

Ecological PRG Table 3

Gasco OU Ecological Groundwater COCs and PRGs – Source Control

Upland to Willamette River Pathways

Gasco OU Ecological Groundwater Contaminants of Concern ¹	Analyte Group	Ecological Fill WBZ and/or Alluvium WBZ Groundwater COCs (Aquatic Life) ¹	Portland Harbor ROD Table 17 Groundwater CULs/PRGs ^{2,3} in µg/L
Cyanide, available	CONV	X	4
Cyanide, free	CONV	X	4
Cadmium	Metals	X	0.094
Chromium	Metals	X	11
Copper	Metals	X	2.74
Lead	Metals	X	0.54
Manganese	Metals	X	430
Vanadium	Metals	X	20
Zinc	Metals	X	36.5
2-Methylnaphthalene	PAH	X	2.1
Acenaphthene	PAH	X	23
Anthracene	PAH	X	0.73
Benzo(a)anthracene	PAH	X	0.0012
Benzo(a)pyrene	PAH	X	0.00012
Benzo(b)fluoranthene	PAH	X	0.0012
Benzo(g,h,i)perylene	PAH	X	0.4
Benzo(k)fluoranthene	PAH	X	0.0013
Chrysene	PAH	X	0.0013
Dibenzo(a,h)anthracene	PAH	X	0.00012
Fluoranthene	PAH	X	6.2
Fluorene	PAH	X	3.9
Indeno(1,2,3-c,d)pyrene	PAH	X	0.0012
Naphthalene	PAH	X	12
Phenanthrene	PAH	X	6.3
Pyrene	PAH	X	10
Total DDx	PEST	X	0.001
1,1-Dichloroethene	VOC	X	7
1,2-Dichloroethene, cis-	VOC	X	70
Benzene	VOC	X	0.44
Ethylbenzene	VOC	X	7.3
Toluene	VOC	X	9.8
Total Xylenes	VOC	X	13
Trichloroethene (TCE)	VOC	X	0.6
C10-C12 Aliphatic Hydrocarbons	TPH	X	2.6

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Upland to Willamette River Pathways

Notes:

1. COCs that have Groundwater Portland Harbor ROD Table 17 CULs/PRGs (EPA 2020) and have at least one exceedance ratio greater than 1 in groundwater at the Gasco OU.
2. Per Portland Harbor ROD Table 17, January 2020 Errata #2 (EPA 2020).
3. Source control PRGs per Wyatt 2023.

µg/L: microgram per liter	OU: operable unit
COC: contaminant of concern	PAH: polycyclic aromatic hydrocarbon
CONV: conventional	PEST: pesticide
CUL: cleanup level	PRG: preliminary remediation goal
DDD: dichlorodiphenyldichloroethane	ROD: Record of Decision
DDE: dichlorodiphenyldichloroethylene	TPH: total petroleum hydrocarbons
DDT: dichlorodiphenyltrichloroethane	VOC: volatile organic compound
DDx: sum of DDT, DDD, and DDE	WBZ: water-bearing zone

References:

EPA (U.S. Environmental Protection Agency), 2020. Errata #2 for Portland Harbor Superfund Site Record of Decision ROD Table 17. January 14, 2020.

Wyatt, Robert, 2023. Regarding: NWN Gasco. Email to: Hunter Young, Elizabeth McKenna, and Stephanie Ebright (U.S. Environmental Protection Agency); Wesley Thomas, Kevin Parrett, and Paul Seidel (Oregon Department of Environmental Quality); Patty Dost (Pearl Legal Group); Michael Zevenbergen (U.S. Department of Justice); and Gary Vrooman (Oregon Department of Justice). Attachment to email: "NW Natural's Framework for EPA Sediment Design and DEQ Source Control Measure FFS and IRAM Design." July 21, 2023

