THE ABANDONED MINE LAND PROGRAM IN NORTH DAKOTA

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INTRODUCTION

Title IV of the Surface Mining Control and Reclamation Act of 1977 (P.L. 95-87) authorized the establishment of an Abandoned Mine Land Fund (AMLF) to be used to reclaim abandoned coal mines, both surface and underground, which present a hazard to public health, safety and general welfare. Money for this fund comes from a tax levied on active coal mining. A comparable State law, North Dakota Century Code Chapter 38-14.2, was passed in 1979. This law provided for the establishment of a state abandoned mine reclamation fund to be administered by the North Dakota Public Service Commission. Money for this fund comes from the AMLF through federal grants from the Office of Surface Mining Reclamation and Enforcement (OSMRE). "North Dakota's Abandoned Mine Land (AML) State Reclamation Plan" (State Reclamation Plan) was submitted to and approved by OSMRE.

This State Reclamation Plan contained, in part, an inventory of all abandoned coal mines in North Dakota. Of the 616 mines that were inventoried, eighty-seven were deemed to be potentially hazardous to the public health, safety and general welfare. Distribution of these mine sites is depicted in Figure 1 along with Planning Units which reflect major watersheds in the region. These eighty-seven were then ranked on the basis of hazard severity (Table 1). Hazards encountered include highwalls and endwalls, water bodies used as swimming holes, vertical openings and shafts into underground mines and tipples. Reclamation of these hazardous sites by the State began in 1981. Nearly 1400 acres have been reclaimed between 1981 and 1988. An estimated 1600 acres deemed potentially hazardous remain to be reclaimed.

RECLAMATION PROCEDURES FOR HAZARDOUS FEATURES

Highwalls, endwalls, water, and tipples are features of abandoned surface coal mines which pose a hazard to the public, particularly if these features are proximal to inhabited dwellings or easily accessed from public roads. Highwalls and endwalls can result in vertical drops of 50 feet or more. Water found in deep pits can be an attractive nuisance to children as a swimming hole. Tipples, structures used in coal processing, can be dilapidated and vulnerable to collapse.

Taxation of active coal mining under P.L. 95-87 for reclamation of AML sites is scheduled to end in 1992. Monies accrued in the AML fund for North Dakota will be sufficient to cover the cost of reclaiming the remaining hazardous AML sites.

