

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final 2/5/99

RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA725)

Current Human Exposures Under Control

Facility Name: Philip Services (Burlington Environmental) - Georgetown
Facility Address: 734 S. Lucille St., Seattle, WA.
Facility EPA ID #: WAD 00081 2909

- 1. Has all available relevant/significant information on known and reasonably suspected releases to soil, groundwater, surface water/sediments, and air, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been considered in this EI determination?

X	If yes - check here and continue with #2 below
	If no - check here and re-evaluate existing data, or
	If data are not available - check here and skip to #6. Enter "IN" (more information needed) status code

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of "Current Human Exposures Under Control" EI

A positive "Current Human Exposures Under Control" EI determination ("YE" status code) indicates that there are no "unacceptable" human exposures to "contamination" (i.e., contaminants in concentrations in excess of appropriate risk-based levels) that can be reasonably expected under current land- and groundwater-use conditions (for all "contamination" subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Current Human Exposures Under Control" EI are for reasonably expected human exposures under current land- and groundwater-use conditions ONLY, and do not consider potential future land- or groundwater-use conditions or ecological receptors. The RCRA Corrective Action program's overall mission to protect human health and the environment requires that Final remedies address these issues (i.e., potential future human exposure scenarios, future land and groundwater uses, and ecological receptors).

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

2. Are groundwater, soil, surface water, sediments, or air **media** known or reasonably suspected to be “contaminated”¹ above appropriately protective risk-based “levels” (applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action (from SWMUs, RUs or AOCs)?

media	Yes	No	?	Rationale/COCs
Groundwater	X			The shallow and intermediate aquifers are contaminated above Preliminary Remediation Goals (PRGs)/Maximum Contaminant Levels (MCLs). Contaminants of concern (COCs) include vinyl chloride and trichloroethene (TCE). Vinyl chloride concentrations have been detected in the 1000s of ppb range. Other COCs: BTEX (benzene, toluene, ethylbenzene, and xylenes), 1-4 dioxane, dichloroethenes (DCEs), metals, other semi-volatile organic compounds (SVOCs).
Air (indoors) ¹	X			Has been assessed, and risks are unacceptable in some locations. COCs include TCE and vinyl chloride. Indoor air contaminant attribution is often unclear. Mitigations have been installed where risks were deemed unacceptable.
Surface Soil (e.g., <2 ft)	X			Primarily on the facility property, although some contamination has been found to the immediate east. The facility area is presently covered with concrete or asphalt. The area to the east is industrial (train yard). COCs include chlorinated organics, BTEX constituents, metals, PCBs, etc. Levels of some of these COCs significantly exceed Region 9 PRGs. Levels off-site (to the east) exceed cleanup levels established to protect groundwater quality.
Surface Water (SW)		X		It is unknown at this point if releases from the Georgetown facility have impacted the Duwamish River above PRGs. However, this is unlikely. Groundwater sampling near the river has indicated that contamination has at least migrated to within a few hundred feet of the Duwamish River, but PSC's contribution to this measured contamination appears to be below levels of concern. <u>Future</u> impacts to the river will be assessed further in the 2005 Feasibility Study (FS) Reports.
Sediments		X		(see SW comments above; it is unlikely that sediments have been unacceptably contaminated by VOCs in PSC releases)
Subsurf. Soil (e.g., >2 ft)	X			(see surface soil comments above)
Air (outdoors)		X		We have assumed that soil gases releasing to the ambient air have not contributed sufficient mass of COCs to exceed ambient air PRGs.

<p>If no (for all media) – check here and skip to #6. Enter “YE,” status code after providing or citing appropriate “levels,” and referencing sufficient supporting documentation demonstrating that these “levels” are not exceeded.</p>

¹ Recent evidence (from the Colorado Dept. of Public Health and Environment, and others) suggests that unacceptable indoor air concentrations are more common in structures above groundwater with volatile contaminants than previously believed. This is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration necessary to be reasonably certain that indoor air (in structures located above (and adjacent to) groundwater with volatile contaminants) does not present unacceptable risks.

X	If yes (for any media) – check here and continue after identifying key contaminants in each “contaminated” medium, citing appropriate “levels” (or provide an explanation for the determination that the medium could pose an unacceptable risk), and referencing supporting documentation.
	If unknown (for any media) – check here and skip to #6. Enter “IN” status code.