Ecological PRG Table 4

Gasco OU Ecological Groundwater COCs and PRGs – Hot Spot Evaluations

Upland to Willamette River Pathways

Gasco OU Ecological Groundwater Contaminants of Concern ¹	Analyte Group	Gasco OU Ecological Risk Assessments	Water Quality Standards		Portland Harbor ROD Table 17		DEQ PRGs			NW Natural IFS SLVs	Gasco OU FS Upland Groundwater Aquatic Life PRGs ⁵
		Ecological Fill WBZ and/or Alluvium WBZ Groundwater COCs (Aquatic Life) ¹	State and Federal Aquatic Life Water Quality Criteria ² in µg/L	Notes	Table 17 Groundwater CULs ³ in µg/L	Notes	DEQ Proposed Aquatic Life PRGs (DEQ 2020 and DEQ 2021) ⁴ in µg/L	Notes	DEQ Water RBCs: Narcosis (DEQ 2020, Table 2) ⁴ in µg/L	IFS SLVs (Anchor QEA 2018) ⁴ in µg/L	
Ammonia	CONV	X	1900	6	-	--	1,900	--	--	19	1,900
Cyanide, available	CONV	X	5.2	6	5.2	7	5.2	--	--	5.2	5.2
Cyanide, free	CONV	X	5.2	6	5.2	7	5.2	--	--	5.2	5.2
Sulfate	CONV	X	--	--	--	--	--	--	--	14,830	14,830
Sulfide	CONV	X	2	6	--	--	2	--	--	2	2
Aluminum	Metals	X	320	8	--	--	320	--	--	87	320
Antimony	Metals	X	--	--	--	--	190	--	--	30	190
Barium	Metals	X	--	--	--	--	220	--	--	4	220
Beryllium	Metals	X	--	--	--	--	11	--	--	0.66	11
Boron	Metals	X	--	--	--	--	7,200	--	--	1.6	7,200
Cadmium	Metals	X	0.094	6	0.094	--	0.094	--	--	0.094	0.094
Calcium	Metals	X	--	--	--	--	120,000	--	--	116,000	120,000
Chromium	Metals	X	24	6	11	--	24	9	--	24	24
Cobalt	Metals	X	--	--	--	--	19	--	--	23	19
Copper	Metals	X	1.4	6	2.74	--	1.4	9	--	2.74	1.4
Iron	Metals	X	1000	6	--	--	1,000	--	--	1,000	1,000
Lead	Metals	X	0.54	6	0.54	--	0.54	--	--	0.54	0.54
Magnesium	Metals	X	--	--	--	--	82,000	--	--	82,000	82,000
Manganese	Metals	X	--	--	1,433	7	93	9	--	120	1,433
Mercury	Metals	X	0.012	6	--	--	0.0013	9	--	0.77	0.012
Nickel	Metals	X	16	6	--	--	16	--	--	16.1	16
Selenium	Metals	X	4.6	6	--	--	4.6	--	--	5	4.6
Silver	Metals	X	0.1	6	--	--	0.1	--	--	0.36	0.1
Vanadium	Metals	X	--	--	20	--	27	--	--	20	20
Zinc	Metals	X	36	6	36.5	--	36	--	--	36.5	36
1-Methylnaphthalene	PAH	X	--	--	--	--	6.1	--	75	2.1	6.1
2-Methylnaphthalene	PAH	X	--	--	2.1	--	4.7	--	72	72.1	2.1
Acenaphthene	PAH	X	--	--	23	--	15	--	56	55.85	23
Acenaphthylene	PAH	X	--	--	--	--	13	--	310	307	13
Anthracene	PAH	X	--	--	0.73	--	0.02	--	21	0.73	0.73
Benzo(a)anthracene	PAH	X	--	--	0.03	7	2.2	--	2.2	0.027	0.03
Benzo(a)pyrene	PAH	X	--	--	0.01	7	0.06	--	0.96	0.014	0.01
Benzo(b)fluoranthene	PAH	X	--	--	0.7	7	0.68	--	0.68	0.677	0.7
Benzo(g,h,i)perylene	PAH	X	--	--	0.4	--	0.012	--	0.91	0.4391	0.4
Benzo(k)fluoranthene	PAH	X	--	--	0.6	7	0.06	--	0.64	0.6415	0.06

