MEMORANDUM

TO: Mark Bohne, PBOW RAB Co-chair and RAB members

FROM: Julie Weatherington-Rice, Ph.D., RAB TAPP Coordinator

RE: Draft Site Characterization Report Remedial Investigation, Part 1 at Acid Area 1, Former Plum Brook Ordnance Works, Sandusky, Ohio – JE Jacobs

DATE: March 27, 2009

Per our current contractual arrangement with US ACE which require both a technical memorandum for each report and an educational explanation to the RAB, this memorandum constitutes the educational review of the J E Jacobs January, 2009 "Draft Site Characterization Report Remedial Investigation, Part 1 at Acid Area 1, Former Plum Brook Ordnance Works, Sandusky, Ohio" documents. Please forward these comments to the other RAB members.

General Comments

This document includes an executive summary, a general text portion including figures and tables and 11 appendixes. The appendixes include the [A] NASA drilling and excavation permit, [B] soil boring logs, [C] land survey documents, [D] piezometer and monitoring well boring logs, [E] monitoring well construction diagrams, [F] well development records, [G] groundwater sampling field data forms, [H] photologs of rock cores, [I] slug test data and calculation sheets, [J] chemical data quality report (evaluation of the primary analytical laboratory data), and [K] chemical quality assurance report (assessment of the QA analytical laboratory data).

This is a summary document of the history of all the investigations that have been completed at Acid Area 1. This summary is compiled to begin the selection process of the next remediation steps for the Acid Area 1 portion of the site. As such, there is an in-depth history of all investigative efforts, including documentation of the installation of monitoring wells and temporary piezometers, lab analyses for ground water, soils, sediment, and surface water samples, etc. This is a very thick document and all 11 detailed appendixes are presented in paper form. It is written in typical engineering style. All figures, tables and photographs are in the back of the initial report or in an appendix as opposed to being included within the body of the text. This makes following the text somewhat cumbersome since it is necessary to refer back in the document to check the figures, tables, and photos. Since the document is overfilling a very large binder, some of the pages must be removed from the rings to turn back to the appendixes. I solved this problem by taking all the text, figures and the tables out of the binder and reading them

separately so that I could reference the figures and other information in the appendixes as needed.

At least some of the information included in the various appendixes was not needed in its complete paper form. The reading of this report would have been significantly enhanced if at least some of the less critical appendixes, such as J and K had been included in a PDF format on a CD in the back. However, there may be a requirement in the contract with US ACE that requires Jacobs to submit this report in this format so this comment should be considered an observation in terms of ease of reading and not an uninformed criticism of the document presentation.

1.1.2 History (Formation of Oleum) page 1-2

There is a description of the manufacturing of oleum that may help explain the presence of vanadium at the site. Vanadium is a very rare trace metal and is not typically naturally occurring in Ohio geologic materials of these ages. This heavy metal and thallium continue to be found at the Plum Brook Ordnance Works (PBOW) site, often in quantities that require remediation. To date, I have only been able to identify coal, which is a biological sponge full of heavy metals, burned in the various boilers and the resulting ashes as a possible source of these rare trace metals. This discussion notes that oleum is formed by melting sulfur and then burning it to form sulfur dioxide. *"The sulfur dioxide was subsequently oxidized by a vanadium pentoxide catalyst to produce sulfur trioxide.*" This comment documents the presence of vanadium at the site as part of the manufacturing process.

In discussing this chemical process with my husband Ed, he mentioned that another source of vanadium that would probably exist at the site, especially in an area full of tanks and piping, is the vanadium that is often included as alloys in arc welding rods. Ed's father founded the family-owned regional welding supply firm, Virginia Welding, until they sold it to Air Gas in the late 1990s. Ed grew up working at the Charleston WV facility and was very familiar with the materials on hand during the period of time that the PBOW was built and operating. I then researched arc welding rods on the internet and found that his childhood memory of vanadium in the rods was correct. A number of the currently available rods have vanadium as well as a number of other trace heavy metal alloys in them. In addition, Ed commented that it was common practice, when using welding rods at a field site, to simply drop the last few inches of the rods on the ground when they became too short to safely hold. Therefore, given the history and construction practices of the time, it is possible that some of the heavy metal contamination at the various sites with tanks and metal piping may simply have come from abandoned welding rods.

2.2.2 AA1 Geology pages 2-2 to 2-3

It is important to note that this section of the report has been updated to include both the 2002 published interim Soil Survey of Erie County and the web-based soil

survey information. This means that the most up to date information on the soils and the underlying geology of the site have been incorporated in this summary document.

5.2.1 Shallow Groundwater page 5-2

The shallow ground water at the Acid Area 1 site is contaminated with manganese (all four wells), iron (two wells), arsenic (two wells round one), thallium (two wells round one) and vanadium (one well round one) that are above the PRGs and so are subject to remediation. All of the explosives, VOCs, and SVOCs found in the shallow ground water were at levels below the PRG action levels and/or were not found in later rounds of sampling.

