

## VAPOR INTRUSION ASSESSMENT WORK PLAN

**CAPITAL INDUSTRIES, INC.  
5801 THIRD AVENUE SOUTH  
SEATTLE, WASHINGTON**

**AGREED ORDER NO. DE 5348**

**Submitted by:  
Farallon Consulting, L.L.C.  
975 5th Avenue Northwest  
Issaquah, Washington 98027  
Farallon PN: 457-004**

**For:  
Mr. Ron Taylor  
Capital Industries, Inc.  
5801 Third Avenue South  
Seattle, Washington**

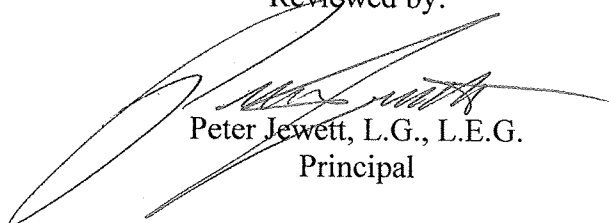
September 16, 2008

Prepared by:

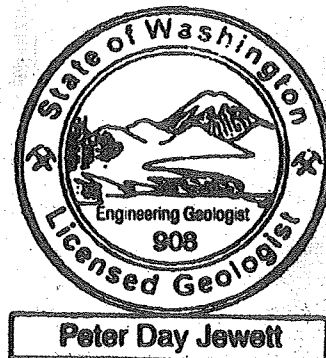


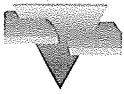
Daniel Caputo  
Project Chemist

Reviewed by:



Peter Jewett, L.G., L.E.G.  
Principal





## TABLE OF CONTENTS

<b>ACRONYMS AND ABBREVIATIONS .....</b>	<b>ii</b>
<b>1.0 INTRODUCTION .....</b>	<b>1-1</b>
1.1 VAPOR INTRUSION ASSESSMENT WORK PLAN OBJECTIVE....	1-1
1.2 VAPOR INTRUSION ASSESSMENT WORK PLAN ORGANIZATION.....	1-1
<b>2.0 SITE DESCRIPTION .....</b>	<b>2-1</b>
<b>3.0 PREVIOUS VAPOR INTRUSION MONITORING AND SURVEYS.....</b>	<b>3-1</b>
3.1 CAPITAL PROPERTY .....	3-1
3.2 OLYMPIC MEDICAL .....	3-1
<b>4.0 VAPOR INTRUSION ASSESSMENT SCOPE OF WORK.....</b>	<b>4-1</b>
<b>5.0 PROGRESS REPORTING .....</b>	<b>5-1</b>
<b>6.0 BIBLIOGRAPHY.....</b>	<b>6-1</b>

## FIGURES

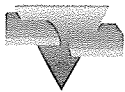
- Figure 1   *Capital Area of Investigation Location Map*  
Figure 2   *Capital Area of Investigation Plan*  
Figure 3   *Area of Investigation Map with Proposed Reconnaissance Boring Locations*

## TABLES

- Table 1    *Calculated Soil Vapor Concentrations in Capital Plant 2*  
Table 2    *Reconnaissance Borings Used for Tier 1 and Tier 2 Building Vapor Intrusion Assessment*

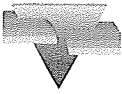
## APPENDIX

- Appendix A    IPIM Action Levels



## ACRONYMS AND ABBREVIATIONS

Agreed Order	Agreed Order No. DE 5348 between the Washington State Department of Ecology and Capital Industries, Inc.
Air SAP	Air Sampling and Analysis
Capital	Capital Industries, Inc.
Capital Area of Investigation	Area south of Mead Street South, north of South Front Street, east of 1 <sup>st</sup> Avenue South, and west of 4 <sup>th</sup> Avenue South; and the property north of South Mead Street
Capital Property	Property located at 5801 3 <sup>rd</sup> Avenue South in Seattle, Washington
COCs	constituents of concern
COPCs	constituents of potential concern
Ecology	Washington State Department of Ecology
ECS	Environmental Consulting Services, Inc.
EPA	U.S. Environmental Protection Agency
Farallon	Farallon Consulting, L.L.C.
FSM	Floyd Snider McCarthy, Inc.
IPIM	Inhalation Pathway Interim Measures
IPIM Approach	<i>Inhalation Pathway Interim Measure Approach</i> prepared by Pioneer Technologies Corporation for Philip Services Corporation in 2002 and Philip Services Corporation (2006)
J & E	Johnson & Ettinger
PCE	tetrachloroethene
PSC	Philip Services Corporation
PTC	Pioneer Technologies Corporation
SOP	standard operating procedure
SSDS	Sub-Slab Depressurization System
TCE	trichloroethene
VIA Work Plan	Vapor Intrusion Assessment Work Plan
VOCs	volatile organic compounds



## 1.0 INTRODUCTION

Farallon Consulting, L.L.C. (Farallon) has prepared this Vapor Intrusion Assessment Work Plan (VIA Work Plan) on behalf of Capital Industries, Inc. (Capital) to provide the scope of work for evaluation of the vapor intrusion exposure pathway for volatile organic compounds (VOCs) to commercial and industrial buildings located within the Capital Area of Investigation (Figure 1), as defined in the Remedial Investigation Work Plan (Farallon 2008). The Capital Area of Investigation is located south of South Mead Street, north of South Front Street, west of 4th Avenue South, and east of 1st Avenue South and includes the property located on the northwestern corner of 4th Avenue South and South Mead Street (Figure 2).

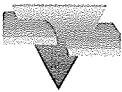
The VIA Work Plan is part of the Remedial Investigation being conducted in accordance with Exhibit D of Agreed Order No. DE 5348 (Agreed Order) entered into by Capital and the Washington State Department Ecology (Ecology) on January 24, 2008. In accordance with the Agreed Order, the Capital Site will be defined by the extent of the concentrations of constituents of concern (COCs) above the screening level released from the Capital Property located at 5801 Third Avenue South in Seattle, Washington (Figure 1).

### 1.1 VAPOR INTRUSION ASSESSMENT WORK PLAN OBJECTIVE

The VIA Work Plan describes the procedures to assess the potential for vapor intrusion of VOCs to indoor ambient air that present a risk to human health at buildings located within the Capital Area of Investigation. The scope of work is consistent with the *Revised Inhalation Pathway Interim Measures (IPIM) Work Plan* (Philip Services Corporation [PSC] 2002), the *Summary of Inhalation Pathway Interim Measure Approach* (PSC 2006), and Arrow Environmental et al. (2007), included as Exhibit D of the Agreed Order.

