



State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

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November 4, 2014

Dear Recipients:

On September 23, 2014, the Department of Natural Resources (the Department) received a list of questions from Citizens for Safe Water Around Badger. The Department is responding to these questions in the attached document. Along with our response, the original CSWAB document is also included here as well as two documents to support the response.

The Department will be attending a meeting on November 12, 2014 to discuss ideas on improving communication of the status of the cleanup at Badger Army Ammunition Plant. There will be a brief discussion of this response from the Department during the meeting.

If you have additional questions about the cleanup project at Badger or your water source, please contact me by mail at 3911 Fish Hatchery Rd., Fitchburg, WI 53711, by telephone at 608-273-5613 or email at will.myers@wisconsin.gov

Sincerely,

Woody Myers
Project Manager
Remediation & Redevelopment

September 23, 2014

Prioritized and Amended* Questions for WDNR:

Subject areas were prioritized based on human health considerations.

- **Community members will receive a response to the following recommendation:**

Quarterly testing should be resumed in the following areas: Keller Road, the Windings of Wisconsin and County Z (homes on top of or adjacent to the southern Propellant Burning Ground and Ethyl Ether plumes).

Comments/concerns: The ethyl ether plume and source area not defined. The short-term and long-term impacts of the MIRM shut-down on groundwater movement and quality are not known. Testing of drinking water wells in the Windings with detects in the last 5 years should be reinstated.

- **Community members will have a better understanding of the groundwater monitoring system (wells) and plan (testing schedule and parameters) that is now in place.**

Comments/Questions: The Army missed ethyl ether in previous testing, could they be missing anything else? Where are the new monitoring well nests located? At what depths are they screened and what is the depth to the water table for each well? (A map showing this information for each well was recommended.) Residents, local government, RAB members and others are being excluded from conversations. This is particularly frustrating when it concerns private wells. Consultation should be before such decisions are finalized.

Why aren't offsite groundwater monitoring wells and private drinking water wells being tested for the degradation products DNT? (Army is only testing onsite wells and for only some of the degradation products identified by state officials.) The DNR explanation on the half-life of degradation products was confusing and contradictory.

What is the depth of all the Village wells and where are these wells located?

What is the depth of the shale formations in and around Badger, including all Village wells?

Why was the "F" well at the southern plant boundary installed? Does it have anything to do with the Village well? Isn't it too far away from the Village well to inform us of anything?

If low levels of contaminants have been detected in municipal wells that are drawing water from the very deep bedrock (below the shale layer), does this indicate that even these wells could be vulnerable? Are they all below the shale level?

Why aren't there *any* monitoring wells west of Highway 12?

- **Community members and local government will have a better understanding of the southern Propellant Burning Ground plume as it approaches and discharges to, or possibly under, the Wisconsin River at Prairie du Sac.**

Questions/Comments: Could contamination be moving under the river? What is the possible impact to the river and aquatic systems? How was this measured and what are the results? Could high capacity wells, including irrigation wells, have an impact on the plume?

- **Community members and local government will have the opportunity to comment on proposed changes in cleanup/environmental monitoring activities before these decisions are finalized.**

Comments: Community members expressed frustration that their only communication regarding test results and changes in testing is a letter in the mail. Residents would like to be consulted before such decisions are finalized so they can ask questions and understand why the changes are being considered. Only people who gave email addresses or are owners/renters get this information.

***What borings or other tests were done below the dam? When were these borings/tests done? Were seeps identified and tested? What were they tested for? Please show locations of seeps on a map. What were the findings of the study below the dam for contaminants reaching the river?**

- **Community members will have a better understanding of the possible health risks associated with multiple contaminants in drinking water.**
- **Community members and local government will be regularly updated and engaged in the investigation, planning and cleanup of Gruber's Grove Bay.**
- **Community members will have a better understanding of what will happen when the Army leaves, particularly if there are problems down the road.**

Comments: At one time, the Army said that it would be required to test groundwater "in perpetuity" as an economic argument for municipal water. Is this correct?

