Site Assessment for the Proposed Coke Point Dredged Material Containment Facility at Sparrows Point

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EXECUTIVE SUMMARY

Capacity of existing placement sites for dredged material from the Baltimore Harbor remains extremely limited, resulting in an ongoing need to study, select, and construct new sites capable of accepting dredged material from within the Baltimore Harbor. A group of community members, citizens groups, and local government representatives, referred to as the Harbor Team, was tasked by the Maryland Port Administration (MPA) with identifying possible locations for placement of dredged material from the navigation channels in Baltimore Harbor. After an extensive screening process by MPA and the Harbor Team, the Coke Point Peninsula (the Peninsula) on the Sparrows Point Facility was identified as one of the potential sites for construction of a Dredged Material Containment Facility (DMCF) to help meet the 20-year dredged material placement requirements. The Sparrows Point Facility is located on approximately 2,300 acres on the north side of the Patapsco River in Baltimore County, Maryland, approximately nine miles southeast of downtown Baltimore. The Coke Point Peninsula comprises about 300 acres of the Sparrows Point property.

The Sparrows Point Facility has a long history of steelmaking activities. Coke production facilities (which were located on the Coke Point Peninsula) were built in the 1930s and operated until 1991. During a portion of this period, byproducts of coking operations and process activities, including coal tar and benzene, were stored in the Coal Tar Storage Area and Benzol Processing Area, respectively. Previous investigations of environmental conditions on the Coke Point Peninsula, which focused on groundwater, indicated that concentrations of multiple organic compounds and metals at the site exceed background concentrations and/or regulatory standards (CH2M 2001, 2002; URS 2005a, 2005b, 2006). These reports concluded that the Coke Point Peninsula, particularly the Coke Oven Area on the Peninsula, is the most impacted portion of the Sparrows Point Facility (USEPA 2009a). Of particular concern were materials associated with the steelmaking process, including petroleum oils and coal tar, which are generally referred to as light non-aqueous phase liquids (LNAPLs) and dense non-aqueous phase liquids (DNAPLs).

Prior to the design/construction of a DMCF, a property transaction would be required between MPA and the current property owner. Because groundwater and soil impacts from historical activity on the Peninsula were suspected to have degraded the offshore surface water and sediment quality, MPA required additional onshore and offshore environmental information before moving forward with consideration of its options regarding the property.

This Site Assessment for the proposed Coke Point DMCF at Sparrows Point was prepared by EA Engineering, Science, and Technology (EA) on behalf of the Maryland Environmental Service (MES), under contract to MPA. This study was designed to collect data to evaluate the nature and extent of onshore sources and to assess the potential impacts to offshore sediment and surface water in support of the ongoing Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI). Results of this study provide updated information related to the conceptual site model for fate and transport and allow for a preliminary evaluation of a range of potential remedial technologies and process options (hereinafter "Remedial Options") that could be implemented to address legacy onshore and offshore impacts on, and adjacent to, the site. These results also could provide a basis for a Corrective Measures Study (CMS), which, in

conjunction with the RFI, is a reporting requirement defined as part of the active RCRA enforcement for the Coke Point geographic region of the Sparrows Point Facility.

The Site Assessment utilized results from previous investigations to assess data gaps and to interpret and analyze the data. One previous study indicated that benzene and naphthalene, which are byproducts of the coking process, were the primary organic constituents in groundwater at the site (URS 2005a, 2006). Metals were also detected in groundwater, but at much lower concentrations than the organics. Impacts appeared to be limited to the upper two aquifers present beneath the site. The shallow, unconfined aquifer exists within the steelmaking slag fill material that comprises the top approximately 30 ft of subsurface across most of the Peninsula. Underlying the shallow aquifer is the intermediate aquifer, which is composed of native sandy material from the upper portion of the Talbot Formation. The aquifers are hydraulically interconnected, but are partially separated by discontinuous lenses of silt and clay. Previous reports indicated that the groundwater impacts to these two aquifers were found to be primarily focused in the Benzol Processing and Graving Dock Areas on the northwestern part of the Peninsula as well as in the Coal Tar Storage Area on the eastern part (URS 2005a, 2006).

