on surface water receptors, and a preliminary evaluation of terrestrial ecologic risk. The section also presents information on disposal of the investigation-derived wastes.

4.1 SOIL INVESTIGATION RESULTS

This section presents the results of the soil investigation conducted during the RI, including a description of the soil lithology encountered and the soil analytical results of the COPCs.

4.1.1 Soil Conditions

The soil types encountered at the boring locations across the Site were generally consistent with the exception of the borings located in the waste pit area. Soil outside of the waste pit area consisted of medium to coarse-grained sand and gravel with a variable silt content. A silt layer with some organic material was encountered between 3 and 5 feet below grade across the Site. Soil beneath a depth of 6 to 7 feet bgs consisted of medium to coarse sand, gravel, and cobbles to the maximum depth drilled of 31.5 feet bgs.

The soil in Area 1, the waste pit area, is capped by the YSF building, the Agri-Tech building, and asphalt in the area between the buildings. The floor of the Agri-Tech building consists of approximately 2-inches of concrete over medium-grained sand and gravel fill. The floor in the central and eastern portions of the YSF building consists of 2-inches of asphalt over silty, medium-grained sand and gravel fill. The floor in the western portion of the YSF building consists of approximately 4-inches of concrete over silty, medium-grained sand and gravel fill. The asphalt surface between the buildings consists of approximately 2-inches of asphalt with an uneven surface due to differential settling.

The soil encountered below the paved surfaces in the waste pit area consisted of sand and gravel with variable silt content. Granular, yellow, sulfur-bearing soil was encountered in borings SP-2, SP-4, SP-5, SP-7, SP-8, and SP-16 at an approximate depth of 2 to 3 feet bgs. The sulfur-bearing soil appeared to be mixed with sand and gravel and was not a homogenous layer. The thickness of the sulfur-bearing soil was up to approximately 2 feet. Some man-made wood debris was also observed in the upper 5 feet of soil within the waste pit area and beneath the Agri-Tech building. A yellow to gray to white substance with the consistency of caulking material was encountered in borings SP-4, SP-7, SP-8, and SP-16 at an approximate depth of 5 feet bgs, immediately below the sulfur-bearing soil. The thickness of this material is generally less than 2 feet, and is inferred to be composed of the lime and sulfur residue that drained into the waste pit. The underlying soil from 5 to 8 feet bgs consisted of black to gray, medium to coarse-grained sand and gravel. The black soil appeared to be organic in nature, and may have been associated with former vegetation at the base of the waste pit. The underlying soil consisted of medium to coarse-grained sand and gravel to 31.5 feet bgs. Soil boring logs are presented in Appendix D. A cross section of the waste pit area is presented in Figures 7 and 8.

The granular sulfur and lime-sulfur material was not laterally continuous across the waste pit area. Therefore, this material would not act as a lining for the base of the waste pit and prohibit the migration of COPCs to the underlying soil and groundwater as was suggested during previous investigations. However, the presence of the lime-sulfur and organic materials in the former waste pit may retard the migration of the COPCs through sorption of the contaminants into the soil matrix. The sorptive properties of the soil matrix in the waste pit is supported by reports from the analytical laboratory concerning difficulties performing sample extractions due to severe soil matrix interference (Appendix F). However, the affects of the adsorptive properties of these materials on contaminant fate and transport were not specifically assessed during the RI.

The surficial soil near Area 2, located east of the YSF building, contained traces of what appeared to be sulfur and lime at depths ranging from approximately 3 to 6 feet bgs in borings SP-26 and SP-27 (Figure 6). This suggests that grading and filling activities have occurred in this area, and that the surficial sand and gravel is fill material. The soil underlying the fill material consisted of a thin silt to silty sand layer with some organics that is interpreted to consist of topsoil at the former land surface prior to fill and grading activities. The soil underlying this layer consisted of the sand, gravel, and cobbles that are consistent with native soils encountered throughout the Site.

The surficial soil at Area 3, located south/southwest of the YSF building (Figure 3), contained wood debris. The wood debris in the soil appeared to have been burned, which is consistent with information provided by Mr. Merv Wark who indicated a former wood building had been burned in this area. There was no evidence of a release of petroleum hydrocarbons to soil in the area, nor were the lime and sulfur materials present. The absence of lime and sulfur materials indicates that overflow from the waste pit was not transported to this area. Soil conditions in this area were generally consistent with Area 2, including the presence of the thin silt to silty sand layer with organics underlain by sand, gravel, and cobbles.

4.1.2 Soil Analytical Results

The soil analytical results are summarized in the sections that follow. The soil analytical data are presented in Tables 1, 2, 8, and 9, and on Figures 7 through 12. The results are compared to the selected preliminary screening levels presented in Table 5. The locations of soil samples exceeding the selected preliminary soil screening levels are presented in Table 4.

4.1.2.1 Volatile Organic Compounds

Concentrations of one or more of the VOCs PCE, TCE, cis-DCE, or 1,2-dichloropropane, were detected at concentrations above the preliminary soil screening levels in soil samples SP1-4, SP2-4, SP-2A-6.5, SP4-7, SP5-6.5, SP7-7, and SP10-4. With the exception of soil samples SP7-7 and SP10-4, these sample locations are beneath the Agri-Tech building. The concentrations of all other VOCs detected were below the preliminary soil screening levels. The VOC analytical data are summarized in Table 1, and select VOC analytical data are presented on Figure 7 and 9.

4.1.2.2 Pesticides and Herbicides

Concentrations of one or more of the organochlorine pesticides 4,4-DDE, 4,4-DDD, dieldrin, endrin, aldrin, or alpha-chlordane were detected at concentrations above the preliminary soil screening levels in soil samples SP2-4, SP2A-6.5, SP4-7, SP5-6.5, SP8-7, and SP10-4. With the exception of soil samples SP8-7 and SP10-4, these sample locations are beneath the Agri-Tech building. The analytical data are summarized in Table 2, and is presented on Figures 8 and 10.

No organophosphorous pesticides or chlorinated herbicides were detected at concentrations at or above the method reporting limits for the two soil samples analyzed, SP4-7 and SP12-8, collected within the limits of the former waste pit. The analytical data are presented in Appendix F.

Ecology submitted duplicate soil samples of SP15-6 and SP12-8 from the waste pit area for analysis of nitrogen-containing pesticides by USEPA Method 1618 and organophosphorous pesticides by USEPA Method 1618. Concentrations of nitrogen-containing pesticides were not detected at or above the laboratory method reporting limits. An estimated concentration of 0.021 mg/kg of the compound ethion, a noncarcinogenic organophosphorous pesticide, was detected in sample SP12-8. The MTCA Method B standard soil cleanup level for ethion which was selected as the preliminary screening level is 40 mg/kg. The Ecology data have been included in Appendix F.

4.1.2.3 Petroleum Hydrocarbon Constituents

Soil samples SP23-8, SP24-7.5, and SP25-4 were collected from Area 3 and analyzed for ORO, DRO, and cPAHs. The soil samples were analyzed both with and without a sulfuric acid/silica gel cleanup procedure to reduce interference from the organic materials derived from the burning of the former wood structure in this area.

Soil sample SP25-4 contained concentrations of 580 mg/kg and 69 mg/kg for ORO and DRO, respectively; prior to applying the cleanup procedure. Following the cleanup procedure, the concentrations decreased to 260 mg/kg and 35 mg/kg, respectively. The laboratory indicated that the DRO analytical results were indicative of ORO eluting in the DRO range. Soil sample SP24-7.5 contained concentrations of 200 mg/kg and 37 mg/kg for ORO and DRO, respectively; prior to the cleanup procedure and were below the method reporting limits following the cleanup procedure. Soil sample SP23-8 did not contain concentrations of ORO or DRO at or above the method reporting limits. These concentrations do not exceed the preliminary screening levels of 2,000 mg/kg for DRO and ORO. The analytical data are summarized in Table 8 and presented on Figure 11.

The soil samples from Area 3 were also analyzed for the cPAHs typically associated with the heavier ranges of petroleum products. However, cPAHs are also the result of the combustion of naturally occurring materials such as wood. Two of the PAHs detected were carcinogenic (chrysene and benzo(b)fluoranthene). These cPAHs were detected in samples SP24-7.5 and SP25-4 at concentrations that were below the soil preliminary screening level of 0.137 mg/kg. The analytical data are summarized in Table 8.

Concentrations of one or more of the following VOCs typically associated with petroleum compounds were detected in soil samples collected from Areas 1, 2, and/or 3:

- Xylenes
- Toluene
- Ethylbenzene
- 1,2-dichloropropane
- n-propylbenzene
- 1,3,5-trimethylbenzene
- 1,2,4-trimethylbenzene
- 4-isopropyltoluene

The concentrations of these compounds were below the selected soil preliminary screening levels with the exception of a single detection of 1,2-dichloropropane in soil sample SP7-7. This sample station is located in the waste pit at Area 1. The analytical data are summarized in Table 1.

4.1.2.4 Metals

Three soil samples from Area 3 were selected for analysis of metals. The soil samples analyzed contained concentrations of one or more of the metals listed as COPCs in Section 3.1.2. All three soil samples contained concentrations of one or more metals above the natural background concentrations established for the Yakima Basin. Cadmium and mercury were the only metals detected at concentrations above the selected soil preliminary screening levels. The metals analytical results and sample depths are summarized in Table 9 and are presented on Figure 12.

4.1.2.5 Polychlorinated Biphenyls

Analyses for the presence of PCBs were conducted for soil samples collected from Areas 1 through 3. There were no PCBs detected at concentrations at or above the laboratory method reporting limits for the soil samples analyzed. The analytical results and sample depths are presented in Table 2.