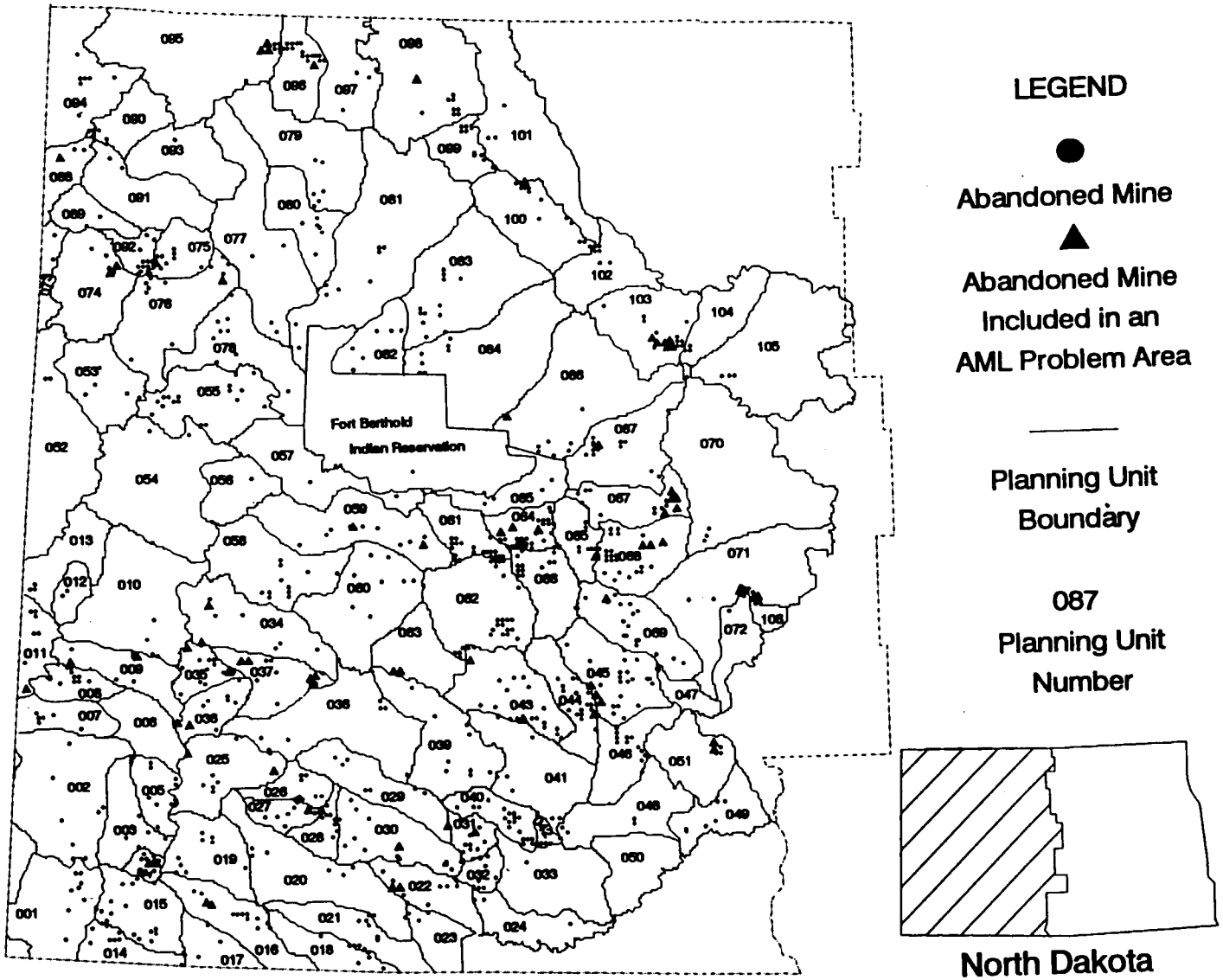

Figure 1. North Dakota Abandoned Mine Land (AML) Sites

Table 1. Sites potentially hazardous to public health, safety and general welfare.

PRIORITY #	MINE TYPE	ACREAGE	STATUS
1	BOTH	40	RECLAIMED
2	UNDERGROUND	2000	PORTIONS RECL.
3	UNDERGROUND	100	RECLAIMED
4	SURFACE	1280	PORTIONS RECL.
5	UNDERGROUND	15	RECLAIMED
6	UNDERGROUND	20	RECLAIMED
7	UNDERGROUND	120	PORTIONS RECL.
8	UNDERGROUND	420	PORTIONS RECL.
9	BOTH	270	PORTIONS RECL.
10	SURFACE	1400	PORTIONS RECL.
11	BOTH	14	RECLAIMED
12	BOTH	25	RECLAIMED
13	UNDERGROUND	10	UNRECLAIMED
14	SURFACE	55	PORTIONS RECL.
15	UNDERGROUND	20	RECLAIMED
16	UNDERGROUND	400	PORTIONS RECL.
17	SURFACE	20	RECLAIMED
18	SURFACE	55	UNRECLAIMED
19	SURFACE (URANIFEROUS)	50	UNRECLAIMED
20	UNDERGROUND	20	UNRECLAIMED
21	UNDERGROUND	10	RECLAIMED
22	UNDERGROUND	40	UNRECLAIMED
23	UNDERGROUND	40	UNRECLAIMED
24	SURFACE (URANIFEROUS)	80	UNRECLAIMED
25	BOTH	25	RECLAIMED
26	UNDERGROUND	80	UNRECLAIMED
27	SURFACE	40	UNRECLAIMED
28	SURFACE	18	UNRECLAIMED
29	SURFACE	4	RECLAIMED
30	SURFACE (URANIFEROUS)	10	UNRECLAIMED
31	BOTH	12	UNRECLAIMED
32	SURFACE	3	UNRECLAIMED
33	UNDERGROUND	25	UNRECLAIMED
34	SURFACE	1800	PORTION RECL.
35	BOTH	20	UNRECLAIMED
36	UNDERGROUND	30	UNRECLAIMED
37	UNDERGROUND	20	UNRECLAIMED
38	UNDERGROUND	60	RECLAIMED
39	SURFACE	12	UNRECLAIMED
40	UNDERGROUND	5	RECLAIMED
41	UNDERGROUND	1	UNRECLAIMED
42	BOTH	35	UNRECLAIMED
43	BOTH	20	UNRECLAIMED
44	BOTH	8	UNRECLAIMED
45	SURFACE (URANIFEROUS)	155	UNRECLAIMED