Rationale and Reference(s): Soils, soil gas, indoor air, and groundwater are contaminated with volatile organic compounds (VOCs) and other contaminants of potential concern. About thirty groundwater COPCs are at levels in excess of EPA Region 9 PRGs or drinking water MCLs. This information is available in the approved Remedial Investigation (RI) Report and associated Addenda. Information contained in multiple Technical Memoranda (discussing the results of supplemental characterization sampling and vapor intrusion assessment) augment the RI material. There is also a draft Feasibility Study (FS) Report and three FS technical memoranda that contain environmental data and analysis.

Indoor air has been contaminated with groundwater VOCs (TCE in particular) via vapor intrusion, and approximately 30 interim mitigation measures, intended to protect occupants from intruding soil gas, have been implemented to reduce risks to human receptors. About two dozen buildings overlying contaminated groundwater have been assessed via indoor air sampling; the vast majority were found to not require mitigation. Almost all buildings potentially at risk have been assessed. Un-mitigated buildings continue to be evaluated quarterly by comparison of groundwater concentrations to target levels.

Groundwater contamination has been detected close to the Duwamish Waterway, downgradient of the facility, but it is likely that the source of the contamination is primarily from local properties, not PSC. Waterway impacts from discharging groundwater contamination, due to PSC facility releases, will be evaluated further in the 2006 FS technical memoranda.

3. Are there **complete pathways** between “contamination” and human receptors such that exposures can be reasonably expected under the current (land- and groundwater-use) conditions?

Summary Exposure Pathway Evaluation Table

Potential **Human Receptors** (Under Current Conditions)

<u>“Contaminated” Media</u>	Residents	Workers	Day-Care	Construction	Trespassers	Recreation	Food ²
Groundwater		—	—	<u>X</u>			
Air (indoors)	<u>X</u>	<u>X</u>	<u>?</u>				
Soil (surface, e.g., <2 ft)	—	<u>X</u>	—	<u>X</u>	<u>X</u>	—	—
Surface Water		—			—	<u>X</u>	<u>X</u>
Sediment		—			—	<u>X</u>	<u>X</u>
Soil (subsurface e.g., >2 ft)				<u>X</u>			—
Air (outdoors)	—	—	—		—		

Instructions for Summary Exposure Pathway Evaluation Table:

1. Strike-out specific Media including Human Receptors’ spaces for Media which are not “contaminated” as identified in #2 above.
2. enter “yes” or “no” for potential “completeness” under each “Contaminated” Media -- Human Receptor combination (Pathway).

² Indirect Pathway/Receptor (e.g., vegetables, fruits, crops, meat and dairy products, fish, shellfish, etc.)

Note: In order to focus the evaluation to the most probable combinations some potential "Contaminated" Media - Human Receptor combinations (Pathways) do not have check spaces ("___"). While these combinations may not be probable in most situations they may be possible in some settings and should be added as necessary.

	If no (pathways are not complete for any contaminated media-receptor combination), check here and skip to #6. Enter "YES" status code, after explaining and/or referencing condition(s).
X	If yes (pathways are complete for any "Contaminated" Media - Human Receptor combination) – check here and continue after providing supporting explanation.
	If unknown (for any "Contaminated" Media - Human Receptor combination) – check here and skip to #6. Enter "IN" status code.

Rationale and Reference(s):

- Indoor air: Residences and businesses lie above shallow groundwater plumes contaminated with VOCs. Shallow groundwater is sufficiently contaminated to pose a potential indoor air inhalation risk (via vapor intrusion). Risks to human receptors from indoor air contamination are being evaluated quarterly and mitigation measures have been installed.
 - Groundwater: If construction workers dig as deep as the water table (8-10' bgs), they would encounter groundwater and could become exposed. PSC has notified utility companies in the affected area, and has controls in place on their own property to minimize the occurrence of such a scenario.
 - Surface soil: Soils are contaminated below the cover/cap on PSC property, and to the east on Union Pacific (UP) property. Any workers accessing the PSC property (the facility is now closed; there is only one building on site and this is used exclusively for storage) would be protected by the cover/cap unless they dug beneath it. Such an activity would be controlled by PSC and conducted per their health and safety plan (H&SP). Workers on UP property could contact exposed contaminated soils in places, although most of the area is paved (covered). UP workers digging beneath the cover must (now) protect themselves per UP's H&SP, although there is no legal mechanism in place yet to require this or to ensure that the plan is sufficiently protective.
 - There are measured concentrations of contaminants in groundwater near the Duwamish Waterway, and it is possible that the levels are associated with an unacceptable current risk via the "food pathway." But, it is likely that most of these concentrations are contributed from other sources in the more local area. The impact of PSC-sourced groundwater contaminants discharging to the Waterway will be further evaluated in the 2006 FS technical memoranda.
 - Subsurface soils: As noted above, soils are contaminated below the cover/cap on PSC property, and to the east on UP property. Any workers accessing the PSC facility could contact contaminated soils if they dug beneath the cap/cover. Such an activity would be controlled by PSC and conducted per their H&SP. UP workers digging beneath the cover would similarly be protected if they adhered to a UP H&SP (although there is no legal mechanism in place to require this). There is one on-site building above soils potentially contaminated with VOCs on UP property, but it is very "open" and unlikely to be impacted unacceptably by vapor intrusion. Subsurface soil contamination on UP property could, however, act as a source of shallow groundwater contamination.
4. Can the **exposures** from any of the complete pathways identified in #3 be reasonably expected to be "**significant**"³ (i.e., potentially "unacceptable" because exposures can be reasonably expected to be: 1) greater in magnitude (intensity, frequency and/or duration) than assumed in the derivation of the acceptable "levels" (used to identify the "contamination"); or 2) the combination of exposure magnitude (perhaps even though low) and contaminant concentrations (which may be substantially above the acceptable "levels") could result in greater than acceptable risks)?

