



Erionite Bulk Sampling Guidelines for North Dakota

(These guidelines may be modified as more information becomes available.)

On October 18, 2007, the North Dakota Department of Health (NDDoH) sent a letter to Mr. Francis G. Ziegler, P.E., Director of the North Dakota Department of Transportation (NDDOT). In that letter, the NDDoH expressed concern about the use of gravel from areas suspected of containing the mineral erionite. The NDDoH requested that the NDDOT not use gravel from these areas because of possible health effects from exposure to erionite fibers. The letter also identified the following areas of concern:

- Exclusion Radius (i.e., where no gravel should be mined)
- Test Radius (i.e., where appropriate testing for the presence of erionite should be conducted)

The presence of any erionite in a sample will automatically cause that area to be re-classified as an exclusion radius area. These areas may be adjusted as more information on erionite becomes available. The following sampling information is intended as a guide for the analytical testing of erionite.

PRINCIPLE AND APPLICABILITY

The danger from erionite lies with inhalation of its fibers, which are contained in certain geologic formations in North Dakota. Specific laboratory techniques are required to determine the presence of erionite. Due to the nature of the rock in which erionite is found in North Dakota, multiple samples may be needed from any one source.

These guidelines apply to the testing of storage piles and exploratory gravel pits.

DEFINITIONS

Bulk Sample: A large sample taken from a large volume of material.

Grab Sample: A small sample taken from a large volume of material.

Composite Sample: A mixture or blend of material from more than one grab sample.

EQUIPMENT

For suspected erionite-containing aggregate storage piles:

- Tube insertion often provides the simplest method for aggregate sampling. Insertion tubes (Figure 1) should have an outside diameter of 2 to 5 inches and be constructed of materials adequate to withstand a relatively rapid continuous penetration force (e.g., 2-inch PVC Schedule 40 pipe). The tubes should be clean and free of imperfections. Further information on insertion tubes can be found in Table 2 and American Society for Testing and Materials (ASTM) D 1587-83.
- A shovel or a hand- or machine-operated auger can be used to collect samples in soils or storage piles.

For suspected erionite-containing sources in gravel pit exploration:

- Geoprobe
- A shovel can be used to collect samples in soils or from surfaces.
- Hand-Operated Augers: Small lightweight augers such as spiral-type augers and ship-type augers may be used. A description of these augers can be found in ASTM D 1452-80.
- Machine-Operated Augers: Heavier augers such as helical augers and stinger augers may also be used. These augers are normally operated by heavy-duty, high-torque machines designed for heavy construction work. Further description of these augers can be found in ASTM D 1452-80.

Note: Augers can be harder to use and decontaminate. Please be careful when sampling with augers, as they can easily be cross-contaminated.

PERSONNEL

Personnel collecting samples should be trained in the proper collection of hazardous mineral fibers (i.e., asbestos). Laboratory personnel should have at least two years experience in the preparation and analysis of environmental samples, and be experienced in the timely, accurate, and precise analysis of environmental samples. Because of the similarity of erionite to asbestos, similar safety measures should be taken to eliminate accidental exposure to the public and to the sampling/ laboratory personnel.

Prior to sampling, be sure to check compliance with applicable Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA) standards regarding employee health, and address this issue in the sampling plan. At a minimum, proper hazard communication, personal protective equipment (PPE) (e.g.,

gloves, respirators, disposable suits) and decontamination procedures (similar to those used during asbestos sampling) should be used.

Extreme care should be taken before and during sampling to clean and decontaminate all equipment, sampling apparatus and containers. Cross contamination of samples can easily occur if the sampling personnel do not adequately clean and decontaminate all equipment, including sieves and shovels. Other than the lab sample, you should not leave the sampling site with any potentially erionite-containing dust.

SAMPLING PLAN

A uniform sampling plan should be developed prior to sampling and be made available to workers for reference during sampling. The sampling plan should include, but not be limited to, the following:

- Qualifications for all employees and analytical laboratories associated with sampling.
- Safety procedures associated with sampling (including PPE and employee training records).
- A description of how uniform sampling locations were chosen.
- The number of samples to be collected.
- How samples were collected.
- Location and depth from which the sample was taken before combination in a composite sample.
- Cleaning/decontamination methods used before, between and after sampling.
- Sample log.

A copy of the sampling plan should also be retained with all samples.

SAMPLE SIZE AND NUMBER

Sample size should be sufficient to provide a 1-quart sample to the laboratory. The landowner should also be contacted to determine if he/she wants a sample for future reference.

A minimum of one composite bulk sample shall be laboratory analyzed (for the presence of erionite) from the following:

- Every acre containing pit exploration test borings, proposed excavation or excavation.
- Every 1000 tons of aggregate stored in piles.

*WARNING: Exposure to airborne erionite fibers constitutes a health hazard. Erionite is a known carcinogen and has been identified as a toxic air contaminant. Samples collected may contain friable erionite fibers and can release these fibers during sampling and handling. Adequate safety precautions should be followed to minimize exposure.