- **Community members will receive a response to the following general questions:**
 - ❖ What laboratories are qualified to test for all the contaminants associated with Badger? Which are not affiliated with Badger?
 - ❖ What resources are available to provide residents with bottled water?
 - ❖ Have private wells just north of the Village been properly closed/abandoned?
 - ❖ What types and where are karst formations in our area?
 - ❖ What are the explosive hazards associated with ethyl ether?

Citizens for Safe Water Around Badger (CSWAB) Environmental Health Committee
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1. Why aren't private wells being monitored more frequently?

A groundwater monitoring program starts with the knowledge of the groundwater dynamics and then it needs a good monitoring well network. At Badger we have both. A significant amount of data has been gathered over several decades of groundwater flow speed and direction as well as the geology that the groundwater flows through. All of this data shows that these dynamics are very consistent at Badger, even under unusual conditions. The groundwater monitoring network at Badger has a large number of wells at varying depths. The Department of Natural Resources (the Department) evaluates the data from these wells to monitor the groundwater flow and samples are taken to determine the contamination plume degree (how much) and extent (how big).

Groundwater is a dynamic not a static system. It is like a river in that it flows following a preferred path and it changes in velocity and volume. Groundwater follows the path of least resistance. Groundwater flows smoothly and does not make erratic movements or sharp turns. This flow at Badger is very predictable. Contaminants dissolved in the groundwater move with the water as a part of the water. Contaminants do not diffuse through the water column instantly, and being a part of the groundwater they do not move faster than the groundwater or in a different direction.

Monitoring of groundwater and drinking water in and around Badger involves two different types of wells: monitoring wells used to evaluate the depth, composition, direction and speed of movement of the groundwater and contaminant plumes under Badger and private wells supplying drinking water.

These wells are designed and constructed differently for very different purposes. As a result, most information gathered from each type of well should not be directly compared.

Data collected from private wells that supply drinking water are used to ensure that human health is protected and that the exposure pathway between humans and any contaminants found at Badger is closed.

Monitoring wells have been placed in strategic areas at Badger. Some of these existing monitoring wells were placed as sentinel wells between the contaminant plume and private wells. They are intended to detect any contaminants if the plume started moving in the direction of private wells. These wells give the Department an opportunity to be proactive, taking action before a private well is impacted. If the sentinel wells were to detect contaminants attributable to Badger, the Department would require the Army to increase the frequency of sampling in private wells with the possible addition of a more active approach.

The proximity of a private well to a contaminant plume or the planned shutdown of a treatment facility such as the Modified Interim Remedial Measures (MIRM) is not by itself a compelling justification for quarterly well testing when past testing shows human health is not at risk.

To summarize, the Wisconsin Departments of Natural Resources and Health Services and the U.S. Environmental Protection Agency all agree that, considering the behavior of groundwater, the groundwater monitoring program, including its use of sentinel wells, and the frequency of annual monitoring of private wells near Badger, all indications are that no one is currently at risk of health impacts in the vicinity of Badger. Monitoring and testing schedules will not be changed unless Department staff concludes that groundwater data changes justify a change.

2. What is happening with ethyl ether detected in the groundwater near Badger? What are the explosive hazards associated with ethyl ether?

Our records indicate that questions about ethyl ether go back as far as June 18, 2007 and that they have been answered. Most recently the Department has posted an ethyl ether fact sheet "[Ethyl Ether and Badger Army Ammunition Plant](#)" at dnr.wi.gov (search for Sauk Prairie Recreation Area and click on the "clean up" tab). The fact sheet has also been distributed at public meetings. It contains general information on ethyl ether as well as how it applies to Badger and the surrounding community. It is important to remember that contamination in groundwater flows with the groundwater and ethyl ether is just one compound the Department is monitoring. There are chemicals that have specific characteristics that are evaluated when looking at impacts to health, but they do not pose a special concern; such as ethyl ether and DNT breakdown products.

