

Ecological PRG Table 1
Gasco OU Ecological Surface Soil COCs

| Gasco and Siltronic GSA(s) Ecological Surface Soil Contaminants of Concern ¹ | Analyte Group | Units | CAS No. | Gasco GSAs Ecological COCs – Bird | Gasco GSAs Ecological COCs – Mammal | Gasco GSAs Ecological COCs – Invertebrate | Gasco GSAs Ecological COCs – Plant | Siltronic GSA Ecological COCs – Bird ² | Siltronic GSA Ecological COCs – Mammal ² | Siltronic GSA Ecological COCs – Invertebrate ² | Siltronic GSA Ecological COCs – Plant ² | Notes |
|---|------------------|-------|------------|---|---|---|--|---|---|---|--|-------|
| Cyanide, total | CONV | mg/kg | 57-12-5 | -- | X | -- | -- | -- | X | -- | -- | 3 |
| Sulfide | CONV | mg/kg | 18496-25-8 | -- | X | -- | -- | -- | X | -- | -- | 3 |
| Aluminum | Metals | mg/kg | 7429-90-5 | -- | -- | -- | -- | -- | -- | -- | -- | 4 |
| Antimony | Metals | mg/kg | 7440-36-0 | -- | X | o | X | -- | X | o | o | |
| Arsenic | Metals | mg/kg | 7440-38-2 | o | o | o | X | o | o | o | o | |
| Cadmium | Metals | mg/kg | 7440-43-9 | o | X | o | o | o | X | o | o | |
| Chromium | Metals | mg/kg | 7440-47-3 | o | o | X | -- | o | o | X | -- | |
| Copper | Metals | mg/kg | 7440-50-8 | o | o | X | X | o | o | X | X | |
| Iron | Metals | mg/kg | 7439-89-6 | -- | -- | X | X | -- | -- | X | X | |
| Lead | Metals | mg/kg | 7439-92-1 | X | o | o | X | X | o | o | X | |
| Manganese | Metals | mg/kg | 7439-96-5 | -- | -- | -- | -- | -- | -- | -- | -- | 4 |
| Mercury | Metals | mg/kg | 7439-97-6 | o | o | X | X | o | o | X | o | |
| Nickel | Metals | mg/kg | 7440-02-0 | o | o | X | X | o | o | o | o | |
| Thallium | Metals | mg/kg | 7440-28-0 | -- | X | -- | X | -- | NT | -- | NT | |
| Vanadium | Metals | mg/kg | 7440-62-2 | o | o | -- | o | X | o | -- | X | |
| Zinc | Metals | mg/kg | 7440-66-6 | X | o | o | X | X | X | X | X | |
| 1-Methylnaphthalene | PAH | µg/kg | 90-12-0 | -- | X | X | -- | -- | o | o | -- | |
| 2-Methylnaphthalene | PAH | µg/kg | 91-57-6 | -- | X | X | -- | -- | o | o | -- | |
| Acenaphthene | PAH | µg/kg | 83-32-9 | -- | o | X | X | -- | o | o | o | |
| Acenaphthylene | PAH | µg/kg | 208-96-8 | -- | o | X | -- | -- | o | o | -- | |
| Anthracene | PAH | µg/kg | 120-12-7 | -- | X | X | -- | -- | o | o | -- | |
| Benz(a)anthracene | PAH | µg/kg | 56-55-3 | -- | X | X | -- | -- | o | o | -- | |
| Benzo(a)pyrene | PAH | µg/kg | 50-32-8 | -- | X | X | -- | -- | o | o | -- | |
| Benzo(b)fluoranthene | PAH | µg/kg | 205-99-2 | -- | X | X | -- | -- | o | o | -- | |
| Benzo(g,h,i)perylene | PAH | µg/kg | 191-24-2 | -- | X | X | -- | -- | o | o | -- | |
| Benzo(k)fluoranthene | PAH | µg/kg | 207-08-9 | -- | X | X | -- | -- | o | o | -- | |
| Chrysene | PAH | µg/kg | 218-01-9 | -- | X | X | -- | -- | o | o | -- | |
| Dibenz(a,h)anthracene | PAH | µg/kg | 53-70-3 | -- | X | X | -- | -- | o | o | -- | |
| Fluoranthene | PAH | µg/kg | 206-44-0 | -- | X | X | -- | -- | o | o | -- | |
| Fluorene | PAH | µg/kg | 86-73-7 | -- | o | X | -- | -- | o | o | -- | |
| Indeno(1,2,3-c,d)pyrene | PAH | µg/kg | 193-39-5 | -- | X | X | -- | -- | o | o | -- | |
| Naphthalene | PAH | µg/kg | 91-20-3 | -- | X | X | X | -- | o | o | o | |
| Phenanthrene | PAH | µg/kg | 85-01-8 | -- | X | X | -- | -- | o | o | -- | |
| Pyrene | PAH | µg/kg | 129-00-0 | -- | X | X | -- | -- | o | o | -- | |
| Total HPAH | PAH | µg/kg | -- | -- | X | X | -- | -- | X | X | -- | |
| Total LPAH | PAH | µg/kg | -- | -- | X | X | -- | -- | o | o | -- | |
| Ethylbenzene | VOC | µg/kg | 100-41-4 | -- | X | -- | -- | -- | o | -- | -- | |
| Total Xylene | VOC | µg/kg | 1330-20-7 | -- | o | -- | X | -- | o | -- | o | |
| Gasoline-range hydrocarbons | TPH | mg/kg | 8006-61-9 | -- | o | X | -- | -- | o | o | -- | |
| Diesel-range hydrocarbons | TPH | mg/kg | 68334-30-5 | -- | X | X | -- | -- | o | o | -- | |

Ecological PRG Table 1

Gasco OU Ecological Surface Soil COCs

Notes:

--: Not applicable

o: Contaminant analyzed in surface soil and determined to not be a COC.