Ecological PRG Table 4

Gasco OU Ecological Groundwater COCs and PRGs – Hot Spot Evaluations

Upland to Willamette River Pathways

Gasco OU Ecological Groundwater Contaminants of Concern ¹	Analyte Group	Gasco OU Ecological Risk Assessments	Water Quality Standards		Portland Harbor ROD Table 17		DEQ PRGs			NW Natural IFS SLVs	Gasco OU FS Upland Groundwater Aquatic Life PRGs ⁵
		Ecological Fill WBZ and/or Alluvium WBZ Groundwater COCs (Aquatic Life) ¹	State and Federal Aquatic Life Water Quality Criteria ² in µg/L	Notes	Table 17 Groundwater CULs ³ in µg/L	Notes	DEQ Proposed Aquatic Life PRGs (DEQ 2020 and DEQ 2021) ⁴ in µg/L	Notes	DEQ Water RBCs: Narcosis (DEQ 2020, Table 2) ⁴ in µg/L	IFS SLVs (Anchor QEA 2018) ⁴ in µg/L	
Chrysene	PAH	X	--	--	2	7	2	--	2	2.042	2
Dibenzo(a,h)anthracene	PAH	X	--	--	0.3	7	0.012	--	0.28	0.2825	0.3
Fluoranthene	PAH	X	--	--	6.2	--	0.8	--	7.1	7.109	6.2
Fluorene	PAH	X	--	--	3.9	--	19	--	39	3.9	3.9
Indeno(1,2,3-c,d)pyrene	PAH	X	--	--	0.3	7	0.012	--	0.28	0.275	0.3
Naphthalene	PAH	X	--	--	12	--	21	--	190	12	12
Phenanthrene	PAH	X	--	--	6.3	--	2.3	--	19	19.13	6.3
Pyrene	PAH	X	--	--	10	--	4.6	--	10	10.11	10
Total PAH TU	PAH	X	--	--	--	--	TU = 1	--	--	TU = 1	TU = 1
4,4'-DDD (p,p'-DDD)	PEST	X	--	--	--	--	0.01	9	--	0.001	0.01
Total DDx	PEST	X	--	--	0.001	--	0.001	9	--	0.001	0.001
2-Methylphenol (o-Cresol)	SVOC	X	--	--	--	--	67	--	--	13	67
4-Methylphenol (p-Cresol)	SVOC	X	--	--	--	--	53	--	--	543	53
3,3'-Dichlorobenzidine	SVOC	X	--	--	--	--	4.5	--	--	4.5	4.5
Benzoic acid	SVOC	X	--	--	--	--	42	--	4,400	42	42
bis(2-Ethylhexyl)phthalate	SVOC	X	--	--	--	--	8	--	--	3	8
Carbazole	SVOC	X	--	--	--	--	4	--	--	3.7	4
Dibenzofuran	SVOC	X	--	--	--	--	4	--	61	3.7	4
Dimethyl phthalate	SVOC	X	--	--	--	--	1,100	--	3,300	3	1,100
Hexachlorobutadiene (Hexachloro-1,3-butadiene)	SVOC	X	--	--	--	--	1	--	--	1.3	1
Phenol	SVOC	X	--	--	--	--	160	--	--	4	160
Total phenols (unspecified)	SVOC	X	--	--	--	--	4	--	--	4	4
1,1-Dichloroethene	VOC	X	--	--	25	7	130	--	--	25	25
1,1-Dichloropropene	VOC	X	--	--	--	--	--	--	--	0.055	0.055
1,2,4-Trimethylbenzene	VOC	X	--	--	--	--	15	--	56	33	15
1,2-Dichlorobenzene	VOC	X	--	--	--	--	23	--	120	14	23
1,2-Dichloroethene, cis-	VOC	X	--	--	590	7	620	--	1,600	590	590
1,3,5-Trimethylbenzene (Mesitylene)	VOC	X	--	--	--	--	26	--	56	71	26
1,3-Dichloropropene, trans-	VOC	X	--	--	--	--	1.7	9	--	0.055	1.7
1,4-Dichlorobenzene	VOC	X	--	--	--	--	9.4	--	--	15	9.4
Acetic acid ¹⁰	VOC	X	--	--	--	--	470	--	--	470	--
Acetone	VOC	X	--	--	--	--	1,700	--	120,000	1,500	1,700
Acrolein	VOC	X	3	8	--	--	3	--	--	--	3
Benzene	VOC	X	--	--	130	7	160	--	2,200	130	130

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Upland to Willamette River Pathways