³ If there is any question on whether the identified exposures are "significant" (i.e., potentially "unacceptable") consult a human health Risk Assessment specialist with appropriate education, training and experience.

	If no (exposures can not be reasonably expected to be significant (i.e., potentially “unacceptable”) for any complete exposure pathway) – check here and skip to #6. Enter “YE” status code after explaining and/or referencing documentation.
X	If yes (exposures could be reasonably expected to be “significant” (i.e., potentially “unacceptable”) for any complete exposure pathway) – check here and continue after providing a description of each potentially “unacceptable” exposure pathway and explaining and/or justifying why the exposures (from each of the complete pathways) to “contamination” may be significant/unacceptable.
	If unknown – check here.

Rationale and Reference(s): As explained above, groundwater is unacceptably contaminated and residences and businesses lie above the plume. Groundwater contamination has extended about 0.75 mile, approaching the Duwamish Waterway. The Georgetown area is zoned industrial, and no private domestic wells have been identified between the facility and the Waterway. In 2004 PSC installed a subsurface barrier wall around their facility, effectively “corralling” groundwater contamination in the shallow and intermediate aquifers.

- **Indoor air:** Shallow groundwater is sufficiently contaminated to pose a potential indoor air inhalation risk (via vapor intrusion). Risks to human receptors from indoor air contamination are being evaluated quarterly and about 30 mitigation measures have been installed to date. Indoor air at about 20 buildings was assessed and ¾ were found to have acceptable levels of VOCs. The only buildings still needing assessment are those whose owners will not allow access, or those located in an area where PSC believes the VI source is due to releases from another source.
Per the PSC IPIM process (the process for selecting which buildings require indoor air sampling, and from that information, which need mitigation), any buildings where the potential for vapor intrusion is deemed unacceptable will be mitigated if the source of the intrusion is groundwater contaminated by the PSC facility. It is possible that some additional buildings will need such mitigation in the future.
- **Groundwater:** it is unlikely that direct contact with contaminated groundwater will be frequent enough to lead to unacceptable exposures.
- **Surface soil:** soils are contaminated, but covered for the most part. It is unlikely that direct contact with any contaminated surface soils will be frequent enough to lead to unacceptable exposures.
- **Subsurface soils:** soils are contaminated, but mostly covered by asphalt or concrete. It is unlikely that direct contact with any contaminated subsurface soils will be frequent enough to lead to unacceptable exposures. Soils are sufficiently contaminated to pose a threat to underlying groundwater, but: a) most areas are covered/capped, which will minimize infiltration; b) the PSC facility is encircled by a subsurface barrier wall, which prevents the migration of shallow and intermediate groundwater contamination; and, c) soils on UP property are almost a mile from the river and contaminants do not appear to be concentrated enough to pose a threat to human health by contaminating fish in the river (i.e., soil contamination can cause groundwater contamination which can eventually cause surface water contamination which can contaminate the fish that live in that surface water. If people eat the fish they will also ingest the contamination. But concentrations do not appear to be high enough in UP soils to cause enough groundwater contamination that the river could be unacceptably impacted.) Soils on UP property could contaminate underlying groundwater which could then threaten downgradient buildings via vapor intrusion.
- **Surface water and sediments:** Concentrations of contaminants have been measured in groundwater near the Duwamish Waterway, and it is possible that the levels are associated with an unacceptable current risk via the “food pathway.” But, it is likely that most of this contamination is contributed by other sources in the more local area.