X: Ecological COC for surface soil

1. COCs listed have at least one exceedance ratio greater than 1 in surface soil within ecological exposure areas of the Gasco OU.

2. The COCs identified for Doane Creek soils are a limited subset of COCs presented for the Siltronic GSA.

3. No PRG required by DEQ for this COC (DEQ 2021).

4. Metal determined to be at background concentration in soil at Gasco OU.

µg/kg: microgram per kilogram

CAS: Chemical Abstracts Service

COC: contaminant of concern

CONV: conventional

DEQ: Oregon Department of Environmental Quality

GSA: geographic subarea

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

LPAH: low-molecular-weight polycyclic aromatic hydrocarbon

mg/kg: milligram per kilogram

NT: not tested

OU: operable unit

PAH: polycyclic aromatic hydrocarbon

PRG: preliminary remediation goal

Siltronic: Siltronic Corporation

TPH: total petroleum hydrocarbons

VOC: volatile organic compound

Reference:

DEQ (Oregon Department of Environmental Quality), 2021. *Contaminants of Concern, Risk-Based Criteria, and Preliminary Remediation Goals; Former Gasco Manufacturing Gas Plant Operable Unit*. December 16, 2021.

Ecological PRG Table 2

Gasco OU Ecological Surface Soil PRGs

| Gasco and Siltronic GSA(s) Ecological Surface Soil Contaminants of Concern | Analyte Group | Units | CAS No. | Gasco OU Ecological PRGs – Bird ¹ | Gasco OU Ecological PRGs – Mammal ¹ | Gasco OU Ecological PRGs – Invertebrate ¹ | Gasco OUs Ecological PRGs – Plant ¹ | Portland Basin Background Value ² | Natural Background Value | Notes | Gasco OU Ecological Soil PRGs ⁶ | Gasco OU Ecological Soil Hot Spot Level ⁷ |
|--|------------------|-------|------------|---|---|---|--|---|-----------------------------|-------|---|---|
| Cyanide, total | CONV | mg/kg | 57-12-5 | -- | -- | -- | -- | -- | -- | 4 | -- | -- |
| Sulfide | CONV | mg/kg | 18496-25-8 | -- | -- | -- | -- | -- | -- | 4 | -- | -- |
| Aluminum | Metals | mg/kg | 7429-90-5 | -- | -- | -- | -- | -- | 52,300 ³ | 5 | -- | -- |
| Antimony | Metals | mg/kg | 7440-36-0 | -- | 2.7 | 78 | 11 | 0.56 | -- | -- | 2.7 | 27 |
| Arsenic | Metals | mg/kg | 7440-38-2 | 32 | 31 | 6.8 | 18 | 8.8 | -- | -- | 6.8 | 68 |
| Cadmium | Metals | mg/kg | 7440-43-9 | 1.6 | 4 | 140 | 32 | 0.63 | -- | -- | 1.6 | 16 |
| Chromium | Metals | mg/kg | 7440-47-3 | 73 | 1,600 | -- | -- | 76 | -- | -- | 73 | 730 |
| Copper | Metals | mg/kg | 7440-50-8 | 43 | 70 | 80 | 70 | 34 | -- | -- | 43 | 430 |
| Iron | Metals | mg/kg | 7439-89-6 | -- | -- | (200*); 36,100** | (10*); 36,100** | -- | 36,100 ³ | -- | 36,100 ⁸ | 100 ⁹ |
| Lead | Metals | mg/kg | 7439-92-1 | (23*); 79** | 170 | 1,700 | 120 | 79 | -- | -- | 79 | 230 |
| Manganese | Metals | mg/kg | 7439-96-5 | -- | -- | -- | -- | 1,800 | -- | 5 | -- | -- |
| Mercury | Metals | mg/kg | 7439-97-6 | (0.13*); 0.23** | 17 | 0.3 | 34 | 0.23 | -- | -- | 0.23 | 1.3 |
| Nickel | Metals | mg/kg | 7440-02-0 | 81 | (21*); 47** | 280 | 38 | 47 | -- | -- | 47 | 210 |
| Thallium | Metals | mg/kg | 7440-28-0 | 45 | (4.2*); 5.2** | -- | (0.05*); 5.2** | 5.2 | -- | -- | 5.2 | 0.5 |
| Vanadium | Metals | mg/kg | 7440-62-2 | (9.5*); 180** | 610 | -- | (60*); 180** | 180 | -- | -- | 180 | 95 |
| Zinc | Metals | mg/kg | 7440-66-6 | (120*); 180** | 980 | (120*); 180** | (160*); 180** | 180 | -- | -- | 180 | 1,200 |
| 1-Methylnaphthalene | PAH | µg/kg | 90-12-0 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | PAH | µg/kg | 91-57-6 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthene | PAH | µg/kg | 83-32-9 | -- | -- | -- | 250 | -- | -- | -- | 250 | 2,500 |
| Acenaphthylene | PAH | µg/kg | 208-96-8 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | PAH | µg/kg | 120-12-7 | -- | -- | -- | 6,800 | -- | -- | -- | 6,800 | 68,000 |
| Benz(a)anthracene | PAH | µg/kg | 56-55-3 | -- | -- | -- | 18,000 | -- | -- | -- | 18,000 | 180,000 |
| Benzo(a)pyrene | PAH | µg/kg | 50-32-8 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b)fluoranthene | PAH | µg/kg | 205-99-2 | -- | -- | -- | 18,000 | -- | -- | -- | 18,000 | 180,000 |
| Benzo(g,h,i)perylene | PAH | µg/kg | 191-24-2 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzo(k)fluoranthene | PAH | µg/kg | 207-08-9 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | PAH | µg/kg | 218-01-9 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(a,h)anthracene | PAH | µg/kg | 53-70-3 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | PAH | µg/kg | 206-44-0 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | PAH | µg/kg | 86-73-7 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-c,d)pyrene | PAH | µg/kg | 193-39-5 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | PAH | µg/kg | 91-20-3 | -- | -- | -- | 1,000 | -- | -- | -- | 1,000 | 10,000 |
| Phenanthrene | PAH | µg/kg | 85-01-8 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | PAH | µg/kg | 129-00-0 | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total HPAH | PAH | µg/kg | -- | 900 ¹⁰ | 5590 ¹⁰ | 18,000 | -- | -- | -- | -- | 900 ¹⁰ | 9,000 |
| Total LPAH | PAH | µg/kg | -- | 67,000 | 540,000 | 29,000 | -- | -- | -- | -- | 29,000 | 290,000 |
| Ethylbenzene | VOC | µg/kg | 100-41-4 | -- | 25,800 | -- | -- | -- | -- | -- | 25,800 | 258,000 |
| Total Xylene | VOC | µg/kg | 1330-20-7 | 410,000 | 1,800 | -- | 100,000 | -- | -- | -- | 1,800 | 18,000 |
| TPH (Former Spent Oxide Area RA-1) | TPH | mg/kg | -- | -- | -- | 197 | -- | -- | -- | 11 | 197 | 1,970 |
| TPH (Former Lampblack Storage Area RA-2) | TPH | mg/kg | -- | -- | -- | 216 | -- | -- | -- | 11 | 216 | 2,160 |