### 1.2 VAPOR INTRUSION ASSESSMENT WORK PLAN ORGANIZATION

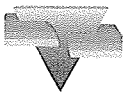
The VIA Work Plan has been organized into the following sections: Section 1 describes the work plan objective; Section 2 provides a description of the Capital Area of Investigation; Section 3 summarizes previous vapor monitoring conducted at the Capital Area of Investigation; Section 4 describes the scope of work for the vapor intrusion assessment; and Section 5 discusses progress reporting for the vapor intrusion assessment. The documents used in preparation of the VIA Work Plan are referenced in Section 6.



## 2.0 AREA OF INVESTIGATION DESCRIPTION

The Capital Property is approximately defined as the property located at 5801 3rd Avenue South between South Mead Street on the north and South Fidalgo Street on the south and between 4th Avenue South on the east and 1st Avenue South on the west in Section 39, Township 24 South, Range 4 East in Seattle, King County, Washington (Figures 1 and 2). The Capital Property consists of four contiguous King County Assessor Parcels: Numbers 1722802255 (5801 3<sup>rd</sup> Avenue South), 1722801620 (5801 3<sup>rd</sup> Avenue South), 1722802245 (5820 1<sup>st</sup> Avenue South), and 1722801530 (5801 3<sup>rd</sup> Avenue South), together totaling 182,468 square feet. Parcels 1722802255, 1722801620, and 1722802245 are developed with five adjoining tilt-up, slab-on-grade buildings designated as Plant 1 through Plant 5. Parcel No. 1722801530 is located north of Plant 4 and has been used for storage of finished products, which include containers and dumpsters. Subsurface utilities that enter the Capital Property from the north and south include natural gas, sanitary sewer, and water services.

The Agreed Order defines the Capital Site as located at 5801 Third Avenue South, Seattle, Washington and will be defined by the extent of COCs that exceed the applicable cleanup levels caused by the release of COCs from the Capital Property. The Capital Area of Investigation is located south of South Mead Street, east of 1st Avenue South, north of South Front Street, and west of 4th Avenue South and includes the property located on the northwestern corner of 4th Avenue South and South Mead Street (Figure 2). The Capital Area of Investigation is located within the Seattle city limits in King County, Washington (Figure 1) and is zoned as industrial light manufacturing (King County, Washington 2007). Properties located within the Capital Area of Investigation include a mixture of light industrial, commercial, and residential properties.



### 3.0 PREVIOUS VAPOR INTRUSION MONITORING AND SURVEYS

This section describes vapor intrusion monitoring and soil vapor surveys conducted in 2004 and 2005 by others at the Capital Property and at the Olympic Medical Building located down-gradient of Capital Plant 2 (Figure 2). Details pertaining to the procedures and results for the vapor intrusion monitoring and soil vapor surveys are provided in the Remedial Investigation (RI) Work Plan and the reports cited in this VIA Work Plan.

#### 3.1 CAPITAL PROPERTY

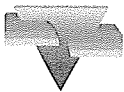
Soil vapor monitoring included sub-slab soil vapor sampling and analysis conducted at the Capital Property in January 2004 after Capital Plant 2 was destroyed by fire in early 2004 (Floyd Snider McCarthy, Inc. [FSM] 2004). Soil vapor and construction monitoring was conducted at the Capital Property in late 2004 during redevelopment of Capital Plant 2 (FSM 2004). Soil vapor sampling was conducted in Capital Plant 2 and Plant 4 in 2004 and 2005 (Environmental Consulting Services, Inc. [ECS] 2005).

Soil vapor intrusion modeling was conducted by ECS (2005) using the U.S. Environmental Protection Agency (EPA) (2002) *Johnson & Ettinger (J & E) Model for Surface Vapor Intrusion into Buildings* to evaluate the potential for migration of VOCs in soil vapors beneath Capital Plant 2 to indoor ambient air quality. The evaluation did not predict concentrations of tetrachloroethylene (PCE); trichloroethylene (TCE); 1,1,-dichloroethylene; vinyl chloride; and benzene, toluene, ethyl benzene and xylenes to be released to indoor ambient air in the office and shop areas of Plant 2 exceeding Washington State Model Toxics Control Act Method B cleanup levels for indoor air ECS (2005). ECS (2005) did not provide the J & E Model spreadsheets for Capital Plant 2; however, the results of the J & E Model summarized by ECS (2005) predicted that concentrations of VOCs from vapor intrusion to indoor ambient air in the Capital Plant 2 office and shop areas would be below applicable human health risk levels (Table 1).

Analytical results of soil vapor samples collected at Capital Plant 4 using Gore Sorber samplers detected concentrations of TCE and PCE above the IPIM Action Levels established by PSC (2006) (ECS 2005). Based on the review of paint spraying operations at Capital Plant 4, the use of personal protection equipment by workers at the plant, and plant ventilation, Ecology concluded that air quality at Capital Plant 4 is unlikely to be unacceptably impacted by vapor intrusion (Ecology 2005).

#### 3.2 OLYMPIC MEDICAL BUILDING

The Olympic Medical Building property is located down-gradient and south of Capital Plant 2 at 5900 1st Avenue South (Figure 2). The Olympic Medical Building consists of a two-story warehouse and manufacturing area on the east, and an office building on the west that was built in 1957. A concentration of TCE of 47.7 micrograms per liter was detected in reconnaissance groundwater samples collected from a direct-push boring located proximate to the Olympic Medical Building (PSC and Pioneer Technologies Corporation [PTC] 2005), which is above the Groundwater IMIP Action Levels (PSC 2006). Concentrations of TCE above the Indoor Air



IPIM Action Levels were detected in indoor ambient air samples collected in the building (PSC and PTC 2005; PSC 2006). Based on the concentrations of TCE detected in indoor ambient air, a mitigation system was proposed by PSC and PTC (2005) for the warehouse on the eastern side of the Olympic Medical Building. Subsequent indoor air sampling conducted by Olympic Medical indicated that a mitigation system is warranted for both the warehouse and the manufacturing portions of the Olympic Medical building, but not for the office area.

Capital has assumed responsibility for mitigation of indoor ambient air at the Olympic Medical building and has proposed to install a Sub-Slab Depressurization System (SSDS) to mitigate concentrations of VOCs to indoor ambient air at the Olympic Medical building. Capital has requested access to the Olympic Medical building; however, access has not yet been granted. Upon receipt of access to the Olympic Medical Building, Capital will acquire the information necessary to prepare a Vapor Intrusion Mitigation Work Plan and a Vapor Intrusion Inspection, Monitoring, and Maintenance Work Plan specific to the Olympic Medical Building for submittal to and review by Ecology. Capital will install, inspect, maintain, and provide long-term monitoring of the SSDS.

