TECHNICAL BRIEFING – DRAFT FINAL AREA C GROUNDWATER LONG-TERM MONITORING REPORT, ROUND F, STATISTICAL EVALUATION - AUGUST 2013

The document reviewed was a semiannual monitoring report for groundwater for Area C. Monitoring wells included in the program are in Area C and in the Southern Boundary Area (SBA). Area C is identified as PICA 206. Long-term monitoring is performed by ARCADIS/Malcolm Pirnie on behalf of Weston in accordance with the Record of Decision for the area signed September 1, 2009 and the Long-Term Groundwater Monitoring Plan (LTGWMP) signed November 2009.

Remedies specified for Area C were as follows:

- Establish land use controls (LUCs)
- Use existing Classification Exception Area (CEA)/Wellhead Restriction Area (WRA)
- Establish and implement a long-term monitoring plan
- Develop exit strategy for groundwater monitoring
- Implement 5-year reviews.

Monitoring Program Wells

There were 16 monitoring wells in Area C and 16 monitoring wells in the SBA at the inception of the monitoring program; the SBA wells are sentinel wells in that they are the most downgradient wells at Picatinny Arsenal and would theoretically be used to detect contamination before it exited the base property. Prior to the statistical evaluation described herein there were 28 monitoring wells remaining in the program.

Analytical Parameters

Analytical parameters are as follows: cis-1,2- dichloroethene (cis-1,2-DCE), vinyl chloride, arsenic, chromium, lead, nickel, thallium, and RDX. The monitoring frequency is specified in the LTGWMP. The winter 2013 semiannual sampling event took place from March 18 to 21, 2013. A total of 15 monitoring wells were sampled during the subject event including four Area C wells, two upgradient wells, and nine SBA wells.

Numerous previous studies were conducted in the area. Area C has limited exceedances of a few volatile organic compounds (VOCs) and explosive compounds in groundwater; the occurrences are isolated and limited in extent. Lead and arsenic detections are more widespread with no specific identifiable source despite intensive investigation. Other metals including iron, manganese, aluminum, and sodium are either naturally occurring and associated with the local geology (rock formations having these constituents naturally) or not known to be related to base activities.

Evaluation of Arsenic and Lead Controls

Arsenic and lead concentrations are affected by many factors in the groundwater chemistry. Arsenic is controlled by desorption, dissolution, oxidation-reduction potential, dissolved oxygen concentration, and adsorption. Lead is affected by adsorption at the solid-water interface, precipitation, and complexation with organic matter. To examine what controls these variables were having on metal concentrations two sets of parameters were measured: for arsenic – dissolved oxygen, pH, redox, and turbidity; and for lead – pH and turbidity. Parameters were compared to analytical results for the metals. No significant difference could be identified regardless of whether the field parameters were to have a positive or negative influence on results.

Evaluation Process for Monitoring Program Analytes and Wells

The exit strategy includes a multi-step process to determine whether analytical parameters would have the frequency of monitoring modified or the analyte would be dropped from the monitoring program.

Step A: Determine If There Are Analytes to Remove. This step does not apply to SBA wells unless all of the Area C wells have had the analyte dropped. If analytes are less than ARARs for four or more consecutive sampling events then a parameter can be discontinued. In this case three analytes passed the test for removal: cis-1,2-DCE, chromium, and RDX.

Step B: Determine Frequency of Sampling for Analytes Remaining in Program

Step B1: Evaluate whether analyte concentrations are increasing or decreasing.

Step B2: If concentrations are not decreasing, determine if concentrations are consistent with historical data. As a result of this step lead was found to be “not increasing” and the sampling frequency was

reduced from semiannual to annual for Wells SB1-5, SB1-6, SB-1-7, and SB3-2. More evaluation was required for the following analytes and listed wells:

- Vinyl chloride - - DM19-1
- Arsenic - - SB2-2, DM19-2, and C-1B
- Lead - - SB1-1, SB1-2, and SB1-3
- Thallium - - SB1-2 and SB2-2.

The data sets were subjected to statistical analysis but "because the data set was small the process did not yield meaningful UCL statistics. Therefore, the concentration range of the historical data was compared to the mean of the most recent data." (according to Arcadis review comments) Of these parameters, vinyl chloride and thallium will remain as parameters on a semiannual frequency. Arsenic and lead will be reduced in frequency from semiannual to annual.

Step C: Determine If Analytes Are Present Above Trigger Levels.

Step C is formulated to determine whether additional investigation is required . Vinyl chloride did not fail Step C for Well DM19-1. For arsenic in Well DM19-2 there is insufficient "long-term monitoring data to make a meaningful statistical evaluation for this well for Step C." (according to Arcadis review comments) The average concentration had exceeded the trigger level even though data from four most recent sampling events showed the concentration to be consistent with historical data.

The first statistical evaluation was conducted after two years of sampling which took place in the fall of 2011. The January 2013 semiannual report contains the results of the second statistical evaluation. On the basis of that evaluation several wells passed Step A for some analytes and those analytes were dropped from the monitoring for those wells; analytes were arsenic in two wells, lead in two wells, cis-1,2-DCE in two wells, and RDX in 12 wells.

Results and Conclusions

Analytical parameters were modified slightly on the basis of evaluation and some wells were removed from the sampling program. Analytes that remain in one more Area C monitoring wells, the two upgradient monitoring wells, and all the SBA monitoring wells are as follows: vinyl chloride, arsenic, lead, nickel, and thallium. RDX, cis-1,2-DCE, and chromium passed Step A of the evaluation and as a

result have been discontinued from all monitoring wells. The majority of the analytes appear to be decreasing in concentration or are at concentrations consistent with historical data.