

Final Technical Report

**COMPREHENSIVE INVENTORY OF KNOWN
ABANDONED MINE LANDS IN THE BLACK HILLS
OF SOUTH DAKOTA**

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Executive Summary

This work focused on compiling a comprehensive inventory of known abandoned mine land (AML) sites in the Black Hills of South Dakota. The project was conducted under contract from the South Dakota Department of Environment and Natural Resources (DENR) in fulfillment of state law SDCL 45-6B-100 enacted in 1993. The law required an inventory of AML sites including information on their location, results of random field truthing activities, and identification of existing AML-related data. The law did not distinguish between land ownership status regarding federal, state, or private lands. Earlier inventory projects in the Black Hills concentrated on federal lands. Because of this, more recent efforts have examined AML sites on state and private lands.

In order to avoid duplication and to take advantage of previous work, three previously existing mineral and AML inventory databases were merged during the compilation of the comprehensive inventory. One concise, useable package was produced. The comprehensive inventory, named Mine Information System (MIS), is in electronic format in Microsoft Access. The electronic database is capable of generating custom forms from database tables and queries, rendering it very flexible for particular searches or combinations of searches. All sites can be searched for the following informational fields:

- Locational data [Township/Range, County, latitude/longitude, Universal Transverse Mercator (UTM) coordinates, watershed, mining district, U.S. Forest Service district, and distance/direction to nearest landmark]
- Name of property [claim name, mineral survey number, primary names, historic names]
- Type of mine [underground, surface, prospect, mill site]
- Minerals mined [primary, secondary, tertiary, commodities mined]
- Site visit and field verification
- Ownership
- Other data [size/acreage, elevation, geology/mineralization such as oxide/sulfide, formation name, physical/environmental hazards (potential and real), and references/bibliography of where information was obtained]

Because certain information not required as part of SDCL 45-6B-100 was present in the previous databases and made part of the comprehensive package, some AML sites contain a different assemblage of informational fields than others. Which information is present depends on the inventory or mineral database from which it originated. Inclusion of the additional information was an added benefit of merging the previous databases into the comprehensive package. In addition to the digital database, a set of overlays is provided for USGS 7.5 minute quadrangle maps showing the locations of the AML sites to the ~~nearest one quarter of a quarter section~~.

*location
data quality*

The databases that were merged include:

- 1) The U.S. Geological Survey (USGS) database for Metallic Mineral Districts and Mines in the Black Hills;
- 2) The U.S. Forest Service's (USFS) inventory of sites on National Forest lands; and
- 3) The state's database that was compiled from a literature search of known AML sites in the Black Hills (i.e., any sites that were located in the state's literature search but were not in the previous two databases).

input databases
MAS/MILS?

The USGS database was chosen as the primary database upon which to build because it was developed specifically for the Black Hills. Additionally, Wilson and DeWitt had made corrections to certain location data that were erroneous in the U.S. Bureau of Mines MAS/MILS database. The MAS/MILS database was available but was not used in this project because its older format could not be merged with the Microsoft Access database.

900

Nearly 900 mine sites were identified in the project. About 700 of those are on private lands. Ten percent of the sites on private land were randomly selected and visited in the field to: 1) field verify UTM coordinates with Global Positioning Systems, 2) estimate the total area affected by mining, and 3) note any obvious physical or chemical hazards. Descriptive notes and a sketch were made for the sites visited in the field. Because all of the sites on Black Hills National Forest lands were field visited and assessed for physical and environmental hazards during the USFS inventory project, there was no need to revisit those sites again during the state's comprehensive inventory. A number of the sites visited on private lands were either mined or reclaimed by active mining operators. The predominant percentage were inactive. A few could not be found at the location listed in the previous databases, but in general, prior information on the sites was accurate.

70 visited
USFS all field-visited

Based on the USFS hazard screening results and observations made during field visits to 10% of the sites on private lands, it is concluded that the majority of the nearly 900 sites inventoried do not warrant significant remedial attention. A few sites, however, pose a considerable environmental or physical safety hazard. The inventory information provides criteria for identifying those sites that require further investigation or characterization of these hazards.

The project was conducted under the oversight of a governor-appointed Abandoned Mined Lands Advisory Committee. Also, in keeping with DENR's efforts to conform with national inventory guidelines, a local stakeholder group of interested parties was formed. The stakeholder group met concurrently with the Advisory Committee on three occasions during the inventory project for purposes of informational updates and decision-making. Members of both groups are listed in the appendix.

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Introduction

This report describes a comprehensive inventory of abandoned mine lands in the Black Hills of South Dakota. The South Dakota School of Mines and Technology (SDSM&T) entered into a contract with the South Dakota Department of Environment and Natural Resources (DENR) to conduct a comprehensive inventory of known abandoned mine lands (AMLs) in the Black Hills pursuant to SDCL 45-6B-100. The inventory includes a list of the locations of known AML sites, field truthing of approximately ten percent of the sites on private lands, selected by random, and a bibliography of existing AML-related data. One requirement of the contract was that locational information already inventoried (e.g. U.S. Forest Service data) need not be duplicated, but will be complemented by acquisition of data for lands outside of the Black Hills National Forest. This includes private land, state lands (state parks and school district property), and other federal land (such as lands administered by the U.S. Bureau of Land Management). The contract required development of an inventory form that would accommodate recording of specified information, and that would be as compatible as possible with previously used inventory forms. This inventory ensures that any additional prioritization of abandoned mines sites will be done consistently. If additional prioritization or site characterization is done in the future, this inventory will assist in making sure it is done consistently and with as much previously available data as possible.

Database Development

Previously Available Databases

Several databases existed for mined areas of the Black Hills. These included:

1. U.S. Forest Service AML Database (**USFSAML**)
2. U.S. Geological Survey Database (**USGSMIN**) for Metallic Mineral Districts and Mines of the Black Hills (SD and WY) - (Wilson and DeWitt, 1992)
3. The state's database that was compiled from a literature search of known AML sites in the Black Hills (i.e., any sites that were located in the state's literature search but were not in the previous databases).