4.1.2.6 Total Organic Carbon Content

The total organic carbon content of the saturated soil was evaluated to determine the potential sorptive and retardation capacity of the Site soils. Only two soil samples, including SP4-7 which was collected from a depth of 4 to 7 feet bgs in the waste pit area, and SP12-8 collected from a depth of 4 to 8 feet bgs in the waste pit area, were submitted for analysis of TOC content. Soil sample SP4-7 also contained the highest concentrations of COPCs of any soil sample analyzed, and contained the granular sulfur and caulk-like lime and sulfur residue.

The analytical data indicated that TOC values for soil samples SP4-7 and SP12-8 were 5,600 mg/kg and 2,450 mg/kg, respectively. The revised MTCA requires that soil organic carbon measurements shall be obtained from uncontaminated soil below a depth of 3 to 4 feet bgs, and in saturated soils that are representative of conditions in which COPCs will migrate (Chapter 173-340-747 (5)(b)(i) WAC). As a result, the TOC concentrations measured in the waste pit cannot be used to calculate Site-specific cleanup levels.

4.2 GROUNDWATER INVESTIGATION

This section presents the results of the groundwater investigation conducted during the RI. This discussion is based on the results obtained from five groundwater monitoring and sampling events conducted in 1997, 1998, and 2002.

4.2.1 Groundwater Conditions

Groundwater monitoring was performed in December 1997, March 1998, June 1998, and September 1998. Another groundwater monitoring event was performed in December 2002 following the installation of supplemental groundwater monitoring wells MW-7A and MW-7B. The measured groundwater levels and corresponding elevation data are presented in Table 11. A groundwater elevation hydrograph is presented as Figure 13. Groundwater elevation contour maps are presented as Figures 14 through 18.

The groundwater elevation data indicate that seasonal groundwater fluctuations are consistent with the regional groundwater conditions noted in the YRRA investigation. The seasonal high groundwater conditions occurred in September 1998, near the conclusion of the regional irrigation season for the Yakima Basin. The seasonal low groundwater conditions occurred in March 1998, when there was no regional irrigation being performed. The average seasonal flux in groundwater elevation observed during the RI monitoring was 3.21 feet. The average groundwater elevation at the site based on water level measurements in all monitoring wells between December 1997 and December 2002 was 997.07 feet above mean sea level. The average depth to water at the time of drilling was approximately 5 feet bgs.

The direction of groundwater flow for all five groundwater monitoring events was to the southeast. The average hydraulic gradient across the Site has been consistently between 0.003 0.004 feet per foot. The vertical head difference between the shallow and deep well pair MW-7A and MW-7B was –0.32 feet for the December 2002 groundwater monitoring event. The vertical gradient is estimated to be –0.018 feet per foot indicating a slight downward vertical gradient.

4.2.2 Groundwater Analytical Results

The groundwater analytical results are presented in the sections that follow. The groundwater analytical data are summarized in Tables 3, 4, 12, and 13 and presented on Figures 19 through 24. The results have been interpreted with respect to the preliminary evaluation of groundwater cleanup levels and the selected preliminary screening levels presented in Table 6. The locations of groundwater samples exceeding the selected preliminary screening levels are presented in Table 14. The associated laboratory analytical reports are presented in Appendix G.

4.2.2.1 Volatile Organic Compounds

The analytical data indicate that concentrations of one or more of the HVOCs PCE, TCE, DCE isomers, or vinyl chloride are present at concentrations that exceed the selected groundwater preliminary screening levels at monitoring wells MW-1 through MW-6 and WDOE-6 (Table 3 and Figure 19).

The data from monitoring well WDOE-6 comprise the only data set that shows a consistent decrease in concentrations of HVOCs (Figure 20). The HVOC concentrations in monitoring well WDOE-6 have significantly decreased since the initial sampling performed by Ecology in 1992.

With the exception of monitoring well WDOE-6, the reported concentrations of PCE have generally been consistent in Site monitoring wells during the first sampling events. PCE values have ranged from 1.27 µg/l to 6.5 µg/l when present at concentrations above the laboratory reporting limits (Figure 21). Concentrations of the PCE degradation products have been low to below laboratory reporting limits with the exception of groundwater samples collected from monitoring wells MW-6 and WDOE-6.

Minor concentrations of other VOCs have been historically been detected at concentrations near the laboratory method reporting limits in the groundwater samples. The monitoring wells and maximum historical VOC concentrations have included:

- Monitoring well MW-1 – Chloroform (1.88 µg/l) and 1,1,1 TCA (0.15 µg/l);
- Monitoring well MW-2 – Chloromethane (12.1 µg/l) and 1,1-DCA (0.19 µg/l);
- Monitoring well MW-3 – Chloroform (2.0 µg/l), chloromethane (9.24 µg/l), and MEK (0.23 µg/l, attributed to laboratory contamination);
- Monitoring well MW-4 – Chloroform (1.15 µg/l), chloromethane (2.78 µg/l), and acetone (24.1 µg/l);
- Monitoring well MW-5 - Chloroform (0.85 µg/l) and chloromethane (2.59 µg/l);
- Monitoring well MW-6 – No VOCs other than PCE and associated degradation products were detected;
- Monitoring well WDOE-6 – 1,2-dichloropropane (1.73 µg/l); and
- Monitoring wells MW-7A and MW-7B - No additional VOCs other than PCE and associated degradation products were detected.

With the exception of chloroform and chloromethane, all other VOCs noted were detected in only one instance. The concentrations of chloromethane have exceeded the selected groundwater preliminary screening level at monitoring wells MW-2 and MW-3. The concentration of 1,2-dichloropropane has exceeded the selected groundwater preliminary screening level at monitoring well WDOE-6.

4.2.2.2 Pesticides and PCBs

Organochlorine pesticides have been the only group of pesticides and herbicides required for analysis in groundwater by Ecology following the testing of the groundwater sample from monitoring well WDOE-6 for organophosphorous pesticides (EPA Method 8141A) and chlorinated herbicides (EPA Method 8151) during the March 1998 groundwater sampling event. The analytical results obtained during March 1998 indicated that concentrations of the organophosphorous pesticides and chlorinated herbicides were all below the laboratory reporting limits (Appendix F).

The only organochlorine pesticides detected in groundwater have been 4,4-DDD, 4,4-DDE, and dieldrin (Table 4; Figure 22). Concentrations of one or more of these pesticides have been detected at concentrations above the selected groundwater preliminary screening levels at monitoring wells MW-2 and WDOE-6, located adjacent to the south and inside the waste pit, respectively.

Groundwater samples from monitoring well MW-2 contained dieldrin whereas groundwater samples from monitoring well WDOE-6 have contained concentrations of 4,4-DDD, 4,4-DDE, and dieldrin. The general trend in organochlorine pesticide concentrations observed at WDOE-6 between March 1998 and December 2002 has been decreasing. The only pesticide detected at monitoring well WDOE-6 during the December 2002 sampling event was 4,4-DDD.

PCB analyses were conducted on groundwater samples from monitoring wells MW-1 through MW-6 and WDOE-6 in December 1997. PCBs were not detected at concentrations at or above the laboratory method reporting limits during that event.

4.2.2.3 Petroleum Hydrocarbons

Ecology requested that the groundwater sample collected from monitoring well MW-5 during the March 1998 groundwater sampling event be analyzed for the presence of DRO, ORO, and cPAHs. This request was made based on the soil analytical data from this area obtained in October 1997 that indicated the potential for these compounds to affect groundwater quality. The groundwater analytical results obtained from monitoring well MW-5 in March 1998 indicated that the concentrations of DRO, ORO, and cPAHs were all below the laboratory method reporting limits. Therefore, Ecology indicated that further sampling for these parameters could be discontinued. The petroleum hydrocarbon and cPAH analytical results are depicted on Figure 23, and the laboratory analytical data reports are included in Appendix F.

The only VOC detected in groundwater during the RI that may be associated with petroleum hydrocarbons was 1,2-dichloropropane which was detected once at monitoring well WDOE-6 during the March 1998 groundwater sampling event at a concentration that exceeded the groundwater preliminary screening level. However, 1,2-dichloropropane is also commonly associated with agricultural applications, including use as a fumigant for grain, and less commonly in insecticides.

4.2.2.4 Water Quality and Natural Attenuation Parameters

In addition to the analyses for the COPCs, the groundwater sample collection process included taking field measurements and conducting analyses for the parameters listed in Section 3.2.2.3.

These supplementary measurements and analytical results were used to assess geochemistry in and outside the waste pit, to assess the contaminant fate and transport characteristics of the dissolved phase plume(s), and to assess whether monitored natural attenuation may be incorporated as an appropriate remedial alternative for the Site. The results are summarized in Tables 12 and 13 and on Figure 24.

Sulfate and alkalinity analyses were performed for all of the groundwater sampling events in accordance with the RI Work Plan. The purpose of these analyses was to assess the potential impacts to groundwater quality from the lime and sulfur deposits in the waste pit. The analytical data indicate that the average alkalinity and sulfate values are similar for groundwater inside and outside the waste pit area and are within typical ranges for groundwater.

The pH data indicate that the average pH of the groundwater is 7.12, which is neutral. There was no significant variability between the pH of groundwater in direct contact with the waste pit and groundwater across and upgradient of the Site.

The temperature of the groundwater ranged from 9.13 degrees Celsius in the winter to 20.70 degrees Celsius in the summer. The specific conductance of the groundwater ranged from 1.70 to 10.92 milliSiemens per centimeter and was typical of normal groundwater conditions. The specific conductance data do not indicate any significant variability between groundwater in the waste pit and other areas of the Site.

The dissolved oxygen values ranged from 0.41 to 5.25 milligrams per liter (mg/l). The ORP values ranged from –93.5 to 398.0 millivolts. The dissolved oxygen values were slightly lower at monitoring wells WDOE-6 and MW-2 than the other areas of the Site. These monitoring wells are located in and adjacent to the waste pit, respectively. The ORP values were variable across the Site and did not indicate any significant differences for groundwater at the waste pit relative to other areas of the Site.

