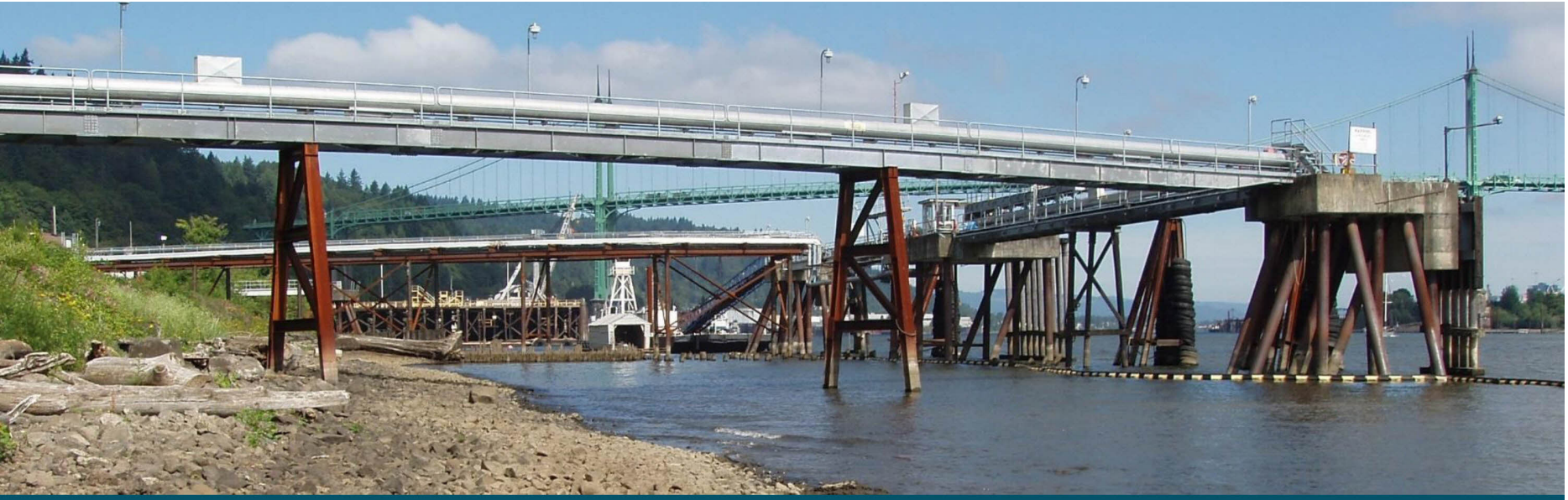


Former Gasco Manufactured Gas Plant Operable Unit Feasibility Study: PICs and PRGs

ANCHOR QEA

June 30, 2020

Preliminary Discussion Document | Do Not Quote or Cite

Meeting Objectives

- Verify use of terms and associated definitions
- Discuss overview of COCs
- Discuss overall FS process
- Discuss and resolve list of PICs and PRGs*

* PRGs are draft cleanup levels for regulatory approval, become CULs once approved by DEQ

Terms and Definitions

- **Contaminants of concern (COCs)**
  - Contaminant of concern with detected concentrations above screening levels
- **Principal indicator compounds (PICs)**
  - Subset of COCs representing greatest magnitude and extent of site risk and encompassing areas of impact of all other COCs
- **Preliminary remediation goals (PRGs)**
  - Numeric criteria developed for PICs, draft cleanup levels for regulatory approval, become **cleanup levels (CULs)** once approved by DEQ
- **Remedial action levels (RALs)**
  - Concentrations that define areas of active remedy

Agenda

- Overview of Process
  - FS milestones to date and next steps
  - Development and use of COCs, PICs, PRGs, CULs, and RALs in the Gasco Upland FS
- Evaluation of additional PICs proposed by DEQ in IFS comments
- Recommended PICs for PRG development

Overview of Process

FS Progress to Date and Next Steps

- FS Milestones to date
  - Final HERA (December 2014)
  - AO Amendment (October 2016)
    - Allen Tract included in Gasco OU
  - Draft IFS (November 2018)
    - DEQ comments (August 2019); RTC submitted (May 2020)
  - Draft RI/HERA Addendum (November 2019)
- Recommended next steps (streamlined schedule)
  - Develop PRGs/PRG reconciliation (October 2020)
  - Fill FS data gaps (March 2021)
  - Complete technology screening and approach for technology assignments (March 2021)
  - Initiate FS (April 2021)

