

**SUBJECT**

Comments on Gas Works Park RI/FS Regarding DNAPL

**TO**Lucille McInerney, Washington State  
Department of Ecology**DATE**

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On behalf of Chevron Environmental Management Company (Chevron), Arcadis U.S., Inc. (Arcadis) is submitting this comment memo on the Gas Works Park (GWP) site Remedial Investigation (RI) and Feasibility Study (FS) provided by the Washington Department of Ecology (Ecology) for public review. At this time, Chevron is providing only focused comments regarding the characterization and interpretation of dense non-aqueous phase liquid (DNAPL) sources as detailed below.

- The 2022 draft GWP RI/FS (Section 5.3.3 DNAPL Distribution and Appendix 5F) identifies a type of DNAPL characterized as “Lower-PAH DNAPL with petroleum” and asserts that this DNAPL type is from a different source because it has “chemical evidence of petroleum”. The description and interpretations provided in the RI/FS that claim there is another source of DNAPL originating from overwater petroleum releases are inaccurate based on our review of the GWP RI/FS data, which indicate that NAPL and tar in upland soil and sediments in the western portion of the investigation area appear to originate from the western portion of the GWP site/former ATCO site. The RI/FS should be revised to correct these statements related to sources and types of DNAPL, including, but not limited to, in Section 5.3.3 and Appendix 5F. This comment is based on the following evaluations of the data presented in the RI/FS:
  - GWP site tar and DNAPL samples have polycyclic aromatic hydrocarbon (PAH) concentrations an order of magnitude higher (e.g., estimated 10% for more weathered samples to greater than 15%) compared with petroleum products (i.e., approximately 1% for typical #2 fuel oil). GWP site DNAPL sample alkylated PAH distributions demonstrate pyrogenic signature based on the distribution of alkylated PAHs.
  - Based on the analytical data (Table 5B) collected from surface soil, groundwater, and sediment close to South Yard and Harbor Patrol (NAPL areas depicted as area 1, 2 ,3 and 5B), most of the samples were dominated by 4-6 ring PAHs. These samples also had elevated high molecular weight PAH concentrations in some areas. Limited diagnostic ratios analysis showed that these samples likely have a pyrogenic origin.
  - There are relatively lower PAH concentrations in some upland DNAPL samples (MW-18 and MW-9 duplicate), indicating weathering of DNAPL within some of the GWP site upland DNAPL. This is an example of DNAPL containing relatively lower PAH concentrations than its original manufactured gas plant (MGP) source, which is indicative of weathering of DNAPL or various sources and ages of MGP releases (as PAH concentrations are still significantly greater than typical petroleum products, and these were located within the GWP upland site), rather than a petroleum product as claimed in the RI/FS.

- Based on the limited supplemental PAH data (eight samples) provided in Appendix 5F, sediment sample PAH distributions are characteristic of a pyrogenic source, and the petroleum hydrocarbons identified in a few samples may be from refined MGP petroleum tar given the predominance of PAH peaks. The data for these eight samples indicate:
  - o Six sediment samples are characterized as pyrogenic based on PAH distributions.
  - o Two sediment samples are predominantly benzene, ethylbenzene, and naphthalene.
  - o Three sediment samples have unresolved complex mixture curves on their total ion chromatograms, consistent with the presence of petroleum hydrocarbons. Two of these samples are in the western offshore area of the GWP site, and one is located nearshore adjacent to the Harbor Patrol/GWP site. Petroleum hydrocarbons in these samples are likely associated with refined MGP petroleum tar given the predominance of PAH peaks.
  - o Note that the supplemental dataset used to support claims of the “Lower PAH DNAPL with petroleum” is based on a limited alkylated PAH dataset and lacks total petroleum hydrocarbon data, and Appendix 5F does not include the complete Zymax laboratory report, including biomarker chromatograms and PAH distribution bar charts.
- In addition, it is noted that low molecular weight PAHs can also be from MGP processes (carbureted water gas and oil gas) that use crude oil or other petroleum products as a source material.
- Finally, the evidence indicates that the DNAPL and tar areas (1 to 5) within the western portion of the GWP site sediment area are primarily due to DNAPL and tar releases from GWP activities (upland and/or overwater), and these DNAPL areas appear to be more connected than indicated on the RI/FS Figures (Appendix 5F figures and Figure 5-26B).

## References

GeoEngineers, 2022. Public Review Draft Remedial Investigation and Feasibility Study, Gas Works Park Site, Seattle, Washington.