

 pennsylvania DEPARTMENT OF ENVIRONMENTAL PROTECTION	REPORT COMMENTS C. David Brown 12 Sep 2013	Commonwealth of Pennsylvania Department of Environmental Protection Southeast Regional Office Environmental Cleanup and Brownfields
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Site: Philadelphia Refinery AOI 11 3144 Passyunk Avenue Philadelphia, PA 19145	eFACTS Facility ID: 745291	Tank Facility ID: <i>n/a</i>
	Incident ID: <i>n/a</i>	NIR Date: 16 Oct 2006
Municipality: Philadelphia	County: Philadelphia	Location: 39.9130°N, 75.1985°W

Comments on “Final Report AOI 11” dated 21 June 2013, prepared by Langan Engineering and Environmental Services, for the former Sunoco Philadelphia Refinery, currently the Philadelphia Energy Solutions Refining and Marketing LLC facility.

General

1. The AOI 11 conceptual site model (§8.0) does not address the cause(s) for the occurrence of hydrocarbons in the Lower Sand aquifer. If the Middle Clay is a barrier to vertical migration of contaminants, then why are there elevated VOC levels in many areas? For example, at wells S-22 (AOI 3) and N-21 (AOI 8) benzene and/or MTBE are consistently elevated, but the Middle Clay is ~20’ thick at these locations.
2. Why are there no downgradient property boundary wells at AOI 9 (i.e., along the western edge, see Fig. 5)? There are clearly potential storage tank and pipeline sources in the area between the existing deep monitoring wells and the property line. The Middle Clay is absent there. Has Sunoco adequately determined conditions at the point of compliance?
3. In Table 3 several wells are missing entries in the “GW elevation August 2012” column. The abbreviation “NG” isn’t footnoted. Please correct the table.
4. A synoptic well gauging event in May 2012 included PGW and DSCP wells. This data wasn’t provided. Please add a table of the data from this event and a groundwater contour map including all of the deep wells.
5. There are several deep DSCP wells on the east side of AOI 1 (e.g., CSX-4, 5; Steen-DW-07, 08, 09; PH-DW-2, 3, 10, 11). Has Sunoco attempted to gain access to these wells for sampling?
6. We request that you prepare a map showing the estimated thickness of the Middle Clay across the site based on the monitoring well logs and other available data.
7. Appendix B contains many excerpts from the literature that are not properly referenced.
8. Please review Appendix C to determine if any deep boring or well logs are missing. We were unable to locate the log for S-264 (AOI 1).
9. Groundwater contour maps for the Aug 2012 and Oct 2012 events were not included in Appendix E.

10. The figure in Appendix F shows an offsite well ~200' downgradient of AOI 9 in the PaGWIS records. Its type is "unknown." Sunoco should make an effort to identify and locate this well, and determine if it is still active or abandoned.

Fate & Transport Modeling

Following are several comments on the modeling. These include general recommendations for future modeling.

11. The input source concentrations were based on a single sampling event (Mar/Apr 2013). The source value should be an upper bound to be conservative or an average of several measurements representative of conditions at that well. One event is not a statistically sufficient sample for establishing the source concentration.
12. Keep in mind that deep aquifer "plumes" were characterized with single, isolated wells. Sunoco did not delineate sources with peripheral wells, so we don't know if the concentrations at the presumed "source" wells are really reflective of the source area. They could be hundreds of feet downgradient or side-gradient of the greatest contamination.
13. You selected first-order decay rates (λ) from Ch. 250 Table 5a. These are literature values from experiments and field tests, generally under aerobic conditions. They can be starting values for model calibrations, but they are not necessarily appropriate or conservative for any given site. Dissolved oxygen levels are low in the deep aquifer, and aerobic degradation may not occur. The report should discuss the applicability of these literature rates to the site. If there isn't data documenting natural degradation or at least conditions conducive to it, then it may be more appropriate to assume zero decay rates. This can make a substantial difference with the predicted plume lengths.
14. You assumed longitudinal dispersivity values (α_x) of 200' for all models. This is excessively high, and it also causes the transverse dispersivity (α_y) to be exaggerated. The dispersivity should be a fraction of the transport distance; $\alpha_x = x/10$ is a common relationship. Your models predict transport distances of ~100' or less. Using a high dispersivity isn't always conservative. I don't expect this to make a large difference in the AOI 11 plume length estimates, however.
15. You chose a hydraulic conductivity of 135 ft/d, an average of USGS pumping test results for the area. For conservative modeling you should consider using a high-range value, not an average. For instance, in the USGS report "[Geohydrogeology of Southeastern Pennsylvania](#)" the median hydraulic conductivity for the Lower Sand is 150 ft/d and the P₇₅ value is 260 ft/d. [Schreffler \(2001\)](#) used a modeled Lower Sand hydraulic conductivity of 164 ft/d. [Pope & Watt \(2004\)](#) selected 300–400 ft/d for their models. This can have a significant effect on the results.
16. None of the models was calibrated. Uncalibrated fate-and-transport models are highly unreliable. Given the other issues above (poorly defined sources, uncertain natural degradation, range of possible hydraulic conductivities), the presented results are not conservative estimates of the maximum plume extents.
17. I suggest you look more closely at the well network and data to determine if there are any wells available for calibration. For example, in AOI-3 wells S-13 and S-8 are downgradient

of BF-108 and might be used to calibrate a MTBE model. Those results (ranges or limits for K and λ) could then be extrapolated to other models to improve their credibility.

18. Other work has been done on modeling groundwater flow in the Lower Sand, such as that by the USGS. How do those results bear on predictions for the migration of contaminants in the deep aquifer at the site?
19. There was no groundwater fate-and-transport analysis for inorganics to infer the potential extent of that contamination in the Lower Sand aquifer.

Attainment/PRCP

20. Refer to [Title 25 Pa. Code Section 93.9e](#) (see excerpt below). The tidal portions of the Delaware River estuary, including the tidal Schuylkill River, are exempt from Ch. 93 potable water supply standards. This includes the 1.0 mg/L Mn and the 0.3 mg/L Fe criteria (§93.7 Table 3) as well as human health criteria for toxic substances (§93.8c Table 5).

Stream	Zone	County	Water Uses Protected	Exceptions To Specific Criteria
1—Delaware Estuary	Tidal Portions of Basin, Big Timber Creek (NJ) to Philadelphia-Delaware County Border	Philadelphia-Delaware	WWF (Maintenance Only); MF (Passage Only); N Delete WC, PWS, LWS and IRS	See DRBC regulations—Water Quality Zone 4

21. The report did not address potential downgradient receptors of the Lower Sand aquifer contamination, particularly for inorganics. This was a concern in DEP’s 9 Dec 2011 comments on the Sep 2011 RIR (item 9). The deep aquifer is a water supply for New Jersey. Sunoco proposes eliminating the groundwater exposure pathway in a 1-mile distance around the facility, but this would not include wells in New Jersey.
22. A recommendation (§12.0) is to continue annual sampling of the deep wells as part of the post-remediation care plan. I’m unclear why this is necessary. There are already a few years of data and considerable historical knowledge of conditions in the deep aquifer. The site-specific standard will be met by pathway elimination, so knowledge of ongoing contaminant concentrations is not essential. I’m not aware of any reason to think that conditions might change in such a way as to violate this standard in the future.
23. The report refers to submitting an environmental covenant, but it does not clearly state what restrictions will be used to meet the SSS. The PRCP in the final report should use language that mirrors the activity and use limitations and reporting requirements to be included in the covenant. Specifically, how will Sunoco ensure ongoing non-use of the deep aquifer in a 1-mile zone around the property?

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