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		Ecological Fill WBZ and/or Alluvium WBZ Groundwater COCs (Aquatic Life) ¹	State and Federal Aquatic Life Water Quality Criteria ² in µg/L	Notes	Table 17 Groundwater CULs ³ in µg/L	Notes	DEQ Proposed Aquatic Life PRGs (DEQ 2020 and DEQ 2021) ⁴ in µg/L	Notes	DEQ Water RBCs: Narcosis (DEQ 2020, Table 2) ⁴ in µg/L	IFS SLVs (Anchor QEA 2018) ⁴ in µg/L	
Butyric acid ¹⁰	VOC	X	--	--	--	--	610	--	--	610	--
Carbon disulfide	VOC	X	--	--	--	--	15	--	--	0.92	15
Ethylbenzene	VOC	X	--	--	7.3	--	61	--	310	7.3	7.3
Isopropylbenzene (Cumene)	VOC	X	--	--	--	--	4.8	--	98	2.6	4.8
m,p-Xylene	VOC	X	--	--	--	--	27	9	--	13	27
n-Butylbenzene	VOC	X	--	--	--	--	7.3	--	--	7.3	7.3
o-Xylene	VOC	X	--	--	--	--	27	9	--	13	27
Propionic acid ¹⁰	VOC	X	--	--	--	--	500	--	--	500	--
sec-Butylbenzene	VOC	X	--	--	--	--	7.3	--	--	7.3	7.3
Styrene	VOC	X	--	--	--	--	32	--	410	72	32
Toluene	VOC	X	--	--	9.8	--	62	--	790	9.8	9.8
Total Xylenes	VOC	X	--	--	13	--	27	--	260	13	13
Trichloroethene (TCE)	VOC	X	--	--	47	7	220	--	760	47	47
Vinyl chloride	VOC	X	--	--	--	--	930	--	2,300	930	930
C6-C8 Aliphatic Hydrocarbons	TPH	X	--	--	--	--	54	9	--	54	54
C8-C10 Aliphatic Hydrocarbons	TPH	X	--	--	--	--	9.6	9	--	9.5	9.6
C8-C10 Aromatic Hydrocarbons	TPH	X	--	--	--	--	240	9	--	212	240
C10-C12 Aliphatic Hydrocarbons	TPH	X	--	--	2.6	--	2.6	9	--	2.6	2.6
C10-C12 Aromatic Hydrocarbons	TPH	X	--	--	--	--	79	9	--	1,000	79
TPH (Former Spent Oxide Area RA-1)	TPH	X	--	--	--	--	160	11	--	--	160
TPH (Former Lampblack Storage Area RA-2)	TPH	X	--	--	--	--	92	11	--	--	92
TPH (Former Lampblack Storage Area RA-2)	TPH	X	--	--	--	--	100	11	--	--	100
TPH (Former Koppers Land Disposal Area RA-4)	TPH	X	--	--	--	--	200	11	--	--	200
TPH (Former Naphthalene Plant Area RA-5)	TPH	X	--	--	--	--	1,200	11	--	--	1,200

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Gasco OU Ecological Groundwater COCs and PRGs – Hot Spot Evaluations

Upland to Willamette River Pathways

Notes:

1. COCs listed have at least one exceedance ratio greater than 1 in groundwater at the Gasco OU.
2. Groundwater hot spot criteria per OAR 340-122-0115 (51) (a)
3. Groundwater hot spot criteria per OAR 340-122-0115 (51) (b); Per January 2020 Errata #2 (EPA 2020). Groundwater CULs based on RAO 4 have been replaced by CULs based on RAO 8 (EPA 2016).
4. Groundwater hot spot criteria per OAR 340-122-0115 (51) (c)
5. Hot spot PRGs per Wyatt 2023: Hierarchy of hot spot criteria sources per OAR 340-122-0155 (51)
6. Oregon National Ambient Water Quality Criteria (AWQC): OAR 340-041-8033, Table 30, Aquatic Life Water Quality Criteria for Toxic Pollutants, 2019: Calculated AWQC per DEQ 2020 (Table 2)
7. RAO 8 based CULs per Portland Harbor FS Tables 2.2-2c and 2.2-2d (EPA 2016).
8. National Ambient Water Quality Criteria Recommended - Aquatic Life Criteria Table; available at <https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table>: Aluminum AWQC calculated with default values (pH=7, hardness = 25, and DOC = 1.25) using the calculator provided on <https://www.epa.gov/wqc/aquatic-life-criteria-aluminum>
9. Chronic aquatic life RBCs per DEQ Conducting Ecological Risk Assessments (DEQ 2020)
10. These analytes had exceedance ratios greater than 1, but DEQ has indicated that they do not consider these fatty acids to be groundwater COCs because they are likely associated with the EIB treatment at the Siltronic site (DEQ 2021).
11. Site-specific TPH RBCs will be applied consistent with the RI/HERA Addendum (Anchor QEA 2019) and as discussed and approved by DEQ on June 27, 2023.

-: COC not included in the PH ROD Table 17 for groundwater.