Ecological PRG Table 2

Gasco OU Ecological Surface Soil PRGs

| Gasco and Siltronic GSA(s) Ecological Surface Soil Contaminants of Concern | Analyte Group | Units | CAS No. | Gasco OU Ecological PRGs – Bird ¹ | Gasco OU Ecological PRGs – Mammal ¹ | Gasco OU Ecological PRGs – Invertebrate ¹ | Gasco OUs Ecological PRGs – Plant ¹ | Portland Basin Background Value ² | Natural Background Value | Notes | Gasco OU Ecological Soil PRGs ⁶ | Gasco OU Ecological Soil Hot Spot Level ⁷ |
|--|------------------|-------|---------|---|---|---|--|---|-----------------------------|-------|---|---|
| TPH (Former Tar Settling Pond Area RA-3) | TPH | mg/kg | -- | -- | -- | 214 | -- | -- | -- | 11 | 214 | 2,140 |
| TPH (Former Koppers Land Disposal Area RA-4) | TPH | mg/kg | -- | -- | -- | 205 | -- | -- | -- | 11 | 205 | 2,050 |
| TPH (Former Naphthalene Plant Area RA-5) | TPH | mg/kg | -- | -- | -- | 185 | -- | -- | -- | 11 | 185 | 1,850 |

Notes:

*: RBCs from 2020 Eco-risk IMD Table 1a (DEQ 2020) or Table A (soils) included as an attachment to the DEQ PRG memorandum (DEQ 2021).

** : RBC below background levels, and the PRG is based on background level.

--: Not applicable

1. The DEQ PRG memorandum indicates that ecological soil PRGs should be selected from the values presented in Table A (soils) included as an attachment to the PRG memorandum (DEQ 2021). Hierarchy of sources for ecological soil PRGs are to apply values from DEQ's RBCs from DEQ's 2020 Eco-risk IMD Table 1a (DEQ 2020) and use of IFS SLVs (Anchor QEA 2018) for COCs without RBCs.

2. Regional default background concentration for Portland Basin based on 95% UPL or 95% Kaplan-Meier UPL (cadmium and selenium) from Table 4 (DEQ 2013).

3. Regional 90th percentile, Clark County, Washington; from Table 1 (Ecology 1994).

4. No PRG required by DEQ for this COC (DEQ 2021).

5. Metal determined to be at background concentration in soil at Gasco OU. No PRG necessary.

6. Ecological soil PRG selected based on systematic comparative approach used for the IFS (Anchor QEA 2018).

7. Ecological soil hot spot level per OAR 340-122-0115 (32) (b) (A) (iii).

8. Surface soil data for iron would exceed this PRG if detected concentration exceeds 36,100 mg/kg PRG and soil pH is <5 or >8.

9. Surface soil data for iron would exceed this hot spot level if detected concentration exceeds 100 mg/kg and soil pH is <5 or >8.

10. NW Natural calculated population-based ground-feeding bird and mammal HPAH RBC based on parameters provided by DEQ.

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.

µg/kg: microgram per kilogram

CAS: Chemical Abstracts Service

COC: contaminant of concern

CONV: conventional

DEQ: Oregon Department of Environmental Quality

GSA: geographic subarea

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

IFS: *Interim Feasibility Study*

IMD: internal management directive

LPAH: low-molecular-weight polycyclic aromatic hydrocarbon

mg/kg: milligram per kilogram

OAR: Oregon Administrative Rule

OU: operable unit

PAH: polycyclic aromatic hydrocarbon

PRG: preliminary remediation goal

RBC: risk-based concentration

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

Siltronic: Siltronic Corporation

SLV: screening level value

TPH: total petroleum hydrocarbons

UPL: upper prediction limit

VOC: volatile organic compound

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*. Gasco OU. Prepared for NW Natural. November 22, 2019.

DEQ (Oregon Department of Environmental Quality), 2013. *Development of Oregon Background Metals Concentrations in Soil*. Technical Report. Land Quality Division, Cleanup Program. March 2013.

DEQ, 2020. *Conducting Ecological Risk Assessments IMD*. September 14, 2020.

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

Ecology (Washington State Department of Ecology), 1994. *Natural Background Soil Metal Concentrations in Washington State*. Publication No. 94-115. October 1994.

