TECHNICAL BRIEFING – 600 AREA DATA REPORT AND FEASIBILITY STUDY – 600 AREA GROUNDWATER PLUME (PICA 58), FINAL – REVISION #2 – APRIL 2013

The document reviewed was a data report and feasibility study (FS) for the groundwater plume in the 600 Area. An earlier such report had been finalized in 2010. Comments from the U.S. Environmental Protection Agency (USEPA) on a Proposed Plan (PP) for the site necessitated additional data collection and the addition of an alternate remedial alternative. In addition the completion of the remedial investigation (RI) for the Inactive Munitions Waste Pit (a Military Munitions Response Program – MMRP) site resulted in new information that was incorporated into the FS.

The 600 Area comprises approximately 450 acres with several large buildings and about 100 small structures used primarily for sheltered viewing during testing operations. The 600 Area includes three sites as follows:

- Site 11 – Buildings 647, 649, and 650; and Munitions Test Range (inactive)
- Site 12 (PICA-013-R-01) – Building 656, Munitions Waste Pit
- Site 13 - Building 640, Munitions/Pyrotechnics Test Area

Elevated levels of trichloroethene (TCE) were originally detected in a supply well installed for the Advanced Warhead Defense Facility (AWDF) in 1994. Subsequent investigation also found the presence of cyclonite (RDX) and methyl tertiary butyl ether (MTBE). The configuration of the TCE groundwater plume (very wide) is believed to be controlled by structural features in the bedrock.

Areas of Concern

Four areas of concern (AOCs) were ultimately identified as follows:

1. Munitions Waste Pit, RI Site 12
2. Metal Containers in Eastern Portion of RI Site 11
3. Partially Buried Drums in Western Portion of RI Site 11
4. Fill and Soil Mounds near Building 647

Work Scope

Work at the 600 Area proceeded in an iterative fashion with multiple work plans and interaction with regulators as data was gathered. Unlike other Picatinny Arsenal sites there is no formal RI report; the

results of the investigations are contained in the Data Report and FS. The various work efforts were described in the following plans:

- 600 Area Groundwater Remedial Investigation Work Plan (2004)
- 600 Area Work Plan Addendum (2005)
- 600 Area Groundwater Investigation – Supplemental Work Plan (2006-2007)
- 600 Area Groundwater Investigation Pump Test Work Plan (2007)
- 600 Area RDX Work Plan (2008)
- 600 Area Work Plan for Vapor Intrusion and Source Area Investigation (2010)

Throughout the various investigations the following tasks were completed:

- Passive soil gas surveys in all AOCs
- Very Low Frequency (VLF) surface geophysical survey of 600 area
- Installation of 11 bedrock monitoring wells
- Borehole geophysical and packer testing of the AWDF supply well and monitoring wells
- Aquifer pumping test
- Groundwater and surface water oxygen isotope sampling
- Groundwater, surface water, sediment, and soil sampling
- Human and ecological risk assessment

Investigation was targeted at determining the source of the TCE. After exhausting likely areas for the source, an area overlain by 10 to 30 feet of rock fragments was suspected. The presence of the rock layer which originated from blasting precluded investigative efforts. Ultimately the rock debris was removed and an investigation performed in the area. A 5-foot layer of affected soil was determined to be the source.

Contaminants in Groundwater

TCE has been detected in exceedance of levels of concern (LOCs) in multiple groundwater samples. MTBE, tetrachloroethene (PCE) and nine other volatile organic compounds (VOCs) have been detected in groundwater samples collected from the area. MTBE exceeded the LOC in two samples. Other LOC

exceedances were the detection of PCE in a single well. RDX was detected in excess of the LOC in five samples.

Contaminants in Surface Water, Soil, and Sediment

VOCs: VOC detections in excess of the LOC have occurred sporadically in surface water samples. The plotted TCE plume extends into the wetlands and thus, groundwater is suspected to be the source for VOCs found in surface water. Low concentrations of TCE were detected in all eight of the soil samples collected in March 2007; none of the concentrations exceeded NJDEP Impact to Groundwater (IGW) values. Sampling was completed in 2011 and 2012 as part of the source area investigation. Soil samples from test pits done in 2011 found TCE in only sample and at a low concentration. Further investigation was halted due to the discovery of a large amount of munitions debris (MD) and one munitions and explosives of concern (MEC) item. Trenching was resumed in 2012 at which time the supposed TCE source was detected based on field meter readings and confirmed by laboratory analysis. There were two historical LOC exceedances for toluene in sediment.

