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February 13, 2012

Ms. Joan Kenney - Commander's Representative
Badger Army Ammunition Plant
2 Badger Road
Baraboo WI 53913-5000

Subject: Preliminary Determination of Feasibility for an Alternative Groundwater Remedial Strategy at and near the Badger Army Ammunition Plant

Dear Ms. Kenney:

The Department of Natural Resources (the Department) has reviewed the Army's request to modify the groundwater clean-up strategy that was approved by the Department on June 1, 1995. The request to modify the clean-up strategy (herein called the AltFS) includes two documents; 1) SpecPro, Inc. and Badger Technical Services, LLC's December 15th, 2011, "Revised Alternative Feasibility Study, Groundwater Remedial Strategy, Badger Army Ammunition Plant" report and plan, and 2) the Army's February 2, 2012, "Revised Alternative Feasibility Study – Groundwater Remedial Strategy" letter, which includes corrections and clarifications to the December 15th, 2011 document referenced above.

With this letter, the Department is notifying you that we have made a preliminary determination, which is the attachment to this letter. Your recommended alternative, alternative 3 of the AltFS, appears feasible. Components of alternative 3 include:

- Installation of a public water supply system that would serve potentially affected well owners down-gradient of the BAAP facility;
- Preparation of a plan for a phased shut-down of the groundwater extraction system that is capturing and treating groundwater from the propellant burning ground (PBG) contaminant plume;
- Additional evaluation of natural attenuation as a final remedial option;

The proposed service area for the public water supply system is to the south and east of the former BAAP site (as it existed prior to land transfers to USDA and WDNR). The public system wells would most likely be located in the Town of Merrimac and, as proposed, in an area unaffected by the contamination from the BAAP facility. Details of the public water supply system will be determined through the involvement of the local municipalities, and the Department's Bureau of Drinking Water & Groundwater approval process.

The current groundwater remediation system, known as the IRM/MIRM (interim remedial measures/modified interim remedial measures), extracts and treats groundwater from the PBG plume. The extraction is performed using several wells, which have pumped an average rate of about 2,400 gallons per minute during recent years. Data included in the AltFS show decreasing concentrations of contaminants in the extracted water and a corresponding decrease in the amount of contaminants removed. The Army asserts that continued operation of the IRM/MIRM is no longer practicable given the existing groundwater contaminant concentrations and has therefore proposed preparing a plan for phased shut down of the IRM/MIRM.

Natural attenuation (NA) is the proposed remedy for groundwater contamination at and near the facility. The Army has concluded that NA processes, such as dispersion, adsorption, dilution, and volatilization are having a stabilizing effect on the volatile organic compounds in groundwater, and that in addition to the effects of these processes, dinitrotoluene is also affected by biological degradation.

Natural attenuation (NA) is a common groundwater contamination remediation strategy in Wisconsin. Compliance with Department administrative codes and policies is required for monitored natural attenuation (MNA) to be the acceptable final remedial alternative. The MNA component to the selected remedy will be performed in conjunction with the phased shut-down of the IRM/MIRM system. The timing and the process of partial and full shut-down of these systems will be subject to specific Department approval(s), as will any changes to the current groundwater monitoring plan and any future closure plan.

The attached Preliminary Determination includes details on the proposed alternative remedial strategy, the Department's current expectations for the feasibility study's final approval, and information on many of the past source control and groundwater cleanup efforts, which the Department has considered in its determination.

The Department will accept comments on the proposed remedy during a public comment period between February 16, 2012 and April 2, 2012. A public informational open house will be held on March 1, 2012 at Devil's Head Resort from 4:30 to 7:30 p.m. The Department will accept only written comments, by letter or e-mail, during the comment period. After the public comment period has ended, the Department will respond to comments received and make its final determination. Please refer to the attached preliminary determination for more information.

Please contact me if you have any questions regarding this letter, either at the address listed above or as indicated below.

Sincerely,

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Mark Giesfeldt – WDNR Remediation and Redevelopment Bureau Director
Eileen Pierce – WDNR Air & Waste Program Manager, SCR Fitchburg
Jeff Ackerman – WDNR Project Manager, SCR Fitchburg

PRELIMINARY DETERMINATION OF FEASIBILITY FOR AN ALTERNATIVE GROUNDWATER REMEDY AT THE BADGER ARMY AMMUNITION PLANT

The Department of Natural Resources (Department) has made a preliminary determination to approve a modification to the clean-up strategy for groundwater contamination at the Badger Army Ammunition Plant (BAAP).