The U.S. Bureau of Mines Minerals Availability System / Mineral Industry Location System (**MAS/MILS**) also was available. However it was not possible to merge the **MAS/MILS** database format with the Microsoft Access database and program that were used for the comprehensive inventory. The **MAS** was acquired through Mr. Michael Sawyer of the U.S. Bureau of Mines in Denver. It included a diskette of non-proprietary data for South Dakota, a list of the mine sites in Custer, Fall River, Lawrence, Meade, and Pennington counties, and documentation for the data. The **MAS** database provides comprehensive information on known mining operations, mineral deposits/occurrences, and processing plants.

The USFS AML database (**USFSAML**) was available at SDSM&T. The USGS database (**USGSMIN**) had already been used by one of the authors (Paterson) and was already available at SDSM&T. A copy of the documentation for **USGSMIN** is provided in Appendix A.

Linking of Databases using Microsoft Access

The choice of suitable database software was facilitated by the availability of a user-friendly, Windows-driven database manager, Microsoft Access. Microsoft Access is the official standard for database management in South Dakota government.

The authors chose the USGS database (**USGSMIN**) as the foundation for the database, because (1) it was developed specifically for the Black Hills, and (2) Wilson and DeWitt (1990) had made corrections to some locational data that were erroneous in the earlier U.S. Bureau of Mines **MAS/MILS** database.

Although the **USGSMIN** database is the primary source of information, other databases can be linked to it directly, while maintaining their own integrity. To allow for linkage of the databases, a new field (SEQ) was added to **USGSMIN** to produce a new database (**MIS**, or Mine Information System). This new field contains sequence numbers, which are unique 10-digit numbers that include a code for the state, county, and mine site within the county. Any other databases (e.g., **USFSAML**) can be linked to the primary database as long as they contain the SEQ field and number for each site location, thus greatly increasing the usefulness and flexibility of the inventory.

Manual correlation of sites between the databases was necessary to identify the correct SEQ number for each site in **MIS**. SEQ numbers were then added to the database. A significant number of sites could not be readily linked with an SEQ number and required extensive research to clarify the discrepancies. If a site in **MIS** did not have an established SEQ, a modified SEQ was assigned by the authors in order to facilitate linkage of the various databases.

SEQ
relat.
field

The structure and relationships in the **MIS** database are shown in Table 1. The database consists of tables of information, similar to spreadsheets. The fields or categories contained within the "**USGSMIN**" table are listed in Table 2. Numerical fields were derived from the **USGSMIN** database. A key for these fields is included on the second page of Table 2. The tables with the prefix of "SD" in Table 1 were linked to the "**USGSMIN**" table. Only those fields required for the creation of the **MIS** database were selected. Additional new descriptive fields were added to the **MIS** database for compliance with the contract for this study. Examples of fields in the final **MIS** are the sequence number, claim name, mineral survey number, location, and other headings.

Documentation for the comprehensive database and its operation is included in Appendix B.

Table 1. Structure of Database MIS

Tables:	USGSMIN *SDCOM *SDLIT *SDMIL *SDMIN
Queries:	All Black Hills AML (886 sites) Non USFS Sites (718 sites)
Forms:	BHAML

* These tables were linked to the "USGSMIN" table

Area of Black Hills Abandoned Mine Land Region

In the South Dakota inventory law, the "Black Hills" are defined as: "Lawrence County south of Interstate 90, Meade County west and south of Interstate 90, and Pennington and Custer Counties west of South Dakota Highway 79."

All AML sites within "USGSMIN" in the latitude range of 43.4744°N to 44.5500°N, and the longitude range of 103.17583°W to 104.0556°W were selected. This area is a rectangle that includes the entire area of the Black Hills AML, as well as small areas outside of the Black Hills AML to the northeast of I-90 and east of U.S. Hwy. 79. From examination of maps and the experience of the authors, it is likely that most AML sites which exist in the Black Hills lie within this rectangle.

By applying these locational specifications to "USGSMIN" table, a list of approximately 900 mine sites (including active ones) was developed. Additional sites were eliminated by identifying those AML sites already inventoried in the USFS project and to prevent duplication of previous work. The remaining sites (approximately 700) identified are the focus of this study.

The fields or categories used for the All Black Hills AML Query are summarized in Table 3, which uses the same key as for Table 2. The specific tables used as sources for the All Black Hills AML Query are listed in the "SQL" section of Table 3. Table 4 lists the Non USFS Sites and Table 5 lists the remaining USFS sites.

Table 2

Page: 1

Properties

Date Created: 7/20/95 5:37:26 PM Def. Updatable: Yesà465X
12/27/95 11:14:17 AM Record Count: 1084 Last Updated:

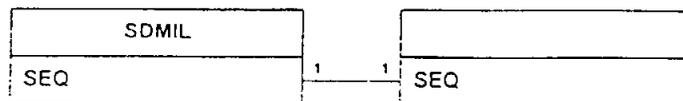
Columns

Name	Type	Size
SEQ	Text	12
1	Number (Integer)	2
2	Text	5
3	Text	28
4	Text	15
Claim Name	Text	50
Mineral Survey Number	Number (Double)	8
5	Text	14
6	Number (Integer)	2
7	Text	4
8	Text	4
9	Number (Single)	4
10	Number (Single)	4
11	Text	16
12	Text	16
Catchment	Text	20
Stream	Text	20
Landmark	Text	20
Bearing to Landmark	Number (Double)	8
Distance to Landmark	Text	10
USFS District	Text	15
13	Text	2
14	Text	64
15	Text	16
Sulfides	Text	50
Oxides	Text	50
Mineral 1	Text	12
Mineral 2	Text	12
Mineral 3	Text	12
Commodity 1	Text	12
Commodity 2	Text	12
Commodity 3	Text	12
Site Visit	Text	8
Size	Text	15
Ownership	Text	15
Physical Hazard 1	Text	12
Physical Hazard 2	Text	12
Physical Hazard 3	Text	12
Physical Hazard 4	Text	12
Physical Hazard 5	Text	12

Chemical Hazard 1	Text	12
Chemical Hazard 2	Text	12
Hazard Potential	Text	8
16	Text	8
17	Text	8
18	Number (Integer)	2
19	Text	4
20	Text	7
21	Text	7
22	Number (Integer)	2
23	Text	7
24	Text	7

Relationships

Reference



Attributes: One to One, Not Enforced, Right Join

Explanation: Code for numerical fields.