With the exception of monitoring well WDOE-6, sulfide was not present at concentrations at or above the laboratory reporting limits. At monitoring well WDOE-6, a sulfide concentration of 0.2 mg/l was detected during the December 2002 groundwater sampling event. The sulfate data collected during the five monitoring events do not indicate any consistent trend since the December 1997 groundwater sampling event, although the values obtained during the December 2002 event were the lowest recorded at all wells. The data indicate that sulfate is not being reduced to sulfide with the possible exception of the waste pit area. The sulfate also does not appear to be utilized by indigenous bacteria based on the comparison of sulfate concentrations inside and outside the waste pit area.

The nitrate data ranged from below the laboratory reporting limits to 2.9 mg/l, and these values are typical of normal groundwater quality. The data indicate that nitrate concentrations near the waste pit area at monitoring wells WDOE-6, MW-2, and MW-6 were lower than other areas of the Site. This may indicate that indigenous bacteria are reducing nitrate, or utilizing it as an electron receptor (energy source). The nitrate concentration at shallow monitoring well MW-7A near the wetland area also was lower than other areas of the Site.

The TOC concentrations in groundwater ranged from 0.75 to 4.5 mg/l, and are relatively low for groundwater indicating there is little organic carbon available as a food source for the indigenous bacteria. There were no significant differences between TOC values at the waste pit area and other areas of the Site.

Chloride concentrations ranged from 12 to 16 mg/l, and did not vary significantly between upgradient monitoring well MW-1 and downgradient monitoring well MW-7A. Chloride is the ultimate breakdown product of PCE degradation and is typically higher in concentration at the source area and downgradient of the source area in comparison to upgradient areas. This trend is not evident at the Site.

Ferrous iron (Fe^{2+}) concentrations ranged from 0.035 mg/l to 4.1 mg/l. Ferrous iron is the reduced form of ferric iron (Fe^{3+}) and is an indicator of microbial activity. The highest concentrations of ferrous iron were observed in groundwater samples from monitoring wells WDOE-6, MW-2, and MW-6, all in or near the waste pit. The ferrous iron data indicate that indigenous bacteria may be using ferric iron near the waste pit as an electron acceptor.

The methane, ethane, and ethene analytical data obtained during the RI indicate that methane was the only compound detected above the laboratory reporting limits. Ethane and ethene are final degradation products of chlorinated ethanes and ethenes. Methane is typically indicative of the biodegradation of petroleum hydrocarbons, the presence of methanogenic bacteria, or reducing conditions. The absence of ethene and ethane may be due to the relatively low concentrations of HVOCs, the rapid degradation of these gases in the absence of a continuing source or complete absence of biodegradation processes. Methane was detected at monitoring wells WDOE-6, MW-2, MW-6, located in or near the waste pit, and MW-7A, located adjacent to the Type 3 wetland. Methane production may be indicative of either biodegradation of residual petroleum compounds in the waste pit area, or the presence of methanogenic bacteria and slightly reducing conditions in the waste pit area and Type 3 wetland.

Total phosphorous concentrations ranged from 0.091 to 0.57 mg/l. Total phosphorous was utilized as an estimate of the phosphate available as a potential nutrient for indigenous bacteria. The concentrations of total phosphorous are relatively low for typical groundwater and were lowest in the waste pit area. The depletion of phosphorous may be indicative of microbial activity in the waste pit area.

4.3 DATA VALIDATION

Data validation for the RI was limited to a review of the field and laboratory quality assurance and quality control (QA/QC) procedures, analyses, and results.

The QA/QC procedures during collection of the soil samples included maintaining chain-of-custody protocols and verification of the laboratory QA/QC data. The soil sample volumes recovered during drilling did not allow for collection and analysis of replicate soil samples. Dedicated sampling equipment and sample containers were utilized to minimize the risk of cross contamination between sample locations. No field or trip blanks were requested by Ecology during completion of the soil sampling.

The laboratory indicated that extraction of soil samples collected from within the waste pit area was difficult due to matrix interference associated with the lime and sulfur residue. The laboratory QA/QC data were also qualified for samples containing the residue because some of the QA/QC procedures either could not be completed or were outside the recommended limits. Discussions with the laboratory indicated that the quality of the data reported should not be compromised by the matrix interferences encountered, and that the primary implications were elevated reporting limits in some instances. Laboratory QA/QC for samples without the residue were within acceptable limits.

The field QA/QC protocols for the groundwater monitoring and sampling events included collection of field duplicate samples, field blanks, and trip blanks. Dedicated sampling tools and standard decontamination procedures were followed throughout the sampling program to ensure the quality of the groundwater samples collected. Ecology also collected duplicate groundwater samples from monitoring well MW-4 for all groundwater sampling events. Chain-of-custody procedures were maintained throughout sample collection and transport to the laboratory. Laboratory QA/QC data were reviewed and verified to ensure the validity of the data presented in the RI.

A minimum of one field QA/QC sample was submitted during each of the five groundwater monitoring and sampling events. The field QA/QC results indicated that all samples collected were within acceptable ranges of tolerance for the specific type of QA/QC sample. The laboratory QA/QC was reviewed and found to be within acceptable ranges of tolerance for all analyses performed.

4.4 DENSE NONAQUEOUS PHASE LIQUID

No evidence of the presence or potential presence of DNAPL in the waste pit area was observed in any of the soil or groundwater samples collected for the RI. The highest concentrations of PCE detected in soil are located beneath the Agri-Tech building at soil borings SP-1, SP-2, SP-4, and SP-5 (Figure 9). Concentrations of PCE in these borings ranged from 2.1 mg/kg to 770 mg/kg. The highest concentration of PCE was in the soil sample collected in soil boring SP-4 which included the caulk-like lime and sulfur residue. The remaining soil samples did not include the lime and sulfur residue but did contain indications of granular sulfur mixed in the soil samples. The samples from soil borings SP-4 and SP-5 were both in direct contact with groundwater, whereas the other soil samples were collected in the unsaturated zone. No direct evidence of DNAPL was observed in any of the soil borings during monitoring well development or groundwater sampling.

4.5 SURFACE WATER

The Type 3 wetland that includes the pond is considered the sole surface water receptor at the Site. The drainage ditch along the eastern boundary of the YSF property drains to the south toward the wetlands area. Flow in the ditch is intermittent, and surface water in the drainage ditch would ultimately impact the pond when present.

The groundwater analytical results from monitoring wells MW-3, MW-4, MW-7A, and MW-7B have been used in lieu of surface water sampling to determine whether there is potential for shallow groundwater to affect the pond. Monitoring wells MW-3 and MW-4 are located approximately 25 to 30 feet west and upgradient of the east drainage ditch. Monitoring wells MW-7A and MW-7B are located approximately 20 feet north and upgradient of the wetland area.

The potential historical impacts of the heavy metals on the unpaved, west adjacent Bay Chemical property were not assessed for the RI. The soil and groundwater analytical data presented in the Bay Chemical RI report, and Site observations during completion of the RI, indicate that there is a potential for the heavy metals detected in soil and groundwater at the Bay Chemical property to affect the wetland area. Farallon understands that additional remedial investigation and feasibility study work has been completed on the Bay Chemical property and the south adjacent property to YSF by the Bay Chemical PLP group. Farallon will review the results of this work once it becomes available to the general public to assess whether the potential effects of the Bay Chemical property on the Site require further evaluation by YSF.

The HVOCs PCE, TCE, and cis-DCE are the only compounds detected in groundwater outside the waste pit area. Concentrations of these HVOCs at the monitoring wells noted above were used to assess potential risks associated with the Type 3 wetland. The MTCA Method B surface water cleanup levels are 4.15 μg/l and 55.6 μg/l for PCE and TCE, respectively. There is no MTCA surface water cleanup level established for cis-DCE, nor has a federal maximum contaminant level (MCL) been established for this compound. Since PCE and TCE are carcinogenic and cis-DCE is not, PCE and TCE were utilized as indicator hazardous substances for evaluating the risk to surface water.

The average concentrations of PCE and TCE at monitoring well MW-3 between December 1997 and December 2002 were 5.2 μg/l and 0.78 μg/l respectively. The average concentrations of PCE and TCE at monitoring well MW-4 were 3.8 μg/l and 0.67 μg/l respectively. The average PCE concentrations at these wells indicate that there is a potential for shallow groundwater to contribute PCE concentrations to the eastern drainage ditch at concentrations that exceed the MTCA Method B surface water cleanup level. The concentrations of TCE are below the MTCA Method B surface water cleanup levels. The effects of hydrolysis, photodegradation, dilution, and sorption in the surface water and sediments in the ditch have not been evaluated but would likely further reduce the risk of surface water in the ditch adversely affecting the pond.

Neither PCE or TCE were present at monitoring well MW-7A in December 2002 at concentrations at or above the laboratory method reporting limit of 2.0 µg/l. The concentration of PCE at monitoring well MW-7B was 2 µg/l, and TCE was not present at or above the laboratory method reporting limit of 2.0 µg/l. Evaluation of the groundwater analytical data indicates that the concentrations of PCE and TCE are below the referenced MTCA Method B surface water cleanup levels.

4.6 TERRESTRIAL ECOLOGICAL RISK EVALUATION

Chapters 173-340-7490 through 173-340-7493 WAC include criteria for evaluation of the terrestrial ecological risk for a site. The Site is located in an area characterized by commercial and industrial uses. Potential terrestrial ecologic receptors, as defined under MTCA, include native plants and animals that live primarily or entirely on land.

The Site does not meet the requirements for an exclusion under Chapter 173-340-7491 WAC due to the shallow depth of contamination at the waste pit, and the absence of institutional controls to ensure that physical barriers such as the pavement cap and buildings' foundations are maintained. Since the contaminated soil at the Site is currently covered by buildings and pavement, this may qualify the Site for an exclusion or a simplified terrestrial ecological evaluation if institutional controls as defined under Chapter 173-340-440 WAC are applied to ensure the pavement cap/buildings remain in place and are maintained.