### **3.3 OTHER BUILDINGS**

Buildings located within the Capital Area of Investigation have been recognized as potential Tier 3 properties (PSC 2002). However, analytical results of groundwater samples collected from the Water Table Zone from direct-push borings located down-gradient of the Capital Property and along 1st Avenue South have not detected concentrations of VOCs above laboratory reporting limits and/or the Groundwater IPIM Action Levels (Farallon et al 2007). The analytical results for reconnaissance groundwater samples collected from direct-push borings and groundwater samples collected from monitoring wells from the Water Table Zone will be reviewed to determine whether concentrations of VOCs exceed the Groundwater IPIM Action Levels proximate to specific buildings, as discussed below.



## 4.0 VAPOR INTRUSION ASSESSMENT SCOPE OF WORK

This section presents the scope of work for the vapor intrusion assessment to be conducted at the Capital Area of Investigation. The area where concentrations of constituents of potential concern (COPCs) released from the Capital Property that exceed the screening levels will be determined by the Remedial Investigation, which will define the area where vapor intrusion assessment is necessary. The Capital vapor intrusion assessment is based on the *Revised Inhalation Pathway Interim Measure Work Plan* prepared by PTC for Philip Services Corporation (PSC) in 2002 and PSC (2006) (IPIM Approach). The IPIM Approach includes four tiers of assessment:

- **Tier 1 and Tier 2 Assessments**—The concentrations of VOCs detected in reconnaissance groundwater samples collected from direct-push borings and groundwater samples collected from monitoring wells in the Water Table Zone located proximate to residential and commercial buildings will be compared to the Groundwater IPIM Action Levels (Appendix A), as defined in the IPIM Approach (PSC 2002 and 2006). Tier 1 Assessments are conducted at residences; Tier 2 Assessments are associated with commercial and industrial properties.
- **Tier 3 Assessment**—Commercial and industrial properties located within the Capital Area of Investigation and situated above groundwater in the Water Table Zone with concentrations of VOCs that exceed the Groundwater IPIM Action Levels defined by PSC (2006) will be identified under the Tier 2 Assessment as having a potential for the vapor intrusion exposure pathway. The Tier 3 Assessment that will be conducted at these buildings will include collection and analysis for VOCs of co-located indoor ambient air, outdoor ambient air, and potentially sub-slab soil vapor and groundwater samples; calculation of concentrations of VOCs in indoor ambient air relative to outdoor ambient air; and comparison of noncarcinogenic and carcinogenic cumulative exceedance factors to a benchmark of 10 in accordance with the IPIM Approach (PSC 2002 and 2006).
- **Tier 4 Assessment**—Commercial and industrial locations where concentrations of VOCs in indoor ambient air exceed the Exceedance Factors (PSC 2002 and 2006) will require interim measures to mitigate or eliminate the vapor intrusion exposure pathway from groundwater to indoor ambient air. Interim measures for commercial and industrial locations may include subsurface ventilation, as defined by PSC (2002, 2003, and 2006). The design and implementation of mitigation systems for indoor ambient air that may be necessary at buildings located within the Capital Area of Investigation will be provided in the Vapor Intrusion Mitigation Work Plan that will be prepared specific to each building in accordance with the Agreed Order.





## 4.1 SCOPE OF WORK

The scope of work has been developed in accordance with the IPIM Approach (PSC 2002 and 2006) to achieve the objectives of the vapor intrusion assessment and to provide sufficient data to proceed with mitigation of indoor ambient air at locations within the Capital Area of Investigation, if required. The objectives of the scope of work for the VIA Work Plan include:

- Tier 1 and Tier 2 Assessment to determine whether concentrations of VOCs in groundwater in the Water Table Zone exceed the Groundwater IPIM Action Levels in the vicinity of specific buildings in the Capital Area of Investigation;
- Tier 3 Assessment to determine whether VOCs exceed the Indoor Air IPIM Action Levels in indoor ambient air in buildings located in the Capital Area of Investigation and situated above groundwater in the Water Table Zone with concentrations of VOCs exceeding the Groundwater IPIM Action Levels.

The scope of work for the vapor intrusion assessment includes the following work elements that have been developed in accordance with the IPIM Approach (PSC 2002 and 2006):

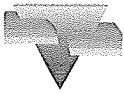
- Reconnaissance Groundwater Sampling and Analysis;
- Groundwater Monitoring and Analysis;
- Tier 1 and Tier 2 Assessment of Groundwater Data; and
- Tier 3 Assessment of Indoor Ambient Air.

The details for these work elements are presented below.

### 4.1.1 Reconnaissance Groundwater Sampling and Analysis

Reconnaissance groundwater samples will be collected during the First Phase of the Capital RI Field Program, as described in the Capital Remedial Investigation Work Plan (Farallon 2008). The reconnaissance groundwater sampling approach has been designed to define the lateral and vertical extent of COPCs released from the Capital Property to groundwater. The analytical results of reconnaissance groundwater samples collected from direct-push borings will be used for the Tier 1 and Tier 2 Assessments to determine whether there is a potential for a vapor intrusion pathway at buildings within the Capital Area of Investigation (Figure 3).

Buildings located within the area where concentrations of VOCs exceed the Groundwater IPIM Action Levels in groundwater in the Water Table Zone will be assessed based on weighted groundwater samples collected from monitoring wells. The analytical results of reconnaissance groundwater samples collected from direct-push borings will be used to support the Tier 1 and 2 Assessment. Table 2 summarizes the direct-push borings that will be used to support the Tier 1 and Tier 2 Assessment for vapor intrusion pathways at buildings located within the Capital Area of Investigation.



#### **4.1.2 Groundwater Monitoring and Analysis**

Monitoring wells will be installed at locations selected based on the analytical results of the reconnaissance groundwater sampling and analysis to assess the concentrations of COPCs above screening levels released from the Capital Property. Consideration will be taken to place monitoring wells at locations up-gradient of buildings where concentrations of VOCs exceeded the Groundwater IPIM Action Levels in reconnaissance groundwater samples. A monitoring well(s) will be located in areas where concentrations of VOCs in reconnaissance groundwater samples collected from the Water Table Zone in close proximity to existing buildings exceed the Groundwater IPIM Action Levels to provide sufficient data for a Tier 1 and Tier 2 Assessment. Additional monitoring wells may be installed to provide adequate monitoring for the Tier 1 and Tier 2 Assessment.

The location and schedule for groundwater monitoring will be provided in the Groundwater Monitoring Work Plan to be prepared after completion of the First Phase of the RI Field Investigation.

#### **4.1.3 Tier 1 and Tier 2 Assessment of Groundwater Data**

The analytical results of groundwater samples collected from the Water Table Zone from the reconnaissance and monitoring well sampling and analysis will be compared to the Groundwater IPIM Action Levels to assess the need for a Tier 3 Assessment. If concentrations of VOCs exceed the Groundwater IPIM Action Levels in groundwater samples collected from the Water Table Zone from monitoring wells, a Tier 3 Assessment likely will be conducted. The scope of work for the Tier 3 Assessment is presented below.