The request to modify the clean-up strategy (herein called the AltFS) includes two documents; 1) SpecPro, Inc. and Badger Technical Services, LLC's December 15th, 2011, "Revised Alternative Feasibility Study, Groundwater Remedial Strategy, Badger Army Ammunition Plant" report and plan, and 2) the Army's February 2, 2012, "Revised Alternative Feasibility Study – Groundwater Remedial Strategy" letter, which includes corrections and clarifications to the December 15th, 2011 document referenced above.

The proposed remedy is alternative 3, as described in the AltFS. The Department's determination is that the Army's proposed remedy is feasible. The proposal includes:

- Installation of a public water supply system that would serve potentially affected well owners down-gradient of the BAAP facility;
- Preparation of a plan for a phased shut-down of the groundwater extraction system that is capturing and treating groundwater from the propellant burning ground (PBG) contaminant plume;
- Additional evaluation of natural attenuation as a final remedial option.

Department Response

The Department's conclusions about the components of the selected groundwater remedial strategy are as follows. Installation of a public water supply system is an acceptable proposal to provide safe drinking water to potentially-affected well owners down-gradient of the BAAP facility where, currently, some monitoring wells have groundwater with contaminants above Department enforcement standards and some private wells have contaminant detections. The Army must comply with State of Wisconsin statutes and WDNR administrative codes as it begins to implement this proposal.

The Army asserts that continued operation of the IRM/MIRM is no longer practicable given the existing groundwater contaminant concentrations, and has therefore proposed preparing a plan for phased shut down of the IRM/MIRM. The Department agrees to preparation of a plan for additional evaluation and trial shut-down of the IRM/MIRM, with the goal of using natural attenuation as a final remedy. The timing and the process of partial and full shut-down of these systems will be subject to specific Department approval(s), as will any changes to the current groundwater monitoring plan and any future closure plan.

Natural attenuation (NA) is an acceptable final remedy for groundwater contamination at many sites in Wisconsin. The use of NA as the final remedy is feasible at the BAAP site. Compliance with Department administrative codes and policies will be required for monitored NA to be the accepted as final remedial alternative. Monitored natural attenuation (MNA) will be performed in conjunction with the phased shut-down of the IRM/MIRM system, to evaluate NA as the long-term remedy.

Public Comment Period and Informational Open House

The Department is inviting the public to comment on this preliminary determination and on the proposed contaminated groundwater remedy. The Department will accept comments on the proposed remedy during a public comment period between February 16, 2012 and April 2, 2012. The Department will accept only written comments, by letter or e-mail, during the comment period.

Copies of the December 15th, 2011, "Revised Alternative Feasibility Study, Groundwater Remedial Strategy, Badger Army Ammunition Plant" report and plan, and the February 2, 2012, "Revised Alternative Feasibility Study – Groundwater Remedial Strategy" letter are available at:

Sauk City Public Library, 515 Water Street
Prairie du Sac Public Library, 560 Park Avenue
Badger Army Ammunition Plant, 2 Badger Road, Baraboo
WDNR, 3911 Fish Hatchery Road, Fitchburg
www.cleanwaterwelldone.com

To provide information on the Department's alternative feasibility study review and approval process and on the groundwater remedy as proposed by the Army, the Department will jointly host, with the Army, a public informational open house on March 1, 2012 from 4:30 until 7:30 p.m. at Devil's Head Resort. Representatives of the Department, the Army and its contractor SpecPro, Department of Health Services, and EPA will be available to respond to attendees questions and comments.

After the public comment period has ended, the Department will respond to comments received and will issue its final determination.

Background Information

The groundwater contamination from the BAAP site is primarily associated source areas at the Propellant Burning Ground (PBG), the Deterrent Burning Ground (DBG), and near the central portion the facility. The groundwater contamination extends beyond the facility boundaries to the south and east and has the potential to affect off-source users.