5. Can the “significant” exposures (identified in #4) be shown to be within acceptable limits?

YE	If yes (all “significant” exposures have been shown to be within acceptable limits) – check here and continue. Enter “YE” after summarizing and referencing documentation justifying why all
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	“significant” exposures to “contamination” are within acceptable limits (e.g., a site -specific Human Health Risk Assessment).
	If no (there are current exposures that can be reasonably expected to be “unacceptable”)-check here and continue. Enter “NO” status code after providing a description of each potentially unacceptable exposure.
	If unknown – check here.

Rationale and Reference(s): As noted above, (1) groundwater is not a current source of drinking water, and (2) contaminated on-site soils are covered. However, off-site soils and soil gas (above contaminated shallow groundwater) are contaminated, and groundwater COC levels approaching the Duwamish River exceed state SW CULs.

- Indoor air: In accordance with PSC’s IPIM process, any buildings where the potential for vapor intrusion is deemed unacceptable will be mitigated if the source of the intruding VOCs is groundwater contaminated by the PSC facility. Mitigations are triggered by exceedances of acceptable indoor air concentrations calculated using the most conservative end of the “new” TCE slope factor range. PSC has already mitigated 30 buildings, even though a number of these were situated in areas where the groundwater contamination was the result of releases from multiple sources (i.e., properties besides their own facility).
Not all buildings needing assessment have been sampled yet. In most cases this is due to difficulties obtaining access from the building owner. It is possible, therefore, that one or more of the buildings still needing assessment will require mitigation in the future (i.e., will have unacceptable impacts and the source of the groundwater contamination will be the PSC facility). It can be reasonably expected, however, that vapor intrusion is no longer leading to unacceptable levels of indoor air COCs in almost all buildings, and every residence where the owner has allowed PSC to mitigate.
- Subsurface soils: Soils are sufficiently contaminated to pose a threat to underlying groundwater, but: a) most areas are covered/capped, which will minimize infiltration; b) the PSC facility itself is encircled by a subsurface barrier wall, preventing the further migration of shallow and intermediate groundwater contamination “behind” the wall; and, c) soils on UP property are almost a mile from the river and contaminants do not appear to be concentrated enough to pose a threat to human health by contaminating edible fish in the river. Soils on UP property could contaminate underlying groundwater which could then threaten downgradient buildings via vapor intrusion. However, the IPIM process is in place to ensure that such a scenario, should it lead in the future to VOC levels in groundwater high enough to pose a vapor intrusion threat, will be detected and mitigation implemented if necessary. PSC will be evaluating options for addressing the soil contamination on UP property in upcoming FS technical memoranda (soils were sampled most recently the week of August 29, 2005).
- Surface water and sediments: There are measurable concentrations of contaminants in groundwater near the Duwamish Waterway, and it is possible, though unlikely, that the levels are associated with an unacceptable current risk via the “food pathway.” Most of the detected contamination, however, appears to be contributed by other, more local sources.

6. Check the appropriate RCRIS status codes for the Current Human Exposures Under Control EI event code (CA725), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (and attach appropriate supporting documentation as well as a map of the facility):

YE	YE, “Current Human Exposures Under Control” has been verified. Based on a review of the information contained in this EI Determination, “Current Human Exposures” are expected to be “Under Control” at the PSC-GT facility under current and reasonably expected conditions. This determination will be re-evaluated when the State becomes aware of significant changes at the facility.
	NO – “Current Human Exposures” are not “under control.”
	IN – More info needed.

Completed by	(signature)	<i>E Jones</i>	Date	8/1/2006
	(print)	Ed Jones		
	(title)	Environmental Engineer		

Supervisor	(signature)	<i>Julie Sellick</i>	Date	8/4/06
	(print)	Julie Sellick		
	(title)			

	(WA State Dept of Ecology)		
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Locations where References may be found:
Washington Department of Ecology, Northwest Regional Office 3190 160 th Ave. SE Bellevue, WA
Georgetown Gospel Chapel Repository 6606 Carleton Ave. S. Seattle, WA
EPA Region 10 1200 Sixth Ave. Seattle, WA

Contact telephone and e-mail number

(name)	Bill Carroll Philip Services Corp
(phone #)	(425)227-6149
(e-mail)	BCarroll@contactpsc.com

FINAL NOTE: THE HUMAN EXPOSURES EI IS A QUALITATIVE SCREENING OF EXPOSURES AND THE DETERMINATIONS WITHIN THIS DOCUMENT SHOULD NOT BE USED AS THE SOLE BASIS FOR RESTRICTING THE SCOPE OF MORE DETAILED (E.G., SITE-SPECIFIC) ASSESSMENTS OF RI