Overview of Process

COCs: Contaminants of concern with detected concentrations above SLs

HERA (2014); HERA Addendum (2019)

Reliable COCs: COCs suitable for guiding alternatives analysis and cleanup decisions

HERA (2014); HERA Addendum (2019); IFS (2018)

PICs: Subset of reliable COCs representing greatest magnitude and extent of site risk and encompassing areas of impact of all other reliable COCs

IFS (2018)

PRGs: Numeric criteria developed for PICs, become **CULs** once approved by DEQ*

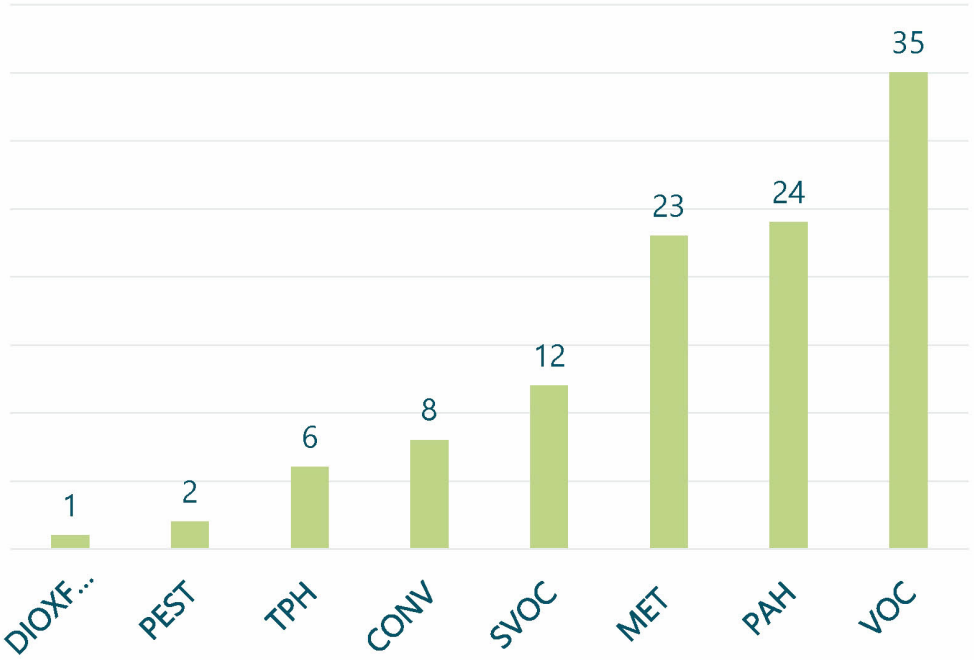
PRG Memo (2020)

RALs: Concentrations that define areas of active remedy

Draft FS Report (2022)

* The control of risks associated with other reliable COCs will be addressed quantitatively or qualitatively in the residual risk assessment for the selected remedial alternative.