Ecological PRG Table 3
Gasco OU Groundwater COCs and PRGs – Source Control
Upland to Willamette River Pathways

| Gasco OU Ecological Groundwater Contaminants of Concern¹ | 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 |

Ecological PRG Table 3
Gasco OU Groundwater COCs and PRGs – Source Control
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 Groundwater CULs and FS Groundwater PRGs | | 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 and FS Groundwater PRGs CULs ³ in µg/L | Notes | DEQ Proposed Aquatic Life PRGs (DEQ 2020, 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 | 4.7 | -- | 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 | 2.6 | -- | 0.68 | 0.677 | 0.7 |

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 Groundwater CULs and FS Groundwater PRGs | | 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 and FS Groundwater PRGs CULs ³ in µg/L | Notes | DEQ Proposed Aquatic Life PRGs (DEQ 2020, 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 | |
| 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 | 0.6 |
| Chrysene | PAH | X | -- | -- | 2 | 7 | 4.7 | -- | 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 HI | PAH | X | -- | -- | -- | -- | HI = 1 | 10 | -- | HI = 1 | HI = 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 | -- | -- | -- | -- | 160 | -- | -- | 4 | 160 |
| 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 ¹¹ | VOC | X | -- | -- | -- | -- | 470 | -- | -- | 470 | -- |

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 Groundwater CULs and FS Groundwater PRGs | | 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 and FS Groundwater PRGs CULs ³ in µg/L | Notes | DEQ Proposed Aquatic Life PRGs (DEQ 2020, 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 | |
| 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 |
| Butyric acid ¹¹ | 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 | -- |
| n-Butylbenzene | VOC | X | -- | -- | -- | -- | 7.3 | -- | -- | 7.3 | 7.3 |
| o-Xylene | VOC | X | -- | -- | -- | -- | 27 | 9 | -- | 13 | -- |
| Propionic acid ¹¹ | 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 | -- |
| C8-C10 Aliphatic Hydrocarbons | TPH | X | -- | -- | -- | -- | 9.6 | 9 | -- | 9.5 | -- |
| C8-C10 Aromatic Hydrocarbons | TPH | X | -- | -- | -- | -- | 240 | 9 | -- | 212 | -- |
| C10-C12 Aliphatic Hydrocarbons | TPH | X | -- | -- | 2.6 | -- | 2.6 | 9 | -- | 2.6 | -- |
| C10-C12 Aromatic Hydrocarbons | TPH | X | -- | -- | -- | -- | 79 | 9 | -- | 1,000 | -- |
| TPH (Former Spent Oxide Area RA-1) | TPH | X | -- | -- | -- | -- | 160 | 12 | -- | -- | 160 |
| TPH (Former Lampblack Storage Area RA-2) | TPH | X | -- | -- | -- | -- | 92 | 12 | -- | -- | 92 |
| TPH (Former Tar Settling Pond Area Area RA-3) | TPH | X | -- | -- | -- | -- | 100 | 12 | -- | -- | 100 |
| TPH (Former Koppers Land Disposal Area RA-4) | TPH | X | -- | -- | -- | -- | 200 | 12 | -- | -- | 200 |
| TPH (Former Naphthalene Plant Area RA-5) | TPH | X | -- | -- | -- | -- | 1,200 | 12 | -- | -- | 1,200 |

Ecological PRG Table 4

Gasco OU Ecological Groundwater COCs and PRGs – Hot Spot Evaluations

Upland to Willamette River Pathways

Notes:

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

--: Not applicable

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); **the Aquatic Life Water Quality Criteria were determined by selecting the lower value between Oregon and National AWQC, where available.**
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 per Portland Harbor FS (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 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 AWQC 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. **The groundwater PRG for total PAHs is based on summing the individual PAH HQs to calculate an HI and compared to an HI = 1.**
11. 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).
12. 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.

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

HI: hazard index

HQ: hazard quotient

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: remedial 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 hydrocarbons

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*. Gasco OU. Prepared for NW Natural. 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 Riverbank Seep COCs and PRGs – Source Control

Upland to Willamette Riverbank Pathway

| Gasco OU Ecological Fill WBZ Wildlife Groundwater Contaminants of Concern ¹ | 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:

--: Not applicable

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.

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.

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 6

Gasco OU Ecological Riverbank Seep COCs and PRGs – Hot Spot Evaluations

Upland to Willamette Riverbank Pathway

| Gasco OU Ecological Fill WBZ Wildlife Groundwater Contaminants of Concern¹ | Analyte Group | Ecological Fill WBZ Groundwater COCs (Wildlife)¹ | DEQ Proposed Wildlife Water Ingestion PRGs for Riverbank Seeps (DEQ 2020,² 2021³) in µg/L⁴ | Notes |
|--|--------------------------|--|--|--------------|
| Cyanide, available | CONV | X | 22 | 5 |
| Cyanide, free | CONV | X | 22 | 5 |
| Total Dioxin/Furan/PCB TEQ | DIOXFUR | X | 0.044 | -- |
| Aluminum | Metals | X | 86,000 | -- |
| Vanadium | Metals | X | 18,000 | -- |
| Benzo(a)pyrene | PAH | X | 44,000 | -- |
| Naphthalene | PAH | X | 570 | -- |
| 4,4'-DDD (p,p'-DDD) | PEST | X | -- | -- |
| Total DDx | PEST | X | 5,300 | -- |

Notes:

--: Not applicable

1. COCs listed have at least one exceedance ratio greater than 1 in Fill WBZ groundwater at the Gasco OU.
2. Per *Conducting Ecological Risk Assessments* (DEQ 2020); Table 1b.
3. Per *Contaminants of Concern, Risk-Based Criteria, and Preliminary Remediation Goals*, Former Gasco Manufactured Gas Plant Operable Unit (DEQ 2021); Table B.
4. Source control PRGs per Wyatt 2023.
5. Per *Anchor QEA (2019) Table 10-7, footnote c.*

µg/L: microgram per liter

COC: contaminant of concern

CONV: conventional

DDD: dichlorodiphenyldichloroethane

DDE: dichlorodiphenyldichloroethylene

DDT: dichlorodiphenyltrichloroethane

DDx: sum of DDT, DDD, and DDE

DEQ: Oregon Department of Environmental Quality

DIOXFUR: dioxin/furan

OU: operable unit

PAH: polycyclic aromatic hydrocarbon

PCB: polychlorinated biphenyl

PEST: pesticide

PRG: preliminary remediation goal

TEQ: toxic equivalents quotient

WBZ: water-bearing zone

References:

Anchor QEA (Anchor QEA, LLC), 2019. Remedial Investigation/Human Health and Ecological Risk Assessment Addendum for the Siltronic GSA. Gasco OU. Prepared for NW Natural. 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.