DOCUMENTATION OF ENVIRONMENTAL INDICATOR DETERMINATION

Interim Final

2/5/99

**RCRA Corrective Action
Environmental Indicator (EI) RCRIS code (CA750)**

Migration of Contaminated Groundwater Under Control

Facility Name: Philip Services Corp (Burlington Environmental) -
Georgetown
Facility Address: 734 Lucile St., Seattle, WA
Facility EPA ID #: WAD 00081 2909

- 1) Has all available relevant/significant information on known and reasonably suspected releases to the groundwater media, subject to RCRA Corrective Action (e.g., from Solid Waste Management Units (SWMU), Regulated Units (RU), and Areas of Concern (AOC)), been **considered** in this EI determination?

<input checked="" type="checkbox"/>	If Yes – check here
<input type="checkbox"/>	If No – check here and re-evaluate existing data
<input type="checkbox"/>	If data are not available – check here and skip to #6 and enter “IN”

BACKGROUND

Definition of Environmental Indicators (for the RCRA Corrective Action)

Environmental Indicators (EI) are measures being used by the RCRA Corrective Action program to go beyond programmatic activity measures (e.g., reports received and approved, etc.) to track changes in the quality of the environment. The two EI developed to-date indicate the quality of the environment in relation to current human exposures to contamination and the migration of contaminated groundwater. An EI for non-human (ecological) receptors is intended to be developed in the future.

Definition of “Migration of Contaminated Groundwater Under Control” EI

A positive “Migration of Contaminated Groundwater Under Control” EI determination (“YE” status code) indicates that the migration of “contaminated” groundwater has stabilized, and that monitoring will be conducted to confirm that contaminated groundwater remains within the original “area of contaminated groundwater” (for all groundwater “contamination” subject to RCRA corrective action at or from the identified facility (i.e., site-wide)).

Relationship of EI to Final Remedies

While Final remedies remain the long-term objective of the RCRA Corrective Action program the EI are near-term objectives which are currently being used as Program measures for the Government Performance and Results Act of 1993, GPRA). The "Migration of Contaminated Groundwater Under Control" EI pertains ONLY to the physical migration (i.e., further spread) of contaminated ground water and contaminants within groundwater (e.g., non-aqueous phase liquids or NAPLs). Achieving this EI does not substitute for achieving other stabilization or final remedy requirements and expectations associated with sources of contamination and the need to restore, wherever practicable, contaminated groundwater to be suitable for its designated current and future uses.

Duration / Applicability of EI Determinations

EI Determinations status codes should remain in RCRIS national database ONLY as long as they remain true (i.e., RCRIS status codes must be changed when the regulatory authorities become aware of contrary information).

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- 2) Is **groundwater** known or reasonably suspected to be **“contaminated”**¹ above appropriately protective “levels” (i.e., applicable promulgated standards, as well as other appropriate standards, guidelines, guidance, or criteria) from releases subject to RCRA Corrective Action, anywhere at, or from, the facility?

X	If yes – check here and continue after identifying key COCs, citing appropriate “levels”, and referencing supporting documentation
	If no – check here and skip to #8. Enter “TE” status code
	If unknown – check here and skip to #8. Enter “IN” status code.

Rationale and Reference(s): Shallow and intermediate zone groundwater has over 30 hazardous compounds, which exceed state cleanup levels established for protecting indoor air quality (via vapor intrusion) and surface water (Duwamish River). Many of these compounds are also present at levels exceeding state drinking water cleanup levels and/or MCLs, but groundwater in the affected area is not used for this purpose.

References: November 2003 Remedial Investigation Report (RI Report), September 2005 draft Feasibility Study (FS) Report, numerous RI/FS Technical Memoranda (beginning in 2001), and quarterly groundwater monitoring reports.

¹ “Contamination” and “contaminated” describes media containing contaminants (in any form, NAPL and/or dissolved, vapors, or solids, that are subject to RCRA) in concentrations in excess of appropriate “levels” (appropriate for the protection of the groundwater resource and its beneficial uses).

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- 3) Has the **migration** of contaminated groundwater **stabilized** (such that contaminated groundwater is expected to remain within “existing area of contaminated groundwater”² as defined by the monitoring locations designated at the time of this determination)?

X	If yes – check here and continue, after presenting or referencing the physical evidence (e.g., groundwater sampling/measurement/migration barrier) and rationale ² .
	If no (contaminated groundwater is observed or expected to migrate beyond the designated locations defining the “existing area of groundwater contamination” ²) – check here and skip to #8, entering “NO” status code
	If unknown – check here and skip to #8. Enter “IN” status code.

