

THE MINING ENVIRONMENT DATABASE ON ABANDONED MINES, ACID MINE DRAINAGE, AND LAND RECLAMATION ¹

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Abstract: Laurentian University Library has developed an on-line Mining Environment Database. The database provides references and abstracts to journal articles, books and government reports dealing with acid mine drainage, land reclamation, and abandoned mines. The database, created in 1988, now contains over 7,900 citations on reclamation planning, acid mine drainage, sulfide-based tailings, soil and water contamination, mine closure techniques, and other related topics dealing with mining environment studies. Subject coverage is international and focuses on hard rock mining topics. A stand-alone product for IBM-compatible computers is now available. The database is mastered on four high-density diskettes, and special search software is provided to allow full keyword searching of the database citations. Laurentian has acquired copies of all the materials cited in the database. Access to the on-line database is free of charge, with the exception of long-distance costs, and copy, delivery, or Fax charges for requested material. Suggestions for materials not found in the database and donations of pertinent research information from individuals, corporations, institutions, and government departments are welcomed. Private consulting reports (with the appropriate client approval) are especially welcomed, because this category of research literature cannot be purchased or obtained using normal methods, and is often discarded after a mine property is closed. The process of building a comprehensive research database requires a continuing partnership of information specialists and research users to develop a world class research literature database on mining environment and reclamation.

Additional Key Words: mining environment database, abandoned mines, acid mine drainage, land reclamation.

Introduction

Increasingly, as mineral resources either are depleted or are no longer profitable with current conventional mining techniques, governments and the private sectors of both developed and emerging economies will be faced with an environmental problem of major proportions. What should be done with the played-out or abandoned mine site, and how can the land be restored to other, more ecologically friendly, purposes? The current level of funding for research into this problem will increase, as more and more abandoned mine sites will come to represent a significant global environmental, health, and safety hazard for the citizens of many countries. The need for a comprehensive research database on abandoned mines, land reclamation, acid mine drainage, and other mining environment issues has therefore never been greater. In the Province of Ontario, Canada, one such effort has been underway since 1988, in order to assist governments, environmental consulting firms, and mining companies in the planning, implementation, and assessment of effective mining environment policies.

Background

In 1981, over 200 sq km of the total land surface of Ontario were directly affected by mining operations. These statistics are contained in Ontario's Mines and Minerals: Policy and Legislation, a green paper prepared in 1988 by the Ministry of Northern Development and Mines. The Green Paper outlined a blueprint for policy direction and priorities to be addressed in a revision of the Mining Act. Bill 71, which received Royal Assent in December 1989, significantly altered the Mining Act, in particular Part IX, which focuses on mining operations. All new and

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existing operations are now required to submit a closure plan to the Ontario Ministry of Mines for review and acceptance. Additional provisions related to claim staking, fees, and assessment requirements are contained in regulations accompanying Bill 71. As a result of the legislation, public safety issues associated with mine site hazards such as surface cave-ins, mine tailings sites, and open mine shafts, have created a demand for more information by government, the mining and research communities, and the general public. The regulations include specific requirements for mine managers to follow to stabilize tailings areas and to revegetate and restore mine and mine tailings sites before and after closure (Rev. Statutes of Ontario, 1980).

In December 1988, all levels of government and the mining industry recognized the need to undertake new research initiatives for the management of waste rock and mine tailings sites. The public awareness and concern for the environment, the requirements of new legislation, and the significant increase in research in the areas of abandoned mines, acidic mine drainage, tailings and mine spoils, and land reclamation techniques established a need for a more comprehensive research literature database available to the mining research community. In May 1988, the Ontario Ministry of Northern Development and Mines and the Ministry of the Environment began funding a series of Environmental Youth Corps projects at Laurentian University, mandated to develop a specialized **Mining Environment Database** on abandoned mines and land reclamation. In 1990 and 1991, MEND provided additional database development funding to focus on the global research literature pertaining to acid mine drainage topics. In October, 1993, additional funding was provided by the Ontario Ministry of Northern Development and Mines for data entry and preparation of abstracts during the 36-week period not covered by funding from the Environmental Youth Corps. Salary, equipment rental, supplies, commercial database searches, purchasing, and overhead costs amount to slightly over \$225,000 since the project's inception in 1988. Over 6 yr, the database has grown to over 7,900 references and abstracts to journal articles, books, and government reports dealing with abandoned mines, acid mine drainage, and land reclamation. The primary focus of the database is on hard-rock mining topics. Topics include reclamation planning, design, and costs; tailings; heavy metals; disposal of hazardous wastes, including acid mine drainage, sulfide-based tailings, and asbestos particles; leaching; radioactive hazards of uranium tailings; soil and water contamination; soil stabilization; liming; fertilizers; seeding techniques; mine closure techniques; and other related topics. Subject coverage is international in scope.

Database Access

The Mining Environment Database is accessible either directly, or as a stand-alone product for a PC. Direct access is possible by accessing Laurentian University Library's computer, with a modem and appropriate communications software. Access is also provided on the Internet, either directly at the Telnet address "laulibr.laurentian.ca," or via the Liberty gateway from Washington & Lee Law Library, Lexington, VA, "liberty.uc.wlu.edu." In September 1993, a stand-alone product for PC and compatible computers was introduced at the Ontario MEND conference in Sudbury, ON.