Table 1. (continued)

PRIORITY #	MINE TYPE	ACREAGE	STATUS
46	UNDERGROUND	9	RECLAIMED
47	UNDERGROUND	100	PORTIONS RECL.
48	UNDERGROUND	4	UNRECLAIMED
49	UNDERGROUND	8	UNRECLAIMED
50	UNDERGROUND	1	UNRECLAIMED
51	UNDERGROUND	5	UNRECLAIMED
52	UNDERGROUND	5	UNRECLAIMED
53	UNDERGROUND	40	UNRECLAIMED
54	UNDERGROUND	1	UNRECLAIMED
55	UNDERGROUND	2	UNRECLAIMED
56	BOTH	6	RECLAIMED
57	SURFACE (URANIFEROUS)	5	UNRECLAIMED
58	UNDERGROUND	3	UNRECLAIMED
59	SURFACE (URANIFEROUS)	5	UNRECLAIMED
60	UNDERGROUND	1	UNRECLAIMED
61	UNDERGROUND	12	UNRECLAIMED
62	UNDERGROUND	280	UNRECLAIMED
63	UNDERGROUND	4	UNRECLAIMED
64	UNDERGROUND	300	PORTIONS RECL.
65	BOTH	20	PORTIONS RECL.
66	UNDERGROUND	40	UNRECLAIMED
67	UNDERGROUND	1	UNRECLAIMED
68	UNDERGROUND	10	UNRECLAIMED
69	SURFACE	40	UNRECLAIMED
70	UNDERGROUND	1	UNRECLAIMED
71	UNDERGROUND	7	UNRECLAIMED
72	both	27	UNRECLAIMED
73	UNDERGROUND	5	UNRECLAIMED
74	UNDERGROUND	8	UNRECLAIMED
75	UNDERGROUND	7	UNRECLAIMED
76	UNDERGROUND	15	UNRECLAIMED
77	UNDERGROUND	3	RECLAIMED
78	UNDERGROUND	20	UNRECLAIMED
79	UNDERGROUND	5	UNRECLAIMED
80	SURFACE	2	RECLAIMED
81	UNDERGROUND	20	UNRECLAIMED
82	UNDERGROUND	2	UNRECLAIMED
83	SURFACE	1.5	UNRECLAIMED
84	UNDERGROUND	1	UNRECLAIMED
85	UNDERGROUND	9	UNRECLAIMED
86	UNDERGROUND	2	UNRECLAIMED
87	UNDERGROUND	22	UNRECLAIMED

Reclamation of highwalls and endwalls typically entails backsloping or backfilling to eliminate the vertical drop. Backsloping (Figure 2) involves cutting the highwall or endwall down with heavy equipment.