Existing Field-#	Suggested Name for Field-#	Field Type and Length	Partial Explanation
Field-1	No.	N	integers 1-1083
Field-2	Type	A6	
Field-3	Mine Name	A36	
Field-4	District	A17	
Field-5	Quadrangle	A18	
Field-6	Sec	N	section numbers 1-36
Field-7	Twp	A3	township, north (N) or south (S)
Field-8	Rng	A3	range, west (W) or east (E)
Field-9	DD latitude	N	shown to 5 decimal places
Field-10	DD longitude	N	shown to 5 decimal places
Field-11	DMS latitude	A14	
Field-12	DMS longitude	A15	
Field-13	S	A1	Y indicates there are synonyms
Field-14	Synonyms	A64	
Field-15	Company	A24	
Field-16	MRDS#1	A7	
Field-17	MRDS#2	A7	
Field-18	IC-7688	A8	entry number
Field-19	S&G	A4	page number, p000
Field-20	IC-7069	A4	page number, p000
Field-21	IC-7112	A4	page number, p000
Field-22	IC-7707	A4	entry number
Field-23	IC-8278	A3	page number, p000
Field-24	B-427	A4	page number, p000

Table 3

Properties

Date Created:	8/23/95 12:58:21 PM	Def. Updatable:	Yes
Last Updated:	12/27/95 11:04:56 AM	ODBC Timeout:	60
Record Locks:	No Locks	Returns Records:	Yes
Type:	Select		

SQL

```
SELECT DISTINCTROW SDMIL.SEQ, {1083mine}.[1], {1083mine}.[3], {1083mine}.[4], {1083mine}.[13],
{1083mine}.[14], {1083mine}.[Claim Name], {1083mine}.[Mineral Survey Number], {1083mine}.[5],
SDMIL.COU, SDMIL.SUB, {1083mine}.[6], {1083mine}.[7], {1083mine}.[8], {1083mine}.[9], {1083mine}.[10],
{1083mine}.[11], {1083mine}.[12], SDMIL.NOR, SDMIL.EAS, {1083mine}.Catchment, {1083mine}.Stream,
{1083mine}.Landmark, {1083mine}.[Bearing to Landmark], {1083mine}.[Distance to Landmark],
{1083mine}.[USFS District], SDMIL.TYP, SDMIL.PLT, {1083mine}.[2], {1083mine}.Sulfides,
{1083mine}.[Mineral 1], {1083mine}.[Mineral 2], {1083mine}.[Mineral 3], {1083mine}.[Commodity 1],
{1083mine}.[Commodity 2], {1083mine}.[Commodity 3], {1083mine}.[Site Visit], {1083mine}.Ownership,
{1083mine}.[Physical Hazard 1], {1083mine}.[Physical Hazard 2], {1083mine}.[Physical Hazard 3],
{1083mine}.[Physical Hazard 4], {1083mine}.[Physical Hazard 5], {1083mine}.[Chemical Hazard 1],
{1083mine}.[Chemical Hazard 2], {1083mine}.[Hazard Potential], SDMIL.ELE
FROM 1083mine INNER JOIN SDMIL ON {1083mine}.SEQ = SDMIL.SEQ
WHERE ((({1083mine}.[9] Between 43.4744 And 44.55) AND ({1083mine}.[10] Between 103.17583 And
104.0556)):
```

Columns

Name	Type	Size
SEQ	Text	255
1	Number (Integer)	2
3	Text	28
4	Text	15
13	Text	2
14	Text	64
Claim Name	Text	50
Mineral Survey Number	Number (Double)	8
5	Text	14
COU	Text	255
SUB	Text	255
6	Number (Integer)	2
7	Text	4
8	Text	4
9	Number (Single)	4
10	Number (Single)	4
11	Text	16
12	Text	16
NOR	Text	255
EAS	Text	255
Catchment	Text	20
Stream	Text	20
Landmark	Text	20
Bearing to Landmark	Number (Double)	8

Distance to Landmark	Text	10
USFS District	Text	15
TYP	Text	255
PLT	Text	255
2	Text	5
Sulfides	Text	50
Mineral 1	Text	12
Mineral 2	Text	12
Mineral 3	Text	12
Commodity 1	Text	12
Commodity 2	Text	12
Commodity 3	Text	12
Site Visit	Text	8
Ownership	Text	15
Physical Hazard 1	Text	12
Physical Hazard 2	Text	12
Physical Hazard 3	Text	12
Physical Hazard 4	Text	12
Physical Hazard 5	Text	12
Chemical Hazard 1	Text	12
Chemical Hazard 2	Text	12
Hazard Potential	Text	8
ELE	Text	255

Table 4

Page: 1

Properties

Date Created:	10/4/95 2:32:31 PM	Def. Updatable:	Yes
Last Updated:	12/27/95 10:59:39 AM	ODBC Timeout:	60
Record Locks:	No Locks	Returns Records:	Yes
Type:	Select		

SQL

```
SELECT DISTINCTROW [1083mine].SEQ, [1083mine].[3], [1083mine].[5], [1083mine].Ownership,
[1083mine].[9], [1083mine].[10], [1083mine].[Site Visit]
FROM 1083mine
WHERE ((([1083mine].Ownership Is Null) AND (([1083mine].[9] Between 43.4744 And 44.55) AND
([1083mine].[10] Between 103.17583 And 104.0556)))
ORDER BY [1083mine].[3];
```

Columns

Name	Type	Size
SEQ	Text	12
3	Text	28
5	Text	14
Ownership	Text	15
9	Number (Single)	4
10	Number (Single)	4
Site Visit	Text	8