~100 COCs Exceed Risk Screening Levels

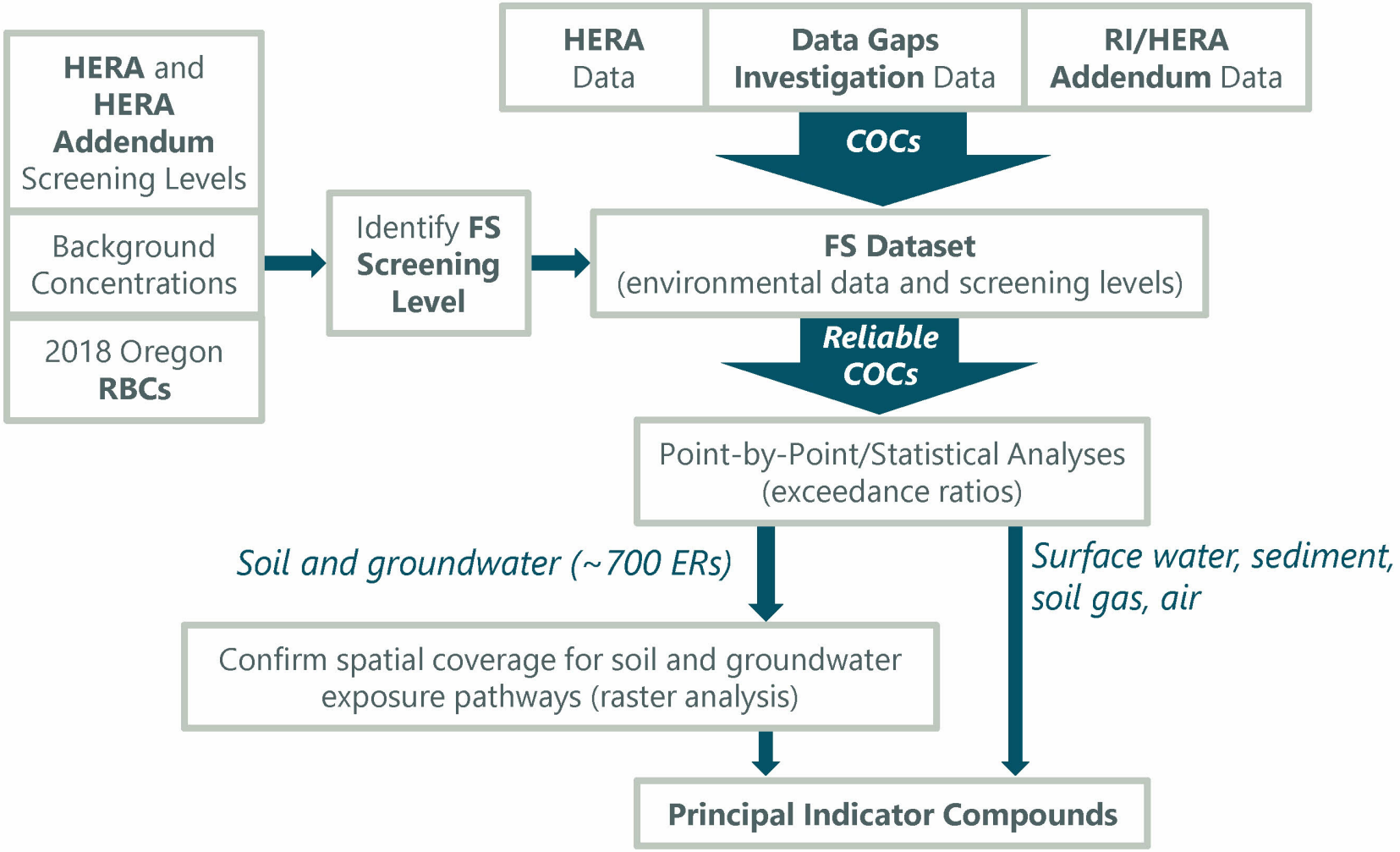


- Table 1 of DEQ's May 22, 2015, letter approving the Gasco Site HERA Report
- Table 11-1 of the Draft RI/HERA Addendum Report (2019)

COCs: Contaminant of concern with detected concentration above screening levels

Reliable COCs: COCs suitable for guiding alternatives analysis and cleanup decisions