The east adjacent Bay Chemical property is presently undeveloped and has confirmed contamination of surficial soil throughout that property and the south adjacent property. The soil contamination at the Bay Chemical property is not presently covered by any buildings or pavement, and is more likely to affect the terrestrial ecologic receptors on the Site and/or adjacent properties than the contaminants present in the former waste pit that are covered and are limited in aerial extent. Farallon will review Ecology's recommendations regarding terrestrial ecologic risk for the Bay Chemical property to determine whether a simplified or site-specific terrestrial ecologic risk assessment may be required if similar concentrations of metals are identified on the southern portion of the YSF property.

4.7 INVESTIGATION DERIVED WASTE

The investigation derived wastes generated between December 1997 and September 1998 included soil cuttings from direct-push drilling and the monitoring well installations. The drill cuttings generated consisted of mostly gravels and cobbles with some sand. The drill cuttings from the direct-push drilling were minimal because most of the soil recovered was used for the laboratory analysis. The drill cuttings from monitoring wells MW-1, MW-2, and MW-6 were placed in Department of Transportation-approved drums. The analytical results of soil from monitoring well borings MW-1 and MW-6 indicated that the soil in these drums did not contain concentrations of COPCs above the laboratory reporting limits, or were present at concentrations below regulatory benchmark values. The direct-push borings near MW-2 indicated that the drill cuttings from boring MW-2 did not likely contain concentrations of COPCs above the laboratory reporting limits, or were present at concentrations below regulatory benchmark values. The soil generated during installation of these wells was spread across the unpaved area of the YSF property. The drill cuttings from monitoring wells MW-3 through MW-5 were also spread across the area of drilling because Ecology had agreed that the risk of soil contamination was low outside the waste pit based on the direct-push boring results. Drill cuttings generated during installation of monitoring wells MW-7A/B were placed in drums pending waste characterization. The soil and groundwater results from these drums indicated that concentrations of COPCs were not detected above the laboratory reporting limits. Therefore, the soil and water mixture was spread across the unpaved area of the YSF property.

Decontamination water from the drilling of the monitoring wells in 1997 was recycled in the vegetated areas on the east side of the YSF building. Decontamination water from the drilling of monitoring well MW-7A/B was placed in Department of Transportation-approved drums due to the proximity to the wetland area.

Groundwater generated by well development, purging, and sampling between 1997 and 2002 was placed in Department of Transportation-approved drums and combined with the decontamination water pending receipt of the analytical results of the groundwater samples for each quarterly groundwater sampling event. The groundwater generated from monitoring wells WDOE-6, MW-2, and MW-6 was segregated into a separate drum. Groundwater from monitoring well MW-1 was also placed in its own drum. Groundwater from monitoring wells MW-3, MW-4, MW-5, and MW-7A/B were combined where possible. The groundwater analytical results were used to develop waste profiles to determine whether groundwater could be recycled on-Site or would need to be removed to an appropriate treatment, storage, and disposal facility. Removal of the groundwater was performed by Envirotech System's Incorporated, who transported the remaining wastewater drums to Emerald Petroleum Services of Seattle, Washington, a licensed treatment storage and disposal facility.

5.0 CONCEPTUAL SITE MODEL

This section discusses the components of the initial conceptual site model developed following completion of the RI, including a discussion of the suspected sources of contamination, the affected media, potential exposure pathways, transport mechanisms, contaminant fate and transport characteristics, and potential receptors.

5.1 SOURCES OF THE CONTAMINANTS OF POTENTIAL CONCERN

The suspected sources of COPCs include those shown to have had an adverse effect on soil and groundwater quality at the Site. The information derived during completion of the RI indicates that there is more than one suspected source of the COPCs detected in soil and groundwater.

The primary source of COPCs at the Site is the former unlined shallow pit constructed by Yakima Farmer Supply sometime between 1952 and 1960 and coinciding with the lime and sulfur formulating plant construction. The soil and groundwater analytical data indicate that the VOCs and pesticides identified as COPCs were deposited in the waste pit in the form of liquids and sludges.

The testimony of Mr. Fred Houck, a former manager at Yakima Farmer Supply, indicated that the waste pit received wash water from the lime and sulfur mixing tank that included no chemical additives. The waste pit also received drain water from the main warehouse building located north and adjacent to the Site. Empty drums of the lime and sulfur pesticide were cleaned at the Site, and residues and wash water were reported to have been placed in a temporary concrete UST, the location of which has not been determined. The contents of the UST were reportedly removed from the Site by a local disposal company.

There was no known use of PCE by Yakima Farmer Supply, Agri-Tech, or YSF. PCE is not used in the agricultural industry for a pesticide, herbicide, or carrier media for pesticides or herbicides. PCE is also not used in the manufacturing of these agricultural chemicals due to the toxicity of this compound to crops. There are references in various chemical use literature to PCE being used as an experimental fumigant for grain, as a nematicide for livestock, and as a disinfectant for food processing equipment but these are less common uses.

The presence of residual pesticide concentrations and VOCs in the waste pit indicates that liquids or solids transferred to the waste pit included more than the reported lime and sulfur wash water and residue. Based on the locations of the highest concentrations of PCE and pesticides in the portion of the waste pit beneath the Agri-Tech building, the source of the release(s) appears to have been in the northern portion of the waste pit. The contaminants were likely spread to the south through the periodic addition of fluids into the waste pit.

The presence of VOC contamination in some of the shallow fill materials is likely due to wicking of dissolved phase contamination upwards during periods of seasonal high groundwater conditions, or as a result of compaction of the fill over the waste pit at the time of filling and grading and not due to a more recent release of VOCs. The time at which the waste pit was filled was likely shortly after 1971 when Yakima Farmer Supply filed for bankruptcy . The available documentation was not clear as to receivership of the land title. However, in 1978 the Yakima Farmer Supply properties were purchased by ANCO Industrial Park. Aerial photographs indicate that the lime and sulfur formulating plant was demolished during the period of time when ANCO Industrial Park owned the Yakima Farmer Supply properties.

The upgradient groundwater analytical data indicate that there is PCE present in groundwater at monitoring well MW-1 and no detected source in the overlying soil. The soil analytical data from samples collected at 5 and 10 feet bgs at monitoring well MW-1, and from 7.5 feet bgs in PLSA's test pit TP-4 (Figure 9, Table 1), indicate there is no source of PCE in these areas. Groundwater samples from monitoring well MW-1 have consistently contained concentrations of PCE and associated degradation products indicating that an upgradient source of dissolved phase PCE exists. A specific source has not been identified, but these constituents may be associated with one or more of the upgradient YRRA subfacilities north of the Site.

Another source of contamination is associated with the heavy metals detected in Area 3, and that may potentially be present in other areas of the Site. The west adjacent Bay Chemical property soil and groundwater analytical data indicate that there is soil contamination from historic operations at Bay Chemical that may have affected the western portion of the Site. This is also supported by aerial and site photographs (Appendix A) indicating that areas of the Site with no vegetation and similar surficial soil conditions to the Bay Chemical property existed prior to development by Agri-Tech and YSF.

5.2 GROUNDWATER CHARACTERISTICS

The groundwater investigation at the Site was limited to evaluation of seasonal groundwater elevation fluctuations and assessment of the groundwater flow direction and gradient. No investigation of aquifer characteristics was included in the RI Work Plan.

The groundwater elevation data indicate that seasonal groundwater fluctuations are consistent with the regional groundwater conditions noted in the YRRA investigation. The seasonal high groundwater conditions occurred in September 1998 during the regional irrigation season for the Yakima Basin. The seasonal low groundwater conditions occurred in March 1998, at a time when no regional irrigation is being performed. The average seasonal flux in groundwater elevation was 3.21 feet during the period from December 1997 through December 2002. The direction of groundwater flow for all five groundwater monitoring events was to the southeast. The average hydraulic gradient across the Site has consistently been between 0.003 and 0.004 feet per foot. The vertical gradient is estimated to be –0.018 feet per foot indicating a very slight downward vertical gradient.

5.3 CONTAMINANT FATE AND TRANSPORT

Contaminant fate and transport will affect the future long-term cleanup action plan for the Site. The fate and transport characteristics of the indicator hazardous substances (IHSs) will partially determine the appropriate cleanup actions for the Site, and are discussed below by class of contaminants.

5.3.1 Halogenated Volatile Organic Compounds

The groundwater analytical data indicate that leaching of HVOCs from the soil matrix within the waste pit occurs extremely slowly. The PCE identified in soil beneath the Agri-Tech building is present at relatively high concentrations, and is in direct contact with groundwater. Consequently, the concentrations of PCE in groundwater should be greater than those observed in the waste pit at monitoring well WDOE-6 and downgradient. The predicted groundwater concentration using Ecology's worksheets of 2,303 µg/l is based on an average concentration of PCE in soil of 24.43 mg/kg, which is significantly less than the maximum concentration observed of 770 mg/kg. The predicted concentrations for the other HVOCs leaching to groundwater from the waste pit are similar to PCE. These data indicate that if the HVOCs present in the waste pit were leaching at the rate predicted by Ecology's model, downgradient HVOC concentrations should be significantly higher, assuming a continuing source and the groundwater velocities documented in the YRRA. The historical groundwater analytical data for the Site and downgradient YRRA RI wells do not support a significant source contribution from the waste pit.

The soil and groundwater analytical data indicate that natural attenuation of PCE is occurring in the waste pit area. PCE degradation products are present in soil, although vinyl chloride, the final derivative prior to degradation to ethene/ethane and carbon dioxide, has not been detected. All of the degradation products of PCE have been observed in groundwater in the waste pit area, but none has been detected in the monitoring wells downgradient of MW-6.