Table 5

Page: 1

Properties

Date Created:	10/4/95 1:11:23 PM	Def. Updatable:	Yes
Last Updated:	10/4/95 1:11:23 PM	ODBC Timeout:	60
Record Locks:	No Locks	Returns Records:	Yes
Type:	Select		

SQL

```
SELECT DISTINCTROW [1083mine].SEQ, [1083mine].[3], [1083mine].Ownership
FROM 1083mine
WHERE (([1083mine].Ownership="USFS"))
ORDER BY [1083mine].[3];
```

Columns

Name	Type	Size
SEQ	Text	12
3	Text	28
Ownership	Text	15

Forms for Collecting and Reporting Data

Microsoft Access is capable of generating custom forms from database tables and queries. For the purpose of reporting data for each site in the Black Hills AML, and for verification and addition of data, a one-page field data form (BHAML) was generated. This form was used by workers in the field; an example is shown on Figure 1, using data for the Gertie Mine in the Hill City topographic quadrangle. Appendix B shows the data base screens when using MIS. Note that the computerized data base screens are different from the field form (Figure 1). Each site can be printed on separate pages in this format. As needed, different form styles and contents can be generated. In addition, tabular listings can be produced, similar to spreadsheets. The Environmental Data section is composed of a field for Physical Hazards, and a separate field for Chemical Hazards, with a number code corresponding to the possible types of hazards that might exist. The one-page field form used at only those sites selected for field verification is a simplified version of the BHAML form.

Bibliography of AML Data

The main references for Black Hills mine sites were already available in the USGS database. References for specific sites are included in the comprehensive bibliography, ordered alphabetically by first author, and identified by a number. The more relevant references for each site will therefore be identified in the report form by a code. Additional references are available in Appendix A.

Compilation of New Data

Minerals

The U.S. Bureau of Mines MAS database table, SDMIN, listed minerals for mine sites. However, this mineral table was far from complete, with only 389 mineral records for a much smaller number of mine sites (most sites had multiple minerals listed). Preliminary literature search has been conducted to update this table, but no modifications to the database have been made at this time. As mentioned above, the U.S. Bureau of Mines database was not linked with the final database because of the older program format, but its availability is pointed out here for completeness and for possible future reference.

Catchments and Landmarks

New fields added to the SDAML database include catchment, stream, landmark, bearing to landmark, and distance to landmark. These data have been compiled on the printed BHAML forms, and subsequently entered in the database

41

Mine Name: **Gertie** SEQ: **0461030018** Mine #: **445**
 District: **Hill City** mine district Ownership: **USFS BLM SDPARK**
 S: Y/N Synonyms: USNATPK PRIVATE
 Claim Name: Min. Surv. No.:

LOCATIONAL DATA
 County: **103** Counties: 033 - Custer, 047 - Fall River, 081 - Lawrence, 098 - Meade, 103 - Pennington
 Quadrangle: **Hill City**
 Twp: **01S** Rng: **04E** Sec: **36** SUB: **C SWNE** subsection
 DD lat: **43.92047** DD long: **103.5854** UTM NOR: **4863713**
 DMS lat: **43 55 13.701** DMS Long: **103 35 7.442** COORDS EAST: **613602**

DRAINAGE AND LANDMARKS
 Catchment: **Marion Lake** Stream: **Spring Cr** Actual name or unnamed
 Landmark: **Bishop Mt** Bear to Lmk: **85** Dist to Lmk: **1915**
 0 to 359 degrees meters
 USFS District: ELE: **1561** meters

MINE INFORMATION
 TYP: **UNDERGROUND** Type of Operation: unknown, surface, placer, underground, surface, underground, proc plant, leach
 PLT: Type of Plant: Benef, leach, agglom, dm, pallet, sinter, smelt, pig, metal, refine

DEPOSIT CHARACTERISTICS
 Type: **F** Deposit-type (Wilson and DeWitt, 1992): A=iron formation, B=Prot Au-U cgltr, C=Prot Au-Ag syngen stratiform, D=Prot Au-Ag vein, E=ksp peg, F=Sr-W peg, G=U peg, H=ksp mica peg, I=mica peg, J=Be peg, K=Prot Fe stratiform, L=Camb. Au placer, M=High-Ga. lst, O=ssst U, P=Quat bog Fe, Q=Quat. Ten. placer, R=Camb. residual Fe, S=Tert base metal vein/repl, T=Tert Au-Ag vein/repl, U=Tert base metal porph, V=Tert Au-Ag porph, W=Tert. H. carb, X=Tert. REE carb, Y=Tert. Au-Ag carb, Z=Phan base Au-Ag vein
 Mineral 1: Mineral 2: Mineral 3:
 Commodity 1: Commodity 2: Commodity 3:

ENVIRONMENTAL DATA
 Visit 1: Y/N Haz Pot: Y/N
 Phys. Haz. 1: Phys. Haz. 2: Phys. Haz. 3:
 Phys. Haz. 4: Phys. Haz. 5:
 Chem. Haz. 1: Chem. Haz. 2:

NOTES
 unmined open shaft
 6 to 8 ft. diameter
 another shaft at least 100 ft. deep

Figure 1. Data form.

Field Verification of AML Sites

Selection of Sites for Field Verification

Approximately 10% of the sites were selected randomly for field verification. Of the nearly 60 sites, a number of sites are still active mines or have been reclaimed by recent mining activities. Table 6 gives the entire list of sites visited. The predominant percentage of sites were inactive. Most did not have serious environmental hazards associated with them. Approximately one half contained one or more physical hazards. A few sites simply could not be found at the location listed from previous databases. In general, prior information on these sites was reasonably accurate. Details of site information from field checking are included both in hard copy form and in the MIS database.

Ownership of Properties

Before any of the privately owned sampled sites were visited, the ownership was determined by checking county courthouse records. The owners were contacted to explain the nature of the project and to request permission to visit the sites to verify locational information. In general, there has been excellent cooperation from the owners. Copies of the field forms were sent to the owners when requested.