--: not applicable

µg/L: microgram per liter

AWQC: ambient water quality criteria

COC: contaminant of concern

CONV: conventional

CUL: cleanup level

DDD: dichlorodiphenyldichloroethane

DDE: dichlorodiphenyldichloroethylene

DDT: dichlorodiphenyltrichloroethane

DDx: sum of DDT, DDD, and DDE

DEQ: Oregon Department of Environmental Quality

EIB: enhanced in situ bioremediation

FS: feasibility study

IFS: *Interim Feasibility Study*

OAR: Oregon administrative rule

OU: operable unit

PAH: polycyclic aromatic hydrocarbon

PEST: pesticide

PH: Portland Harbor

PRG: preliminary remediation goal

RAO: remediation action objective

RBC: risk based concentration

RI/HERA Addendum: *Remedial Investigation/Human Health and Ecological Risk Assessment Addendum for the Siltronic GSA*

ROD: Record of Decision

Siltronic: Siltronic Corporation

SLV: screening level value

SVOC: semivolatile organic compound

TPH: total petroleum hydrocarbon

VOC: volatile organic compound

WBZ: water-bearing zone

References:

Anchor QEA (Anchor QEA, LLC), 2018. *Interim Feasibility Study*. Gasco OU. Prepared for NW Natural. November 21, 2018.

Anchor QEA, 2019. *Remedial Investigation/Human Health and Ecological Risk Assessment Addendum for the Siltronic GSA*. November 22, 2019

DEQ (Oregon Department of Environmental Quality), 2020. *Appendices for: Conducting Ecological Risk Assessments*. September 14, 2020.

DEQ, 2021. *Contaminants of Concern, Risk-Based Criteria, and Preliminary Remediation Goals; Former Gasco Manufactured Gas Plant Operable Unit*. December 16, 2021.

EPA (U.S. Environmental Protection Agency), 2016. *Feasibility Study; Portland Harbor RI/FS*. June 2016.

EPA, 2020. *Errata #2 for Portland Harbor Superfund Site Record of Decision ROD Table 17*. January 14, 2020.

Wyatt, Robert, 2023. Regarding: NWN Gasco. Email to: Hunter Young, Elizabeth McKenna, and Stephanie Ebright (U.S. Environmental Protection Agency); Wesley Thomas, Kevin Parrett, and Paul Seidel (Oregon Department of Environmental Quality); Patty Dost (Pearl Legal Group); Michael Zevenbergen (U.S. Department of Justice); and Gary Vrooman (Oregon Department of Justice). Attachment to email: "NW Natural's Framework for EPA Sediment Design and DEQ Source Control Measure FFS and IRAM Design."

July 21 2023

Ecological PRG Table 5
Gasco OU Ecological Riverbank Seep COCs and PRGs – Source Control
Upland to Willamette Riverbank Pathway

Gasco OU Ecological Fill WBZ Wildlife Groundwater Contaminants of Concern¹	Analyte Group	Ecological Fill WBZ Groundwater COCs (Wildlife)¹	Portland Harbor ROD Table 17 Surface Water CUL/PRGs^{2,3} in µg/L
Cyanide, available	CONV	X	--
Cyanide, free	CONV	X	--
Total Dioxin/Furan TEQ	DIOXFUR	X	5.10E-10
Aluminum	Metals	X	--
Vanadium	Metals	X	--
Benzo(a)pyrene	PAH	X	0.00012
Naphthalene	PAH	X	12
4,4'-DDD (p,p'-DDD)	PEST	X	--
Total DDx	PEST	X	0.01

Notes:

1. COCs listed have at least one exceedance ratio greater than 1 in Fill WBZ groundwater at the Gasco OU.
2. Per Portland Harbor ROD Table 17, January 2020 Errata #2 (EPA 2020).
3. Source control PRGs per Wyatt 2023.

--: not applicable

µg/L: microgram per liter

COC: contaminant of concern

CONV: conventional

CUL: cleanup level

DDD: dichlorodiphenyldichloroethane

DDE: dichlorodiphenyldichloroethylene

DDT: dichlorodiphenyltrichloroethane

DDx: sum of DDT, DDD, and DDE

DIOXFUR: dioxin/furan

OU: operable unit

PAH: polycyclic aromatic hydrocarbon

PEST: pesticide

PRG: preliminary remediation goal

ROD: Record of Decision

TEQ: toxic equivalents quotient

WBZ: water-bearing zone

References:

EPA (U.S. Environmental Protection Agency), 2020. Errata #2 for Portland Harbor Superfund Site Record of Decision ROD Table 17. January 14, 2020.

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