For suspected erionite-containing sources in gravel pit exploration:

Personnel should collect grab samples from a minimum of three randomly chosen locations per acre. A minimum of three samples shall be taken even if the sample area is less than one acre. Sampling personnel may decide the method of randomly choosing the sampling locations, but the method must follow the procedures specified in the sampling plan.

Earlier sections in this document describe some of the possible sampling apparatus used to collect the grab samples. For gravel pit exploration, the sample should only contain equal parts surface and targeted gravel soils. This should help to limit the addition of material from non-erionite formations to the sample composite. Each of the grab samples should be placed in the same sample container. This composite sample should be field sieved to produce a material with a nominal size of less than 3/8 inch. An aliquot of the material shall be put into a labeled, sealed container with a volume of approximately 1 quart. The label shall contain all the information described in the sampling log section (except items 4 and 7).

For suspected erionite-containing aggregate storage piles:

Aggregate storage piles typically have a conical shape. The aggregate is introduced at the top of the pile and is allowed to flow over the side. This action, called sloughing, causes a size segregation to occur with the finer material deposited toward the top of the pile. The locations where grab samples will be taken should be randomly chosen over the surface of the pile. Sampling personnel may decide the method of randomly choosing the sampling locations, but the method must follow the procedures specified in the sampling plan.

For every 1000 tons of aggregate, a grab sample should be taken at a minimum of three randomly chosen sampling locations. A minimum of three grab samples should be taken even if the product pile contains less than 1000 tons of material. The sampling apparatus

should be inserted 1 foot into the pile and the material removed and placed in an appropriate-sized sampling container. Earlier sections in this document describe some of the possible sampling apparatus used to collect the grab samples. Each of the grab samples should be placed in the same sample container. This composite sample should be field sieved to produce a material with a nominal size of less than 3/8 inch. An aliquot of the material shall be put into a labeled, sealed container with a volume of approximately 1 quart. The label shall contain all the information described in the sampling log section (except items 4 and 7).

SAMPLING LOG

A sampling log is an important part of a sampling plan. It will be completed by the field sampler to provide specific (sample composite) information. A sample log must show:

- A unique sample number.
- Facility name.
- Facility address or location where sample is taken. Also include GPS coordinates, accurate within 15 feet for each composite sample.
- A rough sketch, videotape or photograph of the specific sampling locations. Include depths below grade from which each sample was taken before adding to the composite sample.
- Method, date and time of sampling.
- Name and contact information of person performing sampling.
- A copy of the completed chain of custody for samples (when sampling is complete).

ANALYTICAL PROCEDURES

For bulk sample analysis, a combination of scanning electron microscope (SEM) and energy dispersive x-ray spectroscopy (EDS) or x-ray diffraction (XRD) will give an elemental composition required for identification of the mineral erionite. Phased contrast microscopy (PCM), polarized light microscopy (PLM) and transmission electron microscopy (TEM) should not be used on bulk sample analysis because they are not as reliable at discriminating among erionite, asbestos, non-erionite and non-mineral fibers.

Contact your laboratory prior to sending samples to ensure that the lab will be able to perform all required tests and to confirm costs associated with those tests. The laboratory should also be aware of the safety issues associated with the samples prior to

shipping. A partial list of laboratories that offer SEM/EDS or XRD testing is listed in Appendix A. This list is provided only as a service to parties who want to have testing conducted. Inclusion on this list does not constitute an endorsement by the NDDoH. This list is not all inclusive; parties interested in having testing done may wish to consult a telephone directory or other sources to locate additional analytical laboratories. Appendix B includes a copy of the U.S. Geological Survey Report 14012007 that was used in the analysis of 20 samples collected from North Dakota by the U.S. Environmental Protection Agency.

Any and all costs will be the responsibility of the person performing the sampling. All test results should be accompanied by the lab's statement of qualifications which should include: a written quality assurance/quality control (QA/QC) program with procedures; instrumentation summary; list of personnel and qualifications; all accreditations and licenses; and a summary of related work experience.

Samples should be sent to an analytical lab that has a reference sample of erionite from an in-state outcropping of erionite. If a lab does not have this reference sample for test sample comparisons, one may be requested from the NDDoH. The NDDoH will maintain a reference sample, source-collected by the North Dakota State Geologist, for laboratory comparisons. The laboratory should identify this reference sample and its source for the comparison reports. The following paragraph should accompany any erionite samples.

Because of the potential hazardous nature of the samples, extra precautions should be taken in preparing the samples at the laboratory. The samples should be prepared for analysis under a fume hood with minimum handling. Gloves and respirators should be worn during all sample handling and preparation. A small sample of the fine fraction should be selected from the approximate center of the sample with a small spatula. The coarse fraction should be sampled at the same time by selecting a few of the coarse grains nearest to where the fine fraction was sampled.

Using the SEM, each sample should be examined for the distinctive needle-shaped crystals of erionite. Needle-shaped grains that are found should be documented with a digitally captured SEM image and a chemical analysis by EDS or XRD.