Though previous investigations adequately characterized the nature and extent of groundwater impacts, the source areas had not previously been evaluated (with respect to the character of the fill material or the extent of the non-aqueous phase liquid [NAPL]). In addition, the potential impacts to the offshore environment (surface water and sediment) had not previously been characterized, although a limited study indicated that benzene, toluene, and other volatile organic compounds were present in near-shore water along the northwestern shoreline of the Peninsula in the Patapsco River (URS 2005b).

The objectives of the field investigations for this study were to further delineate the sources (i.e., NAPL and impacted slag fill material) of the previously observed subsurface impacts in the Benzol Processing, Graving Dock, and Coal Tar Storage Areas, and to assess the effects of the sources on surface water and sediment quality in the Patapsco River and the turning basin adjacent to the Peninsula. Information gathered through field activities and sample analyses was used to refine the conceptual site model and to conduct a preliminary evaluation to screen Remedial Options that would address human health and ecological risk as well as be complementary to future use of the site as a DMCF.

The onshore and offshore investigations each included a drilling component, in which continuous cores were collected using a hollow stem auger and split-spoon sampler to the depth of the native material. The cores were field screened for indications of NAPL, and samples from each borehole were collected for chemical analysis (volatile organic compounds [VOCs], polycyclic aromatic hydrocarbons [PAHs], and metals). Other analyses that were conducted on various samples included PAH fingerprinting (to determine the industrial source(s) of these compounds), total organic carbon (TOC), and grain size analysis. The offshore investigation also included collection of shallow, intermediate, and deep surface water samples co-located with the surface sediment samples for use in assessing fate and transport of anthropogenic constituents within the Patapsco River environment.

The onshore investigation included installation of NAPL monitoring wells in specific areas where NAPL was positively identified during field screening. The wells were gauged for the presence of NAPL, and recovery testing was conducted where NAPL was present, to assess the viability of different recovery methods for remediation purposes. In addition, NAPL samples were collected for analyses of chemical and physical properties to further characterize these sources.

Onshore results indicated the presence of mobile and residual LNAPL in the Benzol Processing Area and residually trapped DNAPL in the Coal Tar Storage Area. These NAPLs represent sources of organic compounds in groundwater, including mono aromatic hydrocarbons (MAHs) such as benzene, ethylbenzene, and toluene; and PAHs, such as naphthalene. Several MAHs, PAHs, and metals were present in the onshore soils at concentrations exceeding Maryland Department of the Environment (MDE) standards for protection of groundwater. The mobile LNAPL is recoverable, and mass distribution calculations indicate that its removal would significantly decrease the total mass of source material of organic constituents to groundwater. More exhaustive groundwater management measures would be required to address the groundwater impacts that would persist following removal of free NAPL.

The Graving Dock Area was investigated and did not show evidence of NAPL impacts in slag fill material. This supports previous conclusions that high concentrations of dissolved hydrocarbons in this area probably resulted from preferential groundwater flow north/northwest from the Benzol Processing Area because of hydraulic influences related to dewatering of the graving dock.

Results of the offshore investigation showed dissolved MAHs and PAHs in surface water off the northwestern and eastern parts of the Peninsula. The occurrence of these offshore dissolved constituents appears to be related to fluxes from impacted groundwater emanating from the identified onshore source areas. Modeling of the effects of groundwater on surface water indicated that elevated levels of benzene in surface water around the graving dock could exceed the U.S. Environmental Protection Agency (USEPA) ambient water quality criteria for protection of human health (USEPA 2009b). Historical surface water sampling supports this finding (URS 2005b). Although metals were also found to be present in groundwater (URS 2005a, 2006) at concentrations above standards set by MDE (2008), mass flux modeling indicates that metals concentrations in groundwater were not high enough to cause adverse impacts to surface water.

