

SCS BT SQUARED

December 28, 2011

File No. 25211597

Mr. Clair E. Ruenger, PG
Environmental Services Manager
SpecPro, Inc.
1 Badger Road
Badger Army Ammunition Plant
Baraboo, WI 53913-5000

Subject: Responses to Restoration Advisory Board Questions on the
Alternative Feasibility Study for Groundwater

Dear Mr. Ruenger:

At the request of SpecPro, SCS BT Squared (SCS) is providing answers to the following questions from the Restoration Advisory Board (RAB) related to the Groundwater Alternative Feasibility Study (AFS) report for the Badger Army Ammunition Plant (BAAP) in Baraboo, WI:

- a. Where the plumes reach the river or wetlands, is it safe for humans, fish, aquatic ecosystems?
- b. Is the depiction and modeling of the groundwater plumes reasonable for conditions over time/long term?
- c. Impacts on irrigation if the treatment (IRM/MIRM {*interim and modified interim remedial measures*} pump and treat system) is turned off – will the groundwater be safe for use?
- d. Does the remedy actually cleanup rather than use institutional controls?
- e. Is the remedy protective of all receptors and routes of exposure?
- f. Does the proposed remedy comply with regulations?

In the text that follows, SCS answers these questions based on our general experience and the information contained in SpecPro's December 2011 "Revised Alternative Feasibility Study -- Groundwater Remedial Strategy," which includes groundwater sampling data collected through October 2010. Other than the AFS and the Wisconsin regulations and statutes cited below, SCS did not review any other documents to prepare these responses.



a. Where the plumes reach the river or wetlands, is it safe for humans, fish, aquatic ecosystems?

Wisconsin Department of Natural Resources (WDNR) and Wisconsin Department of Health and Family Services (WDHFS) staff are familiar with the BAAP case, and are best qualified to address the underlying question of safety for humans and the environment.

Section 7.4 of the AFS discusses potential wetland and river impacts and concludes:

The general public is subject to some level of risk through recreational use of the Lake Wisconsin/Lower Wisconsin River. VOCs and SVOCs [volatile and semi-volatile organic compounds] do not bioaccumulate in organisms. For this reason, consumption of fish from Lake Wisconsin or the Lower Wisconsin River way is identified as a pathway of no regulatory concern. In addition, a comparison of National Recommended Water Quality Criteria, developed to protect aquatic life from acute and chronic health effects, shows all surface water criteria are much higher than the groundwater concentrations off-site. Therefore, exposure through surface water is currently not a risk or regulatory concern.

Section 8.3 of the AFS covers Wisconsin Water Quality Standards and Criteria and concludes:

Numerous studies or tests have been conducted throughout the years in which surface water samples have been collected and analyzed. Data collected includes Gruber's Grove Bay investigations conducted by Shaw Environmental, Inc. and an April 2007 Weigand's Bay water sample, the December 2007 shallow temporary well water samples (adjacent to Weigand's Bay), and the annual WPDES [Wisconsin Pollutant Discharge Elimination System] Whole Effluent Toxicity Monitoring (background samples collected near Inspiration Point and Weigand's Bay) conducted by SpecPro, Inc. None of the surface water samples collected during these studies showed evidence of contaminants of concern. Based on the data from these investigations and applicable scientific and regulatory information, the residual contaminant plumes do not adversely affect receptors in the environment.

The AFS identifies the primary receptor pathway as ingestion of groundwater from private wells, and the report compares groundwater sampling data to NR 140 Table 1 public health enforcement standards (ES) and preventive action limits (PALs) to evaluate this pathway. AFS Figure 18 shows three primary BAAP source areas, with groundwater plumes and estimated discharge zones. Section 6.2 summarizes the nature and extent of groundwater contamination, including private well sampling data, for each of these source areas:

- Deterrent Burning Ground (DBG)
- Central Plume
- Propellant Burning Ground (PBG)

b. Is the depiction and modeling of the groundwater plumes reasonable for conditions over time/long term?