Rationale and Reference(s): The extent of downgradient groundwater contamination at the site was unknown until early 2001. Since that time monitoring wells were installed (mid-2002) and sampled quarterly. A subsurface barrier wall, encircling the facility, was constructed in late 2003/early 2004. In 2005 it became apparent that other sources of groundwater contamination have added to shallow TCE levels measured west of 4th Ave. S.

COC levels in downgradient groundwater have not appeared to change significantly since mid-2002 and ‘sentry’ wells have, for the most part, not indicated increasing COC levels. Concentrations of COCs at points approaching discharge to the Duwamish River are generally acceptable (one point, in the northern part of the plume, has been shown to have significant vinyl chloride contamination. The PSC facility’s contribution to this contamination, however, is assumed to be relatively minor).

It appears that completion of the barrier wall has lowered COC concentrations in the immediate vicinity of the facility, and in many cases concentrations in this area have dropped significantly. The September 2005 draft FS Report and subsequent FS Technical Memoranda (1-5) have estimated the degree/likelihood of plume stabilization. It is reasonable to conclude at this time that contamination due only to releases at the PSC

² “existing area of contaminated groundwater” is an area (with horizontal and vertical dimensions) that has been verifiably demonstrated to contain all relevant groundwater contamination for this determination, and is defined by designated (monitoring) locations proximate to the outer perimeter of “contamination” that can and will be sampled/tested in the future to physically verify that all “contaminated” groundwater remains within this area, and that the further migration of “contaminated” groundwater is not occurring. Reasonable allowances in the proximity of the monitoring locations are permissible to incorporate formal remedy decisions (i.e., including public participation) allowing a limited area for natural attenuation.

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facility has *stabilized*.

- 4) Does “contaminated” groundwater **discharge** into **surface water** bodies?

X	If yes - continue after identifying potentially affected surface water bodies.
	If no - skip to #7 (and enter a “YE” status code in #8, if #7 = yes) after providing an explanation and/or referencing documentation supporting that groundwater “contamination” does not enter surface water bodies.
	If unknown - skip to #8 and enter “IN” status code.

Rationale and References:

Groundwater discharges to the Duwamish River.

- 5) Is the **discharge** of “contaminated” groundwater into surface water likely to be “**insignificant**” (i.e., the maximum concentration³ of each contaminant discharging into surface water is less than 10 times their appropriate groundwater “level,” and there are no other conditions (e.g., the nature, and number, of discharging contaminants, or environmental setting), which significantly increase the potential for unacceptable impacts to surface water, sediments, or eco-systems at these concentrations)?

	If yes - skip to #7 (and enter “YE” status code in #8 if #7 = yes), after documenting: 1) the maximum known or reasonably suspected concentration ³ of <u>key</u> contaminants discharged above their groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) provide a statement of professional judgment/explanation (or reference documentation) supporting that the discharge of groundwater contaminants into the surface water is not anticipated to have unacceptable impacts to the receiving surface water, sediments, or eco-system.
X	If no - (the discharge of “contaminated” groundwater into surface water is potentially significant) - continue after documenting: 1) the maximum known or reasonably suspected concentration ³ of <u>each</u> contaminant discharged above its groundwater “level,” the value of the appropriate “level(s),” and if there is evidence that the concentrations are increasing; and 2) for any contaminants discharging into surface water in concentrations ³ greater than 100 times their appropriate groundwater “levels,” the estimated total amount (mass in kg/yr) of each of these contaminants that are being discharged (loaded) into the surface water body (at the

³ As measured in groundwater prior to entry to the groundwater-surface water/sediment interaction (e.g., hyporheic) zone.

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	time of the determination), and identify if there is evidence that the amount of discharging contaminants is increasing.
	If unknown - enter "TN" status code in #8.

Rationale and Reference(s):

The 2003 RI Report and its 2004 Addenda, the September 2005 draft FS Report, and subsequent FS Technical Memoranda (1-5) have focused on the downgradient groundwater "plume" and the degree of threat to the river. In the downgradient area there are several COCs that exceed their surface-water cleanup levels (e.g., TCE, vinyl chloride, 1,4-dioxane, some metals). So the discharge of "contaminated" groundwater into surface water is potentially significant.

However, the river is ¼ of a mile from the facility and few COCs exceed these cleanup levels at the point of discharge. Where a COC – such as vinyl chloride – exceeds surface water cleanup levels in groundwater near the river, it is unlikely that releases from the PSC facility contribute significantly to the total concentrations.