Previous remedial actions, investigations, and other source-area-related activities associated with the PBG and DBG and central plume, and their respective source areas, were considered in making this determination. These activities are first listed, and described in more detail as follows:

Propellant Burning Ground

- Soil vapor extraction system (completed in 1999)
- Excavation of contaminated soil, followed by incineration and off-site disposal (completed in 1999)
- Bioremediation to promote contaminant degradation (2000 to 2006)
- A cap/cover over the remaining soil contamination (completed in 2008). The cap/cover requires regular inspection and maintenance, as needed.
- Groundwater extraction and treatment using the interim remedial measures (IRM) and modified interim remedial measures (MIRM) systems (1990 to present)
- Fencing and warning sign installation (completed in 2008)
- Groundwater monitoring at monitoring wells and supply wells (on-going)

A review of the source control remedy is required five years after construction of the cap/cover and in five year increments thereafter.

PBG Remedial Actions and Mitigation Activities

A soil vapor extraction (SVE) system was installed in late 1997 to remove volatile organic compounds (VOCs) from each of the three waste pits. This system began operating in 1997 and was shut down in 1999 when satisfactory removal of VOCs was achieved.

Excavation of contaminated soils was performed at the PBG. The uppermost 20.5-23.5 feet of contaminated soil were removed from waste pit 1, as were the upper 14.5 feet of contaminated soil from waste pit 2 and the upper 13.5 feet from waste pit 3. The excavated soil was taken off-site for treatment at an incinerator, followed by disposal off-site. Contaminated soil remains in the subsurface below the limits of excavation at the former waste pits.

A bioremediation system was installed and operated at the site from November 1999 through July 2000 and from December 2000 through June 1, 2006. This system included the components of water infiltration, air injection, nutrient infiltration, a nitrate removal system, and two source control wells located down-gradient of the pits. The goal of this system was to promote the degradation of dinitrotoluene (DNT) compounds and to reduce the potential for further groundwater contamination.

Existing structures and components associated with the remediation systems at the PBG site were removed to allow for the construction of the site cap/cover. System wells and groundwater monitoring wells that were considered to be unnecessary after the cap/cover had been installed were abandoned.

In 2008, approximately five acres of the PBG site were capped with a composite cap/cover. The bottom layer of backfill soil was used to bring the site to design grades for proper drainage. A geosynthetic clay layer (GCL) was then installed. A GCL is a layer of clay between two geo-textiles, and is equivalent to two feet of compacted clay. The GCL was overlain with a 60-mil high-density polyethylene flexible membrane liner, which was covered with a one-foot layer of granular drainage material. After placement of the next layer of geo-textile fabric, a 30-inch soil cover was installed, which was then covered by six inches of topsoil that was seeded with native grass. This cap/cover limits infiltration of precipitation through, and prevents direct contact with, residual soil contamination that remains beneath the site. Maintenance of the cover will continue to include annual inspections and inspections after large storm events, mowing, and repairs, if necessary.

The IRM groundwater extraction and treatment system began operation in 1990 and the MIRM began in 1996. The current systems use source control wells SCW-1 and SCW-2 along with extraction wells EW-163R, EW-167, EW-168, EW-169, and EW-170R. The intent of this system is capture contaminants released to groundwater from the PBG and to provide hydraulic control of the near-source groundwater contamination. Data included in the AltFS show decreasing concentrations of contaminants in the extracted water and a corresponding decrease in the amount of contaminants removed.

A barbed wire fence and warning signs have been installed around the perimeter of the site.

A Department-approved groundwater monitoring plan will continue to be implemented for this site until modification or termination is approved by the Department. Results of the monitoring are submitted to the Department on the approved, regular schedule. It is expected that the monitoring plan will be modified as the result of private drinking water supply wells being taken out of service, as part of a plan for evaluating the phased shut-down of the IRM/MIRM, and as a part of a long-term monitoring plan for the entire facility.

Five years after implementation of the cap/cover remedy (2008), and in five year increments thereafter, the Army is required to submit a report summarizing the effectiveness of the remedy. Items to be discussed in the report include, but aren't limited to, maintenance actions initiated and completed for the cap/cover, a summary of detected groundwater contaminant concentrations and changes in groundwater quality, and a summary of all other work completed and actions taken at the site during the reporting period.

