Portland Gas Manufacturing Site: Summary of Site Investigation and Recommended Cleanup Actions

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Portland Gas Manufacturing (PGM) Site Regulatory Chronology

- **1987.** EPA CERCLA (Superfund) Assessment – no further action determined necessary
- **2002.** Strategy Recommendation by DEQ recommending action (Low Priority)
- **2008.** Site priority upgraded by DEQ (High) based on proximity of upland to ESA habitat
- **2008.** DEQ requests NW Natural enter into a agreement for upland and in-water “source control”
Portland Gas Manufacturing (PGM) Site Regulatory Chronology

• **2009.** Order on Consent signed between Oregon DEQ and NW Natural

• **2009 – 2014.** Multi-phase sediment Investigation and Upland Source Control Evaluation

• **2014 – 2016.** Feasibility Study (approved by DEQ September 2016)

• **November 2016.** Recommended remedy issued by DEQ
PGM Site History

- **1861 – 1913.** Period of gas plant operations using coal, carbureted water, and oil. Waste products including petroleum, benzene, metals, and cyanide discharged

- **1913.** PGM plant closed and operations were moved downstream to Gasco site. Some structures remain

- **1927 – 1929.** Portland seawall construction results in demolition of near-shore PGM structures. Extensive filling adjacent to seawall

- **1940s – 1970s.** Redevelopment of the remaining site with roads, park, and building
Historical PGM Site Features ca. 1908
PGM Building During Seawall Excavation
Portland Seawall Design

20 feet
Result of Seawall Construction

• During riverbank demolition/prep for seawall, a variety of material ended up in footing area for seawall
• Presumed to include gas plant waste and building debris
• Material was excavated and side-cast into the river,
• Distinct debris “line” can be observed in riverbed.
• River-ward of Block 5, both tar and gas plant debris found. Material protrudes up to 10 feet above mudline.
Site Bathymetry
Offshore Building Debris Mound

Thin surficial tar deposit (diver delineated)

Thin surface tar layer in core
Diver Survey of Offshore Building Debris

- Angle Iron
- Corrugated Metal
- Brick Wall
- Arch Window
Field Investigation Methods

Upland and In-Water Drilling

Porewater Sampling

Diver Surveys

Seepage Meters
Sample Location Map

Main Site of Former Plant Operations
Benzene in Groundwater - ppb
Total PAH Concentrations in Sediment Borings
In-Water Contamination

- Petroleum chemicals found at multiple locations associated with gas plant
- Generally buried by 1-3 feet of cleaner material
- Contamination extends >10 feet at some locations
- Worst contamination off-shore of Block 5
- Shallow contamination including tar present in the "debris field"
Sediment PRG Exceedances

Surface Sediment

Surface and Subsurface Sediment
Sediment PRG Exceedances

Surface Sediment

Surface and Subsurface Sediment
Naphthalene in Porewater (µg/L)

Groundwater Seepage Maps

<table>
<thead>
<tr>
<th>Sample</th>
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Summary of Site Investigation and Recommended Cleanup Actions

December 13, 2016
Remedial Action Objectives

• Protect humans and animals from contaminated sediment, porewater, and surface water

• Prevent groundwater contaminants from impacting the river

• Remove or treat highly-concentrated contamination if feasible

• Provide long-term monitoring, maintenance, and periodic review of the selected remedy to ensure effective performance
<table>
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<th>GENERAL RESPONSE ACTION</th>
<th>REMEDIAL TECHNOLOGY</th>
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<td>Engineering Controls</td>
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<tr>
<td></td>
<td>Institutional Controls</td>
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<tr>
<td>Natural Recovery</td>
<td>Monitored Natural Recovery (MNR)</td>
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<td>Enhanced MNR</td>
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<tr>
<td>In-Situ Containment</td>
<td>Armored Sand Cap</td>
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<td>In-Situ Treatment</td>
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<td>Activated Carbon Cap, Armored</td>
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<td>Organoclay Cap, Armored</td>
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<tr>
<td>Removal</td>
<td>Dredging and Landfill Disposal</td>
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<tr>
<td>Ex-situ Treatment</td>
<td>Dredging, Treatment, and Landfill Disposal</td>
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Technical Work Supporting Remedy Selection

