Phase 1 Groundwater RFI Report for DuPont Oakley Site

EXECUTIVE SUMMARY

This Phase 1 Groundwater RCRA Facility Investigation Report (RFI) for the E. I. du Pont de Nemours and Company (DuPont) Oakley Site (formerly the DuPont Antioch Works) has been prepared to fulfill the requirements of the Corrective Action Consent Agreement (CACA, Section AN-12) issued by the Department of Toxic Substances Control (DTSC; effective date June 17, 2003) for a Groundwater RFI Report. The report was prepared in accordance with Attachment 3.B. of the CACA and presents results collected during execution of the Phase 1 Groundwater RFI Work Plan (DuPont Corporate Remediation Group [CRG], 2003a) as revised in the DuPont response to DTSC comments to the work plan (CRG, 2004a). The work plan was subsequently approved by the DTSC in 2004.

DuPont intends to conduct the Groundwater RFI process at the Oakley Site through three phases of investigation. Each phase will culminate with a report summarizing the activities comprising that phase. Consequently, the Phase 1 Groundwater RFI Report is the first of the three reports that DuPont intends to submit under the CACA Groundwater RFI process. Key points regarding the Phase 1 Groundwater RFI Report are summarized below. The report:

- Reflects the results of executing the work plan originally submitted by DuPont (CRG, 2003a) and subsequently approved by the DTSC on November 10, 2004
- Addresses activities completed between issuance of the Current Conditions Report (CRG, 2003b) and the beginning of Phase 2 Groundwater RFI activities (effectively April 2004)

The Phase 1 Groundwater RFI Report focuses on the western and central portions of Plume 1. The eastern portion of Plume 1 and Plumes 2 and 3 are addressed only as necessary for the completeness of discussion and will be further addressed during completion of the Phase 2 and 3 Groundwater RFIs, respectively. Overall objectives for the Phase 1 Groundwater RFI were to:

- Collect detailed information to characterize the western and central portions of Plume 1 and provide information to support the design of an interim measure (Permeable Reactive Barrier, PRB) for the Lower Aquifer (a pilot PRB located downgradient of the former Chlorofluorocarbon (CFC) Manufacturing Area was installed in 2001, and a full-scale PRB was installed as a groundwater interim measure within portions of the Upper and Lower Aquifer units in 2005)
- To collect information that improves the general understanding of groundwater flow and plume distribution, both for Plume 1 and for Plumes 2 and 3 located to the east.

While completing the Phase 1 Groundwater RFI Report, DuPont has proceeded with various investigations across the Oakley Site through the subsequent submittal of focused groundwater investigation work plans to DTSC. As described above and illustrated in Table 1-1, the results of these investigations will be published in future RFI reports that will compile information pertaining to Phases 2 and 3 of the Groundwater RFI.

Highlights of the Phase 1 Groundwater RFI Report include the following:

- Four separate direct-push sampling programs were conducted at the Oakley Site between October 2002 and October 2003. In total, 69 locations were investigated generally within or downgradient from the former CFC and Anti-knock Compound (AKC) manufacturing areas, and at locations in the northwest portion of the site.
- In total, 56 monitoring wells were installed between November 2002 and March 2004. Of this number, 19 wells were installed as part of a hydraulic characterization effort associated with the pilot PRB. As a modification to the existing site monitoring well network, 25 wells were also abandoned by over-drilling and grouting in accordance with DTSC-approved work plans (DTSC, 2003e; 2003f). This abandonment program was completed in June and December of 2003.
- Environmental Visualization System (EVS) software has been used to model subsurface conditions at the Oakley Site. The EVS model portrays current site stratigraphy as complex, with aquifer units and intervening aquitards extending across the site. This EVS model incorporates all applicable soil boring, monitoring well, and cone penetrometer test (CPT) lithologic data collected through April 2004.
- Lithologies present in the shallow subsurface are predominantly unconsolidated clastic deposits and generally range from silts and silty sands to coarse-grained sands and sandy gravels. Clays and silty clay units are present throughout the Oakley Site. Where present, these units stratigraphically subdivide thicker groundwater-bearing sand and gravel units into three major site-specific aquifer units (the Surficial, Upper, and Lower Aquifers [the Lower Aquifer is further subdivided into an upper L1/L2 Zone and a deeper L3 Zone]). Based on the EVS model and the density of available stratigraphic information (e.g., soil borings, CPT locations), the geology in the area of Plume 1 is understood, and the general sequence of water-bearing units and intervening aquitard intervals is well defined.
- Characterization of groundwater flow within the site aquifer units indicates that groundwater flow is generally from the south to the north or northeast toward the San Joaquin River and Little Break areas. Minor surface water features such as the Central Slough and Little Break areas have the largest impact on the Surficial Aquifer and to a lesser degree, the Upper Aquifer. The Lower Aquifer appeared to reflect predominant discharge to, and interaction with, the San Joaquin River rather than to local surface water features. Groundwater gradients for each of the aquifer units are typically steeper during the wet season (October to April) than for the dry season (May to September).
- Vertical hydraulic gradients for both the dry and wet seasons were calculated from seven nested well clusters located within Plume 1. Dry season vertical gradients between the Surficial and Lower (L3 Zone) Aquifers were negative (downward vertical gradients) in the central portion of Plume 1, and positive (upward vertical gradients) at all other well cluster locations. Wet season vertical gradients were generally negative except for a single cluster located adjacent to the San Joaquin River.

- A dry and wet season tidal study conducted by DuPont in October 2003 and April 2004, respectively, confirmed that the highest tidal efficiencies (defined as the ratio of change in water level in a specific well compared to the change in the level of the river) were in Lower Aquifer wells closest to the San Joaquin River. The least responsive wells were those furthest upgradient. This study also confirmed that groundwater flow direction does not reverse beneath the site during the tidal cycle. Tidal lag times (defined as the time between tidal peaks observed in the San Joaquin River and in the aquifer unit) are shortest in the Lower Aquifer, with observed lag times typically less than 30 minutes. As a result of these short tidal lag times, the hydraulic gradient becomes relatively shallower and steeper twice a day, up to distances of approximately 2,000 feet inland from the San Joaquin River.
- Groundwater concentration data from sampling events have been used to plot the distribution of selected constituents within each of the four aquifer units across the Oakley Site. Volatile organic compound (VOC) and CFC plumes are present within Plume 1, as well as within portions of Plumes 2 and 3. Dissolved arsenic, lead, and organo lead plumes are also present, but are limited to smaller areas (predominantly in Plumes 1 and 2). The distribution of these constituent plumes indicates source areas related to former manufacturing areas (i.e., the former CFC, AKC, and TiO2 manufacturing areas) and waste management units at the site.
- The Current Conditions Report (CRG, 2003b) identified 19 data gaps related to site geology or groundwater issues. Eighteen of these data gaps have been resolved for the Plume 1 area. Additional site investigations are planned for Plumes 2 and 3, the results of which will be presented in the Phase 2 and 3 Groundwater RFI reports, respectively.