#### **4.1.4 Tier 3 Assessment**

Buildings where a Tier 3 Assessment is warranted under the IPIM Approach (PSC 2002 and 2006) based on concentrations of VOCs that exceed the Groundwater IPIM Action Levels in groundwater samples collected from the Water Table Zone from monitoring wells will undergo a Tier 3 Assessment. A site walk/building evaluation will be conducted at each location prior to air sampling, and a location-specific Air Sampling and Analysis (Air SAP) will be prepared and submitted to Ecology for review and approval. The Air SAP will document the results of the site walk/building evaluation and propose sampling details, including the number of air samples of each type to be collected, and locations. Upon approval of the Air SAP and forecasted desired weather conditions, the air sampling event will be coordinated with the building tenant.

Additional air sampling may include collecting co-located sub-slab soil vapor, indoor ambient air, and outdoor ambient air samples. Air samples will be collected concurrently using evacuated 6-liter Summa canisters. Each canister will be equipped with a vacuum gage and a flow regulator to collect an 8-hour time-integrated sample (for commercial/industrial properties). The weather forecast will be monitored, and an attempt will be made to collect samples during a period of decreasing barometric pressure, preferably when a storm-generated low has reached the area. Weather conditions (i.e., temperature, wind speed, wind direction, and barometric pressure) observed at the Boeing Field weather station before, during, and at the conclusion of the sampling event will be recorded.



Upon completion of sampling, all Summa canisters will be packed into their original shipping containers and sent to Air Toxics Laboratory in Folsom, California for analysis of COCs using EPA TO-14/TO-15 analytical methods. Target reporting limits will be documented in the Air SAP.

The specific methods for indoor ambient air, outdoor ambient air, and sub-slab soil vapor sampling are discussed briefly below.

#### **4.1.4.1 Indoor Ambient Air Sampling**

Indoor ambient air sampling will be conducted in accordance with PSC's standard operating procedure (SOP) No. PSC-127 (PSC 2002). Indoor air samples will be collected concurrently with no fewer than one ambient outdoor air sample.

#### **4.1.4.2 Outdoor Ambient Air Sampling**

Outdoor ambient air sampling will be conducted in accordance with PSC's SOP No. PSC-128 (PSC 2002). Outdoor ambient air samples will be collected from a minimum height of 2 meters above ground surface. An attempt will be made to measure ambient air concentrations upwind of the building being assessed.

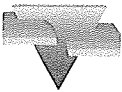
The concentrations of VOCs detected in the indoor ambient air samples will be corrected by subtracting the maximum detected VOC concentration detected in the outdoor ambient air sample from the maximum detected VOC concentrations detected in the indoor ambient air sample. This correction is made to account for the contribution of VOCs detected in the outdoor ambient air sample to the VOC concentration detected in the indoor air sample.

#### **4.1.4.3 Sub-Slab Soil Vapor Sampling**

The analytical results of concurrent sampling of soil vapor beneath a building slab may not always be necessary or practical, but can be useful in interpreting indoor air sampling results. The merits of sub-slab soil vapor sampling will be evaluated on a case-by-case basis in the location-specific Air SAP, and a recommendation will be made. If included in the sampling event, sub-slab soil vapor sampling will be conducted in accordance with PSC's SOP No. PSC-129 (PSC 2002).

## **4.2 TIER 4 ASSESSMENT**

A Tier 4 Assessment will be conducted if the results of the Tier 3 Assessment indicate that there is a migration pathway for VOCs to indoor ambient air that presents a risk to human health. The Tier 4 Assessment will include development of recommendations for the design and installation of interim measures to mitigate the risk to human health. A Vapor Intrusion Mitigation Work Plan and a Vapor Intrusion Maintenance and Monitoring Plan will be prepared for each building that is identified for mitigation that will be submitted to Ecology for review and comment.



### **4.3 SCHEDULE**

The Tier 1 and Tier 2 Assessment and the Tier 3 Assessment will be conducted concurrently with the Capital RI Field Program. The Capital RI Field Program will be conducted in two phases, with the Capital vapor intrusion assessment conducted during both phases. A brief description of the activities and the associated timeline are presented below.

#### **4.3.1 Phase 1—Reconnaissance Groundwater Sampling**

Data collected during reconnaissance groundwater sampling conducted in the Water Table Zone will be used to support the Tier 1 and Tier 2 Assessment of buildings located down-gradient of the Capital Property. Reconnaissance groundwater sampling will be conducted in two tiers. The first tier will assess the nature and extent of COPCs above screening levels in groundwater in proximity to the Capital Property. The second tier will assess the nature and extent of COPCs above screening levels in groundwater not defined by the first tier of reconnaissance groundwater sampling. Completion of the reconnaissance borings proposed in the second tier reconnaissance sampling is dependant on the data collected in the first tier sampling. The data collected from the reconnaissance borings completed will be used to assess vapor intrusion in that area.

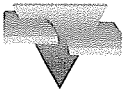
#### **4.3.2 Phase 2—Groundwater Monitoring**

Monitoring wells will be installed at locations based on the data collected during the reconnaissance groundwater sampling phase of work. Monitoring wells will be strategically located to sufficiently monitor the migration of COPCs in groundwater and provide vapor intrusion assessment data. Locations of monitoring wells will be provided in the Capital Groundwater Monitoring Report.

After monitoring wells are installed and developed, groundwater monitoring will begin on a quarterly basis. Groundwater monitoring data collected from the Water Table Zone will be reviewed quarterly for Tier 1 and Tier 2 Assessment.

#### **4.3.3 Tier 3 Assessment**

The Tier 3 Assessment of buildings previously established under the IPIM Approach for buildings identified will be based on the results of the Tier 1 and Tier 2 Assessment. If the Tier 3 Assessment identifies a building(s) that requires reassessment, annual reassessment will be conducted.



## **5.0 REPORTING**

### **5.1 PROGRESS REPORTING**

Progress reports describing the results of the vapor intrusion assessment will be prepared quarterly in accordance with the Agreed Order. The progress reports will include:

- A brief narrative of the scope of work and procedures followed for the vapor intrusion assessment;
- A summary of the field activities conducted;
- Summary tables presenting groundwater, sub-slab boring, and ambient air analytical results;
- Figures depicting sample locations and concentrations of volatile COCs in groundwater, soil vapor, and ambient air; and
- A discussion of whether mitigation of indoor ambient air is necessary.

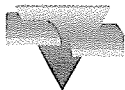
Following review and approval by Capital, each progress report will be provided to Ecology for review and comment.