Site Visit Procedures

The primary purpose of the site visits was to verify the locational information. A Global Positioning System receiver was used to check the Universal Transverse Mercator (UTM) coordinates of the site. In addition, the total area affected by mining was estimated, and any obvious hazards (physical or chemical) were noted. Descriptive notes and a sketch of the site also were made. The notes have been entered into the MIS database through the introduction of several note fields.

Weekly sessions were held with technical assistants and field personnel before field work began in order to agree on consistent usage of sometimes subjective determinations within the field form.

Summary of AML Site Visits

Hazards

Nearly half of the visited sites contained physical hazards that could pose a significant threat if public access was allowed to these sites. Examples of the hazards

Table 6. Sites Visited

Mine Locations That Have Been Visited	
Grand Junction	Climax Mica(East)
Omega	L5 No. 3
Pinney	Old Bill
Dakota	Coletta(East)
Wells Fargo	Gunnison and Vulcan
American Express	Tornado
Columbus	Fannie
Kicking Horse	Old Decorah
Penobscott	Alpha Plutus
Highland Lode	Commercial
Gertie	Manchester
Dyke No.2	Yeddo
St. Anthony	J.R. Extension
Hidden Treasure	J.R. #1-5
Eureka	Lincoln No. 1
Washington	Red Rose No. 1 *
Two Bit	Beecher Lode
Crown Point	Tut Lode
Mohawk	New York Mica
Hayes	Gopher Lode
Ben Skinner	Big Chief
Red Cloud	Joe Dollar
Echo	Lucky Boy
Rusty	Burt Mica
Bear Gulch Mining	Jersey No. 1
Iron	Bald No. 1
Old Ironsides	Bald No. 2

* Currently active mine permitted by state.

would be open adits, open shafts, rock faces with significant deterioration or over hanging walls, unstable rock piles and collapsing structures. Adits and shafts posed a threat because of collapse and depth of some existing shafts. Examples of sites that included some of the above hazards are: (1) The Joe Dollar Mine has a remaining open adit 6 ft in diameter with rotted and collapsing beams shortly inside. (2) The Gertie Mine has an unfenced open shaft with a diameter of 6 to 8 ft. The owner stated the original depth was more than 400 ft. (3) The Highland Lode has a remaining rock face 100 ft high that is severely undercut and beginning to collapse. (4) The Lucky Boy Mine has a remaining rock pile, at least 100 ft high, which is composed of large diameter material (> 1 ft) that are extremely unstable. (5) The Old Ironsides Mine has structures which are completely collapsed. It is assumed this collapsed building covers a possible shaft because no other evidence of a shaft or adit was found near the property. These examples illustrate some of the more severe remaining dangers at these sites. It is estimated that hazards as severe as these are present at 30% of the total sites visited. Larger operations often contain remaining rock faces which are collapsing and large steep waste rock piles that are unstable. Remaining structures are usually in disrepair or complete collapse, sometimes covering shafts or adits or other unknown dangers. Some owners have taken measures to minimize or eliminate the remaining hazards at these sites. Observed measures range from complete reclamation to fencing or posting warning signs. Public access is not typically readily available at most of these sites.

Obvious chemical hazards were not observed at any of the sites that were visited. The only possible chemical hazards were from active sites that used chemicals for processing of the commodities.

Accuracy of Database

With few exceptions, locational data were accurate within about 500 ft. It is estimated that perhaps 20% of site locations were verified by finding recent mineral survey markers at the site. At most of the remaining sites, the locational data was found to be reasonably accurate because evidence of activity was usually present within 500 ft of the given coordinates or the site was visited with the current owner. Of the exceptions where location was found to be inaccurate, discrepancies of 0.3 to 0.5 miles were found. The location for the Beecher Lode was found to be 0.4 miles from the data available in the database. The current owner verified the property description.

Ownership Records

Ownership information is the least accurate part of this data base. Records in Custer County were highly disorganized and outdated. However, the current ownership information that was found in Custer County was generally accurate. Some discrepancies arose in Lawrence County because of the extensive royalties that Homestake owns, but current private ownership was found to be generally accurate. Pennington county ownership records were the least accurate when attempting to get

permission for site visits. A number of times, the owner listed at the county courthouse was not the current owner. Occasionally, the owner would suggest visiting a site that was not originally intended but was owned by that specific individual. On one occasion while attempting to obtain permission to visit a site in Pennington County, an owner gave permission to visit a site that was not listed in the database. The property location and name were confirmed through mineral survey markers and maps. There could be other sites such as this that were not recorded in the database.

Finally, for many sites that do not have current information, it was found the the property had been turned over to the agency that originally owned it (e.g., the USFS). Land exchanges frequently occur between the USFS and larger mine companies. Properties owned by these agencies can change ownership at nearly any time when one of these exchanges is approved. For example, a large land exchange between Pacer Corporation and the USFS occurred in September 1995 and was not discovered until the current tax records showed the changes in ownership. No current evidence was found in the general mine ownership records.

Summary and Conclusions

This work developed an inventory of inactive and abandoned mines on state and private lands in of South Dakota after passage of legislation by the State of South Dakota requiring a comprehensive inventory. The primary focus of the inventory was to gather locational information only. The only physical or environmental hazards noted were those that were obvious during the site visits. Earlier inventory projects in the Black Hills concentrated on federal lands and focused on identifying, examining, and ranking the physical and environmental hazards at inactive and abandoned mine sites. The inventory information provided criteria for identifying those sites that require further investigation or characterization of the physical safety or environmental hazards. Physical hazards often included open and unfenced shafts and adits, unstable structures, and steep highwalls.

Information from databases of the U.S. Geological Survey and U.S. Forest Service was combined in this comprehensive inventory. As a result, nearly 900 mines sites in total were identified in the Black Hills area. Mines on U.S. Forest Service land were identified during previous work, leaving approximately 700 sites on private land as the focus of this study. Forms were developed for entering data and for field visits. Approximately 10 % of sites were selected for visits for field truthing. During the field visits, a Global Positioning System receiver was used to check the Universal Transverse Mercator (UTM) coordinates of the site. In addition, the total area affected by mining was estimated, and any obvious hazards (physical or chemical) were noted. Descriptive notes and a sketch of the site also were made.