FS Dataset Screening and PIC Selection



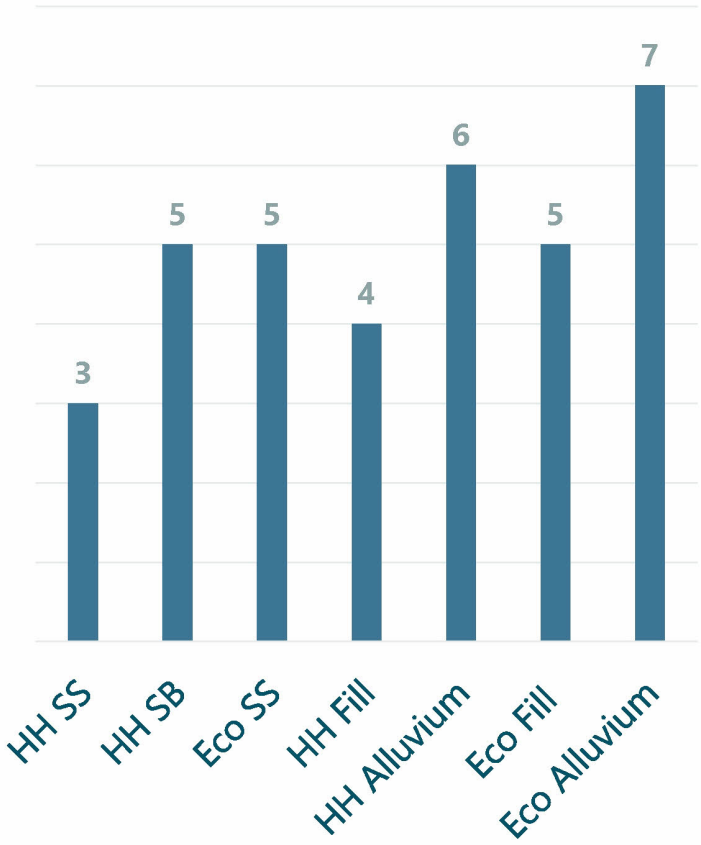
NWN-PCI0781880

PIC Selection Criteria

- Represent the key risk drivers
  - Point-by-point statistical analysis
  - Maximum ER for each sample
  - Highest magnitudes and frequencies of exceedance
- Spatially bound all other COCs (GIS raster analysis)
  - GIS-based raster interpolations
  - Calculate maximum ER at any point on site
  - Define the maximum footprint of impacted soil or groundwater
- Provide representation of major chemical groups that contribute significantly to site-wide risk

PICs: Subset of Reliable COCs representing greatest magnitude and extent of site risk and encompassing areas of impact of all other reliable COCs

Current PIC List: 35 NW Natural PICs



Exposure Pathway	NW Natural PICs
Surface Soil – HH	Total cPAH, naphthalene, TPH
Subsurface Soil – HH	Total cPAH, TPH, naphthalene, cyanide, benzene
Surface Soil – Eco	Total HPAH, antimony, lead, nickel, zinc
Fill WBZ – HH	Naphthalene, benzene, 1-methylnaphthalene, TCE
Alluvium WBZ – HH	Naphthalene, benzene, vinyl chloride, TCE, available cyanide, benzo(a)anthracene
Fill WBZ – Eco	Benzo(a)pyrene, benzo(a)anthracene, indeno(1,2,3-c,d)pyrene, BTEX, available cyanide
Alluvium WBZ – Eco	Benzo(a)pyrene, benzo(a)anthracene, naphthalene, zinc, lead, BTEX, available cyanide

PRG Guidance

- Development of Remediation Goals Under CERCLA (USDOE 1997)
  - "PRGs should be developed for **principal threat chemicals**, i.e., those chemicals that are major contributors to unacceptable cancer risks or non-cancer hazards."
  - "PRGs are refined into RGs during the course of the Remedial Investigation/Feasibility Study (RI/FS) process based on cost, technical feasibility, community acceptance, **uncertainty in the baseline risk assessment**, schedule, and other risk management considerations."

PRGs: Numeric criteria developed for PICs, become **CULs** once approved by DEQ

Recommended Approach for Developing Soil PRGs

- **Human Health Surface Soil:** Based on occupational worker direct contact RBCs from the HHRAs
- **Human Health Subsurface Soil:** Based on construction worker direct contact RBCs from the HHRAs
- **Ecological Soil:** Based on Los Alamos National Lab Ecological PRG methodology (2017)
  - Accepted federal method for developing ecological soil PRGs
  - Uses refined toxicity values and area-use factors
  - Designed to avoid unnecessary habitat destruction associated with overly protective remediation goals

