Environmental Health Considerations
at Badger Army Ammunition Plant

While there is significant publicly-available information about known hazardous waste sites and structures at Badger Army Ammunition Plant, there is a tendency to assume that outside these distinct areas there is little or no potential for residual contamination. These potential environmental health considerations need to be brought to the attention of future owners, site visitors, teachers, workers, and the public including children, expectant mothers, and other populations at risk. Becoming informed not only protects human health, it also serves as the foundation for successful future use such as grazing, prairie restoration, research, and wildlife habitat.

For these reasons, in areas where site conditions are not well characterized, CSWAB strongly recommends appropriate environmental testing before prescribed burning, ecological restoration, agriculture, grazing, road construction, and all other site disturbance activities occur.

Discussion:

Environmental investigations by the Army are only conducted in areas where there is evidence that a spill or release to the environment was likely. Early environmental investigations by the Army, beginning in the 1970's, relied primarily on records searches and interviews with site personnel. Unfortunately, historical records for certain activities such as spills and other environmental releases are limited and in many cases do not exist. Prior to 1970, for example, there are no publicly-available records for chemical spills that may have occurred during active production and interim years. Environmental sampling is only conducted in specific areas where there is sufficient evidence to justify the effort and associated costs.

CSWAB is not the first group to recommend facility-wide testing for certain contaminants at Badger. In 1983, a facility-wide Hazardous Materials and Pesticide Management/Control Study was recommended by the Army. In accordance with Army Regulations 200-1, the Army recommended a special study to "define sources of pollution and develop remedial measures." The basis for the study was that "during normal operations and agricultural leasing over the past forty-plus years, many potential toxic and/or hazardous chemicals and/or pesticides have been used within Badger AAP's boundaries." The Army notes that "no accurate records exist as to type or quantities that may have found their way into the environment." The Statement of Work recommends a "systematic soil sampling and analysis study" for "all areas at Badger AAP." The responsibility for the use, control, and disposal of pesticides at Badger, including but not limited to insecticides, herbicides, and rodenticides, is the responsibility of the U.S. Army Armament Material Readiness Command.[1]

It is not unusual to find contamination in unexpected areas at Badger. As recently as this year, environmental testing detected explosives contamination in areas that both regulators and the Army believed were completely unaffected by historical site activities. As part of a recent eco-risk assessment study by the Army, two areas were selected in a cooperative effort by the Army and the WDNR (Wisconsin Department of Natural Resources). The Army's environmental consultants found the explosive DNT at levels above remediation goals in both areas even though there was no known history of manufacturing activities, spills, or disposal. According to all the information available to the Army, these sites should have been clean and unaffected by historical activities by the Army. DNT is not naturally occurring and was used in the manufacture of military propellants at Badger. DNT is classified by the U.S. EPA as a probable human carcinogen. According to health officials, exposure to high levels of two forms of DNT (2,4-DNT and 2,6-DNT) may affect the nervous system and the blood. Both are known to cause cancer in laboratory animals.

[1] Department of Army, Headquarters, United States Army Armament, Munitions, and Chemical Command, Environmental Assessment for Total Plant Operations, BAAP, Introduction, Mission and Operations, page 6, July 1983.

The Army has tested soils for only 2 of the 6 isomers (forms) of DNT found at Badger. Unlike 2,4- and 2,6-DNT, these less common isomers have not been shown to biodegrade and are therefore expected to be more persistent in the environment. The testing has not been conducted, in part, because laboratory standards have not yet been developed.[2]

In other areas where independent environmental testing has been conducted, results contradict those that the Army reported to the public. Two years ago, the Army tested sediments at Gruber's Grove Bay on Lake Wisconsin and reported that all samples throughout the bay were below the approved cleanup goal of 0.36 parts per million (ppm). The WDNR conducted independent sampling of bay sediments and found that the majority of samples (6 out 8) failed to meet the cleanup goal of 0.36 ppm. The highest concentration found was 9.0 ppm, making it one of the worst mercury-contaminated sites in the state even after two remedial actions involving dredging and sediment removal.

In addition to soil and water contamination, the Army has documented specific risks to children associated with buildings. The draft Findings of Suitability for Transfer (FOSTs) prepared by the U.S. Army for the WDNR states a restriction precluding "any type of educational purpose for children/young adults in grades kindergarten through 12" for certain buildings. Even with this restriction, the FOSTs do not address risks to other populations at risk such as women of child-bearing age, the human fetus, and to children from birth to age 7. Other susceptible populations are expected to include persons with compromised immune systems. Unless altered, the FOSTs will relieve the Army of responsibilities to investigate and remediate environmental hazards that are present on the property that pose a measurable risk to human health, ecological receptors and systems, and the environment.