LEHIGH A(3)

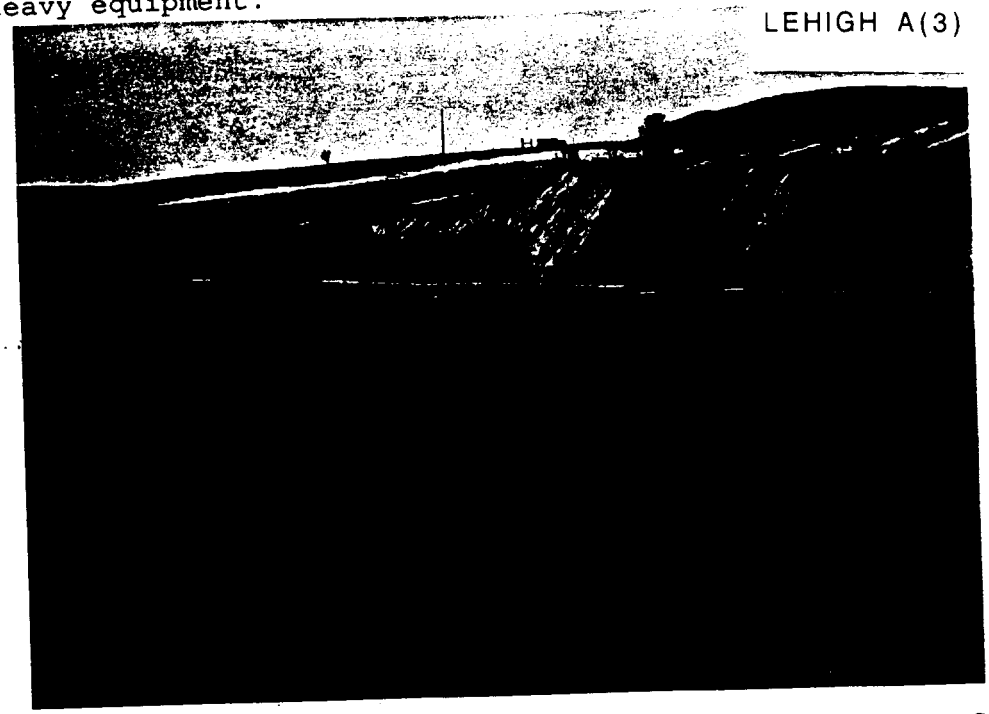

Figure 2. Highwall backsloping at Lehigh A(3) AML site, Stark County, ND.

Backfilling (Figure 3) requires pushing material up against the highwall face. Once the hazard is eliminated, salvaged topsoil is respread and the site is fertilized, seeded and mulched.

HARDMEYER (B)

Figure 3. Backfilling at the Hardmeyer B AML Site, Hettinger County, ND

The two other primary hazards associated with abandoned surface mines are water and tipples. The potential hazard associated with water-filled pits can be ameliorated by fencing the area off or by backfilling the pit (Figure 4).