It is also the case that these cleanup levels assume no dilution. That is, they are the levels that would be unacceptable if found in surface water. It is likely that concentrations in surface water (which have not been determined through sampling), due only to contaminant contributions from groundwater, are less than discharging groundwater concentrations (due to dilution effects).

- 6) Can the **discharge** of "contaminated" groundwater into surface water be shown to be "**currently acceptable**" (i.e., not cause impacts to surface water, sediments or eco-systems that should not be allowed to continue until a final remedy decision can be made and implemented⁴)?

X	If yes - continue after either: 1) identifying the Final Remedy decision incorporating these conditions, or other site-specific criteria (developed for the protection of the site's surface water, sediments, and eco-systems), and referencing supporting documentation demonstrating that these criteria are not exceeded by the discharging groundwater; OR 2) providing or referencing an interim-assessment, ⁵ appropriate to the potential for
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⁴ Note, because areas of inflowing groundwater can be critical habitats (e.g., nurseries or thermal refugia) for many species, appropriate specialist (e.g., ecologist) should be included in management decisions that could eliminate these areas by significantly altering or reversing groundwater flow pathways near surface water bodies

⁵ The understanding of the impacts of contaminated groundwater discharges into surface water bodies is a rapidly developing field and reviewers are encouraged to look to the latest guidance for the appropriate methods and scale of demonstration to be reasonably certain that discharges are not causing currently unacceptable impacts to the

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	<p>impact, that shows the discharge of groundwater contaminants into the surface water is (in the opinion of a trained specialists, including ecologist) adequately protective of receiving surface water, sediments, and eco-systems, until such time when a full assessment and final remedy decision can be made. Factors which should be considered in the interim-assessment (where appropriate to help identify the impact associated with discharging groundwater) include: surface water body size, flow, use/classification/habitats and contaminant loading limits, other sources of surface water/sediment contamination, surface water and sediment sample results and comparisons to available and appropriate surface water and sediment "levels," as well as any other factors, such as effects on ecological receptors (e.g., via bio-assays/benthic surveys or site-specific ecological Risk Assessments), that the overseeing regulatory agency would deem appropriate for making the EI determination.</p>
	<p>If no - (the discharge of "contaminated" groundwater can not be shown to be "currently acceptable") - skip to #8 and enter "NO" status code, after documenting the currently unacceptable impacts to the surface water body, sediments, and/or eco-systems.</p>
	<p>If unknown - skip to 8 and enter "IN" status code.</p>

Rationale and Reference(s):

Potential routes of exposure to contaminants once they have migrated to the river include:

- contacting surface water or sediments contaminated by GW discharges. Receptors include off-site fishermen and recreational receptors.
- ingesting fish/shellfish contaminated by contacting surface water/sediments, contaminated by groundwater discharges. Receptors include off-site fishermen, and individuals obtaining fish/shellfish from these fishermen (including residents).

Significant areas between the facility and river exceed cleanup levels based on protecting such receptors. However, it is unclear exactly how much of the groundwater contaminant concentrations entering the Duwamish Waterway is contributed solely by PSC.

No actions have been implemented, or are planned, to prevent ingestion of Duwamish fish through the use of ICs (signs, e.g.). Nevertheless, current levels of vinyl chloride and perhaps other COCs in groundwater are above their state surface water cleanup levels where groundwater discharges to the river. It is possible that contributions from PSC-facility releases may be responsible for adding to their contaminant levels.

surface waters, sediments or eco-systems.

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However, Ecology has previously concluded that current contaminant levels at the groundwater/surface water interface – likely to have been contributed by the PSC facility -- are not leading to unacceptable human health risks. It remains unlikely that risks/hazards associated with this exposure (contact/ingestion) pathway exceed MTCA thresholds.

Based on the COC concentrations seen in the downgradient monitoring well network, there appears to be a stabilized “plume” in the sense that concentrations per well either do not seem to be changing much or are dropping, and contaminant levels in wells at the boundaries of the plume do not seem to significantly increasing. No Final Remedy decision has been developed yet for the site, but it is anticipated that the future cleanup action plan will be consistent with this hypothesis.