Additional water quality and geochemical parameters were measured during the December 2002 groundwater sampling event to assess contaminant fate and transport characteristics and to obtain information pertaining to the natural attenuation of the PCE. Evaluation of these data indicates that conditions in the waste pit appear to be conducive to reductive dechlorination of the PCE via biodegradation. This determination was made by comparing the groundwater data from monitoring wells WDOE-6, MW-2, and MW-6 to data from monitoring wells MW-1, MW-3, MW-4, and MW-5. Monitoring wells MW-7A and MW-7B were not used in the comparison due to the proximity to the Type 3 wetlands area, which appears to have anaerobic characteristics similar to the waste pit. The data used in the natural attenuation assessment are summarized on Table 12.

Evaluation of the groundwater data indicates that there is some methane production in the waste pit and downgradient at monitoring wells MW-2 and MW-6, whereas methane concentrations were below the laboratory method reporting limits in all other monitoring wells. Methane is an indicator of a reducing environment. However, the concentrations of methane in and near the waste pit were low and not indicative of a strong reducing environment. Other indications of a slightly reducing environment in the waste pit include the lower dissolved oxygen and ORP measurements compared to the monitoring wells outside the waste pit area. However, the data suggest that sulfate is not being reduced to sulfide, and may indicate that sulfate-degrading bacteria that typically reduce sulfate to sulfide are not dominant. These sulfate-degrading bacteria also degrade PCE. The sulfate and sulfide data inside and outside the waste pit area are similar, which also indicates that the lime and sulfur residue has not adversely affected groundwater quality.

Reduction of ferric iron (Fe^{3+}) to ferrous iron (Fe^{2+}) is an indicator of reductive dechlorination via biodegradation. The concentrations of ferrous iron in the waste pit area were higher than the other monitoring wells. The concentration of ferrous iron at monitoring well WDOE-6 was approximately two orders of magnitude greater than the concentrations of ferrous iron at monitoring wells MW-1, MW-4, and MW-5.

Phosphorous and nitrogen are nutrients that enhance the production of bacteria. The total phosphate and nitrate data indicate that the availability of these nutrients is relatively low throughout the Site. Nitrate reduction is an indicator of bacterial activity. The nitrate concentrations at monitoring wells WDOE-6, MW-2, and MW-6 are significantly lower than at monitoring wells MW-1, MW-4, and MW-5, indicating bacteria in the waste pit area are utilizing nitrate as an energy source.

Alkalinity is used as an indicator of the production of carbon dioxide produced by bacteria during the reductive dechlorination process. Alkalinity values were comparable inside and outside the waste pit, and are inconclusive with respect to whether microbial activity is greater inside or outside the waste pit area. However, the alkalinity data does indicate that the lime and sulfur residue is not caustic and has not affected groundwater quality. This is further supported by the pH values measured in groundwater that ranged from 6.30 to 8.51 in the waste pit, and from 6.00 to 8.68 in groundwater outside the waste pit area. The pH values are within the optimum range of 5 to 9 that are conducive to reductive dechlorination.

Available food and nutrients may limit the rate of biodegradation. The TOC content of groundwater is used an indicator of the availability of carbon sources to fuel the dechlorination process. The TOC concentrations in groundwater inside and outside the waste pit area were similar and low, indicating that the available carbon sources are not optimal to fuel reductive dechlorination processes.

Ethene/ethane gas and chloride are end products of the dechlorination processes and are used as indicators of bacterial reduction of HVOCs. Concentrations of ethene/ethane were below the laboratory method reporting limits in all monitoring wells analyzed. There has been little evidence of vinyl chloride production, indicative of the latter stages of degradation. Therefore, the absence of significant quantities of ethene/ethane gas is expected. Ethene/ethane also has an extremely short half-life, and low concentrations generated by limited reductive dechlorination processes may not be observed due to rapid degradation.

Accumulation of chloride is also an indicator of dechlorination processes, and a leading edge tracer of HVOC plumes undergoing degradation. The chloride concentrations inside and outside the waste pit area were on the same order of magnitude as the concentrations at monitoring wells WDOE-6 and MW-7A. The chloride data indicate that a widespread plume of HVOCs exists and is consistent with the PCE groundwater analytical data distribution and source conclusions. The chloride data are inconclusive with respect to indications of strong reductive dechlorination processes inside the waste pit.

The preliminary evaluation of HVOC behavior in the waste pit area indicates that leaching of contaminants to groundwater is occurring, albeit slowly, based on groundwater analytical data from monitoring wells WDOE-6, MW-2, and the recent groundwater analytical data from monitoring well MW-6. The mass of contaminant leached into groundwater from the source area within the waste pit is relatively small, and reductive dechlorination processes appear to be able to degrade the releases to vinyl chloride and to the nonhazardous end products. The PCE and degradation products that cannot be degraded are transported via the groundwater pathway into the more aerobic groundwater conditions outside the waste pit area. PCE and TCE will not degrade readily under aerobic conditions, and are subsequently transported downgradient with the dissolved phase plume attributed to an off-site source within the YRRA. This is supported by the relatively low concentrations of PCE and TCE observed outside the waste pit area. The DCE isomers and vinyl chloride that migrate from the waste pit area prior to being degraded by reductive dechlorination are likely degraded aerobically along the flow path and appear to naturally attenuate to concentrations below the preliminary groundwater screening levels at the downgradient Site monitoring wells. This is supported by the concentrations of cis-DCE and vinyl chloride observed at monitoring wells MW-2 and MW-6, and the absence of similar concentrations of these compounds at downgradient monitoring wells MW-3, MW-4, MW-5, MW-7A, or MW-7B.

5.3.2 Pesticides

The pesticides present in the waste pit are predominantly organochlorine pesticides. The only exception to this finding was one detection of the organophosphorous pesticide ethion during the soil sampling conducted by Ecology. Pesticides have strong sorptive properties, low solubility in water, and are relatively resistant to biodegradation processes.

Dieldrin is considered an extremely persistent pesticide in the subsurface and does not readily desorb from soil in the presence of water, nor does it biodegrade. The dissolved phase dieldrin concentrations observed may be due to the presence of the VOCs in the waste pit area. Pesticides such as those identified as COPCs are typically mixed with petroleum-based carriers, such as oil, acetone, or other VOC-based solvents. This contaminant is not expected to be mobile and will likely persist in the waste pit materials for an unknown period of time, depending on the actual mass of contaminant present. The soil analytical data indicate that dieldrin is present primarily beneath the Agri-Tech building, with low concentrations identified in the central portion of the waste pit. The maximum concentrations detected in soil and groundwater were 3.36 mg/kg and 0.242 µg/l, respectively; with the remaining detections being much lower, suggesting that the mass of contaminant released was minimal. The release may have been associated with residues from past barrel cleaning operations. There is little risk of this contaminant reaching downgradient groundwater or surface water receptors at concentrations that would require further actions.

The compound 4,4-DDE is an impurity in 4,4-DDT, and also a biodegradation product. This pesticide has very low solubility in water and strongly sorbs to soil with negligible biodegradation potential. The 4,4-DDE may evaporate off sand and gravelly soil with low organic content. However, the lime and sulfur soil matrix in the waste pit includes this pesticide making the probability of evaporation low. The presence of VOCs in the waste pit may be increasing the solubility of 4,4-DDE. The maximum concentrations detected in soil and groundwater were 11.5 mg/kg and 0.586 µg/l, respectively; with the remaining concentrations being much lower, suggesting that the mass of contaminant released was minimal. Endrin has been identified in soil only and has similar properties to dieldrin and 4,4-DDE. The maximum concentration of endrin detected in soil beneath the Agri-Tech building was 1.13 mg/kg. These releases may have been associated with residues from past barrel-cleaning operations.

5.3.3 Metals

The metals cadmium and mercury are expected to occur in shallow soil along the western portion of the Site bordering the Bay Chemical property. The origin of these and other metals at the Site is suspected to be the west adjacent Bay Chemical property. Aerial and Site photographs prior to occupation of the Site by YSF (Appendix A) indicate that development of the Site resulted in placement of a partial cap of fill and/or pavement over areas that previously appeared to have been affected by the former Bay Chemical property operations. The metals are persistent contaminants that will be retained in soil unless physical or chemical processes disturb the soil matrix. Concentrations of total metals in groundwater would be attributed to metals in the soil that are in direct contact with groundwater. However, no investigation of groundwater quality relative to metals has been performed at the Site.

The affected areas of the Bay Chemical property are all unpaved. Airborne dusts may transport metals from the Bay Chemical property to surficial soils and surface water at the Site. If airborne deposits have reached the Type 3 wetlands on the YSF property, accumulations of the metals in the pond sediments would be expected. The confirmed presence of metals in the drainage ditch on the south adjacent property (Bay Chemical RI) indicates that airborne deposition of metal particulates may have also occurred within the southern portion of the Site.

5.4 TERRESTRIAL ECOLOGICAL AND HUMAN HEALTH RISK

The two areas of risk for exposure associated with the releases of COPCs at the Site include terrestrial ecologic risk and human health risk. This section presents the evaluations and conclusions derived regarding these risks at the Site.

5.4.1 Terrestrial Ecologic Risk

Based on the findings of the RI, the potential terrestrial ecologic risk associated with Area 1 is estimated to be low. Area 1 is the only area of the Site with confirmed soil contamination above the preliminary screening levels. The soil contamination in the waste pit is limited in aerial extent, and the pit is covered by buildings and pavement that serve as physical barriers and result in an incomplete exposure pathway.

Site conditions are sufficiently protective of terrestrial ecologic receptors for the contaminants identified during the RI that are also listed in Chapter 173-340-900 WAC, Table 749-2. The physical barriers to the contamination qualify the Site for termination of further assessment, with the condition that institutional controls are implemented to ensure that the physical barriers are maintained and remain in place until the concentrations of the listed substances in Table 749-2 are below the concentrations for either unrestricted or commercial/industrial land use. Land use at the Site and the area surrounding the Site indicates that the commercial/industrial concentrations in Table 749-2 are most applicable to the Site.