Ownership for as many AML sites as possible in the Black Hills was established following an exhaustive search of existing county records. Claim name(s) and mineral

survey numbers (if available) were determined for most sites. Drainage catchments and landmarks as well as the minerals and commodities sections of database were completed for as many sites as possible. Final linkage to the USFS data base has been completed and is currently being evaluated. The Geographic Information System (GIS) work is expected to be completed during the spring of 1998.

Meetings were held with local stakeholders such as mining companies, archeologists, biologists, and the environmental community to seek input on important items to include on the inventory forms. Members of stakeholder groups who attended meetings are listed in Appendix C.

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Appendix A

Supporting Documentation for USGSMIN Database

U.S. DEPARTMENT OF THE INTERIOR

U.S. GEOLOGICAL SURVEY

Database for metallic mineral districts and mines of the Black Hills,
South Dakota and Wyoming

By

Anna Burack Wilson and Ed DeWitt

Open-File Report

OF-92-523-A Discussion (paper copy)

OF-92-523-B,C Database (2 diskettes)

1992

This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey (USGS) editorial standards nor with the North American stratigraphic codes. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the USGS. Although these data have been used by the USGS and have been successfully imported into database programs, no warranty, expressed or implied, is made by the USGS as to how successfully or accurately the data can be imported into any specific application software running on any specific hardware platform. The fact of distribution shall not constitute any such warranty, and no responsibility is assumed by the USGS in connection therewith.

U.S. Geological Survey
Denver, Colorado

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DISCUSSION

1083 mines in 80 metallic mineral districts have been located in the Black Hills of South Dakota and Wyoming. This database contains updated mine and location information used by the authors for a series of publications on the mineral deposits and resource potential of the Black Hills (DeWitt, Redden, and others, 1986; DeWitt, Buscher, and others, 1987a-z; DeWitt, Redden, and others, 1989; DeWitt and Wilson, 1990; Wilson and DeWitt, 1990).

Mine information is provided in several different formats, including ASCII, on the enclosed 1.44MB diskettes for easy import into virtually any database the user may chose. Data files begin with "1083MINE." followed by a two or three letter extension. The extension (eg. .ASC) indicates the database with which the file should be used. Paradox version 3.0 or 3.5 users should use the .DB file, Lotus 1-2-3 version 2.0 the .WKS, DBase version 3.0 the .DBF, Quattro version 2.0 the .WKQ, Excel version 3.0 the .XLS; other programs may require the ASCII file .ASC. The data were compiled in Paradox 3.5 and exported to the various other database programs. All data in the ASCII file are supplied in quote and comma delimited fields for easy import into virtually any other database the user may choose. The data may be imported to the Apple Macintosh through Excel version 3.0. README.TXT is a copy of this text.

Structure of database file 1083MINE.ASC if imported to Paradox 3.0 or 3.5

Field types: N numeric field
 A alpha-numeric field, number of spaces

Existing Field-#	Suggested Name for Field-#	Field Type and Length	¹ Partial Explanation
Field-1	No.	N	integers 1-1083
Field-2	Type	A6	
Field-3	Mine Name	A36	
Field-4	District	A17	
Field-5	Quadrangle	A18	
Field-6	Sec	N	section numbers 1-36
Field-7	Twp	A3	township, north (N) or south (S)
Field-8	Rng	A3	range, west (W) or east (E)
Field-9	DD latitude	N	shown to 5 decimal places
Field-10	DD longitude	N	shown to 5 decimal places
Field-11	DMS latitude	A14	
Field-12	DMS longitude	A15	
Field-13	S	A1	Y indicates there are synonyms
Field-14	Synonyms	A64	
Field-15	Company	A24	
Field-16	MRDS#1	A7	
Field-17	MRDS#2	A7	
Field-18	IC-7688	A8	entry number
Field-19	S&G	A4	page number, p000
Field-20	IC-7069	A4	page number, p000
Field-21	IC-7112	A4	page number, p000
Field-22	IC-7707	A4	entry number
Field-23	IC-8278	A3	page number, p000
Field-24	B-427	A4	page number, p000

¹Full explanation of replacement field types are on the following page

Full Explanation of suggested replacement field names

No. is the mine number. In general, these increase from northwest to southeast.

Type is the deposit type as classified in DeWitt, Redden, and others (1986) and on the accompanying table of deposit types (Table 1)

Mine Name is the common or preferred name of a mine. An = symbol indicates that the mine name is abbreviated as shown on the 7 1/2 minute map series (DeWitt, Buscher, and others, 1987a-z). A descriptor in brackets [] indicates that the mine had more than one opening plotted on the map. Each opening is given its own mine identification number.

District is the name assigned by the authors to the metallic mining district. This name may not be the same as has been commonly used for conventional and historical mining districts in the Black Hills.

Quadrangle is the 7 1/2 minute topographic map on which the mine is located.

Sec, Twp, and Rng are the locations by Section, Township, and Range of the mines as determined by the authors and plotted on 7 1/2 minute series maps of DeWitt, Buscher, and others, 1987 a-z).

DD latitude is the latitude in decimal degrees North, shown to five decimal places.

DD longitude is the longitude in decimal degrees West, shown to five decimal places.

DMS latitude is the latitude in degrees, minutes, seconds, North.

DMS longitude is the longitude in degrees, minutes, seconds, West.

S stands for synonyms, Y indicates that there are synonyms listed in the next entry.

Synonyms include any alternate mine names or spellings that were found in the literature or on maps (both published and unpublished). Claim names are used as synonyms only if it could be verified that the mine is on or immediately adjacent to the claim. Names that appear to be used synonymously with an owner or operator are noted in the next listing, Company.

Company is company name used in the literature that owned or owns, operated or operates the mine.

MRDS#1 is the primary entry for the mine in the U.S. Geological Survey's Mineral Resource Database System.

MRDS#2 is a secondary entry for the mine in the U.S. Geological Survey's Mineral Resource Database System.