AFS Figures 19 through 37 depict the distribution of specific contaminants of concern at a “point in time” based on groundwater samples collected between August and October 2010, though some older data are represented in some figures. There are several factors affecting these plumes –geologic conditions near each monitoring point, well pumping, surface water interactions, biodegradation, dilution, and many more. Therefore, it is reasonable to develop a conceptual hydrogeologic site model that describes the observed data as best as possible, as is done in Section 7.0 the AFS. As new wells and sampling data are collected, the geologic cross sections and plume depictions will necessarily evolve. Continued groundwater monitoring is part of the proposed remedy. While groundwater modeling has been completed at the BAAP, our understanding is that the modeling results were not a significant factor in developing the conceptual site model or selecting the proposed remedy.

c. Impacts on irrigation if the treatment (IRM/MIRM pump and treat system) is turned off – will the groundwater be safe for use?

Issues of groundwater safety are best directed to the Wisconsin Department of Natural Resources (WDNR) and/or Wisconsin Department of Health and Family Services (WDHFS).

Section 7.4 of the AFS (Exposure Pathways and Receptors) states:

There are irrigation wells located in the off-site portion of the PBG plume. However, the WDNR has not required monitoring of the irrigation wells.

d. Does the remedy actually cleanup rather than use institutional controls?

To the best of our knowledge, there is no human effort that would completely clean up all remaining BAAP-related groundwater contamination – this goal is technically and economically infeasible. The approach proposed in the AFS is designed primarily to mitigate risk and exposure pathways. For a site as complex as the BAAP, it is common for the overall remediation strategy to include a mixture of active cleanup, capping, monitored natural attenuation (MNA), alternative water supplies, and institutional controls.

As proposed in the AFS, the long-term groundwater remedy will include installation of a public water system, a phased shutdown of the IRM and MIRM systems, a modified groundwater monitoring program, and natural attenuation of the PBG, DBG, and Central Plumes. Various other cleanups/remedies have already been implemented for specific media, especially in areas with elevated soil and groundwater contaminant concentrations.

South and east of the primary source areas and extending off site, the current challenge is to address lower-concentration, but more widely spread, residual groundwater contaminant plumes. As these plumes migrate and become more dilute, active remediation methods become less

practical, less effective, and more expensive. The AFS acknowledges that the presence of private, potable water supply wells downgradient of the BAAP creates an unacceptable pathway for exposure to contaminants. Therefore, the AFS proposes to replace the known and potentially-affected wells (in the general area shown on Figure 39) as a way to mitigate this risk pathway.

Long-term groundwater remedies often include capping and institutional controls with continuing obligations that pass to subsequent property owners. Section 9.0 (MNA Evaluation) states that "...there will be municipal ordinances and deed restrictions limiting groundwater use in the affected areas."

Even if MNA is not 100% effective at removing residual, lower-concentration contaminants from groundwater within in a reasonable period of time, providing a public water system makes sense at this time. Especially when compared to the current approach of running the interim groundwater remediation systems and replacing private wells (and/or providing bottled water) on an ad-hoc basis as contamination is encountered during sampling events, installing a public water system is more:

- protective of human health in the short- and long-term;
- proactive, rather than responsive; and
- cost effective.

e. Is the remedy protective of all receptors and routes of exposure?

Assuming that the new water source is safe and that the proposed area covered by public water supplies is sufficiently conservative, the primary exposure route for human health (ingestion of groundwater) should be adequately protected.

f. Does the proposed remedy comply with regulations?

Section 8.0 (Regulatory Requirements) references the state ARARs (Applicable or Relevant and Appropriate Requirements) for groundwater cleanups in Wisconsin – the Spill Law, NR 140, and the NR 700 series. NR 722 is the appropriate, guiding regulation for preparation of the AFS. Due to the proximity of the Lake Wisconsin Reservoir and Lower Wisconsin River, Section 8.3 discusses surface water regulations NR 102 and NR 105.

Compliance with environmental regulations is best interpreted by the WDNR as the regulatory authority for the BAAP cleanup.

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SCS appreciates the opportunity to provide input on these important issues. Feel free to contact me at (608) 216-7320 or jtweddale@scsengineers.com if you have additional questions.

Sincerely,

A handwritten signature in black ink that reads "John B. Tweddale". The signature is written in a cursive style with a long horizontal flourish extending to the right.

John B. Tweddale, PG, CHMM
Vice President, Hydrogeologist
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JBT/lmh/EO

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