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 7

Gasco OU Ecological Fill WBZ Groundwater Migration to Doane Creek and Doane Creek Surface Water COCs

| Siltronic GSA Fill WBZ Groundwater Migration to Doane Creek and Doane Creek Surface Water Ecological Contaminants of Concern ¹ | Analyte Group | Units | CAS No. | Siltronic GSA Ecological Fill WBZ Migration to Doane Creek and Doane Creek Surface Water COCs | Siltronic GSA Ecological Fill WBZ Groundwater Migration to Doane Creek COCs – Aquatic Life | Siltronic GSA Ecological Fill WBZ Groundwater to Doane Creek COCs – Aquatic Dependent Wildlife | Doane Creek Ecological Surface Water COCs – Aquatic Life | Doane Creek Ecological Surface Water COCs – Aquatic Dependent Wildlife |
|---|---------------|-------|------------|---|--|--|--|--|
| Cyanide, total | CONV | mg/L | 57-12-5 | X | X | X | X | o |
| Cyanide, available | CONV | mg/L | CYANAVAIL | X | X | X | -- | o |
| Cyanide, free | CONV | mg/L | CYANFREE | X | X | o | o | o |
| Sulfate | CONV | mg/L | 14808-79-8 | X | X | -- | o | -- |
| Aluminum | Metals | µg/L | 7429-90-5 | X | X | o | X | o |
| Barium | Metals | µg/L | 7440-39-3 | X | X | o | X | o |
| Beryllium | Metals | µg/L | 7440-41-7 | X | X | o | o | o |
| Cadmium | Metals | µg/L | 7440-43-9 | X | X | o | o | o |
| Calcium | Metals | µg/L | 7440-70-2 | X | X | -- | o | -- |
| Chromium | Metals | µg/L | 7440-47-3 | X | X | o | o | o |
| Copper | Metals | µg/L | 7440-50-8 | X | X | o | X | o |
| Iron | Metals | µg/L | 7439-89-6 | X | X | -- | X | -- |
| Lead | Metals | µg/L | 7439-92-1 | X | X | o | X | o |
| Manganese | Metals | µg/L | 7439-96-5 | X | X | o | o | o |
| Nickel | Metals | µg/L | 7440-02-0 | X | X | o | o | o |
| Zinc | Metals | µg/L | 7440-66-6 | X | X | o | o | o |
| 1-Methylnaphthalene | PAH | µg/L | 90-12-0 | X | X | -- | o | -- |
| Anthracene | PAH | µg/L | 120-12-7 | X | X | -- | o | -- |
| Benzo(a)anthracene | PAH | µg/L | 56-55-3 | X | X | -- | X | -- |
| Benzo(a)pyrene | PAH | µg/L | 50-32-8 | X | X | o | X | o |
| Benzo(b)fluoranthene | PAH | µg/L | 205-99-2 | X | X | -- | o | -- |
| Benzo(g,h,i)perylene | PAH | µg/L | 191-24-2 | X | X | -- | o | -- |
| Benzo(k)fluoranthene | PAH | µg/L | 207-08-9 | X | X | -- | o | -- |
| Chrysene | PAH | µg/L | 218-01-9 | X | X | -- | o | -- |
| Dibenzo(a,h)anthracene | PAH | µg/L | 53-70-3 | X | X | -- | o | -- |
| Fluoranthene | PAH | µg/L | 206-44-0 | X | X | -- | o | -- |
| Fluorene | PAH | µg/L | 86-73-7 | X | X | -- | o | -- |
| Indeno(1,2,3-c,d)pyrene | PAH | µg/L | 193-39-5 | X | X | -- | o | -- |
| Phenanthrene | PAH | µg/L | 85-01-8 | X | X | -- | o | -- |
| Pyrene | PAH | µg/L | 129-00-0 | X | X | -- | o | -- |
| Total PAH HI | PAH | µg/L | -- | X | X | -- | X | -- |
| TPH | TPH | mg/L | -- | X | X | -- | o | -- |

Notes:

--: Not applicable

o: Contaminant analyzed in Fill WBZ groundwater or Doane Creek surface water and determined to not be a COC.

X: Ecological COC

1. COCs listed have at least one exceedance ratio greater than 1 in Fill WBZ groundwater migrating to Doane Creek or Doane Creek surface water in the Siltronic GSA.

