

SCS BT SQUARED

March 7, 2012
File No. 25211597.00

Mr. Tim McCumber, Town Administrator
Town of Merrimac
PO Box 115
Merrimac, WI 53561

Subject: Corrections and Clarifications to the Groundwater Alternative Feasibility Study
Badger Army Ammunition Plant, Baraboo, Wisconsin

Dear Mr. McCumber:

SCS BT Squared (SCS) is pleased to provide this interpretation of the U.S. Department of Army's February 2, 2012 *Corrections and Clarifications* to the December 2011 "Revised Alternative Feasibility Study – Groundwater Remedial Strategy" (AFS) for the Badger Army Ammunition Plant (BAAP) site. SCS prepared this letter for the Town of Merrimac, under a contract with SpecPro, Inc. (consultant that prepared the AFS), as part of the Army's Other Government Agencies (OGA) assistance program.

As described in greater detail below, the AFS corrections and clarifications fall into two general categories – vertical hydraulic gradient calculations and contaminant mass calculations.

VERTICAL HYDRAULIC GRADIENT

The vertical hydraulic gradient within an aquifer (or between two aquifers separated by an aquitard) is calculated by dividing the difference in hydraulic head (or water level elevation) by the vertical (elevation) distance between the well screen midpoints. Typically, the two wells are closely-spaced at the ground surface. In the AFS, a positive vertical gradient indicates potential for upward water flow, and a negative vertical gradient shows downward flow potential. Especially in heavily-studied sites like the BAAP, hydrogeologists review both the horizontal and vertical gradients to better understand the potential transport of contaminants in groundwater.

Table 8 of the AFS summarizes SpecPro's calculations of vertical hydraulic gradient based on water level data from groundwater monitoring wells installed at multiple depths in the Propellant Burning Ground (PBG), Deterrent Burning Ground (DBG), and Central plume areas. The table includes calculations for three water level elevation measurement dates – May 2010, September 2010, and March 2011 – plus an average for the three dates. Water level data were not available for all well clusters on all dates in the DBG and Central plume areas.

The revised AFS Table 8R corrects spreadsheet calculation errors, and shows that vertical hydraulic gradients at BAAP are approximately two orders of magnitude lower than SpecPro



originally estimated. The corrections directly address one of SCS's comments on the draft AFS – that the conceptual site model did not adequately account for what appeared to be vertical gradients that greatly exceeded horizontal gradients. With the corrections to Table 8, it is now reasonable to conclude that in general, horizontal and vertical gradients in the sand & gravel aquifer are within the same order of magnitude, which is typical of the more uniform/continuous outwash aquifer at the BAAP. In contrast, outwash aquifers with laterally continuous clay lenses sometimes show vertical gradients that are much greater than horizontal gradients.

CONTAMINANT MASS

In Table 14 of the AFS, SpecPro estimates the mass of carbon tetrachloride (CTET) and total dinitrotoluene (DNT) remaining in the PBG groundwater plume. Table 15 includes an estimated DNT mass for the DBG and Central plumes. The calculations take into account the plume geometry, average contaminant concentration, and soil porosity. Compared to the original AFS tables, the corrected calculations in Tables 14R and 15R show:

- An order of magnitude decrease in residual CTET and DNT mass for the PBG plume
- A 40 percent increase in the residual DNT mass for the DBG plume
- No significant change in the residual DNT mass for the Central plume

Similarly, revisions to AFS Table 2 reflect order of magnitude increases in the estimated residual soil DNT concentrations from the DBG and PBG source areas. Since the original contaminant mass calculations did not materially affect SpecPro's site interpretation or evaluation of remedial alternatives, the corrections have no significant effect on the AFS conclusions.

Feel free to contact me at (608) 216-7320 or jtweddale@scsengineers.com if you have any further questions or concerns about the AFS or other BAAP issues.

Sincerely,



John B. Tweddale, PG, CHMM
Senior Hydrogeologist, Vice President
SCS BT SQUARED

JBT/lmh/EO

cc: Clair Ruenger, SpecPro