The second area of concern that may require further investigation is the Type 3 wetland located on the southern portion of the YSF property, adjacent to areas of confirmed soil contamination associated with the Bay Chemical property. The soil analytical data from the Bay Chemical RI indicate that metals are present at concentrations above those listed in Table 749-2. Further, the soil contamination is present at depths less than the point of compliance for terrestrial ecologic risk exclusions of 15 feet bgs without institutional controls, or 6 feet with engineering and institutional controls (Chapter 173-340-7491 WAC). This area of the Site is vegetated, a wetlands area, and is frequented by local wildlife. Because soil in this area will not be covered by a barrier to exposure as defined in Chapter 173-340-7491 (1)(b), a simplified terrestrial ecological risk evaluation may be required in the future if concentrations of metals exceed the final cleanup levels. Farallon will review Ecology's recommendations to assess what actions are being implemented to address terrestrial ecologic risk for the Bay Chemical property.

5.4.2 Human Health Risk

The COPCs originally listed in Section 3.1.2 will be reduced during completion of the CAP based on the RI soil and groundwater sampling data. IHSs will be selected in accordance with Chapter 173-340-703 WAC during the Cleanup Action. Evaluation of the soil and groundwater analytical data for the RI indicates that the IHSs will likely include:

Soil	Groundwater
PCE	PCE
TCE	TCE
cis 1,2-DCE	cis 1,2-DCE
1,2-dichloropropane	Chloromethane
4,4-DDD	1,2-dichloropropane
4,4-DDE	Vinyl chloride
Dieldrin	4,4-DDD
Endrin	4,4-DDE
Heptachlor epoxide	Dieldrin
Alpha chlordane	Endrin
Cadmium	
Mercury	

These compounds are present in soil and/or groundwater at concentrations that exceed the most stringent preliminary soil and groundwater screening levels selected for screening purposes in this RI. The locations of these compounds will determine the potential exposure scenarios for human health affects during the cleanup action. The following sections present the conclusions with respect to human health risk and the corresponding exposure pathways.

5.4.2.1 Soil Pathway

The exposure pathways for shallow soil include the direct contact and vapor pathways. The direct contact pathway includes direct contact with the soil in the waste pit area and may include dermal contact and ingestion pathways. Exposure to the soil in the waste pit would require compromising either the building structures or pavement cap overlying the waste pit that currently minimize exposure to site workers and visitors. If this is accomplished, the inhalation pathway for airborne soil particulate or soil vapors may be another potential exposure pathway. The risk of these exposures can be minimized through the application of engineering and institutional controls.

Metals contamination in soil is suspected to occur along the entire western Site boundary in shallow soils immediately beneath the pavement, and in fill materials and the pond area on the southern portion of the YSF property. Potential exposure pathways include direct contact via dermal contact and ingestion. The risk of exposure to the metals cannot be fully estimated, since the RI data included a limited assessment of these contaminants in these locations.

5.4.2.2 Groundwater Pathway

Potential exposure pathways for groundwater include the dermal contact and ingestion pathways. Exposure to groundwater in the waste pit area would require compromising either the building slabs or pavement cap overlying the waste pit. The risk of exposure in this area can be minimized through the application of engineering and institutional controls.

There are no groundwater wells at the Site that are utilized for purposes other than groundwater monitoring and sampling. The groundwater analytical data for the downgradient Site monitoring wells (MW-3, MW-4, MW-5, MW-7A, and MW-7B) and the downgradient RI wells for the YRRA (well pairs RI-7 through RI-11), located between the Site and the nearest drinking water wells, indicate that the average concentrations of PCE between December 1997 and December 2002 are below the YRRA action level/drinking water standard of 5 µg/l. The risk associated with potential exposure to PCE beyond the Site boundaries via potable drinking water is thereby within acceptable standards. The concentrations of other IHSs at the downgradient wells are sufficiently low that they do not pose a threat to human health beyond the Site boundaries. No further evaluation of this pathway is warranted.

5.4.2.3 Vapor Pathway

The evaluation of the potential for exposure via the vapor pathway and the need to consider air cleanup standards were not included in the approved scope of work for the Agreed Order. The soil and groundwater analytical data were used to assess whether further investigation of this exposure pathway is warranted.

The preliminary IHSs that may represent a future concern are the HVOCs, including PCE and its degradation products. The other IHSs are not volatile. The presence of low concentrations of PCE in soil in Areas 2 and 3 indicate that there is a potential for vapor transport of HVOCs from groundwater to the overlying soil. This transport pathway yields extremely low concentrations of PCE indicating that this transport mechanism is negligible in areas outside the immediate vicinity of the waste pit.

The soil analytical data indicate that the highest concentrations of HVOCs are beneath the Agri-Tech building in both unsaturated and saturated soil. The increased soil and air temperatures in the subsurface during warmer seasonal conditions are suspected to result in some degree of volatilization of HVOCs and other non-halogenated VOCs into vapor that will migrate through soils until a point of release to the atmosphere is reached. This may be through cracks in the building foundation or pavement surrounding the building. The vapor pathway may need to be considered during future investigation work to determine whether contaminant vapors are able to enter the Agri-Tech building through the building slab, and whether efforts to mitigate this risk are warranted. This may include indoor air sampling and/or inspection of the building slab.

6.0 CONCLUSIONS

This section presents the conclusions of the RI conducted at the Yakima Steel Fabricators and Agri-Tech, Inc. facilities in Yakima, Washington. The interpretation of the analytical data has been referenced with respect to the MTCA Method B soil and groundwater preliminary screening levels protective of a potable groundwater source, and are presented in Tables 5 and 6. Site-specific soil and groundwater cleanup levels will need to be negotiated with Ecology, based on actual reasonable maximum exposure scenarios derived from the RI data for the Site and surrounding area land uses.

The data gaps that remain following completion of the scope of the RI are also discussed in this section. The information presented in this section may be used to develop a feasibility study that may include supplemental phases of investigation to address remaining data gaps, to refine the conceptual Site model, and to move forward toward developing a cleanup action plan for the Site. Completion of this RI fulfills the requirements of the existing Agreed Order.

6.1 CONTAMINANT DISTRIBUTION IN SOIL

The IHSs with detected concentrations above the preliminary screening levels for soil include:

- PCE
- TCE
- cis 1,2-DCE
- 1,2-dichloropropane
- 4,4-DDE
- 4,4-DDD
- Dieldrin
- Endrin
- Heptachlor epoxide
- Aldrin
- Alpha chlordane
- Cadmium
- Mercury

With the exception of cadmium and mercury, the IHSs listed above were detected at concentrations above the preliminary screening levels and are located in the waste pit. Cadmium and mercury are associated with Area 3. The highest concentrations of IHSs are located beneath the Agri-Tech building, with the exception of soil borings SP-8 and SP-10 that are located near the central portion of the waste pit. These constituents have been used as the preliminary IHSs in the discussion of the soil analytical results. The specific boring locations for the soil samples that exceed the preliminary soil screening levels are presented in Table 4.

6.1.1 PCE and Degradation Products

The detected concentrations of PCE outside Area 1 are attributed to vapor transport from groundwater affected by the dissolved phase PCE plume migrating across the Site. This is supported by the extremely low concentrations of PCE in Areas 2 and 3 ranging from 0.002

mg/kg to 0.009 mg/kg. This data indicates that there is no PCE source in these areas. The low concentrations of PCE in Area 3 indicate that the former drainage pathway noted by Ecology in the aerial photographs was not a preferential pathway for contaminant migration. This is further supported by the rapid decline in the concentrations of all VOCs from north to south in the waste pit itself. No further investigation for PCE outside of Area 1 is required.

The soil analytical data indicate that the primary area of the PCE release was beneath the current Agri-Tech building. A determination of the vertical extent of contamination could not be made within the Agri-Tech building due to probe refusal in the gravels at the base of the borings. Evaluation of the soil analytical data indicates that the contamination is present in unsaturated soil beneath the building slab, and extends into the saturated soil to a depth of at least 7 feet bgs. The lateral extent of the PCE contamination beneath the building may be estimated with the existing data, but further investigation is necessary to define the vertical extent of contamination prior to determining an appropriate remedy. The soil analytical data from monitoring well boring MW-1 and PLSA Test Pit 4 (soil sample YSF-6) indicate that soil contamination does not extend north to these locations.

The concentrations of PCE and associated degradation products in soil decrease rapidly from north to south in the waste pit. The location of the side-sewer line for the Agri-Tech building was not determined during the RI. However, this line may be in direct contact with groundwater and extend through the waste pit, connecting with the main sewer cleanout vault in the center of the waste pit. The side sewer trench may serve as a conduit for dissolved phase contaminants to be transported to the central area of the waste pit, and requires further investigation to confirm the location and elevation of the piping with respect to groundwater. Farallon does not anticipate that concentrations of contaminants have been transported through the existing sanitary sewer pipes themselves because these systems were installed after the demolition of the Yakima Farmer Supply Site improvements.

The lateral extent of soil contamination to the east of the central portion of the waste pit is not delineated, based on the soil analytical data from soil boring SP-10 (Table 1). However, the existing soil data suggest that PCE concentrations to the east of the waste pit would be relatively low if present.

The vertical extent of contamination in the central portion of the waste pit was adequately characterized using soil data from borings B-1 and B-2. The soil analytical data indicate that concentrations of IHSs attenuate rapidly with depth, and that no further investigation in this area is required.