In order to ensure that information about the groundwater monitoring program is more accessible to the public, the most recent groundwater monitoring and private well sampling data also have been placed online on the Sauk Prairie Recreation Area web page under the cleanup tab. A request we received for locations of sampled private wells cannot be provided. The United States Department of Homeland Security restricts the release of information regarding the location and specifics of drinking water supply sources.

The Department is creating a map with the locations and names of the monitoring wells. This map can already be found in multiple U.S. Army documents on file in the public information repositories at the Sauk Prairie and Prairie du Sac public libraries, and the map will be placed online to increase the access. Private wells are plotted only as approximate locations without names.

3. Why aren't offsite groundwater monitoring wells and private drinking water wells being tested for the degradation products DNT?

This question of dinitrotoluene, or DNT, degradation products or breakdown products has been asked and answered in the past. A formal letter was submitted to the Department and a formal response was sent out. This letter has been added as an attachment to these answers and can also be found posted under the cleanup tab of the SPRA webpage. To summarize the answer that has been given in the past, breakdown products do not accumulate and therefore will not be found in greater or equal amounts to the parent products. The concentrations of DNT are very low outside to the Badger property. So if there is very little DNT, the breakdown products will be in even smaller quantities. Given the specific quantities of DNT it is very unlikely that any breakdown products would be detected.

4. Why was the "F" well at the southern plant boundary installed? Does it have anything to do with the Village well? Isn't it too far away from the Village well to inform us of anything? If low levels of contaminants have been detected in municipal wells that are drawing water from the very deep bedrock (below the shale layer), does this indicate that even these wells could be vulnerable? Are they all below the shale level?

Recently, the Badger Restoration Advisory Board and the public received a presentation on current groundwater monitoring work at Badger that addressed questions about the Village of Prairie du Sac's municipal wells and a newer monitoring well drilled at the southern end of Badger.

A large part of Badger is underlain by a layer of shale rock approximately 80 feet thick. A monitoring well, designated as an "F" well which means it extends through the shale layer, was recently drilled at the southern end of Badger. This well was deliberately installed to investigate potential groundwater pathways and to define the contamination plume boundaries.

Data from this well show three important things. First, the shale is so dense that little if any water is able to move through the shale, effectively isolating groundwater above the shale

from water below the shale. Second, that there is positive water pressure below the shale, similar to an artesian well where water is forced up to the surface. And third, water below the shale has no contaminants attributable to Badger.

We know from other existing wells between Badger and the Village of Prairie du Sac's municipal wells and beyond, that this same shale layer is also present under the Village. The Village wells are cased to a depth below the shale layer. The casing prevents any groundwater from above the shale from entering the well. The wells draw water only from below the shale layer.

The sum of all this information shows that it is almost impossible for any contaminated groundwater from Badger to reach any of the municipal wells in Prairie du Sac and there are no detections of any contaminants found in the Prairie du Sac municipal wells that can be attributed to Badger. In addition to having the protection of this shale layer, the Village wells are not in line with groundwater flow directions and the plume path.

5. Why aren't there *any* monitoring wells west of Highway 12?

Groundwater monitoring wells were installed on the west side of U.S. Highway 12 in 1991. These wells were installed to determine the groundwater flow direction. It was consistent with the groundwater flow direction found on the east side of U.S. Highway 12 at Badger. This flow is consistently to the south-southeast. There was no need to take samples to look for groundwater contamination in these wells because the wells on the east side of Badger (west of the know propellant Burning Ground plume) are and have been free from contamination.

6. Could contamination be moving under the river? What borings or other tests were done below the dam? When were these borings/tests done? Were seeps identified and tested? What were they tested for? Please show locations of seeps on a map. What were the findings of the study below the dam for contaminants reaching the river?