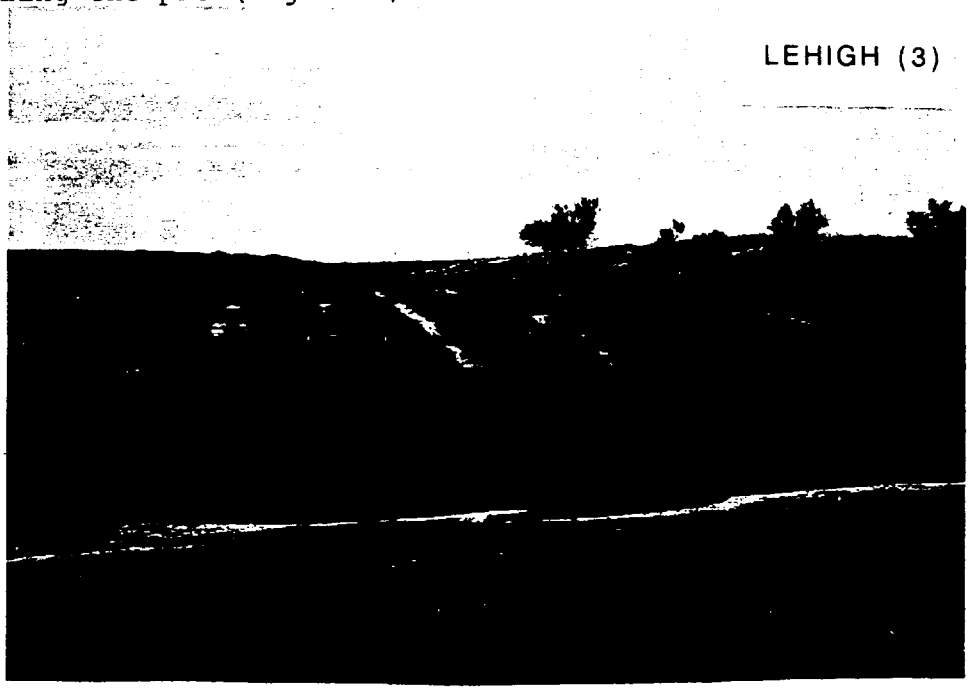

Figure 4. Backfilling a water-filled pit at Lehigh A(3) AML site, Stark County, ND.

In the case of a wooden structure, tipple demolition can be accomplished by bulldozing the structure and burning the debris (Figure 5). Tipples constructed of metal beams can be dismantled (Figure 6) using welding torches.

Figure 5. Tipple demolition at Havelock C AML site, Hettinger County, ND.

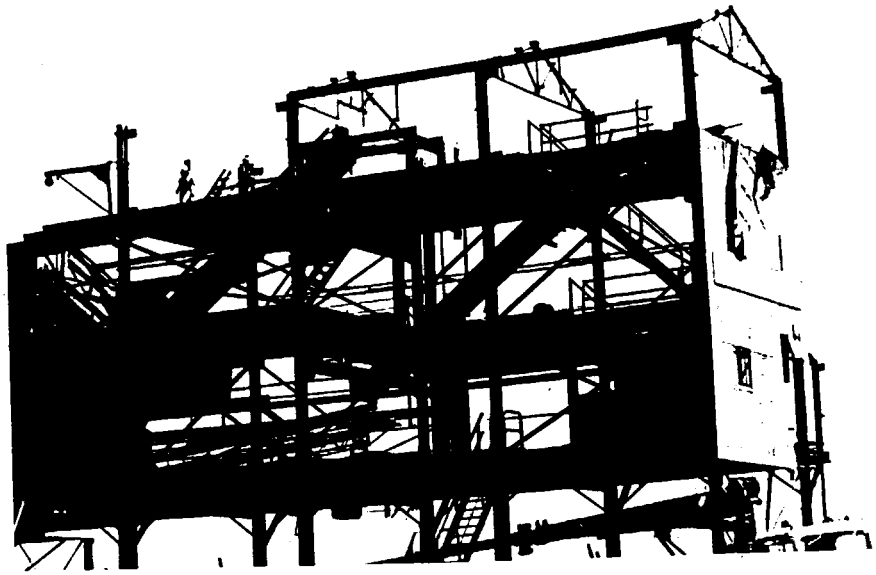

Figure 6. Demolition of Dakota Star tipple, Mercer County, ND.

Hazards created from abandoned underground mines are more intractable. Collapse of underground mine workings is manifested at the surface as depressions known as subsidence features. If these depressions are deep enough so that someone who fell in could not climb out they are called "vertical openings" (Figure 7). Vertical openings which directly connect with tunnels are referred to as "shafts", which range from 20 to 120 feet deep.

Figure 7. Vertical opening at Beulah AML site, Mercer County, ND.

Reclamation of subsided areas can be accomplished several ways. Daylighting (Figure 8), one of the more expensive techniques, involves excavating the underground tunnels and rooms with heavy equipment.