### **5.2 VAPOR INTRUSION MITIGATION WORK PLANS**

Vapor Intrusion Mitigation Work Plans will be completed for buildings designated as Tier 4 locations under the IMIP Approach. The location-specific Vapor Intrusion Mitigation Work Plan will describe the type of mitigation to be used at that particular location and the methods for installation. Vapor Intrusion Mitigation Work Plans will be submitted to Ecology for approval 30 days after a specific building has been designated as a Tier 4 structure and access to the building has been provided.

### **5.3 VAPOR INTRUSION, INSPECTION, MONITORING, AND MAINTENANCE WORK PLANS**

Vapor Intrusion, Inspection, Monitoring, and Maintenance Work Plans will be completed for buildings designated as Tier 4 locations under the IMIP Approach where a mitigation system has been installed (PSC 2002). The Vapor Intrusion, Inspection, Monitoring, and Maintenance Work Plans will be location-specific and will provide the scope of work for successful maintenance of the systems installed to mitigate Tier 4 locations. Location-specific Vapor Intrusion, Inspection, Monitoring, and Maintenance Work Plans will be submitted to Ecology for approval 30 days after a specific building has been designated as a Tier 4 structure and access to the building has been provided.



## 6.0 BIBLIOGRAPHY

- Arrow Environmental; Aspect Consulting; Farallon Consulting, L.L.C.; and Pacific Groundwater Group (Arrow et al.). 2007. *Draft Interim Vapor Intrusion Plan*. May 1.
- Environmental Consulting Services, Inc. (ECS). 2005. *Draft Remedial Investigation Report, Capital Industries Site, Seattle, Washington*. Prepared for Capital Industries, Inc., Seattle, Washington. June.
- Farallon Consulting, L.L.C. (Farallon). 2008. *Remedial Investigation Work Plan, Capital Industries, Inc., 5801 Third Avenue South, Seattle, Washington* (RI Work Plan). September 16.
- Farallon Consulting, L.L.C. (Farallon); Aspect Consulting, LLC; Pacific Groundwater Group; Arrow Environmental, LLC (Farallon et al.). 2007. Letter Regarding West of 4<sup>th</sup> Avenue South Investigation Area Revised Interim Vapor Intrusion Plan. To Ed Jones, Environmental Engineer, Washington State Department of Ecology. May 1.
- Floyd Snider McCarthy, Inc. (FSM). 2004. *Capital Industries, Inc. Soil Vapor and Construction Monitoring Report*. July 6.
- King County, Washington. 2007. *GIS Center, Parcel Viewer*. No date.  
[http://www.metrokc.gov/gis/mapportal/PViewer\\_main.htm#newsHead](http://www.metrokc.gov/gis/mapportal/PViewer_main.htm#newsHead).  
(December 31, 2007.)
- Philip Services Corporation (PSC). 2002. *Revised Inhalation Pathway Interim Measures Work Plan*. August.
- \_\_\_\_\_. 2003. *Supplemental Inhalation Pathway Interim Measures Work Plan*. May.
- \_\_\_\_\_. 2006. *Summary of the Inhalation Pathways Interim Measure Approach, Seattle, WA*. October.
- PSC and Pioneer Technologies Corporation (PTC). 2005. *Tier 3 Sampling Report for Inhalation Pathway Interim Measures, 5801 Third Avenue South, Seattle, Washington*. January.
- U.S. Environmental Protection Agency (EPA). 2002. *Johnson & Ettinger Model Spreadsheets*.  
SL.ADV.xls and SG.ADV.xls.
- Washington State Department of Ecology (Ecology). 2005. *Capital Industries Plan 4 Vapor Intrusion Assessment*.