To satisfy the Department's Condition 5 of the 2013 Groundwater Alternative Feasibility Study approval, the Army investigated the interaction between the groundwater plume and Lake Wisconsin and the Wisconsin River. The Army conducted this work at the direction of the Department and submitted a report on November 21, 2013.

Although this work has been discussed briefly in several meetings, there has not been a comprehensive presentation to the public on the work, results and implications of the conclusions. The Department will suggest that it be added to the list of agenda items for the next RAB/Public meeting and a presentation will be developed. In the interim, the results of the surface water investigation and other groundwater investigations indicate that groundwater from Badger, more importantly contamination attributable from Badger, is not impacting Lake Wisconsin or the Wisconsin River and contamination is not migrating to the east side of these waters. The seeps or springs on the east bank of the Wisconsin River are evidence that indicate that groundwater is not flowing under the river. They have not been sampled and at this time there is no need to sample them, given the low levels of contamination near the river's west bank and a mixing and dilution factor that occurs naturally.

7. Could high capacity wells, including irrigation wells, have an impact on the plume?

The question about high capacity wells and irrigation wells was submitted as a part of the 2013 Groundwater Alternative Feasibility Study. The question was answered in the response to public comments as well as at several RAB and public meetings. Given the groundwater volume, flow and the short-time operations of these wells, there is no evidence that they significantly impact the groundwater dynamics.

8. Are there concerns with multiple contaminants and how the risk is evaluated?

This question was originally asked about soil concentrations, but it also applies to groundwater. For both soil and groundwater at Badger the concentrations are low, there is very limited interaction between compounds and the standards are very conservative. In dealing with DNT, the health advisory level takes into account multiple compounds. The Enforcement Standard for one isomer, or individual compound, of DNT is 0.05 parts per billion. The Enforcement Standard for DNT total is 0.05 parts per billion. For example, the concentration of the individual isomers could be below the 0.05 parts per billion, but the sum of the concentrations cannot exceed the DNT total of 0.05 parts per billion or the Enforcement Standard is triggered.

On this topic, the following was copied from a Department of Health Services response to questions sent to Representative Clark and Senator Erpenbach from CSWAB. The full list of questions and responses is on the SPRA webpage.

Q9. USEPA RSLs are calculated under the assumption that only one contaminant is present, however multiple contaminants, including those in similar categories, are present in soils at the Settling Ponds. How were the default USEPA RSLs adjusted in response to potential additive and cumulative risks? How were additive and cumulative risks included in the calculations of SSRCLs?

A9. Cumulative risk assessments of human exposures to chemical mixtures are extremely complex and challenging. Individual chemicals target different tissues and have different mechanisms of toxicity and/or carcinogenicity. Additionally, chemicals do not always behave the same in mixtures as they do individually, and there is little toxicological research on chemical mixtures with which to inform these types of risk assessments. Lastly, the former BAAP consists of thousands of acres of land, and any mixtures of residual chemicals of concern are not uniformly present across the site, making a rigorous cumulative risk assessment unfeasible. With that said, the levels of any residual contaminants of concern in surficial soils (0-4 feet) across the majority of the former BAAP site are currently below levels of laboratory detection, and cleanup levels for individual chemicals are based on conservative exposure assumptions and human toxicity values that often incorporate considerable margins of safety.

9. Will the community be notified about the clean-up in Gruber's Grove Bay?

There is very little to report with regard to Gruber's Grove Bay other than Department staff members have been discussing potential remedial action in the bay. However, when a proposal has been submitted, the Department will suggest that it be put on the agenda for the Army's next RAB/Public meeting and will post important information on the SPRA web page.