At this time, the WDNR has still not made a determination as to whether or not asbestos detection methods and cleanup measures are sufficient to eliminate risks to children associated with direct contact with affected soils and inhalation of fugitive dust. For industrial applications, OSHA has defined an asbestos-containing material as any material with greater than 1% bulk concentration of asbestos. However, it is important to note that 1% (currently used by the Army) is not a health-based level, but instead represents the practical detection limit in the 1970s when the regulations were made.[3] Counting fibers using the regulatory definitions does not adequately describe the risk of health effects as fiber size, shape, and composition can contribute collectively to risks in ways that are still being studied. For example, shorter fibers appear to deposit preferentially in the deep lung, and longer fibers can disproportionately increase the risk of mesothelioma, a form of cancer caused by exposure to asbestos.[4]

The effects of asbestos on children are thought to be similar to adults, however, children could be especially vulnerable to asbestos exposures because they are more likely to disturb fiber-laden soils or indoor dust while playing, they are closer to the ground and thus more likely to breathe contaminated soils or dust.[5] Children have faster breathing rates that may increase the level of exposure to asbestos and children could be more at risk than those exposed later in life because of the long latency period between exposure and onset of asbestos-related respiratory disease.

Additional testing and consultation with health officials concerning asbestos is currently proposed by WDNR and supported by CSWAB.

Activities such as prescribed burning may liberate certain contaminants that are found in soils at Badger, including those that are readily taken up by plants. Toxic metals, in particular, are a concern as burning does not destroy these contaminants and may cause the dispersal of soil and plant contamination to the air often as respirable particulates. Through inhalation, incidental

---

[2] U.S. Army, Badger Army Ammunition Plant, e-mail from Joan Kenney to Laura Olah, CSWAB, November 19, 2008.
[3] U.S. Agency for Toxic Substances and Disease Registry, Public Health Assessment, Libby Asbestos Site, Libby, Lincoln County, Montana, Current Standards, Regulations, and Recommendations for Asbestos, May 15, 2003.
[4] U.S. Agency for Toxic Substances and Disease Registry, Public Health Assessment, Libby Asbestos Site, Libby, Lincoln County, Montana, Methods for Measuring Asbestos Content, May 15, 2003.
[5] U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, Division of Health Assessment and Consultation, Health Consultation, W.R. Grace Newark Plant, Newark, California, September 22, 2005.

ingestion, and, to a lesser degree, dermal exposure both adults and children may be exposed to emissions and fugitive dust.

Even now, previously unknown sites are being discovered. As recently as September 2008, WDNR representatives said that the Army continues to find building foundations and other structure remnants where none were expected. Many of these areas are subsequently tested and require remediation.

The term “road oil" refers to any heavy petroleum oil that is used as a dust suppressant and surface treatment on roads and highways.[6] The use of road oil has declined in recent years because of reductions in the proportion of unpaved roadways, the presence of highly toxic contaminants in used oils (PCBs, dioxins, furans), competition from other used oil end uses (re-refining), and new environmental regulations.[7] Used mineral-based crankcase oil (used motor oil or used engine oil) contains polycyclic aromatic hydrocarbons (PAHs) and may contain metals such as aluminum, chromium, copper, iron, lead, manganese, nickel, silicon, and tin.[8]

U.S. Army records confirm that road oil was indeed present at Badger – and in extremely large quantities. A July 1983 report published by the U.S. Department of Army documents that Badger Army Ammunition Plant had a 52,000-gallon above ground tank that was used for storing road oil.[9] A 1977 building inventory by the U.S. Army identified the same facility as “road oil storage.”[10] By comparison, other used oil storage tanks at Badger held only 500 to 1,000 gallons.

Badger Army Ammunition Plant has an extensive network of more than 130 miles of roads.[11] While many of the roads in the core industrial area are paved, the majority of outlying roads at Badger are unpaved.

Proposed deed restrictions on properties pending transfer include no commercial, residential (including any type of educational purpose for children/young adults in grades kindergarten through 12), utility, or subsurface recreational use; no use of groundwater without United States Department of the Army and WDNR approval; and no digging or disturbance of soils within certain areas at Badger. Prohibited ground intrusive activities in certain areas include raking, scratching, scraping, tilling, moving, digging, excavating, and plowing.[12]

It is CSWAB’s mission to inform, educate, and empower the public about environmental health issues in our community. It is our responsibility to advise against activities that may pose a known or potential risk to human health and the environment. In summary, if there is no site specific data, there is simply no way of establishing the degree of environmental health risk to workers, volunteers, and populations such as children and the human fetus.