The remaining entries are bibliographic references for the individual mines. Page numbers (p) or site numbers (letter prefix) are given if the reference contains information about the specific deposit.

IC-7688: U.S. Bureau of Mines, 1954, Black Hills mineral atlas, South Dakota (Part 1): U.S. Bureau of Mines Information Circular IC-7688, 123 p.

S&G: Shapiro, L.H., and Gries, J.P., 1970, Ore deposits in rocks of Paleozoic and Tertiary age of the northern Black Hills, South Dakota: U.S. Geological Survey Open-File Report 70-300, 235 p.

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Table 1. Deposit Types: Abbreviated description of deposit types used for Field-2. Detailed descriptions of the deposit types are in DeWitt, Redden, and others (1986).

A:	Archean(?) and Early Proterozoic taconite iron formation
B:	Early Proterozoic uranium-gold quartz-pebble conglomerate
C:	Early Proterozoic gold-silver syngenetic stratiform
D:	Early Proterozoic gold-silver vein
E:	Early Proterozoic potassium feldspar pegmatite
F:	Early Proterozoic tin-tungsten pegmatite
G:	Early Proterozoic lithium pegmatite
H:	Early Proterozoic potassium feldspar-mica pegmatite
I:	Early Proterozoic mica pegmatite
J:	Early Proterozoic beryllium pegmatite
K:	Early Proterozoic mica or iron stratiform syngenetic
L:	Cambrian gold and silica paleoplacer
M:	Paleozoic high-calcium limestone.
O:	Cretaceous roll-front uranium
P:	Quaternary bog iron
Q:	Quaternary and Tertiary gold or tin placer
R:	Cambrian residual iron
S:	Tertiary base-metal-rich vein or replacement
T:	Tertiary precious-metal-rich vein or replacement
U:	Tertiary base-metal porphyry
V:	Tertiary precious-metal porphyry
W:	Tertiary thorium-rich disseminated or carbonatite
X:	Tertiary rare-earth-element disseminated or carbonatite
Y:	Tertiary precious-metal-rich disseminated or carbonatite
Z:	Phanerozoic base- or precious-metal-rich vein
² Mn:	Phanerozoic manganese vein or bedded

²not included as deposit type in DeWitt, Redden, and others (1986).

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Appendix B

Documentation for MIS Database

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728 St. Charles
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(605) 342-2191

J Scott Poole & Associates

Mine Information System

A Software Application for Microsoft Access 2.0

August 1997

Application Overview

The Mine Information System was originally developed as a Foxpro 2.6 application in 1993 as a way to record information about abandoned mines in the Black Hills region. To facilitate reporting the findings to the United States Forest Service, the structure of the data tables used is identical to a similar application used internally by the USFS. Since that time, many mines have been visited and their attributes are stored in the original FoxPro application.

The State of South Dakota would also like to view information about these mines. South Dakota, however, has standardized upon Microsoft Access as their database platform. This version of the Mine Information System is designed to provide an avenue of access to the original data for the State while at the same time allowing the existing FoxPro application to be used indefinitely.

In addition, over one thousand additional mines have been added to the Mine Information System from a similar project being performed by Colin J. Paterson at the South Dakota School of Mines. The following sections give a detailed guide on how to use the Access v2.0 version of the Mine Information System.

Please note that at the end of this paper is an important section pertaining to the structure of the database tables.

Loading the Mine Information System for Access v2

System Requirements

The Mine Information System requires that a complete installation of Access version 2.0 or higher reside on your computer. The application does not provide a runtime version of the Access database software.

Any computer which meets Microsoft's guidelines for running Access 2.0 will be able to run the Mine Information System. The MIS application does require that the FoxPro 2.6 data access driver be installed. This driver is installed by default on Access 2.0 installations.

Determination of Your Situation

The live copy of the Access 2.0 version of the Mine Information System is located at the South Dakota School of Mines and Technology on their campus PC network. To enable users who cannot directly access the SDSM&T network to see the mine information, the MIS database provides an export function. This export automatically creates a single diskette containing the application, all current data files, and an automated installation routine.

Extremely Important

Floppy disks created by the application are designed for Viewing only. The live MIS database tables reside solely at the South Dakota School of Mines and Technology campus in Rapid City, South Dakota, and any changes made to the mine database tables must be made at that location. Any changes made to information retrieved from an export diskette will not affect the live copy running at SDSM&T. For more information about changing mine information, contact Dr. Arden Davis at (605) 394-2473 or Dr. Cathleen Webb at (605) 394-1239.

If you are running the application on a computer connected to the SDSM&T network, follow the directions in the next section. If you have received an export disk and will be running the program on your local hard drive, refer to the section entitled **Running MIS from a Floppy Disk**.

Starting the Program on the SDSM&T Campus

If an icon has been set up on the Windows desktop running on the computer that you are using, simply double click on that icon. If not, begin by loading Microsoft Access. This can be accomplished by double-clicking the Access icon in Windows. Next, select File Open from the pull-down menu at the top left of the Access screen. Open the filename `F:\PROGRAMS\DEPT\CHEM\MIS\MIS.MDB`, with F: mapped to the FS1 file server. All faculty default to the FS1 server. The program will load and display the opening screen.

Running MIS from a Floppy Disk

If you are running the application from a local hard drive, you will need an export disk created from a computer at the SDSM&T campus. This disk contains a compressed copy of the MIS database application and a copy of the data files which the application refers to.

Before you can run the application, you must first install it on the local hard drive. This process requires:

1. Approximately 2-3 megabytes of local hard drive space. The installation disk will automatically recreate the same directory structure on your hard drive as is used on the computers at the SDSM&T campus. All files will be contained in `C:\PROGRAMS`.
2. A complete installation of Access 2.0 or equivalent runtime. Due to its size, the runtime is not included on the export disk.

To install the export disk from a DOS prompt, make your default drive the floppy by typing

```
A: <Enter>
```

If your 3 1/2 inch floppy is your B: drive, type

```
B: <Enter>
```

Begin the installation process by typing

```
INSTALL <Enter>
```

The disk will create the program's directory structure, copy the files to the hard drive, and decompress them when finished.