The concentrations of PCE in unsaturated soil in the waste pit will not likely reach groundwater due to the overlying building which prevents infiltration of precipitation. HVOC reductions in the unsaturated zone are expected to occur via the vapor pathway. The hot summer seasons and increased soil and air temperatures in the subsurface will continue to volatilize HVOCs and other non-halogenated VOCs into a vapor state that will migrate through soils until a point of release to the atmosphere is reached. This may be through cracks in the building foundation or pavement surrounding the building. Based on the soil and analytical data in areas outside the waste pit, the vapor pathway is not anticipated to be a significant pathway for contaminant migration.

The extremely low concentrations of PCE in Areas 2 and 3 are indicative of volatilization of dissolved phase PCE in groundwater and transport via the vapor pathway. This appears to be a minor physical component of the natural attenuation process and is not expected to result in any adverse health or ecological affects based on the concentrations of PCE observed.

The concentrations of PCE in the unsaturated soil will not likely reach groundwater due to the overlying building which prevents infiltration of precipitation to drive the HVOCs downward into groundwater. HVOC reduction in the unsaturated zone is expected to occur via the vapor pathway. The hot summer seasons and increased soil and air temperatures in the subsurface will continue to volatilize HVOCs and other non-halogenated VOCs into a vapor state that will migrate through soils until a point of release to the atmosphere is reached. This may be through cracks in the building foundation or pavement surrounding the building. Based on the soil and the analytical data in areas outside the waste pit, the vapor pathway is not anticipated to be a significant pathway of contaminant migration. The vapor pathway if contaminant vapors are able to enter the Agri-Tech building through the building slab.

The extremely low concentrations of PCE in Areas 2 and 3 are indicative of volatilization of dissolved phase PCE in groundwater and transport via the vapor pathway. This appears to be a minor physical component of the natural attenuation process and is not expected to result in any adverse health or ecological affects based on the concentrations of PCE observed.

6.1.2 Pesticides

The distribution of the pesticides was similar to the distribution of PCE and its degradation products. The highest concentrations of pesticides are located beneath the Agri-Tech building, and at soil boring SP-8 and SP-10 located near the central portion of the waste pit. The lateral distribution of soil containing concentrations of these contaminants above the preliminary soil screening levels have been adequately defined by the soil borings completed for the RI. The vertical limits of contamination beneath the Agri-Tech building may require further investigation due to the presence of concentrations of these substances that exceed the preliminary soil screening levels at the maximum depth of exploration of 7 feet bgs at soil boring SP-4. However, based on the information presented in the conceptual site model, there is little risk of these contaminants reaching downgradient receptors at concentrations that would require further actions.

6.1.3 Petroleum Hydrocarbons

The concentrations of ORO, DRO, cPAHs, and petroleum-related VOCs in Area 3 were all below the preliminary soil screening levels. No further action is necessary in Area 3 with respect to the petroleum hydrocarbons detected.

6.1.4 Heavy Metals

The concentrations of cadmium and mercury identified at the Site are likely attributable to releases from the adjacent Bay Chemical property. Similar concentrations of these metals have been detected in soil samples collected on the southern portion of the Site and near the western Site boundary that adjoins Bay Chemical (Figure 12) during the Bay Chemical RI. The Bay Chemical RI further indicates that the highest concentrations of metals are located on the southern portion of that property. The proximity of the soil contamination to the Type 3 wetlands located on the Site indicates there is the potential for metals to be present at elevated concentrations on the western portion of the Site. Farallon understands that the Bay Chemical Company PLP group is in the process of performing further assessment at that property and the south adjacent property for the purpose of assessing the limits of contamination and developing a cleanup action plan. Review of this work as it becomes available to the public, and further investigation to determine the distribution of metals on the Site is warranted.

6.2 CONTAMINANT DISTRIBUTION IN GROUNDWATER

The lateral and vertical distribution of IHSs in groundwater was assessed using monitoring wells MW-1 through MW-7A/B and WDOE-6. The YRRA groundwater investigation data were also used to assess the potential extent of historical releases and their affects on downgradient receptors. The groundwater data from the wells located on the west adjacent Bay Chemical property could not be used to evaluate the distribution of HVOCs, or the influence of potential off-Site contributions, because the sampling program at that Site has not included these compounds. However, conclusions regarding the potential for migration of heavy metals onto the Site via the groundwater pathway are based on the analytical results from the Bay Chemical RI.

The IHSs detected in groundwater that exceed the preliminary screening levels include:

- PCE
- TCE
- cis 1,2-DCE
- Vinyl chloride
- 1,2-dichloropropane
- Chloromethane
- 4,4-DDE
- 4,4-DDD
- Dieldrin

These constituents have been used as the preliminary indicator hazardous substances in the discussion of the groundwater analytical results. The specific monitoring well locations for the groundwater samples that exceeded the preliminary groundwater screening levels are presented in Table 4.

6.2.1 PCE and Degradation Products

The groundwater analytical data indicate that there is an upgradient contributing source of dissolved phase PCE that may be associated with one or more of the YRRA subfacilities or another unidentified upgradient source. Ecology has concurred with this conclusion, and did not require the additional upgradient monitoring wells to further support the presence of an upgradient source of PCE as proposed by Farallon during the supplementary RI work performed in 2002. The concentrations of PCE at upgradient monitoring well MW-1 have ranged from 3.39 µg/l to 6.0 µg/l.

Concentrations of PCE at monitoring well WDOE-6, located near the center of the waste pit, have ranged from below the laboratory method PQL during the most recent sampling event in December 2002, to 420 µg/l during the first sampling event conducted in May 1992. The concentrations of PCE at monitoring well WDOE-6 exceeded the preliminary groundwater screening level of 5.0 µg/l for all groundwater sampling events from May 1992 to September 1998. The groundwater sample results for the December 2002 groundwater sampling event at monitoring well WDOE-6 indicate that there is not a continuing source of contamination (i.e., DNAPL), and that the residual source is being reduced either by biodegradation or dispersion and dilution.

Concentrations of PCE at monitoring wells MW-3 and MW-6, located downgradient and outside the limits of the waste pit have ranged from below the laboratory method PQL to 6.06 µg/l, slightly exceeding the preliminary groundwater screening level of 5.0 µg/l during at least one groundwater sampling event. Concentrations of PCE at the remaining downgradient monitoring wells have been at or below the preliminary groundwater screening level of 5.0 µg/l. This data indicates that the contribution of PCE from the waste pit area appears to be minimal.

The groundwater analytical data for the PCE degradation products TCE, cis-DCE, and vinyl chloride indicate that the only locations where these compounds have historically exceeded the preliminary groundwater screening levels are monitoring wells WDOE-6, MW-2, and MW-6 located in, and immediately downgradient of the waste pit. The presence of these constituents in and downgradient of the waste pit indicates that biodegradation of PCE in the waste pit area is occurring.

The presence of higher concentrations of cis-DCE in groundwater is considered indicative of the PCE source in the waste pit. Cis-DCE has been detected at higher concentrations in groundwater samples from all monitoring wells at, and directly downgradient of the waste pit. The absence of appreciable concentrations of cis-DCE at upgradient monitoring well MW-1 and crossgradient monitoring well MW-3 in comparison to the higher concentrations at downgradient monitoring wells MW-2, MW-4, MW-5, MW-6, MW-7A and MW-7B support the contribution of an upgradient and off-site source of PCE that is not associated with the source of PCE in the waste pit.

The vertical distribution data are limited, since the scope of work for the RI Work Plan was focused on similar well completions to the YRRA RI. The data from shallow monitoring wells MW-2, MW-6, and MW-7A indicate that the IHSs from the waste pit have had minimal impact on downgradient groundwater quality. Concentrations of PCE and associated degradation products have been historically low to below laboratory detection limits at monitoring wells MW-2 and MW-6. The December 2002 groundwater sampling event marked the first increase in PCE and associated degradation products in shallow groundwater downgradient of the waste pit at monitoring well MW-6. However, downgradient monitoring wells MW-4, MW-5, MW-7A, and MW-7B did not exhibit a corresponding increase in contaminant concentrations, indicating that the degradation products are naturally attenuating along the flow path.

The presence of higher concentrations of PCE and cis-DCE at monitoring well MW-7B, which is screened between a depth of 28 to 33 feet bgs, indicates that dissolved-phase PCE is present in groundwater much deeper than the vertical extent of soil contamination in the waste pit based on the data obtained from soil borings B-1 and B-2. The results are more consistent with the Site monitoring wells MW-1, MW-3, MW-4, and MW-5 that were also constructed with well screens placed at depths up to 28 feet bgs. The soil and groundwater analytical data from upgradient/background monitoring well MW-1 and downgradient monitoring wells with similar PCE concentrations support the presence of an off-Site contributing source of PCE.

Ecology's YRRA data indicate that the effects of PCE on the deeper water-bearing zone below a depth of 30 feet bgs are negligible. Further, the concentrations of PCE and daughter products in the Site monitoring wells are low enough to indicate that deeper water bearing zones are not at risk and require no further evaluation.

The analytical results for groundwater samples from the YRRA RI wells used to evaluate the shallow water bearing zone (RI wells RI-7s to RI-11s) located downgradient of the Site have been below 5.0 μg/l since inception of the YRRA groundwater sampling program in December 1997. The highest concentration of PCE in any of these shallow RI wells has been 2.53 μg/l in a sample obtained from monitoring well RI-10s in June 1999. The analytical results for groundwater samples from the RI wells used to evaluate the deep water bearing zone (RI wells RI-7d to RI-11d) have also been below 5.0 μg/l since inception of the YRRA groundwater sampling program in December 1997. The highest concentration of PCE in any of these deep RI wells has been 0.761 μg/l in monitoring well RI-10d in September 1998. Although historic groundwater releases associated with the Site may have occurred, they have not affected downgradient receptors or groundwater quality at concentrations that require further action or treatment.