Offshore sediment also had elevated PAHs and metals, with many constituents present at concentrations exceeding average background sediment concentrations in the Baltimore Harbor channels (EA 2009). Calculations based on sediment analyses indicated that PAHs were likely present in some sediment locations as residual NAPLs. These NAPLs are associated with placement of byproducts of coking operations, or with historical placement of slag laden with byproducts. The magnitude of sediment impacts did not correlate with the highest fluxes of impacted groundwater, and sorption modeling indicated that the naphthalene present in the sediments could not result solely from contact with groundwater. However, PAH fingerprinting suggested that the sediment impacts are related to release(s) resulting from industrial practices at Sparrows Point.

A preliminary screening level evaluation of Remedial Options was conducted to address NAPL, groundwater impacts, slag fill impacts, and sediment impacts. In the evaluation, Remedial Options that were incompatible with site conditions and potential future use as a DMCF were screened out. Remedial technologies carried forward for further evaluation in a later step include:

- ***Onshore NAPL Removal*** - *Multi-Phase Extraction* (removal of impacted groundwater, separate-phase petroleum product, and/or hydrocarbon vapor using a high-vacuum system) and *Surfactant Enhanced Product Recovery* (addition of non-toxic food-grade surfactants to mobilize and recover NAPL from impacted regions of the subsurface);
- ***Onshore Groundwater Containment/Control*** - *Slurry Wall Containment* (trenches filled with a low-permeability semi-liquid mixture of soil, bentonite, and water, to cut off, contain, or divert impacted groundwater) and *Aerobically Enhanced Bioremediation* (adding oxygen into groundwater to stimulate biodegradation of organic constituents);
- ***Isolation of Onshore Slag Fill Material*** - *DMCF Capping* (placement of low permeability dredged material over the existing land surface) and *Engineered Capping* (placement of low-permeability geotextiles, liners, or clay material from offsite over the existing land surface); and
- ***Removal and/or Isolation of Offshore Sediments*** - *DMCF Capping* (low permeability dredged material placed within the dikes constructed for the DMCF), *Offshore Impermeable Capping* (placing a layer of low-permeability material at a thickness of up to 5 feet over impacted sediments), and *Dredging* (removing impacted sediments for placement on land).

It is important to stress that the MPA has not finished its executive deliberations on the Remedial Options under consideration, or on other matters related to acquiring a portion of the Sparrows Point Property. It should be noted, however, that this preliminary evaluation indicates that there are several Remedial Options that would be feasible, implementable, and effective corrective measures for the environmental conditions discussed in this Site Assessment. In particular, capping and containment remedies would be very effective at mitigating environmental impacts to offshore sediments and onshore subsurface media and could be seamlessly implemented with the DMCF construction.

If MPA were to acquire the Coke Point Peninsula for use as a DMCF, the Remedial Options for each of the impacted media would be further evaluated within the framework of the RCRA CMS process. Specific recommendations for further study include the following:

- Conduct groundwater modeling to confirm the direction and velocity of groundwater flow in response to dredged material placement;
- Assess the Graving Dock pumping to evaluate the necessary design parameters for groundwater response measures in this area;
- Conduct a geotechnical investigation to evaluate the potential for differential settling that may affect groundwater flow in response to dredged material loading on the existing land surface;
- Conduct additional offshore investigations to the southwest to further delineate sediment impacts for the design of offshore dikes; and

- Comply with additional reporting requirements as part of the RCRA enforcement at the site and the National Environmental Policy Act (NEPA) requirements for potential DMCF use.

Once MPA's internal deliberations about the site are complete, they anticipate that any recommendations arising from their deliberations would be shared and discussed with the Harbor Team. Further, any Remedial Options that could ultimately serve as corrective measures at the site will need to be further evaluated within the framework of the RCRA CMS process in accordance with MDE and USEPA review and concurrence.