As noted above, PSC’s 2003 RI Report and its 2004 Addenda, the September 2005 draft FS Report, subsequent FS Technical Memoranda (1-5), and Ecology responses to these documents discuss groundwater contamination and the nature of its threat to surface water. Essentially, the conclusion that has been reached is that:

- groundwater discharging to the river downgradient of the facility has contaminants
- some of the contaminants in groundwater exceed their surface water cleanup levels (based on a 1E-6 human health risk)
- some of these contaminants are the same contaminants found in upgradient groundwater, presumably resulting from a PSC-facility release
- there are other (than PSC) documented sources in the area that have contributed to the groundwater contamination
- it is likely that, for those contaminants in groundwater exceeding their surface water cleanup levels at the discharge point, PSC facility releases have only contributed a fraction of the contaminant mass
- it is likely that, for those contaminants in groundwater exceeding their surface water cleanup levels at the discharge point, after discharge to the river the impact on human health due to PSC facility releases is acceptable (utilizing EPA’s E.I. 1E-5 risk basis)

It is possible that in the future this determination may need to be modified. There is a great deal of uncertainty associated with vinyl chloride degradation. Though the concentrations of vinyl chloride at monitoring wells have been relatively stable, it is unknown how much natural attenuation of the compound is likely to take place from 1st/2nd Avenues S to the river, a distance of over 1000 feet. There is also uncertainty about how much dilution and dispersion can be expected to keep 1,4-dioxane levels below surface water cleanup levels at the discharge point. Ecology and PSC are currently trying to decide if a dioxane mass-reduction cleanup action is needed to more confidently reduce downgradient concentrations.

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We have assumed that the groundwater contamination -- associated with PSC -- discharging to the river is primarily a water column concern (i.e., that we can ignore impacts to sediments). But we have only a poor idea of how contamination, carried by GW to the river, affects the water column and the ecological receptors inhabiting or passing through the water column. In the future, improved knowledge of the fate of chlorinated VOCs and dioxane once discharged to this river may require re-visiting our surface water cleanup levels for the site.

We do not know at this time if the surface water cleanup levels we have been applying will be protective of tribal consumers of Duwamish fish. Although the levels have been modified to be protective of local API fish ingestion, it is anticipated that native American fish ingestion rates may be high enough to require further modification of the levels. This will not be known until the Duwamish River Superfund Site has performed a risk assessment to derive protective site-specific surface water cleanup levels.

- 7) Will groundwater **monitoring** / measurement data (and surface water/sediment/ecological data, as necessary) be collected in the future to verify that contaminated groundwater has remained within the horizontal (or vertical, as necessary) dimensions of the "existing area of contaminated groundwater?"

X	If yes - continue after providing or citing documentation for planned activities or future sampling/measurement events. Specifically identify the well/measurement locations which will be tested in the future to verify the expectation (identified in #3) that groundwater contamination will not be migrating horizontally (or vertically, as necessary) beyond the "existing area of groundwater contamination."
	If no - enter "NO" status code in #8.
	If unknown - enter "IN" status code in #8.

Rationale and Reference(s):

Groundwater monitoring is currently being performed and will be performed in the future as long as COCs remain above cleanup levels. Currently, the wells being monitoring are identified in the PSC "Pre-Corrective Action Monitoring Program Plan." The Plan will be modified once the final remedy is established in a Cleanup Action Plan (2007/2008).

Groundwater monitoring is also currently being performed downgradient of PSC by three companies where TCE releases have contaminated groundwater.

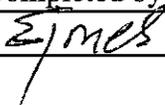
However, it should also be recognized that: a) presently there is little ability to monitor groundwater very close to the river (between Slip 2 Lucile St.), and b) although

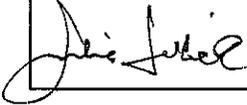
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monitoring is in place and will continue, questions about PSC's contributions to concentrations measured west of 4th Ave. S. remain, and will continue to complicate plume stability determinations.

- 8) Check the appropriate RCRIS status codes for the Migration of Contaminated Groundwater Under Control EI (event code CA750), and obtain Supervisor (or appropriate Manager) signature and date on the EI determination below (attach appropriate supporting documentation as well as a map of the facility).

YE	YE - Yes, "Migration of Contaminated Groundwater Under Control" has been verified. Based on a review of the information contained in this EI determination, it has been determined that the "Migration of Contaminated Groundwater" is "Under Control" at the PSC-Georgetown facility, EPA/Ecology ID# WAD 00081 2909. It is likely that plume spread is being controlled by PSC's barrier wall and to a large extent "naturally," through natural attenuation and other loss mechanisms.
	NO - Unacceptable migration of contaminated groundwater is observed or expected.
	IN - More information is needed to make a determination.

Completed by:			Date
	(signature)	Ed Jones	8/24/07
	(title)	Environmental Engineer, Ecology	

Supervisor			Date
	(signature)	Julie Sellick	
	(title)	Supervisor Northwest Regional Office Hazardous Waste and Toxics Reduction Program	8/29/07

Locations where References may be found: Washington Department of Ecology Northwest Regional Office 3190 160 th Ave. SE

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Locations where References may be found:
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