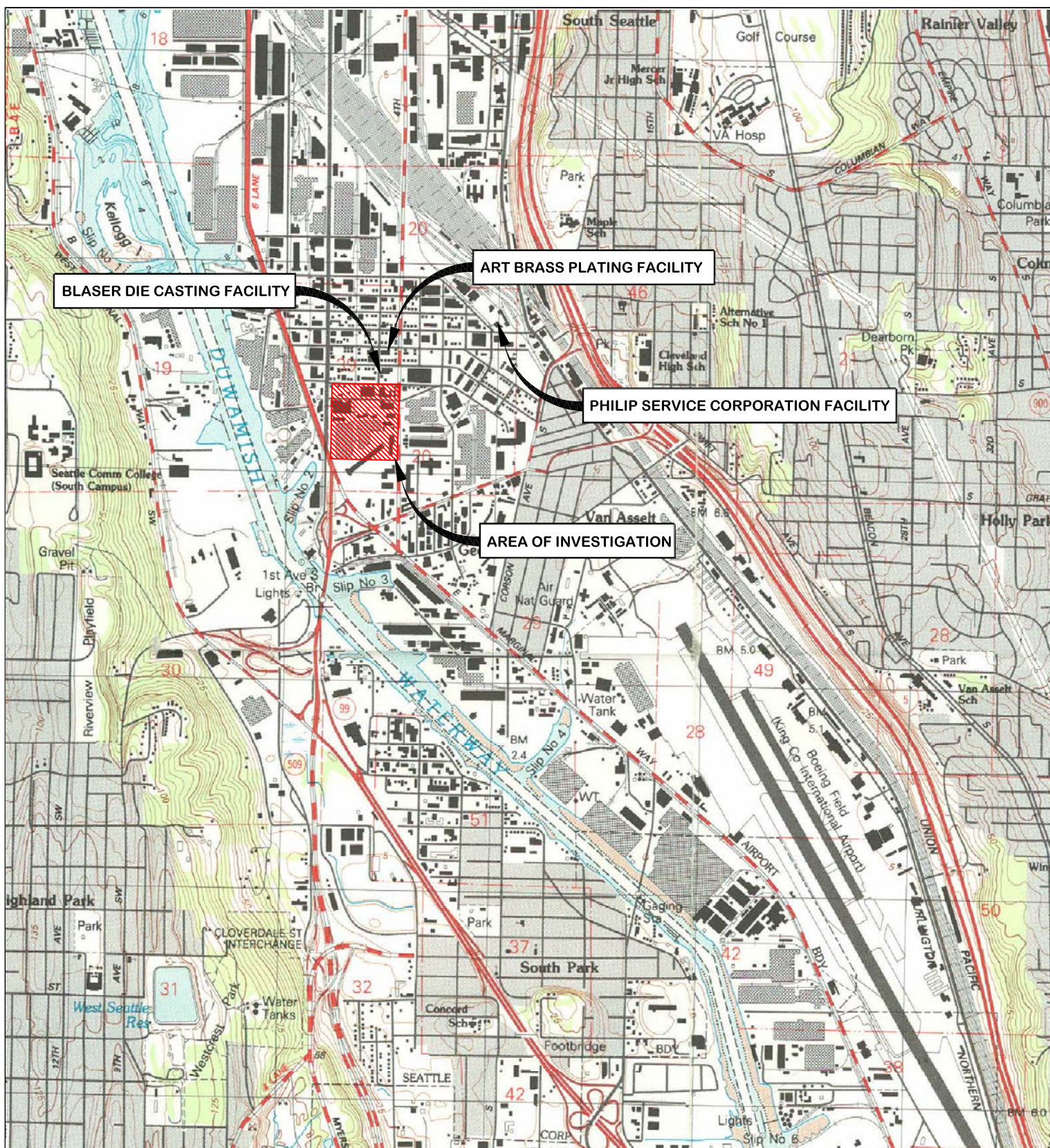
## **FIGURES**

### **VAPOR INTRUSION ASSESSMENT WORK PLAN**

Capital Industries, Inc.  
5801 Third Avenue South  
Seattle, Washington

Farallon PN: 457-004





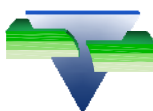
REFERENCE: 7.5 MINUTE USGS QUADRANGLE SOUTH SEATTLE, WASHINGTON. DATED 1983

0 500

APPROXIMATE SCALE IN METERS



WASHINGTON



FARALLON CONSULTING  
975 5th Avenue Northwest  
Issaquah, WA 98027

## FIGURE 1

CAPITAL AREA OF INVESTIGATION  
LOCATION MAP  
VAPOR INTRUSION ASSESSMENT WORK PLAN  
CAPITAL INDUSTRIES, INC.  
SEATTLE, WASHINGTON