µg/L: microgram per liter

CAS: Chemical Abstracts Service

COC: contaminant of concern

CONV: conventional

GSA: geographic subarea

HI: hazard index

mg/L: milligram per liter

PAH: polycyclic aromatic hydrocarbon

Siltronic: Siltronic Corporation

TPH: total petroleum hydrocarbons

WBZ: water-bearing zone

Ecological PRG Table 8

Gasco OU Ecological Fill WBZ Groundwater Migration to Doane Creek and Doane Creek Surface Water PRGs

| Siltronic GSA Fill WBZ Groundwater Migration to Doane Creek and Doane Creek Surface Water Ecological Contaminants of Concern | Analyte Group | Units | CAS No. | Siltronic GSA Ecological Fill WBZ Migration to Doane Creek and Doane Creek Surface Water Aquatic Life PRGs ¹ | Notes | Siltronic GSA Ecological Fill WBZ to Doane Creek PRGs – Aquatic Dependent Wildlife |
|--|---------------|-------|------------|---|-------|--|
| Cyanide, available | CONV | mg/L | CYANAVAIL | 0.0052 | -- | 0.022 ² |
| Cyanide, free | CONV | mg/L | CYANFREE | 0.0052 | -- | 0.022 ² |
| Sulfate | CONV | mg/L | 14808-79-8 | 14,830 | -- | -- |
| Aluminum | Metals | µg/L | 7429-90-5 | 320 | -- | -- |
| Barium | Metals | µg/L | 7440-39-3 | 220 | -- | -- |
| Beryllium | Metals | µg/L | 7440-41-7 | 11 | -- | -- |
| Cadmium | Metals | µg/L | 7440-43-9 | 0.094 | -- | -- |
| Calcium | Metals | µg/L | 7440-70-2 | 120,000 | -- | -- |
| Chromium | Metals | µg/L | 7440-47-3 | 24 | -- | -- |
| Copper | Metals | µg/L | 7440-50-8 | 1.4 | -- | -- |
| Iron | Metals | µg/L | 7439-89-6 | 1,000 | -- | -- |
| Lead | Metals | µg/L | 7439-92-1 | 0.54 | -- | -- |
| Manganese | Metals | µg/L | 7439-96-5 | 1,433 | -- | -- |
| Nickel | Metals | µg/L | 7440-02-0 | 16 | -- | -- |
| Zinc | Metals | µg/L | 7440-66-6 | 36 | -- | -- |
| 1-Methylnaphthalene | PAH | µg/L | 90-12-0 | 6.1 | -- | -- |
| 2-Methylnaphthalene | PAH | µg/L | 91-57-6 | 2.1 | -- | -- |
| Acenaphthene | PAH | µg/L | 83-32-9 | 23 | -- | -- |
| Acenaphthylene | PAH | µg/L | 208-96-8 | 13 | -- | -- |
| Anthracene | PAH | µg/L | 120-12-7 | 0.73 | -- | -- |
| Benzo(a)anthracene | PAH | µg/L | 56-55-3 | 0.03 | -- | -- |
| Benzo(a)pyrene | PAH | µg/L | 50-32-8 | 0.01 | -- | -- |
| Benzo(b)fluoranthene | PAH | µg/L | 205-99-2 | 0.7 | -- | -- |
| Benzo(g,h,i)perylene | PAH | µg/L | 191-24-2 | 0.4 | -- | -- |
| Benzo(k)fluoranthene | PAH | µg/L | 207-08-9 | 0.6 | -- | -- |
| Chrysene | PAH | µg/L | 218-01-9 | 2 | -- | -- |
| Dibenzo(a,h)anthracene | PAH | µg/L | 53-70-3 | 0.3 | -- | -- |
| Fluoranthene | PAH | µg/L | 206-44-0 | 6.2 | -- | -- |
| Fluorene | PAH | µg/L | 86-73-7 | 3.9 | -- | -- |
| Indeno(1,2,3-c,d)pyrene | PAH | µg/L | 193-39-5 | 0.3 | -- | -- |
| Naphthalene | PAH | µg/L | 91-20-3 | 12 | -- | -- |
| Phenanthrene | PAH | µg/L | 85-01-8 | 6.3 | -- | -- |
| Pyrene | PAH | µg/L | 129-00-0 | 10 | -- | -- |
| Total PAH HI | PAH | µg/L | -- | HI = 1 | 3 | -- |
| TPH (Former Spent Oxide Area RA-1) | TPH | µg/L | -- | 160 | 4 | -- |
| TPH (Former Tar Settling Pond Area RA-3) | TPH | µg/L | -- | 100 | 4 | -- |

Notes:

--: Not applicable

1. Per Anchor QEA Ecological PRG Table 4, "Gasco OU Ecological Groundwater COCs and PRGs – Hot Spot Evaluations Upland to Willamette River Pathways."

2. Per Anchor QEA (2019) Table 10-7, footnote c.

3. The groundwater PRG for total PAHs is based on summing the individual PAH HQs to calculate an HI and compared to an HI = 1.

4. 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.

µg/L: microgram per liter

CAS: Chemical Abstracts Service

CONV: conventional

DEQ: Oregon Department of Environmental Quality

GSA: geographic subarea

HI: hazard index

HQ: hazard quotient

mg/L: milligram per liter

PAH: polycyclic aromatic hydrocarbon

PRG: preliminary remediation goal

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

Siltronic: Siltronic Corporation

TPH: total petroleum hydrocarbons

WBZ: water-bearing zone

Reference:

Anchor QEA (Anchor QEA, LLC), 2019. Remedial Investigation/Human Health and Ecological Risk Assessment Addendum for the Siltronic GSA . Gasco OU.

Prepared for NW Natural. November 22, 2019.

DEQ (Oregon Department of Environmental Quality), 2021. Contaminants of Concern, Risk-Based Criteria, and Preliminary Remediation Goals; Former Gasco Manufacturing Gas Plant Operable Unit . December 16, 2021.