RDX: There were no RDX exceedances in five surface water samples collected in the October 2007 sampling but the compound was detected in four of the samples. RDX was also detected in a single sample in June 2008. Two RDX exceedances were found in downstream samples in the November 2006 and March 2007 sampling. Other downstream detections have occurred in multiple sampling rounds (November 2006, March 2007, June 2007, October 2007, and June 2008). The highest detection of RDX was found in a pond sample; the pond discharges to the stream and suspected to be spring fed.
Explosives were not detected in soil samples collected during 2011 test pit and trench excavation. RDX was the only explosive compound detected in one of four soil samples collected during the June 2012 trenching investigation but the concentration was not in excess of LOCs.
Baseline explosives sampling of sediment was started in January 2006 at a single location with subsequent samples collected in June 2006, March 2007, and June 2008. Two additional locations were added in June 2008. No LOC exceedances were detected and nitrobenzene was the only explosive compound detected.

Conceptual Source Models

There are two models that have been devised to describe the nature of the contaminant source. The Inactive Source Model reflects an inactive or rapidly declining TCE source. The result of this model is a 53-year cleanup time using the USEPA time-dependent degradation rate method. The other concept is the Soil Leaching Model. In the Soil Leaching Model there is an ongoing but declining source of TCE based on soil leaching rates; the time to attain cleanup is 35 years using NJDEP Impact to Groundwater Standards for TCE and the model VLEACH. For costing purposes for the various remedial alternatives a source life of 50 years was utilized.

Remedial Action Objectives

The remedial action objectives (RAOs) for the site are as follows:

- Prevent human exposure to contaminated groundwater that could cause unacceptable risk over the duration of the response action
- Restore groundwater to the more stringent of maximum contaminant levels (MCLs) or New Jersey Groundwater Quality Standards (GWQS) for contaminants of concern (COCs) in a reasonable time frame.
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FS Components

Several steps lead to development and evaluation of the remedial alternatives. The steps are as follows:

- Identification of Applicable or Relevant and Appropriate Requirements (ARARs)
- Development and screening of alternatives
- Detailed analysis

Completion of the first two steps resulted in the formulation of six remedial alternatives described in the following section.

Remedial Alternatives

Six remedial alternatives (RA) were formulated to attain the RAOs for the site. The alternatives are as follows:

- GW-1: No action
- GW-2: Monitored natural attenuation (MNA) with institutional controls (ICs)

- GW-3: In situ chemical oxidation and MNA polishing with ICs
- GW-4: In situ enhanced aerobic bioremediation and MNA polishing with ICs
- GW-5: TCE source material excavation and MNA polishing with ICs
- GW-6: Total landfill removal with MNA polishing with ICs

Remedial Costs

Total costs (present worth) for each of the alternatives are provided below:

- GW-1: No action - $0.00
- GW-2: Monitored natural attenuation (MNA) with institutional controls (ICs) - $680,235.73
- GW-3: In situ chemical oxidation and MNA polishing with ICs - $1,081,495.01
- GW-4: In situ enhanced aerobic bioremediation and MNA polishing with ICs - $1,203,064.81
- GW-5: TCE source material excavation and MNA polishing with ICs - $1,661,678.98
- GW-6: Total landfill removal with MNA polishing with ICs - $2,610,027.62

Detailed Analysis

The nine criteria against which each RA has to be assessed are as follows:

1. Protection of human health and the environment.
2. Compliance with ARARs.
3. Long-term effectiveness and permanence.
4. Reduction of toxicity, mobility, or volume through treatment.
5. Short-term effectiveness.
6. Implementability.
7. Cost.
8. State acceptance.
9. Community acceptance.

The seven screening criteria are employed in the FS. State acceptance and community acceptance are factored in during the public comment period. The first two are considered to be threshold criteria; nos. 3 through 7 are primary balancing criteria; and the final two are modifying criteria. In past Picatnny Arsenal reports an RA had been recommended as the preferred alternative in the FS; this practice has

been discontinued. Only the detailed analysis is presented in the FS. The no-action alternative does not meet the threshold criterion of protecting human health and the environment. The remaining alternatives satisfy some or all of the first six criteria. Cost is the final balancing criteria.