

Exploratory Drilling In North Dakota

What do you do in the subzero, snow-packed winters in North Dakota? For the Abandoned Mine Lands (AML) Division of the North Dakota Public Service Commission, the answer is Exploratory Drilling. In the past several years, the North Dakota AML Division has extended its construction season through the winter months by conducting exploratory drilling in road rights-of-way and near buildings to gather information on potentially hazardous abandoned underground mines. Last winter, more than 72,000 feet were drilled at four different locations. This winter, work has begun on another exploratory drilling project in which approximately 50,000 feet will be drilled at four sites in west-central North Dakota.

Historic underground coal mines in North Dakota were fairly shallow (often 50 feet or less), with thick seams (10-20 feet) and frequently overlain with unconsolidated glacial till. Collapse can result in large and deep vertical openings which are extremely dangerous beneath roadways or structures.

Exploratory drilling is an intermediate step in a systematic approach to the reclamation of hazardous abandoned underground mines. The steps involved in identifying, classifying and reclaiming underground mines near roads and structures include:

- **Review of State AML Inventory** The State Reclamation Plan contains an inventory of abandoned coal mines in North Dakota. Of the 616 surface and underground mines that were inventoried, eighty-seven were deemed to be potentially hazardous to public health, safety and general welfare.
- **Observation and Public Input** The AML Division continually reviews and updates this inventory through aerial and ground surveys, information from road and other governmental authorities, review of available mine maps, and reports from the general public. Several hazardous sites have been added to the inventory as a result of investigation and public input. The AML Division has cooperative agreements with the State Department of Transportation and other road authorities regarding underground mine subsidence along roadways. The AML Division is also planning to plot site locations on digitized USGS Quad Maps and other available mapping resources using ArcView® computer software. This should help to better classify AML Sites based on topographic setting and proximity to roads and structures.
- **Exploratory Drilling** When available information indicates that an underground mine may be located near roads or structures, exploratory drilling is conducted. Drilling confirms the presence of the underground mine and its condition, and provides information necessary to design a reclamation project. Drilled holes that intercept mine cavities are cased with PVC pipe and these can be used as a conduit for grout injection. A downhole camera is frequently used to view the underground mine workings. If drilling indicates that underground mine workings are a hazard to the public, development of a reclamation project is initiated.
- **Reclamation** Pressurized grout backfilling is the preferred method for reclamation of hazardous collapsing underground mine workings beneath roads and structures. When mine workings have begun to collapse, pressurized injection is needed in order for grout to penetrate rubble and to fill voids at different levels. Grout (consisting of cement, flyash, water, sand, and other admixtures) is pumped under pressure, through drilled holes, directly into the mine voids. Subsequently, this material sets up and stabilizes the overburden to reduce the likelihood of collapse. Reclamation design and work are closely coordinated with the property owners, road authorities, and other interested parties. Sites are closely monitored for several years after reclamation.

Exploratory Drilling has already yielded significant results in North Dakota. Drilling in 1994-95 led to a 1996 pressure-grouting reclamation project beneath State Highway 23 and an occupied farmstead, both near the city of Parshall. Drilling was done in 1995-96 along a paved roadway near Dickinson on which collapse of underground mine workings resulted in a 15' diameter, 8' deep vertical opening on the driving surface. This feature was filled immediately by the road authority. Later in 1996, a pressure-grouting reclamation project was conducted to stabilize a ¾-mile segment of the roadway.

Several near-surface mining voids have been encountered in the drilling this winter in the ditch of State Highway 36, near Wilton, including an eleven foot clear void only fifteen feet below surface. Mining voids can easily be detected during drilling because the drill stem drops abruptly and the air or water that is circulated to bring cuttings to the surface is lost into the void.

The 1996-97 drilling project is being conducted on road rights-of-way near Wilton, Garrison, Beulah, and Dickinson. Drilling will also be done near a business, a radio station, and several occupied dwellings near Beulah. Drilling at Beulah and Dickinson is a continuation from last year and pressure-grouting reclamation projects are already being designed for these sites for the summer of 1997.

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