MnDOT Office of Environmental Stewardship
Environmental Investigation Unit

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Environmental Investigation Unit
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MnDOT has prepared this guidance document to provide its internal procedures and requirements for work performed on MnDOT Rights of Way, including MnDOT-owned facilities. This document should not be construed as a full description of all regulations pertaining to the subject matter. Contact the Environmental Investigation Unit (EIU) in the MnDOT Office of Environmental Stewardship for additional information or legal requirements.

Background
The Minnesota Department of Transportation (MnDOT) current (2016) Standard Specification for Construction manual allows taconite to be used in bituminous mixtures and states that taconite tailings “…shall be obtained from ore that is mined westerly of a north-south line located east of Biwabik, MN (R15W-R16W); except that taconite tailings from ore mined in southwestern Wisconsin will also be permitted for use.” Historically, starting in the 1950s, MnDOT constructed roadways in northern Minnesota using taconite tailings for aggregate in road base and bituminous. No records were kept documenting the origin of the taconite. Many of these roadways now require reconstruction which requires excavation of taconite tailings.

Taconite Geology
As described by Jirsa et al. (2008), the Biwabik Iron Formation is a layered sequence of iron-rich sedimentary rocks that was metamorphosed by intrusions of the Duluth Complex. The metamorphic recrystallization of iron-
formation locally produced iron-rich amphiboles and other fibrous iron-
silicate minerals. McSwiggen et al. (2008) state that most of the Biwabik
Iron Formation has not been metamorphosed to any extent but the
emplacement of the Duluth Complex resulted in metamorphism of a 2-3
mile-wide band (metamorphic aureole) of the formation on the east end
of the mining range. The east range contains a significant number of
metamorphic silicates such as the grunerite-cummingtonite series which
has minerals that generally resemble some asbestos-like minerals. Because
the minerals associated with the Biwabik Iron Formation are complex, it
cannot be assumed that the mineralogy of one mine or part of the range
will correlate with other mines or parts of the range.

Iron ore was discovered in Minnesota in 1865, and when, by 1940, the high-
grade natural ore had been removed, a process was developed to mine
the low-grade ‘taconite” rock that surrounded the enriched ore deposits.
The process produced iron-rich taconite pellets and unwanted waste
rock—taconite tailings (Bemdt et al. 2008).

**Taconite Studies**

Zanko et al. (2008) examined 18 samples of coarse taconite tailings (which
generally meet the construction industry definition of fine aggregate, rock
that is less than 3/8 inch) from five western taconite operations for
mineralogy using X-ray diffraction, polarized light microscopy, scanning
electron microscopy, transmission electron microscopy and two
Environmental Protection Agency methods. They concluded that no
regulated asbestos minerals or amphibole minerals were detected in
western Biwabik Iron Formation samples. A small number of non-asbestos
and non-amphibole mineral cleavage fragments/mineral fibers were
detected by scanning electron microscopy (26 out of 1000 fields sampled).
One sample of eastern Biwabik Iron Formation detected the presence of
amphibole, which when pulverized to -200 mesh, can produce a larger
number of cleavage fragments/mineral fibers than comparably pulverized
western range taconite. Zanko et al. (2008) stated that “…the Superfund
Method for the Determination of Releasable Asbestos in Soils and Bulk
Materials (United States Environmental Protection Agency (USEPA), 1997)
as modified by Berman and Kolk (2000) failed to generate any protocol
fibers, i.e., fibers longer than 5 um and thinner than 0.5 um, from either the
western coarse tailings samples or the single eastern Biwabik Iron Formation
sample. The combined findings suggest coarse tailings and other taconite
mining byproducts should be treated with the same common sense safety
and industrial hygiene approach practiced for all mineral-based materials
that have the potential to generate respirable dust.”
In 2009 MnDOT collected samples of taconite-containing aggregate road base and bituminous in a portion of TH 61 where old road plans indicated taconite was used for construction. MnDOT completed analysis of the samples using the National Emission Standards for Hazardous Air Pollutants (NESHAP), the required method of Polarized Light Microscopy (PLM), to determine the presence of asbestos. Taconite with no detection of fibers using the PLM method would not be regulated by NESHAP. Because of the potential presence of eastern range amphibole minerals in the taconite, MnDOT also completed Transmission Electron Microscopy (TEM) analyses of the samples. The results of the analyses showed no detection of fibers from either method in bituminous samples. Aggregate base samples also showed no detection of fibers using PLM analysis. However, the minerals cummingtonite-grunerite and actinolite were detected in some samples by the TEM method (MnDOT, 2009).

Conclusions
Sample testing conducted by MnDOT and others indicates that taconite tailings are not subject to asbestos regulations. MnDOT has produced this best practice for management of tailings used in highway construction, recognizing that even though taconite tailings are not subject to regulation, some reasonable handling techniques are prudent because a fraction of the minerals found in taconite have an asbestos-like form. This best practice is based on MnDOT sampling and on studies conducted by others which are cited in this document.

Best Management Practice of Roadway Taconite Tailings
Future MnDOT highway construction contract special provisions will inform potential bidders of the presence of taconite tailings in road sections where MnDOT knows or suspects the material was historically used to construct the roadway.

The MnDOT District Safety Administrator in the district where a highway project with suspect or known taconite tailings is located will provide awareness training for all MnDOT project personnel regarding proper safety and industrial hygiene practices to follow when working with mineral-based materials such as taconite tailings.

Safety and industrial hygiene practices, such as wetting active work areas, will be used when handling taconite tailings, to minimize the generation of respirable dust.

Temporary stockpiles of taconite tailings will be covered with minimum 10 mil reinforced plastic or wetted to minimize generation of respirable dust.
All taconite tailings excavated for the project will be re-used on the project as part of road base, fill areas (such as berms) or fill slopes. All taconite tailings re-used on a project will be covered with either pavement or minimum of six inches of soil.

References


Minnesota Department of Transportation, Office of Environmental Stewardship, 2009, State Project 3806-60 Trunk Highway 61 Taconite Sampling and Analysis.