PRGs: Numeric criteria developed for PICs, become **CULs** once approved by DEQ

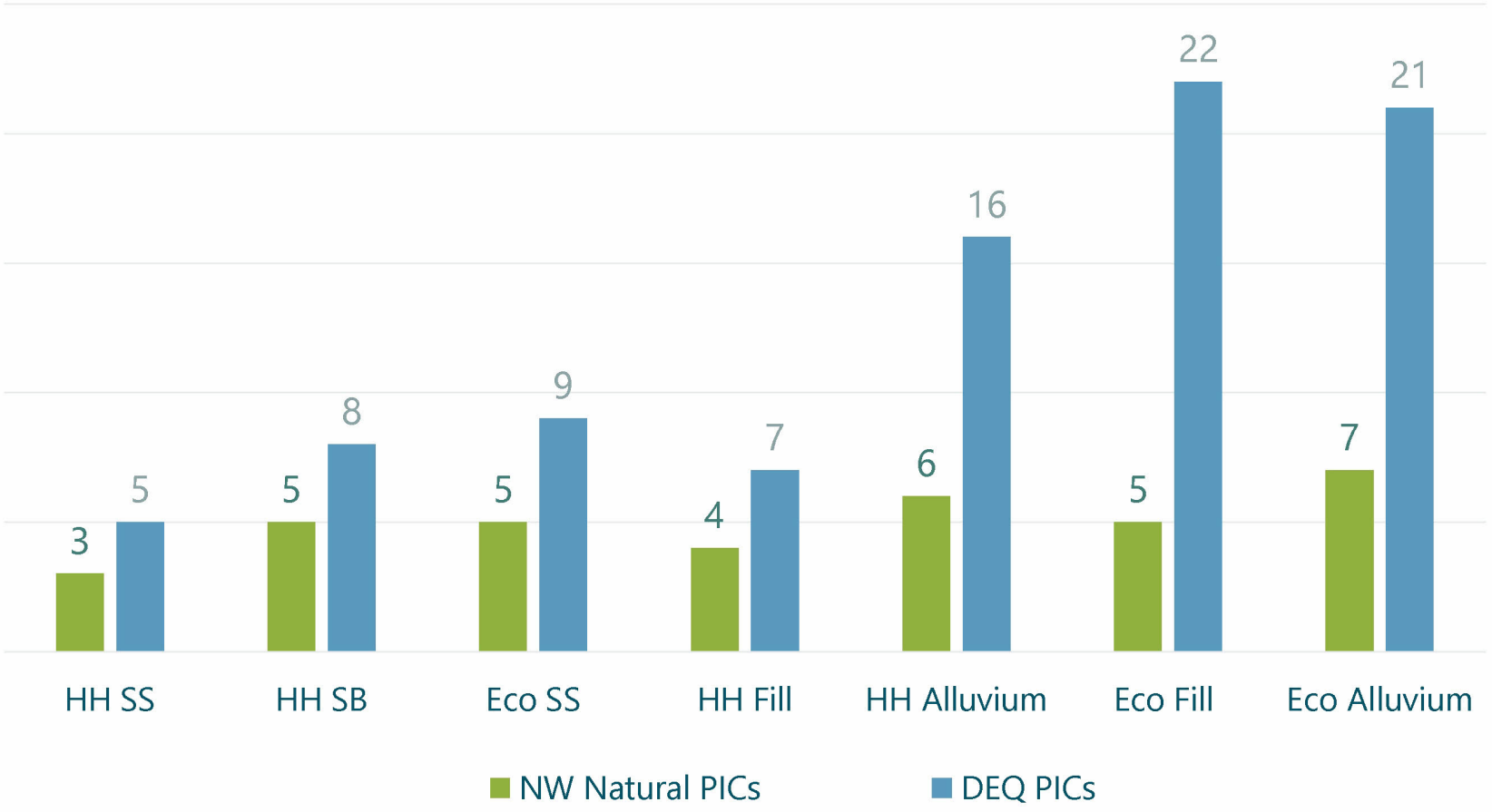
Approach for Developing Groundwater PRGs

- **HH Fill WBZ PRGs:** Construction/excavation worker RBCs
- **HH Alluvium WBZ PRGs:** Occupational worker dermal and inhalation exposure scenario RBCs
- **Eco Fill and Alluvium WBZ (Aquatic Life) PRGs:** Portland Harbor ROD Table 17 groundwater CULs/PRGs (January 2020 Errata No. 2 Revision).
- **Eco Fill WBZ (Riverbank Wildlife) PRGs:** Remedial action to address the riverbank was selected by EPA in the Portland Harbor ROD and is being designed under the EPA consent order (included due to DEQ IFS comment requesting inclusion of this pathway in IFS)

PRGs: Numeric criteria developed for PICs, become **CULs** once approved by DEQ

Evaluation of Additional PICs Proposed by DEQ in IFS Comments

NW Natural Identified 35 PICs, DEQ Added 53



Escalation of Unique PIC Counts

			All Pathways	GW to SW Pathway[2]	Not in Table 17[3]
COCs[1]	HERA/HERA Addendum 2014/2019		~100	90	61
PICs[1]	DEQ	Nov. 2015 (FS planning meeting)[4]	16	9	2
	NW Natural	Nov. 2018 (IFS)	19	11	0
	DEQ	Aug. 2019 (IFS comments)	50	35	18

Notes:

1. Counts represent a sum of unique COCs and PICs within each category ("All Pathways," "GW to SW Pathway," and "Not in Table 17"), some of which are present in multiple pathways.
2. Includes Eco Fill WBZ and Eco Alluvium WBZ groundwater exposure pathways.
3. Number of PICs for Eco Fill WBZ and Eco Alluvium WBZ exposure pathways that are not listed in Table 17.
4. DEQ stated its expectation that numeric PRGs should be developed for the 16 preliminary indicator compounds identified by DEQ via email on November 2, 2015, for all pathways, media, and receptors (distributed meeting notes from FS Planning Meeting, November 16, 2016)

Concerns with DEQ's Additional PICs

- Concentrations of conventionals and metals below natural background in soil or groundwater
- Uncertain or unrepresentative screening levels
- Use of total metals susceptible to field artifacts
- Ecological COCs not retained as PRGs in Portland Harbor
- Weak exceedance ratios and frequencies (i.e., not primary risk drivers)
- Chemicals associated with injections or byproducts of the EIB system
- COCs derived from off-site sources that are not subject to NW Natural's Voluntary Agreement

Evaluation of PICs Proposed by DEQ

Defer to Portland Harbor for GW-to-SW Pathway

	HH SS	HH SB	Eco SS	HH Fill	HH Alluv.	Eco Fill	Eco Alluv.	Total (Sum)
DEQ Added PICs	2	3	4	3	10	3	4	29
Accept	2	2	2	2	4	3	4	19
Disagree	0	1	2	1	6	0	0	10

Retain DEQ PICs for GW-to-SW Pathway

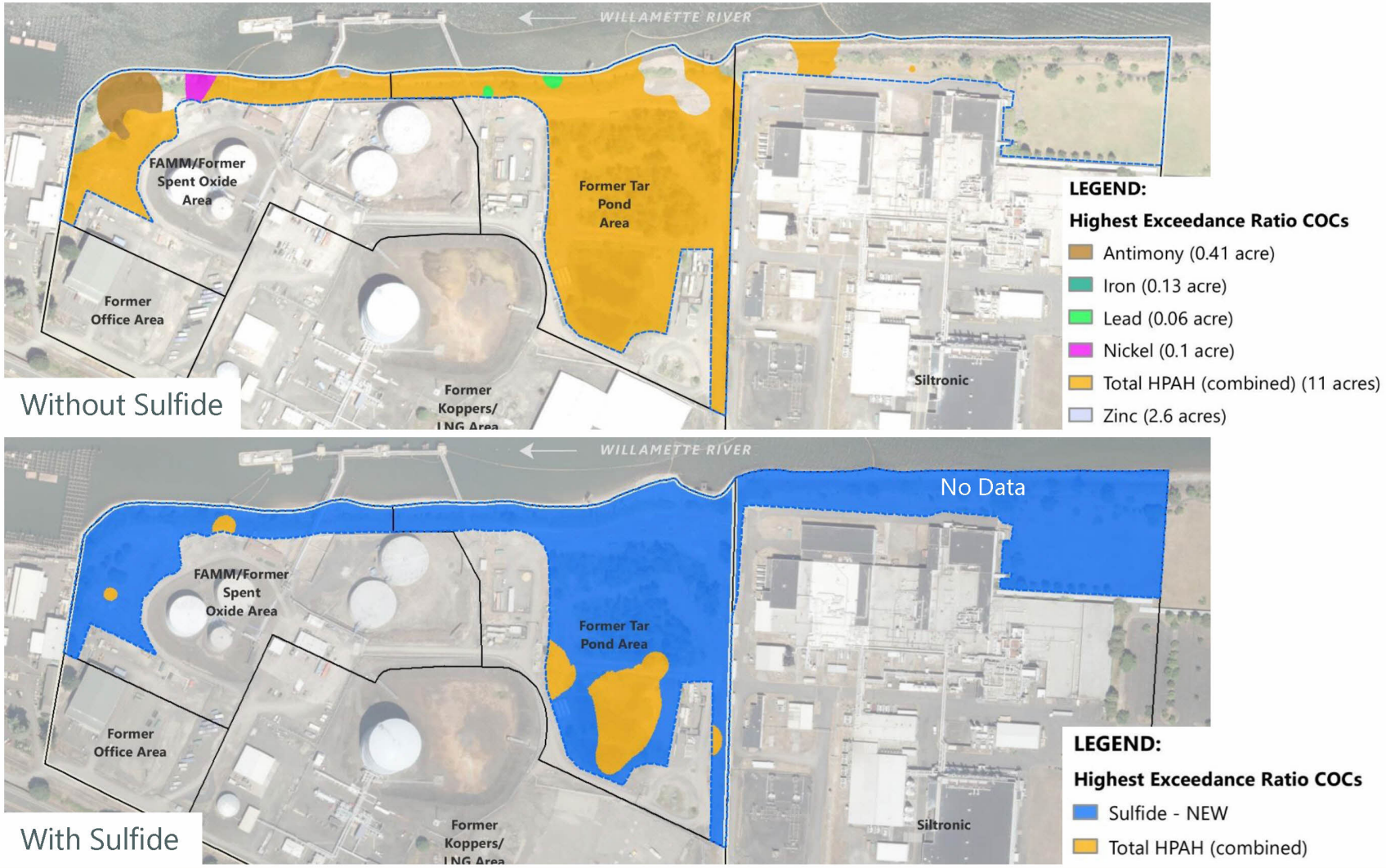
	HH SS	HH SB	Eco SS	HH Fill	HH Alluv.	Eco Fill	Eco Alluv.	Total (Sum)
DEQ Added PICs	2	3	4	3	10	17	14	53
Accept	2	2	2	2	4	3	4	19
Disagree	0	1	2	1	6	14	10	34