You may alternatively run the installation program from within Windows by selecting File Run from the Program manager screen and entering `A:INSTALL`

Once the installation process has completed, load Microsoft Access. This can be accomplished by double-clicking the Access icon in Windows. Next, select File Open from the pull-down menu at the top left of the Access screen. Open the filename `C:\PROGRAMS\DEPT\CHEM\MIS\MIS.MDB`. The program will load and display the opening screen, shown at the top of the next page.

Using our previous example, you could choose to limit the displayed mines to only those located in Fall River county. At the right-hand side of the screen under the County heading, click on the down arrow to the right of *in* to display a list of all the counties referenced in the database. Scroll down to Fall River and click your mouse on the name to select that county. Once selected, the name "Fall River" will appear in the box under the county subheading on the screen.

The criteria on the lower half of the screen are all simple text boxes. This means that you can click your mouse on any one of the entry fields and simply type in the appropriate value. In our example, we wanted to display only mines with an environmental degradation between 3 and 5. This would be entered by placing a 3 in the > field under the **Env Hazard** heading and a 5 in the < field. Please note that all fields on the lower half of the screen are inclusive in their selection. A 3 will include the value 3.

If you make a mistake or simply want to start over, clicking the **Clear All Criteria** button at the lower left will clear all entries on the screen. Press Return when you have finished defining your criteria to display the list of mines which meet your selection.

Viewing Mine Information

Each mine has a large amount of information associated with it. To effectively display all of a mine's records, the information has been divided into seven groups. Each group of information directly corresponds to the groups used by the United States Forest Service. To display a specific group of information about a mine, select the tab that corresponds to that group's title. For example, to view the pertinent literature for the displayed mine, click on the **Literature** tab at the far right.

Several of the groups contain samples information. The Adits/Shafter, Tailings, Metals, and Water groups all display screens that can contain multiple records. The Adits/Shafter screen is shown below:

Appendix C

Members of Stakeholder Groups

Abandoned Mine Lands Advisory Committee Members:

Bob Townsend, DENR
Duff Erickson, SDSM&T
* Carol Koerner, Mining Industry

Don Murray, Forest Service
Mike Hohn, Environmental Group
Fred Carl, Citizen at Large

Interested Stakeholders - Black Hills Abandoned Mine Inventory
As of January 27, 1998

Tom Durkin, SD Department of Environment and Natural Resources
Mike Cepak, SD Department of Environment and Natural Resources
Mark Keenihan, SD Department of Environment and Natural Resources
Gary Haag, SD Department of Environment and Natural Resources
Lee Baron, SD Department of Environment and Natural Resources
Jon Epp, SD Department of Environment and Natural Resources
Foster Sawyer, South Dakota Geological Survey (Rapid City Regional Office)
Dick Hammond, South Dakota Geological Survey
Lynn Hedges, Retired
Tom Chapman, SD Department of Game, Fish, and Parks
Jack Erickson, SD Department of Game, Fish, and Parks
Ron Koth, SD Department of Game, Fish, and Parks
Bruce Penner, SD State Historical Society
Colin Paterson, SD School of Mines and Technology
Kate Webb, SD School of Mines and Technology
Arden Davis, SD School of Mines and Technology
Bill Roggenthen, SD School of Mines and Technology
Perry Rahn, Retired
Chuck Kliche, SD School of Mines and Technology
Briant Davis, SD School of Mines and Technology
Eric Fritsch, SD School of Mines and Technology, Mineralogy Curator
Cheryl Naus, SD School of Mines and Technology
Jeff Poole, Rapid City, SD (SDSM&T Consultant to Inventory)
* **Carol Koerner**, representing Wharf Resources and Golden Reward Mining Company
Rick Bachman, Homestake Mining Company (Sparks, NV)
Larry Mann, Homestake Mining Company
Phil Barnes, Homestake Mining Company
Todd Duex, LAC Minerals Richmond Hill Mine
Dianna Miller, South Dakota Mining Association
Pacer Corporation, Custer, SD
Tom Leigland, MinTech Corporation
Joel Tignor, Coltura Di Polcenigo, Italy (formerly with USFS)
Vern Schmidt, U.S. Forest Service, Physical Resources (Lakewood, CO)
Byron Shark, U.S. Forest Service
Steve Van Matre, U.S. Bureau of Land Management
Dex Hight, U.S. Bureau of Land Management
Russ Pigors, U.S. Bureau of Land Management
Joyce Williamson, U.S. Geological Survey
Stan Church, U.S. Geological Survey
Bob Higgins, U.S. National Park Service
Kathie Atencio, U.S. EPA
Jim Dunn, U.S. EPA
Ken Wangerud, U.S. EPA
Gary Broetzman, Colorado Center for Environmental Management
Alene Jones, Arizona State Mine Inspector
Dale Shay, RIMCON, Spearfish, SD
Myron Andersen, Private Consultant
Cary Pieterick, LBG
Don Pay, Environmental Interest
Dick Fort, ACTION for the Environment
Dale Baity, South Dakota Public Broadcasting
Bob White, Local Resident
Bill Harlan, Rapid City Journal
Dale Cockrell, Murphy, Robinson, Heckathorn & Phillips, P.C.
Mark Gabel, Black Hills State University (Biology Department)
Dave Bucknam, Colorado Division of Minerals and Geology
Chris McKinnon, Western Governors' Association
Wayne Sundstrom, Sundstrom, Inc.
Allen Schrierer, NJS Engineering

(continued on next page)

Roger Hodson, Maxim Technologies
Steve Schelske, Maxim Technologies
Dallas Dietrich, Rapid City, SD
Dwain Friez, Spearfish, SD
Jerry Wickstrom, Spearfish, SD
Mark Hobart, Hill City, SD
Pearl Johnson, Hill City, SD
Laetta Heltibridle, Sturgis, SD
Chad Hilde, Madison, SD
Dr. Ed Metz, Crawford, NE
Mark Stromberg, Shawnee, KS
Mark Nelson, Newcastle, WY