Deterrent Burning Ground

- Excavation of contaminated soil (performed in 1999 and 2000)
- Enhanced bioremediation to promote contaminant degradation (2003 to 2008)
- A cap/cover over the remaining soil contamination (2003). The cap/cover requires regular inspection and maintenance, as needed.
- Fencing and warning sign installation (completed in 2003)
- Groundwater monitoring at monitoring wells and supply wells (on-going)

A review of the source control remedy is required five years after construction of the cap/cover and in five year increments thereafter. The first five-year review report was submitted in January 2009.

DBG Remedial Actions and Mitigation Activities

The excavation of contaminated soil was completed at the three waste pits of the DBG in 1999 and 2000 to depths of between 15-20 feet. The soil was transported off-site for treatment at an incinerator. Contaminated soil remained in the deeper subsurface.

The cap/cover was installed in 2003. This cap/cover limits infiltration of precipitation through, and prevents direct contact with, residual soil contamination that remains beneath the site. Maintenance of the cover will continue to include annual inspections and inspections after large storm events, mowing, and repairs, if necessary.

Biological activity was enhanced to promote the degradation of DNT by periodically introducing water with added nutrients into the soil beneath the cap. This enhanced biological system started in 2003 and ended in 2008 when water was no longer available to continue the effort.

A barbed wire fence and warning signs have been installed around the perimeter of the site.

A Department-approved groundwater monitoring plan will continue to be implemented for this site until modification or termination is approved by the Department. Results of the monitoring are submitted to the Department on an approved, regular schedule. It is expected that the monitoring plan will be modified as the result of private drinking water supply wells being taken out of service and as a part of a long-term monitoring plan for the entire facility.

Five years after implementation of the cap/cover remedy (2003), and in five year increments thereafter, the Army is to review the effectiveness of the remedy and submit a report summarizing the findings. Items to be discussed in the report include, but aren't limited to, maintenance actions for the cap/cover, a summary of detected groundwater contaminant concentrations and changes in groundwater quality, and a summary of all other work completed and actions taken at the site during the reporting period. The first five-year review report was submitted in January, 2009. The next review is to be performed in 2013.

Central Plume

The Army has not been able to identify with certainty a source for this plume of low DNT concentrations, in spite of a significant effort of monitoring well installation and monitoring. However, indications are

that the source of this plume may have been located throughout the Rocket Paste area and related to production wastewater that was discharged to an extensive system of process and storm water ditches. The Army has surmised that, if these ditches were the source of groundwater contamination, this source may have been removed by the excavation of the ditches' top foot of soil in 1998 and by the termination of operation of the plant, and the use of the ditches, in 1976.

Soil contaminant investigations were conducted in the area of the Pre-Mix Houses (2007), in the ditches leading from the Rocket Paste and nitroglycerine (NG) areas (2008), and near production buildings in the NG Production area. The soil samples either contained no detectable levels of or low concentrations of total DNT.

The Army replaced two private residential drinking water wells, located in the Water's Edge Subdivision, that contained 2,6-DNT above the Department's enforcement standard (2005) and installed eight monitoring wells in the vicinity. Additional monitoring of existing wells and the installation and monitoring of additional monitoring wells resulted in indications that the source of the groundwater contaminants of the Central Plume was the ditches in the Rocket Production area. Testing data has shown no ES exceedances have recently occurred near the Rocket Production area, with low-level ES exceedances occurring further down-gradient near the plant boundary.

Institutional controls

Institutional controls will be implemented for these source areas and other portions of the site, as needed. These institutional controls include listing of sites on the Department's GIS Registry for Soil and Groundwater Contamination, and use restrictions included on the property deeds. For the Soil Registry, the Army must determine the boundaries of the cap/cover and limits of residual contamination, using Global Positioning System (GPS) coordinates. For the Groundwater Registry, all properties with groundwater exceeding one or more of the ch. NR 140, Wis. Adm. Code, enforcement standards as a result of contaminants originating at the facility will be listed. Restrictions on future property uses will likely be required by the Army, and will be included on the quitclaim deeds for the former BAAP parcels. Responsibility for any continuing obligations will also be addressed, in accordance with ss. 292.12, Wis. Stats.

Comments regarding the selected remedy can be sent by letter or e-mail to:

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