Recommended PICs List and Path Forward

Pathway	DEQ PIC	Evidence Against Selection
HH SB	Thallium	Max ER = 1.5, EF = 1/144, natural background
Eco SS	**Cyanide***	**Uncertain SL with 300x bias, Max ER = 10**
	Sulfide*	**Uncertain and inappropriate SL with extreme bias, common crustal element, redox sensitive, associated with EIB**
HH Fill WBZ	Carbazole	Uncertain SL (dibenzofuran surrogate), Portland Harbor COC not retained for PRG, EF = 2/50
HH Alluvium WBZ	Carbazole	See HH Fill WBZ; EF = 1/54
	Phosphorus	Likely associated with EIB; common crustal element; groundwater background
	PCP	1/32 detections; does not meet COC threshold of 5% detection in DEQ HHRA guidance (2010)
	Dioxin/Furan*	**Nondetect bias >1,000x, off-site source excluded by DEQ Agreement**
	Arsenic, Total	Willamette Valley background; EF = 1/68; Max ER = 1.1; susceptible to field artifacts
	Manganese, Total	Natural background and common crustal element; susceptible to field artifacts; EF = 1/68 and irreproducible; associated with EIB
Discharge to Willamette River	**COIs not in ROD Table 17***	**EPA ROD, EPA to confirm sediment remediation addresses Table 16**

* Bold items are the chemicals of greatest concern to NW Natural.

Confounding Effects of Eco Soil Sulfide SL



Recommended PICs for PRG Development

Exposure Pathway	NW Natural PICs	Accepted DEQ Additional PICs
Surface Soil – HH	Total cPAH, naphthalene, TPH	Arsenic, benzene
Subsurface Soil – HH	Total cPAH, TPH, naphthalene, cyanide, benzene	Arsenic, lead
Surface Soil – Eco	Total HPAH, antimony, lead, nickel, zinc	Total LPAH, copper
Fill WBZ – HH	Naphthalene, benzene, 1-methylnaphthalene, TCE	2-methylnaphthalene, dibenzofuran
Alluvium WBZ – HH	Naphthalene, benzene, TCE, cyanide, vinyl chloride, benzo(a)anthracene	1-methylnaphthalene, dibenzofuran, hexachlorobutadiene, ethylbenzene
Fill WBZ – Eco[1]	Benzo(a)pyrene, benzo(a)anthracene, indeno(1,2,3-c,d)pyrene, BTEX, cyanide	Lead, other PAHs, C_{10-12} aliphatics
Alluvium WBZ – Eco[1]	Benzo(a)pyrene, benzo(a)anthracene, naphthalene, zinc, lead, BTEX, cyanide	Manganese, other PAHs, cis-1,2-DCE, TCE

Note:
1. Assumes DEQ is not requiring work that is duplicative or inconsistent with EPA's ROD or RD performed under EPA order.

Questions/Discussion