Database searching is free with the exception of long-distance costs, and charges for photocopy, delivery, or Fax. An IBM-compatible computer, a modem (up to 9,600 baud rate), and appropriate communications software are required. Kermit communications software and a valid user account and password are available free by sending a formatted diskette to Ronald Slater at the address shown below. Requests for materials in the collection should be directed to the Interlibrary Loan section, J. N. Desmarais Library, Sudbury, ON, P3E2C6, (705) 675-1151, ext.3318, or by Fax at (705) 673-6524. Copies of articles, or document delivery by Fax, are available for the cost of reproduction and delivery. Photocopying is limited to Canadian copyright provisions related to fair dealing for the purposes of research, and study and copyright fees may be charged.

Stand-Alone Version. A stand-alone product that resides on an IBM-compatible computer is now available. The database is mastered on four diskettes, and special search software is provided to allow full keyword searching of the database citations. The cost is CDN \$275 for the search software and the first cumulation, which can be stored on a local hard drive with 20 megabytes of free hard disc space. Yearly updates will be available for CDN \$100. An unlimited use site license will be available for each client purchasing a copy of the Mining Environment

Database. The software is available from the CIMMER Office, Laurentian University, Sudbury, ON, P3E2C6, (705) 675-1151 ext. 2280.

Format, Scope, and Contents of the Database

An on-line catalog format was chosen for the database. A print-based format was considered, but not adopted owing to the cost of publishing the catalog and the delays in obtaining current information between updates. As the database grew, that decision proved to be even more cost effective, in allowing funding to be used for the purchase of more materials, abstracting, and data entry. In future, if there is sufficient demand, the database could be mastered on a CD-ROM disc and sold to clients at a lower cost than printing the catalog.

The Mining Environment Database contains references or citations to materials that have been added by purchase and by donation to Laurentian's collection on abandoned mines, acid mine drainage, and land reclamation. The largest category of material consists of journal articles, followed by papers in conference proceedings, and finally, government publications, reports, and books. The government publications, conference proceedings, and books are integrated into Laurentian's existing circulation and reference collections. The journal articles are housed in the library's periodical collection or, in the case of offprints, in vertical filing cabinets located in the Archives and Rare Books section of the library.

Methodology Employed in Building the Database

Literature reviews are often time consuming, even when searching commercial on-line databases, because the results normally produce only a list of citations. The researcher must then attempt to obtain the articles, reports, or books from a local library or an unknown source through interlibrary loan. This process can take weeks or months. In contrast, because all citations are in the Library's collections, the Mining Environment Database can save valuable research time in locating and obtaining information.

To improve access to conference proceedings, a decision was made to provide full analytic coverage. This involved providing complete individual citations and subject analysis to all individual papers contained in the proceedings of a conference. The current practice of most libraries is to provide a single citation and general subject analysis for the proceedings of a conference, but not to the individual papers presented.

After consulting with a number of local researchers, it was decided to enter a short four to five-line abstract for each citation in the database, providing the user with a brief glimpse of the contents in each book, article, or report added to the database. Students were chosen to write the abstracts, based on their subject knowledge of the mining environment and their abstracting skills.

How To Search the On-Line Database

Searching an on-line catalog requires practice, and a useful technique is to search subject terms in the Title Catalog before searching in the Subject Catalog. Entering a subject term in the Title Catalog will often produce a list of citations, and it is then possible to verify the correct subject heading used in the Subject Catalog by checking the assigned subject term used at the bottom of each record. Repeating a search using the correct subject heading will often result in a significant increase in citations, more than using only a Title Catalog search, as the subject term of interest may not have been used in the title of the book, article, or report.

Subject analysis, which has been completed for approximately one-third of the citations, is based primarily on terms found in Library of Congress Subject Headings (LCSH), the subject list used in most academic and research libraries in the United States and Canada. Because LCSH is designed for general research collections, it does not contain many specific terms used in specialized disciplines. Where appropriate, new terms and subdivisions have been created, based on terms provided by researchers and specialists using the database. Database maintenance and

quality control is an ongoing exercise, and the project editors welcome any suggestions from researchers or users for improvements or modifications to subject analysis, the method of presentation, or individual citations.

Donation of Consulting Reports From Mining Research Community

Private consulting reports often contain essential scientific and factual evidence on particular mine properties and are prepared by individual researchers and consulting firms for individuals, corporations, institutions, and government departments. These reports, with the appropriate client approval, would be especially welcomed for inclusion in Laurentian's Mining Environment Database, because this category of research literature cannot be purchased or obtained using normal methods. Estimates from members of the mining research community indicate that this category of literature is substantial, and the number of such reports could easily be double the literature available through regular commercial sources.