FARALLON PN: 457-004

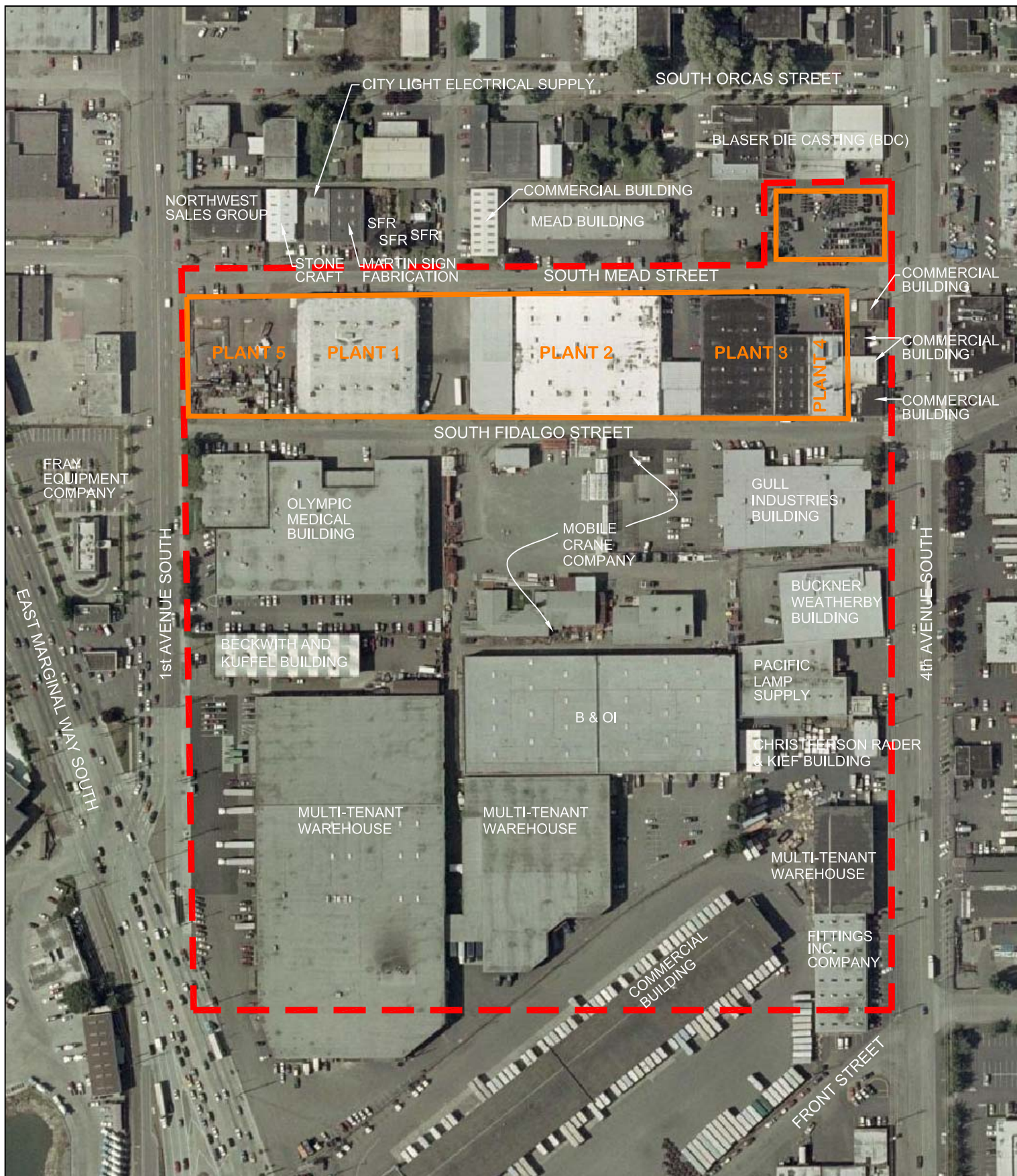
Drawn By: DEW

Checked By: DC

Date: 9/16/08

Disk Reference: 457004a

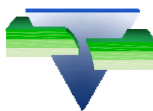




#### LEGEND

- CAPITAL AREA OF INVESTIGATION
- CAPITAL PROPERTY
- SFR SINGLE FAMILY RESIDENCE

0 200  
APPROXIMATE SCALE IN FEET



**FARALLON CONSULTING**  
975 5th Avenue Northwest  
Issaquah, WA 98027

#### FIGURE 2

CAPITAL AREAS OF INVESTIGATION  
VAPOR INTRUSION ASSESSMENT WORK PLAN  
CAPITAL INDUSTRIES, INC.  
SEATTLE, WASHINGTON

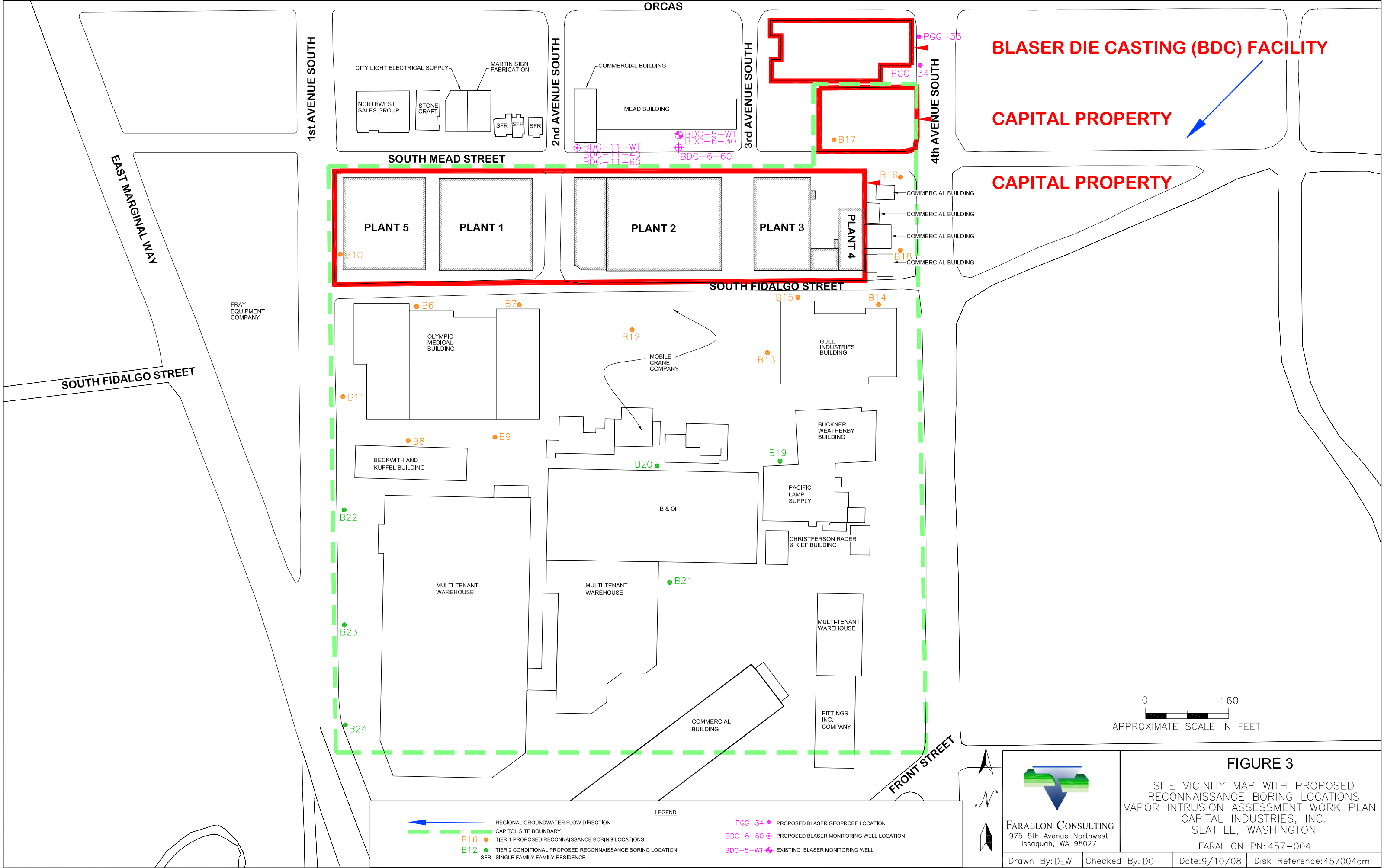
FARALLON PN: 457-004

Drawn By: DEW

Checked By: DC

Date: 9/16/08

Disk Reference: 457004a



## **TABLES**

### **VAPOR INTRUSION ASSESSMENT WORK PLAN**

Capital Industries, Inc.  
5801 Third Avenue South  
Seattle, Washington

Farallon PN: 457-004



**Table 1**  
**Calculated Soil Vapor Concentrations in Capital Plant 2**  
**Vapor Intrusion Assessment Work Plan**  
**Capital Industries**  
**Seattle, Washington**  
**Farallon PN: 457-004**

Compound <sup>1</sup>	Building						Office					
	Air Exchange Rate (1/hr)	Indoor Concentration		CUL	Safety Factor		Air Exchange Rate (1/hr)	Indoor Concentration		CUL	Safety Factor	
		FR UCLC	SC UCLC		FR UCLC	SC UCLC		FR UCLC	SC UCLC		FR UCLC	SC UCLC
PCE		268	2438	0.417				268	2438	0.417		
	1	0.0029	0.0265		144	16	4.5	0.0023	0.0211		181	20
TCE		25	10	0.022				25	10	0.022		
	1	0.0003	0.0001		73	220	4.5	0.0002	0.0001		110	220
cis-1,2-DCE		25	5	0.05				25	5	0.05		
	1	0.0003	0.0001		167	500	4.5	0.0002	0		250	Infin
trans-1,2-DCE		122	5	0.05				122	5	0.05		
	1	0.0013	0.0001		38	500	4.5	0.0011	0		45	Infin
VC		52	3	0.28				52	3	0.28		
	1	0.0006	0		457	Infin	4.5	0.0004	0		700	Infin
Toluene		157	94	183				157	94	183		
	1	0.0017	0.001		107,647	183,000	4.5	0.0014	0.0008		130,714	228,750
Ethylbenzene		399	160	4570				399	160	4570		
	1	0.0043	0.0017		1,062,791	2,688,235	4.5	0.0034	0.0014		1,344,118	3,264,286
Xylenes		1644	813	320				1644	813	320		
	1	0.0179	0.0088		17,877	36,364	4.5	0.0142	0.007		22,535	45,714

Notes:

<sup>1</sup>Table is based on information presented in Table 4-2 in *Draft Remedial Investigation Report, Capital Industries Site, Seattle, Washington* prepared by Environmental Consulting Services Inc. in June 2005.