Figure 8. Daylighting at the Scranton AML site, Bowman County, ND.

Blasting (Figure 9), which can expedite tunnel collapse, has been used sparingly in North Dakota because of expense and the potential for structural damage to nearby houses. Furthermore, surface grading is still required to blend the collapsed area with surrounding topography.

Figure 9. Blasting to collapse underground mine tunnels at the New Leipzig AML site, Grant County, ND.

Surface grading (Figure 10) is the most cost-effective approach to underground mine subsidence. Highly subsided areas indicate that natural tunnel collapse has occurred. These areas are first stripped of topsoil, graded to blend with the surrounding area, respread with topsoil and then reseeded and mulched.

Figure 10. Surface grading of subsidence holes at the Andrews Lake AML site, Bowman County, ND.

Roads have been built over underground mine tunnels. The potential hazard is that the road will cave in when a tunnel collapses. In these cases the portion of the tunnel beneath the road is remotely backfilled (Figure 11) with a slurry of sand and water or flyash, sand and water. The slurry is confined to the portion of the tunnel beneath the road by the use of barrier walls, usually constructed of rock that is injected through large drill holes in the road right-of-way.

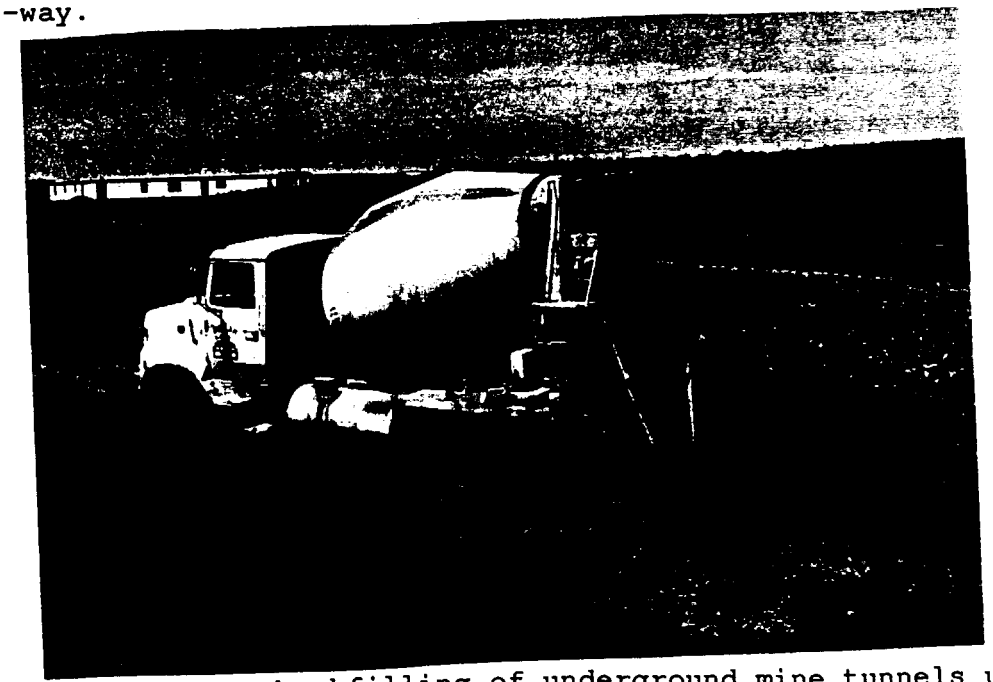

Figure 11. Remote backfilling of underground mine tunnels under Highway 200, North of Beulah, ND.

Reclaimed AML sites are routinely inspected to insure there are no recurring hazards. The most difficult reclamation problem has been to stabilize the vegetation in areas with little or no topsoil. Research, funded by the U.S. Bureau of Mines, is currently underway to assess the effectiveness of plant substrate amendments.