Ecological PRG Table 9

Gasco OU Ecological Doane Creek Sediment COCs

| Siltronic GSA Ecological Doane Creek Sediment Contaminants of Concern ¹ | Analyte Group | Units | CAS No. | Doane Creek Sediment Ecological COCs | Doane Creek Sediment Ecological COCs – Benthic | Doane Creek Sediment Ecological COCs – Bird Bioaccumulation | Doane Creek Sediment Ecological COCs – Fish Bioaccumulation | Doane Creek Sediment Ecological COCs – Mammal Bioaccumulation | Portland Basin Background Value ² | Natural Background |
|--|---------------|-------|-----------|--------------------------------------|--|---|---|---|--|---------------------|
| Cyanide, total | CONV | mg/kg | 57-12-5 | X | X | -- | -- | -- | -- | -- |
| Arsenic | Metals | mg/kg | 7440-38-2 | X | X | X | X | X | 8.8 | |
| Iron | Metals | mg/kg | 7439-89-6 | X | X | -- | -- | -- | -- | 36,100 ³ |
| Lead | Metals | mg/kg | 7439-92-1 | X | X | o | o | o | 79 | |
| 1-Methylnaphthalene | PAH | µg/kg | 90-12-0 | X | X | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | PAH | µg/kg | 91-57-6 | X | X | -- | -- | -- | -- | -- |
| Acenaphthene | PAH | µg/kg | 83-32-9 | X | X | -- | -- | -- | -- | -- |
| Anthracene | PAH | µg/kg | 120-12-7 | X | X | -- | -- | -- | -- | -- |
| Benz(a)anthracene | PAH | µg/kg | 56-55-3 | X | X | -- | -- | -- | -- | -- |
| Benzo(a)pyrene | PAH | µg/kg | 50-32-8 | X | X | -- | -- | -- | -- | -- |
| Benzo(b)fluoranthene | PAH | µg/kg | 205-99-2 | X | X | -- | -- | -- | -- | -- |
| Benzo(g,h,i)perylene | PAH | µg/kg | 191-24-2 | X | X | -- | -- | -- | -- | -- |
| Benzo(k)fluoranthene | PAH | µg/kg | 207-08-9 | X | X | -- | -- | -- | -- | -- |
| Chrysene | PAH | µg/kg | 218-01-9 | X | X | -- | -- | -- | -- | -- |
| Dibenz(a,h)anthracene | PAH | µg/kg | 53-70-3 | X | X | -- | o | o | -- | -- |
| Fluoranthene | PAH | µg/kg | 206-44-0 | X | X | -- | -- | -- | -- | -- |
| Fluorene | PAH | µg/kg | 86-73-7 | X | X | -- | -- | -- | -- | -- |
| Indeno(1,2,3-c,d)pyrene | PAH | µg/kg | 193-39-5 | X | X | -- | -- | -- | -- | -- |
| Naphthalene | PAH | µg/kg | 91-20-3 | X | X | -- | -- | -- | -- | -- |
| Phenanthrene | PAH | µg/kg | 85-01-8 | X | X | -- | -- | -- | -- | -- |
| Pyrene | PAH | µg/kg | 129-00-0 | X | X | -- | X | o | -- | -- |
| Total HPAH | PAH | µg/kg | -- | X | X | -- | -- | -- | -- | -- |
| Total LPAH | PAH | µg/kg | -- | X | X | -- | -- | -- | -- | -- |
| Total PAHs | PAH | µg/kg | -- | X | X | -- | -- | -- | -- | -- |
| PAH ESBTU | PAH | µg/kg | -- | X | X | -- | -- | -- | -- | -- |
| Carbazole | SVOC | µg/kg | 86-74-8 | X | X | -- | -- | -- | -- | -- |

Ecological PRG Table 9

Gasco OU Ecological Doane Creek Sediment COCs

Notes:

--: Not applicable

o: Contaminant analyzed in sediment and determined to not be a COC.

X: Ecological COC for sediment

1. COCs listed have at least one exceedance ratio greater than 1 in sediments in Doane Creek in the Siltronic GSA.

2. Regional default background concentration for Portland Basin based on 95% UPL from Table 4 (DEQ 2013).

3. Regional 90th percentile, Clark County, Washington; from Table 1 (Ecology 1994).

µg/kg: microgram per kilogram

CAS: Chemical Abstracts Service

COC: contaminant of concern

CONV: conventional

ESBTU: equilibrium partitioning sediment benchmark toxic unit

GSA: geographic subarea

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

LPAH: low-molecular-weight polycyclic aromatic hydrocarbon

mg/kg: milligram per kilogram

PAH: polycyclic aromatic hydrocarbon

Siltronic: Siltronic Corporation

SVOC: semivolatile organic compound

UPL: upper prediction limit

References:

DEQ (Oregon Department of Environmental Quality), 2013. *Development of Oregon Background Metals Concentrations in Soil*. Technical Report. Land Quality Division, Cleanup Program. March 2013.

Ecology (Washington State Department of Ecology), 1994. *Natural Background Soil Metal Concentrations in Washington State*. Publication No. 94-115. October 1994.