In preliminary research for decommissioned mine sites, environmental consultants and mining companies are looking for answers to the following questions: (1) What environmental impact studies have already been done for the site; (2) what reclamation techniques were suggested for the site, and, if implemented, with what degree of success; and (3) for similar sites in other jurisdictions, what other reclamation strategies were attempted? Too often, during the development of a closure plan, consultants and companies devote considerable time and money to basic research that has already been done, either for the particular site or for another mine facing the identical problem.

At present, even a simple list of the consulting reports on a particular mine property is not available through any public research database. Unfortunately, as mining properties close, many consulting reports are often discarded, in the mistaken belief that no one in the future will ever be interested in reading a report prepared on a mining property that has been closed. The cost and the lack of storage facilities are also given as reasons for disposing of old reports. At a recent conference, one of the principals in a mine that had been closed was asked what he was going to do with the consulting reports that his firm had commissioned for the mine closure. His answer was that he was about to dispose of the material because he no longer had space in his office for the reports, which occupied 6 linear ft, and he had no idea that anyone would be interested in keeping them for future research. When asked if he was concerned about corporate secrets being made available if the reports were in a public research database like ours, he stated that he might be concerned about geophysical exploration studies that were done by the consulting firms, but he certainly was not concerned about releasing the engineering, operational, and land reclamation reports that were prepared either in house or by outside consultants for his firm.

Out-of-print material is another category of the research literature that is difficult to obtain, and is usually acquired through donations from individuals or companies.

Invitation To Contribute

Building a research literature database and collection is an ongoing process involving concentrated and patient efforts by information specialists and research users. Suggestions for materials not found in the database, and for more appropriate subject terms, are welcome. A number of researchers who have already used the database have provided materials from their private and corporate collections and have offered to assist in providing a more comprehensive list of subject terms that are more meaningful to those working in the field. Suggestions for a more consistent and hierarchical subject catalog and for the addition of the Latin names of organisms for plant and species references will be adopted, with the assistance of specialists who have volunteered to check and modify the subject heading terms that have already been assigned.

Laurentian encourages suggestions for improving the database, and donations of pertinent research information from individuals, corporations, institutions, and government departments. Income tax receipts may be issued for appropriate donations of materials upon request. If you have suggestions for materials that you feel should be in the database, or donations that you would like to contribute to enrich the collection, please contact the Gifts and

Exchange representative at (705)675-1151, ext 3322; Fax (705)673-6524.

If the materials you wish to donate require special archival conditions, Laurentian has a modern archival facility that has restricted access and special humidity and temperature control. The library can accommodate a donor's request for archival storage of records. For example, a donor may request that a particular document or report can only be released to researchers after a specified number of years. Laurentian can also accommodate requests for release forms signed by researchers, allowing the report to be read but not photocopied or used without the author's, or in the case of private consulting reports, the client's written approval. Laurentian maintains the right to refuse donations of materials that we consider will have little or no benefit to the collection, and that may contain use restrictions or other conditions with which we are unable to comply.

If it is not possible to provide Laurentian with an actual copy of a document, a simple citation listing with information on how a researcher could obtain access to the report would be welcome. As one consultant mentioned, even providing an author, title, date, and mine property list of the private consulting reports would be helpful to future owners of mine properties, consultants, and researchers. Access to a comprehensive and accessible research database on abandoned mines, land reclamation, and acid mine drainage can save governments, consulting firms, and mine companies many millions of dollars in the development of a closure strategy. All three partners must work to ensure that research reports are preserved and shared on a much wider basis than is done currently.

Conclusion

The database is growing as a direct result of the continued support provided by the Canadian mining industry, federal and provincial government agencies, and mining consulting firms. We are confident that the Mining Environment Database will advertise and promote the efforts of the Canadian mining community in finding solutions to the problems and issues surrounding abandoned mines, acid mine drainage, and land reclamation.

The Mining Environment Database, initially developed for researchers in Canada, can now be made available to other countries having similar research interests, in an easy-to-use, stand-alone version. In addition, the active participation of the international mining community in improving coverage for other countries, where mine closure and mined land rehabilitation is an important environmental issue, is encouraged. The fact that the field of mining environmental studies covers an increasingly wide range of topics, combined with a phenomenal growth rate in the research literature, means that one database cannot hope to offer comprehensive coverage on an international scale. For example, the majority of citations in the Mining Environment Database deal with the environmental aspects of hard rock mining, with a particular focus on Northern Ontario and Canada. While a substantial number of references deal with coal mining, coverage in this area has been done on only a partial basis. Therefore, cooperation is also being sought with other mining research institutions, or libraries with a significant collection in mining environment studies, in the development of an international network of mining environment databases.

Consulting reports, as well as a mechanism for gaining access to and preserving this category of literature for future research, are critical to developing a more comprehensive information network on mining and reclamation. Donating materials that are about to be discarded to Laurentian, or to other local research or public libraries, will assist the library and archival communities in providing the mining community with the materials needed in future research efforts. The process of building a comprehensive database on the mining environment will require a continuing partnership of information specialists and users, in jointly developing a world-class research literature database and collection of materials on abandoned mines, acid mine drainage, land reclamation, and related topics of concern to the mining industry across Canada and around the world.

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