10. Will the Army's lack of presence at Badger change anything?

One of the agenda items for the next RAB/Public meeting will be the details of what will change when the Army is no longer present at Badger. This will include a communications plan between the two agencies. Specifically the Army will be required to monitor groundwater until that time when the Department has evaluated all of the factors of natural attenuation and it has been shown to be an effective long term remedial strategy. The Army's lack of presence at the former plant in no way relieves them of their responsibilities. For example, if there is a change in the groundwater plume dynamics, the Army will still need to respond appropriately, depending on the nature of the change.

11. What laboratories are qualified to test for all the contaminants associated with Badger? Which are not affiliated with Badger?

This is a link to the DNR's list of certified laboratories:
<http://dnr.wi.gov/regulations/labCert/LabLists.html>. This database has all of the laboratories that are certified by the state. Not all labs are certified for the same compounds, but here are two examples of labs that are certified to analyze groundwater samples for DNT compounds:

CT Laboratories, Baraboo, WI
Accutest Laboratories of New England, Marlborough, MA

12. What resources are available to provide residents with bottled water?

The Department will only require a responsible party to provide residents with an alternative water supply in the event that a drinking water supply well is confirmed to have reached or exceeded an enforcement standard found in state law (s. NR140 and s. NR708.05). There is no need for bottled water to protect human health around Badger.

13. Have private wells just north of the Village been properly closed/abandoned?

Improperly abandoned wells are a concern as they provide a direct conduit to the aquifer. There is one private well that has been discontinued for use and two other wells that were replaced by the Army and are still in use for non-potable purposes. Because the Army does not own these wells, it is not its responsibility to ensure they are abandoned.

14. What types and where are karst formations in our area?

Subsurface geology plays a significant role in protecting groundwater from pollutants and contaminants spilled or spread at the surface. Different types of soil and rock provide different levels of protection. One of the least protective types of subsurface geology is called Karst. Karst in Wisconsin generally consists of limestone and dolomite type rock and is generally close to or just below the surface. Both of these rock types are relatively easily eroded and fractured, forming interconnected channels and cavities in the below-surface geology. The fractures and channels provide pathways for contaminants, carried in water, to flow downward relatively easily, potentially contacting groundwater.

Karst does not exist under Badger. Being close to the southern edge of the last great glacier to cover Wisconsin, Badger is underlain by 100 to 140-feet of what geologists call glacial till. Till in this case is unconsolidated rock and soil left behind when the glacier melted. Under the till is a layer of sandstone and under that the dense shale mentioned earlier.

15. Why isn't there public consultation before decisions are finalized?

There appears to be a misunderstanding of the process the Department follows to regulate responsible parties as they clean up releases of hazardous materials to the environment and the extent to which the public has a part of this regulatory process. The process of environmental cleanup was discussed at a RAB meeting in the summer of 2012. The Department is given its authority to regulate environmental cleanups through state statute chapters 289 and 292. The details of this authority were included in the chapter NR 700 series administrative code. The section that deals with public participation and public notification is chapter NR 714. To summarize these rules, the department is mandated to inform the public of threats and to establish methods to communicate the progress of environmental cleanups. The concept of public

concurrence or consensus is not a part of the regulatory process. The law does not allow or require public consensus on cleanup decisions such as standards that apply or acceptable methodology. In these areas, there is no legal need or legal authority for public consultation prior to Department decisions being finalized.

The process of making these decisions is based first on governmental rules, both federal and state. Then, federal and state guidance are applied. All of these sources are based on sound, reviewed scientific principles to protect human health and the environment.

This being said, the Department does not exclude the potential for the public to comment on decisions that have been made and in fact encourages comments. The Department has exceeded mandated public comment period deadlines in the past to solicit more input and at no time has the Department refused comments submitted outside of a formal comment period.

The Department strongly encourages residents with questions to contact us directly. The contact information for the Private Water Supply Specialist for the area around Badger is listed below for your convenience. We strive to ensure that the public is aware of what has been done, what is being done and, most importantly, what the risks to human health and the environment are.

DNR Contacts:

Private Water Supply Specialist:
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Lead Clean-up Project Manager:
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