Ecological PRG Table 10

Gasco OU Ecological Doane Creek Sediment PRGs

| Siltronic GSA Ecological Doane Creek Sediment Contaminants of Concern | Analyte Group | Units | CAS No. | Doane Creek Sediment Ecological COCs | Doane Creek Sediment Ecological PRGs – Benthic ¹ | Doane Creek Sediment Ecological PRGs – Bird Bioaccumulation ² | Doane Creek Sediment Ecological PRGs – Fish Bioaccumulation ² | Doane Creek Sediment Ecological PRGs – Mammal Bioaccumulation ² | Portland Basin Background Value ³ | Natural Background | Doane Creek Sediment Ecological PRGs – Benthic ⁴ | Doane Creek Sediment Ecological PRGs – Bioaccumulation ⁵ | Doane Creek Sediment Ecological Hot Spot Level ⁶ |
|---|---------------|-------|-----------|--------------------------------------|---|--|--|--|--|---------------------|---|---|---|
| Cyanide, total | CONV | mg/kg | 57-12-5 | X | -- ⁷ | -- | -- | -- | -- | -- | -- | -- | -- |
| Arsenic | Metals | mg/kg | 7440-38-2 | X | (6*); 8.8** | 7 | 7 | 7 | 8.8 | -- | 8.8 | 7 | 60 |
| Iron | Metals | mg/kg | 7439-89-6 | X | (20,000*); 36,100** | -- | -- | -- | -- | 36,100 ⁸ | 36,100 | -- | 200,000 |
| Lead | Metals | mg/kg | 7439-92-1 | X | (35*); 79** | -- | -- | -- | 79 | -- | 79 | -- | 350 |
| 1-Methylnaphthalene | PAH | µg/kg | 90-12-0 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 2-Methylnaphthalene | PAH | µg/kg | 91-57-6 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthene | PAH | µg/kg | 83-32-9 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Acenaphthylene | PAH | µg/kg | 208-96-8 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Anthracene | PAH | µg/kg | 120-12-7 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benz(a)anthracene | PAH | µg/kg | 56-55-3 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzo(a)pyrene | PAH | µg/kg | 50-32-8 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzo(b)fluoranthene | PAH | µg/kg | 205-99-2 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzo(g,h,i)perylene | PAH | µg/kg | 191-24-2 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzo(k)fluoranthene | PAH | µg/kg | 207-08-9 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Chrysene | PAH | µg/kg | 218-01-9 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Dibenz(a,h)anthracene | PAH | µg/kg | 53-70-3 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Fluoranthene | PAH | µg/kg | 206-44-0 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Fluorene | PAH | µg/kg | 86-73-7 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Indeno(1,2,3-c,d)pyrene | PAH | µg/kg | 193-39-5 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Naphthalene | PAH | µg/kg | 91-20-3 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Phenanthrene | PAH | µg/kg | 85-01-8 | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Pyrene | PAH | µg/kg | 129-00-0 | X | -- | -- | 1,900 | -- | -- | -- | -- | 1,900 | 19,000 |
| Total HPAH | PAH | µg/kg | -- | X | 193 | -- | -- | -- | -- | -- | 193 | -- | 6,500 ⁹ |
| Total LPAH | PAH | µg/kg | -- | X | 76 | -- | -- | -- | -- | -- | 76 | -- | 5,300 ⁹ |
| Total PAHs | PAH | µg/kg | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| PAH ESBTU | PAH | µg/kg | -- | X | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Carbazole | SVOC | µg/kg | 86-74-8 | X | 140 | -- | -- | -- | -- | -- | 140 | -- | 1,140 |

Ecological PRG Table 10

Gasco OU Ecological Doane Creek Sediment PRGs

Notes:

*: Sediment RBC per Table 10-8, "Doane Creek Sediment Ecological Screening Levels" (Anchor QEA 2019) as directed by DEQ (Thomas 2023).

** : RBC below background levels, and the PRG is based on background level.

--: Not applicable

1. Per Table 10-8, "Doane Creek Sediment Ecological Screening Levels" (Anchor QEA 2019) as directed by DEQ (Thomas 2023).

2. Sediment Bioaccumulation RBCs from *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment* (DEQ 2007).

3. Regional default background concentration for Portland Basin based on 95% UPL from Table 4 (DEQ 2013).

4. Ecological sediment PRG for benthic endpoint.

5. Ecological sediment PRG for bioaccumulation endpoint.

6. Ecological sediment hot spot level per OAR 340-122-0115 (32) (b) (A) (iii) with the exception of site-specific LPAH and HPAH hot spot criteria as agreed upon during the October 5, 2023, Ecological PAH PRG meeting with DEQ.

7. Benthic RBC based on free cyanide and no PRG required (DEQ 2021).

8. Regional 90th percentile, Clark County, Washington; from Table 1 (Ecology 1994).

9. Site-specific hot spot criteria based on UET, freshwater sediment (NOAA 1999) as agreed upon during the October 5, 2023, Ecological PAH PRG meeting with DEQ.

µg/kg: microgram per kilogram

CAS: Chemical Abstracts Service

COC: contaminant of concern

CONV: conventional

DEQ: Oregon Department of Environmental Quality

ESBTU: equilibrium partitioning sediment benchmark toxic unit

GSA: geographic subarea

HPAH: high-molecular-weight polycyclic aromatic hydrocarbon

LPAH: low-molecular-weight polycyclic aromatic hydrocarbon

mg/kg: milligram per kilogram

OAR: Oregon Administrative Rule

PAH: polycyclic aromatic hydrocarbon

PRG: preliminary remediation goal

RBC: risk-based concentration

Siltronic: Siltronic Corporation

SVOC: semivolatile organic compound

UET: upper effects threshold

References:

Anchor QEA (Anchor QEA, LLC), 2019. *Remedial Investigation/Human Health and Ecological Risk Assessment Addendum for the Siltronic GSA*. Gasco OU. Prepared for NW Natural. November 22, 2019.

DEQ (Oregon Department of Environmental Quality), 2007. *Guidance for Assessing Bioaccumulative Chemicals of Concern in Sediment*. Environmental Cleanup Program. October 2020 update.

DEQ, 2013. *Development of Oregon Background Metals Concentrations in Soil*. Technical Report. Land Quality Division, Cleanup Program. March 2013.

DEQ, 2020. *Conducting Ecological Risk Assessments IMD*. September 14, 2020.

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

Ecology (Washington State Department of Ecology), 1994. *Natural Background Soil Metal Concentrations in Washington State*. Publication No. 94-115. October 1994.

NOAA (National Oceanic and Atmospheric Administration), 1999. "Screening Quick Reference Tables." Upper Effects Thresholds (UET), Freshwater Sediment. Coastal Resources Coordination Branch. Hazmat Report 99-1. (updated February 2004).

Thomas, Wesley, 2023. Regarding: Gasco OU FS PRGs - Riverbank COC/PRG Tables 5a and 5b. [with comments on Ecological PRG Tables 1 through 13]. Email to: Taku Fuji (Anchor QEA). September 26, 2023.