5.2.2 Bedrock Groundwater page 5-3, 5-4

The bedrock ground water at the Acid Area 1 site is contaminated with a number of VOCs, nitroaromatics, SVOCs and metals. Some of the VOCs and SVOCs are associated with naturally occurring petroleum. Some of the contaminants exceeded the PRGs. The contaminants that clearly cannot be related to the petroleum are 2,4,6-Trinitrotoluene, 2-Nitrotoluene, RDX, TCE, Cyanide, Manganese, Thallium, Vanadium, and Arsenic.

6.1 Distribution of Contaminants in Surface Water page 6-1

Surface water contains the following contaminants above the PRGs; iron, manganese, arsenic, thallium, aluminum, vanadium, trichloroethene, and carbon tetrachloride.

6.2 Distribution of Contaminants in Sediment pages 6-1 and 6-2

The following contaminants exceeding PRGs are found in the sediment. They include; PCB (aroclor 1260), PCB (aroclor 1254), Benzo(a)pyrene, lead, aluminum, vanadium, nickel, and N-Nitroso-di-n-propylamine.

7.0 Conclusions and Recommendations page 7-1

More work is needed to determine the final delineation of contaminated soils.

7.1 Soil Investigation pages 7-1 and 7-2

There appears to be a relationship between high lead levels and high PCB levels in the surface soils. The subsurface soils are mostly contaminated with metals such as aluminum, vanadium and cadmium. There is a deep soils contamination near building 302.

7.3 Surface Water and Sediment Investigation pages 7-2 and 7-3

Surface water contaminated sediments have contaminants similar to that of soils, the concentrations are decreasing further away from the Acid Area 1 site, as expected.

7.4 Conceptual Site Model pages 7-3 and 7-4

A good summary of this model is contained in the second paragraph which reads as follows:

> *"The facility profile addressing site structures, physical boundaries, and the current and historical processes, is presented in Sections 1.0 and 2.0 of the document. The primary source of contamination at the site is surface soil in the vicinity of former buildings and storage tanks. Contaminants present in the surface soil include PCBs, benzo(a)pyrene, lead, and TCE. Another source of contamination is the sediment in the ditches. Contaminants present in the sediment include PCBs, benzo(a)pyrene, and lead. The highest concentrations of PCBs and lead are found in the vicinity of the former storage tanks."*

7.5 Recommendations page 7-5 (quoted in it's entirety)

> *"Further actions should be considered to address the contaminants exceeding the USEPA Region 9 PRGs in soil, sediment, and surface water in the northern drainage ditch. The recommendations are as follows:*
>
> - *Perform a human health and ecological risk assessment using existing site data.*
> - *Evaluate the need for further contaminant delineation in soil and sediment based on results from human health and ecological risk assessments.*
> - *Evaluate the need for an investigation of the shallow groundwater north of Building 302 and confirmation of TCE discharge into the northern drainage ditch.*
> - *Evaluate the need for any further remedial actions based on results from the human health and ecological risk assessments."*

<u>Specific Comments - Site Characterization Report Remedial Investigation, Part 1 at Acid Area 1</u>

2.3.1 PBOW Description page 2-4 last sentence

This sentence reads as follows: *"The nearest recorded well is 6115 Schenk Road, approximately 6200 ft northwest of AA1; however, a closer well was observed at 1810 Scheck Road, located approximately 5300 ft northeast of AA1."* Using the most up to date version of Google Earth, I located the two addresses on Scheck Road and measured into the center of the Acid Area 1 location. I found that the house at 1810 Schenk Road

is actually approximately 10,250 ft northwest of Acid Area 1 and that the house at 6115 Scheck Road is approximately 7,300 ft west-northwest of Acid Area 1. This section needs to be corrected.

Figure 7-1 Chlorinated Hydrocarbons in Soil and Surface Water

I found this figure confusing. The figure shows shallow ground water elevation contours, a series of soil borings that are non-detect, contaminated, and only one above PRGs. In addition, there are two surface water sampling points down gradient that are both above PRGs. Is this figure trying to represent that the high surface water readings are the result of flushing of chlorinated hydrocarbons out of the soils, through the shallow ground water to the surface water discharge point? If not, is it trying to show two separate pathways? Please consider redrafting this figure, perhaps breaking it up into two figures for ease of understanding.

Appendix H Photologs of Rock Cores

This presentation of boring locations and bedrock cores is very helpful and quite attractive.

This concludes my educational comments on these Draft Site Characterization Report Remedial Investigation, Part 1 at Acid Area 1, Former Plum Brook Ordnance Works, Sandusky, Ohio documents. If you have any questions and/or need further clarification on any point discussed in this memorandum, please feel free to contact me.