REPORTING

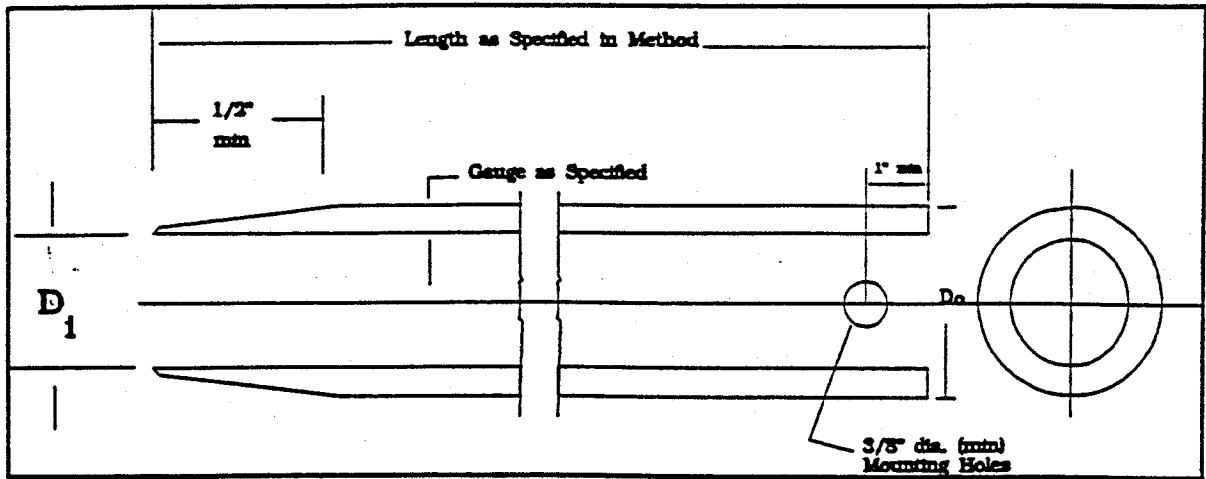
Parties conducting erionite sampling should submit a copy of their sampling plan to the NDDoH for review prior to sampling. The NDDoH will return the plan with any revisions within two weeks. Once revisions are incorporated, samples should be collected and submitted to the laboratory selected. The laboratory should provide results within two weeks.

Once the party doing the sampling receives final laboratory results, it has two weeks to send a copy of all results, along with the sampling plan, to the NDDoH. The NDDoH

will provide written denial or approval of the site to the party submitting the samples within two weeks.

Note: Contractors providing gravel for roadways must provide the NDDoH written approval to the North Dakota Department of Transportation two weeks prior to starting to mine or process material.

Figure 1. Thin Wall Tube for Sampling



Note 1. Minimum of two mounting holes on opposite sides for 2- to 3-inch diameter sampler.

Note 2. Minimum of four mounting holes spaced at 90° for samplers 4-inch diameter and larger.

Note 3. Tube held with hardened screws.

Note 4. Two-inch outside diameter tubes are specified with an 18-gauge wall thickness to comply with area ratio criteria accepted for "undisturbed samples." Users are advised that such tubing is difficult to locate and can be extremely expensive in small quantities. Sixteen-gauge tubes are generally readily available.

Table 2

Dimensional Tolerances for Thin Walled Tubes

Nominal Tube Diameters from Table 1 ^A Tolerances, inches			
Size Outside Diameter	2	3	4
Outside Diameter	+0.007 -0.000	+0.010 -0.000	+0.015 -0.000
Inside Diameter	+0.000 -0.007	+0.000 -0.010	+0.000 -0.015
Wall Thickness	+0.007	+0.010	+0.015
Ovality	0.015	0.020	0.030
Straightness	0.030/ft	0.030/ft	0.030/ft

^A Intermediate or larger diameters should be proportional. Tolerances shown are essentially standard commercial manufacturing tolerances for seamless steel mechanical tubing. Specify only two of the first three tolerances; O. D. and I. D. or O. D. and Wall, or I. D. and Wall.

Appendix A

Listed below is contact information for laboratories that may be available to do SEM and EDS testing for the presence of the mineral erionite in bulk soil samples. These are private laboratories, contacted by the department, that have indicated they have the ability to conduct this testing. This list is provided only as a service to parties who want to have testing conducted. Inclusion on this list does not constitute an endorsement by the North Dakota Department of Health (NDDoH). This list is not all inclusive – parties interested in having testing done may wish to consult a telephone directory or other sources to locate additional environmental consulting firms. The NDDoH recommends that you contact the laboratory prior to sending samples to determine costs, analysis turnaround and shipping methods.

EMSL Analytical, Inc.
200 Route 130 North
Cinnaminson, NJ 08077
phone: 856-303-2500; Contact: Ed Cahill

Actlabs Materials Testing
1428 Sandhill Drive
Ancaster, Ontario L9G 4V5
phone: 905-648-2430 ext. 150; Contact: Aniceta Skowron, PhD

H &M Analytical Services
35 Hutchinson Road
Allentown, NJ 08501-1415
phone: 609-758-5700; Contact: Walter Helfrecht

Cannon Microprobe
1041 NE 100th Street
Seattle, Washington 98125
phone: 206-522-9233; Contact: Bart Cannon

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