• **Contaminant Mapping.** Development of Sediment Management Areas for remedial technology application

• **Natural Recovery Analysis.** Geochemical modeling of sediments and porewater to estimate natural recovery time frames

• **Cap Modeling Analysis.** Development of cap treatment specifications to achieve RAOs for centuries

• **Erosion Protection Evaluation.** Development of armor specifications to resist extreme floods, waves, and propeller turbulence
Propwash Analysis
Sedimentation Analysis, 2004 through 2009
Sediment PRG Exceedances

Surface Sediment

Surface and Subsurface Sediment
Developing Cleanup Alternatives

• Four main alternatives developed based on:
  • Location and concentration of contaminants
  • Amount of natural recovery observed
  • Potential to be disturbed by flooding, boats, etc.
  • Proximity to seawall (dredging restrictions)
  • Considered a range of alternatives for each cleanup “polygon”
FS Remedial Alternatives

<table>
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<tr>
<th>MNR Focus</th>
<th>Treatment Focus</th>
<th>Dredge/Treatment Hybrid</th>
<th>Dredge Focus</th>
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<tr>
<td>ALTERNATIVE 2</td>
<td>ALTERNATIVE 3</td>
<td>ALTERNATIVE 4</td>
<td>ALTERNATIVE 5</td>
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</tbody>
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- **ALTERNATIVE 2**: Monitored Natural Recovery (MNR) Fill: 3,090 CY
- **ALTERNATIVE 3**: Enhanced MNR (EMNR) Fill: 6,070 CY
- **ALTERNATIVE 4**: Carbon-amended EMNR Cut: 3,760 CY Fill: 4,860 CY
- **ALTERNATIVE 5**: Partial Dredge and Treatment Cap Cut: 12,340 CY Fill: 3,780 CY

Legend:
- Monitored Natural Recovery (MNR)
- Enhanced MNR (EMNR)
- Carbon-amended EMNR
- Partial Dredge and Amended EMNR
- In-situ Treatment Cap
- Partial Dredge and Treatment Cap
- Dredge to PRG and Residual Cover (C1 Receives Amended Cover)
- Surface Product Removal with Treatment Cap (Alternatives 2, 3, 4) or Dredge to PRG (Alternative 5)
Proposed Alternative 4

- MNR and Enhanced MNR
- Activated Carbon Cap, Armored (In-situ Treatment)
- Activated Carbon Cap with Dredging
- Dredging
- Activated Carbon Cover (In-situ Treatment)
- Enhanced MNR
Proposed Remedial Alternative 4

- **Effectiveness.** Immediate risk mitigation through removal, in-situ treatment, and sand cover application
- **Reliability.** Remedy is armored for erosion protection and pre-dredged to maintain vessel access.
- **Implementability.** Remedy provides optimal blend of active and passive technologies to control energy use, emissions, waste generation, and community impacts
- **Cost.** Estimated at $8.9 million
- **Hot Spots.** Shallow hot spots and tar are removed
Conceptual Cap Design

- 1989 Dredging Elevation
- 24" Clearance to Top of Cap
- 6" Overplacement Allowance
- 12" Minimum
- 6" Overplacement Allowance
- 6" Minimum

Armor Layer
\( D_{50} = 3 \text{ to } 4 \text{ inches} \)

GAC – Amended Isolation Layer

In-Situ Sediments
Advantages of the Proposed Alternative

• Immediately achieves remediation goals over a majority of the site, including the highest risk areas

• Uses well-established, reliable technologies, and monitoring to ensure long-term remedy effectiveness

• Maintains access for visiting ships

• Optimizes the mix of technologies (dredging, treatment caps and covers, EMNR, MNR) to effectively manage:
  – Material handling and transport risks
  – Carbon emissions and waste generation
  – Risk of re-exposing buried contamination
Questions

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