Recommendations specific to children, expectant mothers, and other populations at risk:

- Children, expectant mothers, and other susceptible populations such as the elderly and those with compromised immune systems should avoid certain areas and buildings at Badger that may contain lead, explosives, PCBs, asbestos, and other toxic substances.
- Children, expectant mothers, and other susceptible populations should avoid direct contact with soils and inhalation of fugitive dust in certain areas at Badger.

---

[6] County of Santa Barbara Planning and Development Energy Division, *Oil and Gas Glossary*, undated.
[7] United Nations Environment Programme, Secretariat of the Basel Convention, *Basel Convention Technical Guidelines on Used Oil Re-Refining or Other Re-Uses of Previously Used Oil, Basel Convention on the Control of Transboundary Movements on Hazardous Wastes and Their Disposal,* September 1995.
[8] U.S. Army Toxics and Hazardous Materials Agency, Public Health Statement for Used Mineral-based Crankcase Oil, September 1997.
[9] Department of the Army, Headquarter, United States Army Armament, Munitions, and Chemical Command, Environmental Assessment for Total Plant Operations, Badger AAP, July 1983.
[10] U.S. Army Toxics and Hazardous Materials Agency, Installation Assessment for Badger Army Ammunition Plant, May 1977.
[11] General Services Administration, Preliminary Highest and Best Use Analysis, Badger Army Ammunition Plant, May 15, 1998.
[12] U.S. Army, Finding of Suitability to Transfer, (FOST), Badger Army Ammunition Plant (BAAAP), Parcels O, O1, O5, Q2, U2, and X1, October 2008.

- Children, expectant mothers, and other susceptible populations should avoid exposure to sediments at Gruber's Grove Bay. Bay sediments contain elevated levels of mercury and other toxic metals.
- Children, expectant mothers, and other susceptible populations should avoid exposure to smoke and fumes from prescribed burning and decontamination activities in certain areas at Badger.
- All people should limit consumption of fish from the Ballistics Ponds and other ponds at Badger as consistent with guidance from the Wisconsin Division of Health.
- Children, expectant mothers, and other susceptible populations should not consume fish from the Ballistics Pond at Badger. This advisory extends to all ponds where data is unavailable.

CSWAB is encouraging future owners to address these data gaps sooner rather than later. Once identified, risks are much more likely to be addressed while there is still an Army presence at the base. In such cases, **comprehensive independent environmental testing** may be the only means to define these risks and leverage adequate remediation. In the interim, appropriate signage and other institutional controls should be implemented and maintained.

Potential resources for independent environmental testing:

- As a condition of transfer, future owners should consider a requirement that the Army provide resources to conduct independent environmental study.
- As part of the Defense/State Memorandum of Agreement (DSMOA) negotiations between the WDNR and Army – which affords reimbursement of expenses to the State – the WDNR should ask for resources to conduct independent environmental testing.
- Future non-federal owners and partners should consider funding sources such as Community-Based Brownfield Redevelopment which has historically supported sustainable reuse such as organic farming. The Trust for Public Land is an example of a program that helps communities leverage funds to transform brownfields into public green spaces.
- Future owners and partners should consider funding sources such as private and corporate foundations, and public research dollars.

Questions about known conditions in specific buildings and areas at Badger Army Ammunition Plant should be directed to:

Joan Kenney, Installation Director, U.S. Department of Army, Badger Army Ammunition Plant, 2 Badger Road, U.S. Hwy 12, Baraboo, WI 53913 Phone: (608) 643-3361

Questions about the health risks associated with contaminants found at Badger should be directed to:

Henry Nehls-Lowe, Wisconsin Division of Public Health, 1414 E. Washington Ave., Room 96, Madison, WI 53703, Phone: (608) 266-3479 Email: nehlshl@dhfs.state.wi.us

January 2009

Citizens for Safe Water Around Badger is working to mobilize and empower rural communities near Wisconsin's Badger Army Ammunition Plant in support of a sustainable future that will protect and restore the integrity of soil, water, air, and biological diversity.

For more information contact: CSWAB, E12629 Weigand's Bay South, Merrimac, WI 53561 (608) 643-3124 or http://www.cswab.org