FR UCLC = Field Results Upper Confidence Limit Soil Vapor Concentration ( $\mu\text{g}/\text{m}^3$ )

SC UCLC = Summa Canister Results Upper Confidence Limit Soil Vapor Concentration ( $\mu\text{g}/\text{m}^3$ )

CUL = MCTA Method B indoor air cleanup action limit ( $\mu\text{g}/\text{m}^3$ )

**Table 2**  
**Reconnaissance Borings Used for Tier 1 and Tier 2 Building Vapor Intrusion Assessment**  
**Vapor Intrusion Assessment Work Plan**  
**Capital Industries**  
**Seattle, Washington**  
**Farallon PN: 457-004**

<b>Reconnaissance Boring ID<sup>1</sup></b>	<b>Building Name<sup>1</sup></b>	<b>Street Address</b>
<b>Proposed Reconnaissance Borings</b>		
B6	Olympic Medical Building	5900 1st Avenue South
B7	Olympic Medical Building	5900 1st Avenue South
B8	Beckwith and Kuffel Building	5930 1st Avenue South
B9	Beckwith and Kuffel Building/Multi-Tenant Warehouse	5930 1st Avenue South/5960 1st Avenue South
B10	Fray Equipment Company and others	5903 1st Avenue South/5940 East Marginal Way S.
B11	Fray Equipment Company and others	5903 1st Avenue South/5940 East Marginal Way S.
B12	Mobile Crane Company	5917 4th Avenue South
B13	Mobile Crane Company	5917 4th Avenue South
B14	Gull Industries Building	5901 4th Avenue South
B15	Gull Industries Building	5901 4th Avenue South
B16	Commercial Buildings along 4th Avenue South	5801, 5807, and 5815 4th Avenue South
B17	Capital Plant 3 and 4	5801 3rd Avenue South
<b>Conditional Reconnaissance Borings</b>		
B19	Pacific Lamp Supply/Buckner Weatherby Building	5935 4th Avenue South/5935 4th Avenue South
B20	B & OI	5990 1st Avenue South
B21	Multi-Tenant Warehouse	5960 1st Avenue South

Notes:

<sup>1</sup>Reconnaissance boring locations and the locations of buildings are presented on Figure 3.

**APPENDIX A**  
**IPIM ACTION LEVELS**

**VAPOR INTRUSION ASSESSMENT WORK PLAN**

Capital Industries, Inc.  
5801 Third Avenue South  
Seattle, Washington

Farallon PN: 457-004

Table 2-2 – Indoor Air and Groundwater IPIMALs for Residential and Commercial Scenarios

COPC	Residential Air IPIMAL (ug/m³)		Commercial Air IPIMAL (ug/m³)		Residential Groundwater¹ IPIMAL (ug/L)		Commercial Groundwater¹ IPIMAL (ug/L)		Inhalation Reference Dose (mg/kg-day)		Inhalation Slope Factor (mg/kg-day)⁻¹	
	Cancer	Noncancer	Cancer	Noncancer	Cancer	Noncancer	Cancer	Noncancer				
1,1,1-trichloroethane	--	1.0E+02	--	4.3E+02	--	1.1E+03	--	4.7E+03	6.3E-01	⁴	--	⁸
1,1-dichloroethane	--	2.3E+01	--	9.7E+01	--	7.5E+02	--	3.2E+03	1.4E-01	²	--	⁸
1,1-dichloroethylene	--	9.1E+00	--	3.9E+01	--	5.3E+01	--	2.3E+02	5.7E-02	³	--	⁸
1,2,4-trimethylbenzene	--	2.7E-01	--	1.2E+00	--	1.3E+01	--	5.5E+01	1.7E-03	⁴	--	⁹
1,2-dichloroethane	7.8E-02	2.2E-01	2.2E-01	9.5E-01	1.0E+01	3.0E+01	3.0E+01	1.3E+02	1.4E-03	⁴	9.1E-02	³
1,3,5-trimethylbenzene	--	2.7E-01	--	1.2E+00	--	9.8E+00	--	4.2E+01	1.7E-03	⁴	--	⁹
2-hexanone	--	8.0E-01	--	3.4E+00	--	6.1E+02	--	2.6E+03	5.0E-03	⁴	--	⁹
Benzene	2.6E-01	1.4E+00	7.5E-01	5.8E+00	7.8E+00	4.1E+01	2.2E+01	1.7E+02	8.6E-03	³	2.7E-02	³
Chloroethane	--	4.6E+02	--	1.9E+03	--	5.4E+03	--	2.3E+04	2.9E+00	³	--	⁹
Chloroform	8.8E-02	2.2E+00	2.5E-01	9.5E+00	3.3E+00	8.5E+01	9.6E+00	3.6E+02	1.4E-02	⁵	8.1E-02	³
Cis-1,2-dichloroethylene	--	1.6E+00	--	6.8E+00	--	7.3E+01	--	3.1E+02	1.0E-02	⁶	--	⁹
Ethylbenzene	--	4.6E+01	--	1.9E+02	--	1.3E+03	--	5.4E+03	2.9E-01	³	--	⁹
Naphthalene	--	1.4E-01	--	5.8E-01	--	5.9E+01	--	2.5E+02	8.6E-04	³	--	⁹
P-isopropyltoluene	--	1.8E+01	--	7.8E+01	--	7.5E+01	--	3.2E+02	1.1E-01	⁶	--	⁹
Propylbenzene	--	1.6E+00	--	6.8E+00	--	2.7E+01	--	1.1E+02	1.0E-02	⁶	--	⁹
Sec-butylbenzene	--	1.6E+00	--	6.8E+00	--	2.3E+01	--	9.9E+01	1.0E-02	⁶	--	⁹
Tetrachloroethylene	3.4E-01	2.7E+01	9.7E-01	1.2E+02	4.0E+00	3.3E+02	1.2E+01	1.4E+03	1.7E-01	⁴	2.1E-02	⁷
Toluene	--	1.8E+01	--	7.8E+01	--	5.0E+02	--	2.1E+03	1.1E-01	³	--	⁹
Trans-1,2-dichloroethylene	--	3.2E+00	--	1.4E+01	--	6.5E+01	--	2.8E+02	2.0E-02	⁶	--	⁹
Trichloroethylene	2.0E-02	1.6E+00	5.0E-02	6.8E+00	4.0E-01	3.0E+01	9.0E-01	1.3E+02	1.0E-02	⁴	4.0E-01	⁴
Vinyl Chloride	2.3E-01	4.6E+00	6.6E-01	1.9E+01	1.0E+00	2.1E+01	3.0E+00	8.8E+01	2.9E-02	³	3.1E-02	³

Notes:

= No toxicity value was available. Therefore, an IPIMAL could not be calculated.

The IPIMALs presented in this table are based on the Preliminary Remedial Action Levels (PRALs) presented in the HHERA (PSC, 2001) and do not take into account multipathway or multiconstituent exposures, impacts to ecological receptors, migration from soil to groundwater, or background concentrations of COPCs.

The HHERA PRALs were developed using the following target risk goals for individual COPCs:

Cancer Risk (CR) = 1E-06

Hazard Quotient (HQ) = 0.1

OPC – Constituent of Potential Concern

IPIMAL – Inhalation Pathway Interim Measure Action Level

Calculated using the Maximum GIVF for 1,1-DCE per IPIM Tech Memo 1.

HEAST2 (Table 2), 1997.

RIS (1st Quarter), 2005.

NCEA.

NCEA value provided by Marcia Bailey.

ITV – IPIMAL Surrogate Toxicity Value.

Email from M. Bailey of USEPA 06/17/03.

Email from M. Bailey of USEPA 09/18/02.

No Value on IRIS 05, HEAST 97, or NCEA.