The biodegradation processes described in the conceptual site model may continue with time, but are not likely to significantly reduce the concentrations of PCE in the source area beneath the Agri-Tech building within an acceptable timeframe. The PCE in the saturated media will slowly degrade as new material is leached into groundwater, but will likely take a significant amount of time to reduce the contaminant mass. Any disturbance of the soil matrix may result in periodic increases in contaminant levels that may be dispersed downgradient before biodegradation processes can reduce the PCE to its nonhazardous end products. This is supported by the recent increase in HVOC concentrations observed at monitoring well MW-6 during the December 2002 groundwater sampling event. Institutional controls to prevent disturbance of the soil matrix would be necessary as a component of a long-term cleanup action that proposes leaving the waste pit materials in-place.

6.2.2 Pesticides

The groundwater analytical data indicate that concentrations of 4,4-DDE and/or dieldrin have been detected in groundwater samples from monitoring wells MW-2 and WDOE-6 located in the waste pit area. These pesticides were detected at monitoring well MW-2 only during the December 1997 groundwater sampling event, and have not been detected above the laboratory method reporting limits since that time. These pesticides have been detected at monitoring well WDOE-6 between March 1998 and September 1998, but were below the laboratory method reporting limits for the recent December 2002 groundwater sampling event. Evaluation of the pesticide groundwater analytical results indicates that these contaminants are limited to the waste pit itself and do not represent a risk to downgradient groundwater quality or deeper water bearing zones. This is due to the low solubility in groundwater and strong soil sorptive properties of these compounds.

6.2.3 Petroleum Hydrocarbons

The concentrations of VOCs associated with petroleum hydrocarbons have been below laboratory reporting limits at all monitoring wells located in Areas 1, 2, or 3. DRO, ORO, and cPAHs were not detected above the laboratory reporting limits at monitoring well MW-5 in Area 3. No further investigation is required.

Ecology has indicated the potential for petroleum compounds to be used as carrier oils associated with agricultural use of pesticides. However, the findings of RI indicate that pesticide and petroleum-related soil and groundwater analytical data are sufficiently low, and do not support further investigation of petroleum hydrocarbons in the waste pit area.

6.2.4 Heavy Metals

Total and dissolved metals analyses were not included in the scope of work for the RI. The groundwater analytical data for the Bay Chemical property monitoring wells located along the western Site boundary were used for preliminary evaluation of the potential for groundwater impacts from heavy metals associated with the Bay Chemical property to have adversely affected the Site. There are four groundwater monitoring wells located along the western Site boundary (Figure 4). The groundwater analytical data from the Bay Chemical monitoring wells indicate the potential for concentrations of the metals cadmium, lead, manganese, mercury, and zinc to affect groundwater quality at the Site. Further investigation of total and dissolved metals concentrations at select monitoring wells may be required to determine whether groundwater quality at the Site has been impaired due to migration from the adjacent property. Review of more recent groundwater sampling results associated with the recent investigation work conducted by the Bay Chemical PLP group should also be reviewed to assess current conditions.

6.3 SURFACE WATER

The groundwater analytical data from monitoring wells MW-3, MW-4, and MW-7A/B were used to evaluate the potential for IHSs to affect surface water receptors at and downgradient of the Site. Surface water receptors at the Site include the Type 3 wetland located on the southern portion of the YSF property. The COPCs associated with the Site that could potentially affect the surface water receptors include PCE and TCE. Off-Site contributions of PCE and TCE from the dissolved phase PCE plume associated with the YRRA subfacilities upgradient are also considered. The potential effects of the Bay Chemical property were evaluated using the soil and groundwater analytical data from the Bay Chemical RI.

The average PCE concentrations at monitoring wells MW-3 and MW-4 indicates there is a potential for shallow groundwater to contribute PCE concentrations to the eastern drainage ditch at concentrations that exceed the MTCA Method B cleanup level for surface water but not the MTCA Method C cleanup level. The concentrations of TCE are below the MTCA Method B and Method C surface water cleanup levels. Surface water present in the ditch may drain to the pond area but would likely be diluted or sorbed onto sediment particulate and volatilize rapidly during times when water is not present in the ditch. Further investigation of surface water or sediment quality in the eastern drainage ditch is not warranted.

The analytical results from monitoring wells MW-7A and MW-7B indicate concentrations of PCE and TCE are sufficiently low and not a risk to the pond. No further investigation is required for evaluation of HVOCs in the pond area or Type 3 wetland soil/sediments.

The soil and groundwater analytical data from the Bay Chemical property indicate that there is a potential for the pond area and Type 3 wetland to be affected by heavy metals associated with the Bay Chemical property. Concentrations of the metals cadmium, lead, manganese, mercury, and zinc detected in soil and/or groundwater are sufficient to indicate that contamination of surface water and sediments in this area of the Site may have occurred. Further investigation may be required to confirm whether these metals are present in the pond at concentrations that require further action.

6.4 DNAPL

The concentrations of HVOCs in groundwater in and around the waste pit area are not indicative of the presence of DNAPL at the Site. The concentrations of PCE in monitoring wells WDOE-6, MW-2, and MW-6 do not suggest that a sufficient quantity of PCE has been released in the waste pit to produce a DNAPL plume. Concentrations of HVOCs at monitoring well WDOE-6 located in the waste pit materials have been consistently decreasing with time, suggesting that the available source is diminishing. The decreasing HVOC concentrations are not indicative of a DNAPL source in direct contact with groundwater. Concentrations of HVOCs in soil in other areas of the waste pit are sufficiently low and do not indicate that the release of PCE was widespread. Therefore, the presence of DNAPL in other areas of the waste pit is unlikely. Further, no indications of DNAPL were observed in the direct-push drilling soil core samples or in the lime and sulfur residue.

6.5 DATA GAPS

The RI has provided sufficient data to formulate the conclusions presented herein. Sufficient information is available to recommend evaluation of technically feasible remedial alternatives for a future feasibility study. However, refinement of the conceptual site model through filling of data gaps may be warranted prior to developing a long-term cleanup action plan for the Site. The following data gaps should be evaluated during future Site work and prior to determining a final cleanup action:

- The limits of soil contamination beneath the Agri-Tech building have not been adequately assessed. Specifically, the current soil analytical data indicate that the limits of soil contamination have not been identified around the north end of the waste pit and to the east of the central portion of the waste pit. Evaluation of the limits of contamination beneath the Agri-Tech building are required to confirm that the highest concentrations of IHS have been located, and to assist in determining an appropriate long-term remedy that is protective of human health and the environment.

- The side sewer trench for the Agri-Tech building may be a preferential pathway for contaminant migration and should be located to further assess whether this is a migration pathway for the elevated IHS concentrations in the central portion of the waste pit area. This may include locating the piping and determining whether the piping and trenching materials are in direct contact with groundwater.

- The locations of the subsurface improvements for the former Yakima Farmer Supply operations, including the septic system, concrete underground storage tank, and drain piping from the main warehouse located north and adjacent to the Site have not been confirmed. The locations of the former septic drainfield and the concrete underground storage tank were likely beneath the existing building on the Agri-Tech property. The location of the drain piping that connected the main warehouse to the waste pit may have been a potential conduit for contaminant transport. A ground penetrating radar investigation and additional research may yield information on former subsurface structures.

- Site-specific foc data were not collected in accordance with the revised MTCA requirements. Future subsurface investigation should include collection of soil samples for assessing the Site-specific foc data. This would result in a more accurate calculation of site-specific cleanup levels. The present preliminary soil cleanup levels are based on the lowest potential foc value of 0.001 for the YRRA. Soil porosity, dry bulk density, and volumetric water content may also be collected simultaneously and used to refine the Site-specific soil and groundwater cleanup levels selected for a cleanup action plan, and to facilitate the design process.

- The conclusions presented herein regarding natural attenuation have been based on the limited groundwater analytical results. Groundwater monitoring and sampling data for natural attenuation parameters should continue to be collected for evaluation.

- Aquifer characteristics such as Site-specific hydraulic conductivity, transmissivity, and yield may be required to determine appropriate engineering controls to treat or capture downgradient releases associated with potential source removal.

- The existing monitoring well network is not designed to evaluate current or future releases from leaching of IHSs in the area where the highest concentrations of contaminants have been observed. Installation of additional monitoring wells east of the waste pit may be useful to determine whether the increases in IHSs observed at monitoring wells MW-2 and MW-6 are representative of the maximum concentrations of IHSs exiting the waste pit area. The data indicate that the Columbia Investment property (Tax Parcel No. 19133141011), located east and adjacent to the Agri-Tech property is suspected of being affected by the release of IHSs in the waste pit area. The current owners may not allow site access for installation of monitoring wells without the assistance of Ecology.

- Assessment of the potential impacts from the west adjacent Bay Chemical property has not been conducted. A more complete evaluation of Site background metals concentrations versus metals concentrations on the western portion of the Site is necessary to assess whether further actions are necessary. Farallon does not recommend evaluation of the sediments in the pond until information confirming soil and or groundwater contamination associated with contaminants from the Bay Chemical property can be reviewed. Counsel for the Site owner may then approach Ecology and/or the Bay Chemical PLP group to determine what future actions are necessary.

These data gaps may be addressed in the future as a component of a feasibility study. The data gaps should be addressed prior to, or incorporated into, any long-term cleanup action plan.

7.0 REFERENCES

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8.0 LIMITATIONS

The conclusions and recommendations contained in this report/assessment are based on professional opinions with regard to the subject matter. These opinions have been arrived at in accordance with currently accepted hydrogeologic and engineering standards and practices applicable to this location and are subject to the following inherent limitations:

- **Accuracy of Information.** Certain information utilized by Farallon in this report/assessment has been obtained, reviewed, and evaluated from various sources believed to be reliable, including the local health districts, fire departments, and the previously discussed interviews. Although Farallon's conclusions, opinions, and recommendations are based in part on such information, Farallon's services did not include the verification of its accuracy or authenticity. Should such information prove to be inaccurate or unreliable, Farallon reserves the right to amend or revise its conclusions, opinions, and/or recommendations.