

Summary of the DNR's Molybdenum and Boron Investigation

For the full report, visit the DNR website at <http://dnr.wi.gov/topic/Groundwater/molybdenum.html>

Purpose of the Molybdenum and Boron Investigation

The investigation was intended to evaluate and, if possible, find a source of the elevated molybdenum and boron concentrations in area water supply wells.

Background

We Energies found elevated molybdenum levels in private water supply wells located near the We Energies Oak Creek power plant property. The sampling was carried out as part of We Energies' local land-use agreement with the Village of Caledonia. We Energies reported the elevated molybdenum levels to the DNR in August 2009. Subsequent sampling found two private wells with elevated boron levels. Molybdenum and boron are naturally occurring elements that can sometimes be found in higher concentrations in certain materials, such as coal ash, and in certain settings such as landfills.

The We Energies Oak Creek/Caledonia property is located between Highway 32 and Lake Michigan, in Milwaukee and Racine counties. The We Energies Oak Creek power plant began commercial power production in 1953, generating coal ash as a result. The coal ash is buried in three ash landfills and in other low lying areas on the We Energies property. The private wells where elevated molybdenum levels were initially found are located between the We Energies property and the Hunts Landfill, which is located 1.5 miles southwest of the We Energies property. The Hunts Landfill accepted municipal and industrial wastes between 1959 and 1974. In the mid 1990s, the landfill was capped.

In 2009 and 2010, We Energies conducted its own investigation to determine if coal ash deposited on its property was a source of the elevated molybdenum and boron. The company concluded that the coal ash on its property is not a source of the molybdenum or the boron found in the private water supply wells. The DNR did not issue a determination at the time, but decided to conduct its own investigation.

Description of the DNR Investigation

Beginning in the fall of 2011, DNR staff collected water samples from 24 private water supply wells, 33 groundwater monitoring wells associated with either the Hunts Landfill or the We Energies Oak Creek and Caledonia ash landfills, coal ash and leachate samples from We Energies ash landfills, and leachate samples from the Hunts Landfill (leachate is water that has come into contact with waste in the landfill).

The samples were analyzed for several manufactured compounds (e.g., solvents) and for some natural elements, including certain metals associated with coal ash. Isotopes of molybdenum, boron and strontium were also analyzed. Isotopes are variations of the same element. The variations can sometimes indicate the likely source of the element. Samples were also analyzed for tritium, an unusual form of hydrogen released into the atmosphere in the late 1950s and 1960s during weapons testing. Because detectable tritium is only found in groundwater that entered the soil more recently than the 1950s, it can help determine whether the water that contains the molybdenum and boron infiltrated into the ground before or after deposition of ash from the Oak Creek power plant, which began in the early 1950s.

Findings of the DNR Investigation

- The investigation did not succeed in identifying the source of the molybdenum. The molybdenum isotope data were inconclusive.
- The boron isotope data suggest that neither the We Energies Oak Creek/Caledonia coal ash landfills nor the Hunts Landfill is the origin of the boron found in area private wells.
- The Hunts Landfill is not a likely source of elevated molybdenum because the concentrations in the Hunts Landfill leachate are much lower than those in the area's groundwater. Elevated boron levels were found in the Hunts Landfill leachate and in two Hunts monitoring wells.

- High molybdenum and boron levels were found in leachate from the We Energies ash landfills.
- Low levels of molybdenum and boron were found in two archived samples of clay till soil and in two archived samples of the Maquoketa Shale, all of which were collected by the Wisconsin Geological and Natural History Survey (WGNHS) in 1953 around the time the Oak Creek power plant was placed into service and before most of the ash on the property was generated. The levels are detectable but below the level that current lab techniques can quantify with certainty.
- Elevated molybdenum levels are present eleven miles west of Caledonia in southeastern Waukesha County. Subsequent data have established that molybdenum levels are elevated throughout much of the area from Oak Creek and Caledonia to the Town of Norway and the City of Muskego. The highest molybdenum concentrations found in the study were in wells located several miles west and southwest of the We Energies Oak Creek property.
- A major east-west oriented, buried bedrock valley exists along the Milwaukee County and Racine County line that may be correlated with elevated molybdenum levels in groundwater. Despite the apparent correspondence between this geological feature and the elevated molybdenum concentrations in the groundwater, a causal relationship between observed concentrations and the buried valley has not been determined.
- The tritium data suggest that most of the water in the private water supply wells may be older than 1953—one could interpret this to mean that molybdenum may have entered the water before ash from the Oak Creek power plant was disposed of on the We Energies property. Mixing of older and younger water may complicate interpretation of the tritium results.

Additional Information

- The Department is reaching out to scientists at the WGNHS, the United States Geological Survey and universities, to review the data and continue to study the elevated molybdenum.
- The southern and southwestern extent of elevated molybdenum levels in groundwater has not yet been determined. The Department is continuing with additional sampling to help determine the extent of elevated molybdenum. Results will be provided on the DNR's website.
- The Department of Health Services (DHS) is finalizing a public health assessment on molybdenum exposures in Caledonia and Oak Creek area private wells. DHS advises residents to avoid excess molybdenum exposure by not consuming water with molybdenum over 90 micrograms per liter (ug/L). The groundwater standard is set using 12 factors specified in state law, such as the quantity and quality of scientific data on health effects, the relative importance of the effect on sensitive human organs, the amount of variation in when the health effect occurs, interactions with other contaminants, and the point at which the health effect is irreversible.
- U.S. Environmental Protection Agency is studying molybdenum occurrence, health effects and treatment to determine whether to require all public water systems to routinely monitor for and remove elevated levels of molybdenum. U.S. EPA's current lifetime advisory level is 40 ug/l.
- The Department of Safety and Professional Services (DSPS) has approved in-home devices for removal of molybdenum. Information about approved in-home water treatment devices is available at http://dsps.wi.gov/php/sb-ppalopp/contam_alpha_list.php

