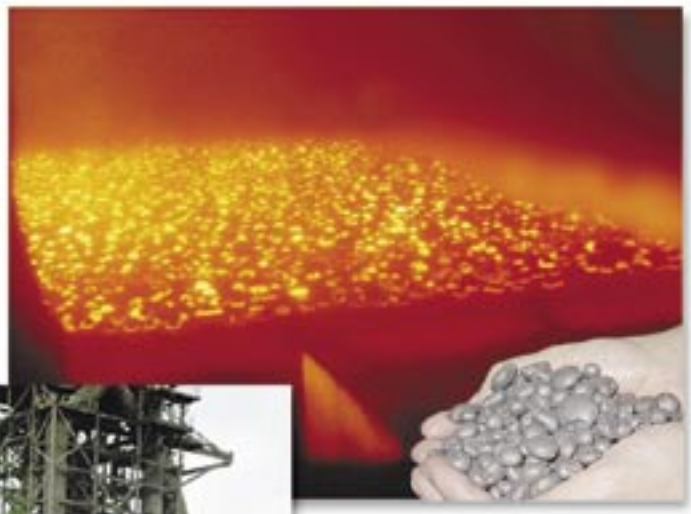
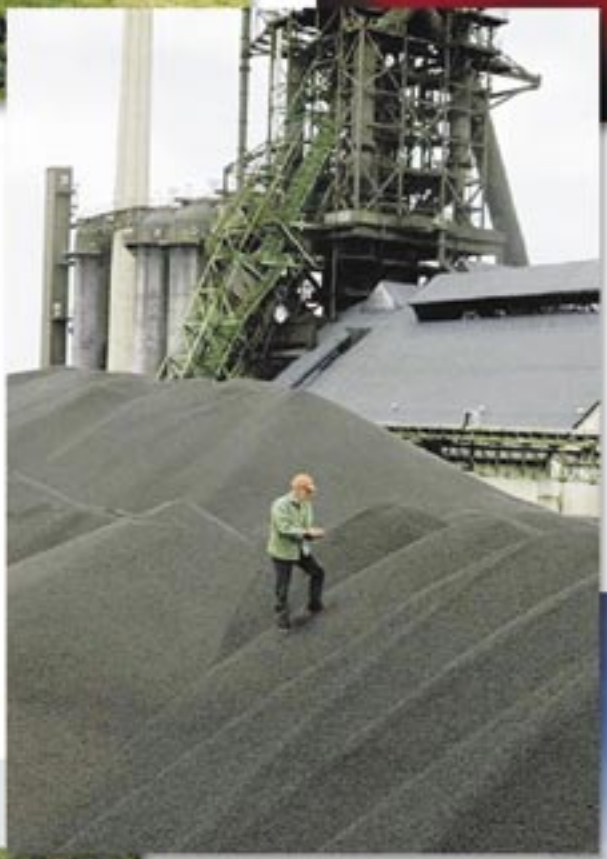
Governor's Committee on Minnesota's Mining Future

FINAL REPORT • SEPTEMBER 2004





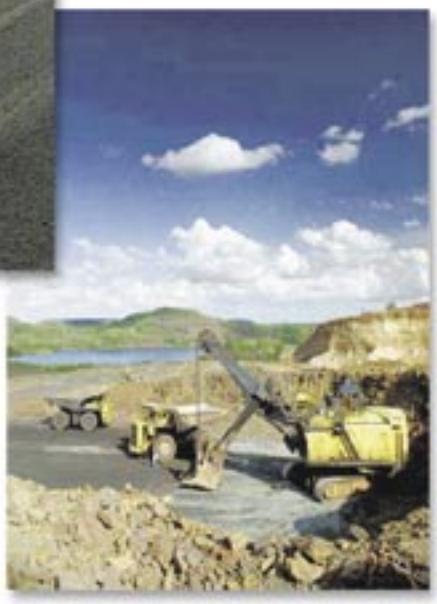


Table of Contents

Executive Summary

Charge

Governor Tim Pawlenty appointed a 15-member Committee on Minnesota's Mining Future in January 2004, to recommend actions that can be taken to strengthen and develop a sustainable, more diversified mining and minerals industry in Minnesota, and more specifically to:

- Evaluate government policies that affect the mining and minerals industries;
- Develop public policy strategies to enhance the growth of the mining and minerals industry; and
- Advise and serve as a catalyst for the development of partnerships between industry, institutions, funding groups, and state and federal resources and other entities.

Process

Advising the governor required the committee to reach agreement among a diverse group of stakeholders on 1) industry needs, 2) findings and conclusions, and 3) recommendations. Decisions were made using a "due process" of four steps:

- Developing subject-matter awareness
- Generating ideas, goals and strategies
- Formulating draft agreements
- Making consensus decisions

That process occurred over six meetings. Developing subject-matter awareness was accomplished through detailed presentations to the committee with adequate time for questions, comments and clarification of key components that describe the state of the industry.

A list of presentations to the committee and web addresses to view or download copies are included in the appendix to this report.

The committee held its final meeting on August 9, 2004, at the Iron Range Resources office near Eveleth. The report that follows represents the consensus reached by the committee at that meeting as well as final editing, which occurred prior to September 3, 2004.

Members

Governor Tim Pawlenty Appointed Commissioners:

Sandy Layman – Commissioner, Iron Range Resources (**Committee Co-chair**)
Sheryl Corrigan – Commissioner, Minnesota Pollution Control Agency
Paul A. Moe – Serving on behalf of Matt Kramer, Commissioner, Department of Employment and Economic Development
Gene Merriam – Commissioner, Department of Natural Resources

Governor Tim Pawlenty Appointees:

Jim Swearingen - Former General Manager, US Steel – Minntac (**Committee Co-chair**)
Stan Daniels – State Government Affairs Director, District 11, United Steelworkers of America
Margaret Hodnik – Manager – Public Affairs, Minnesota Power
Ernest Lehmann – President, Minnesota Exploration Association
Dr. Kathryn Martin – Chancellor, University of Minnesota – Duluth
Mary Mathews – President, Northeast Entrepreneur Fund
Jim McConnell – General Manager, US Steel Minnesota Ore Operations: Minntac and Keewatin Taconite
John Tuomi – General Manager, Hibbing Taconite Company and United Taconite, LLC

Senator Norm Coleman Appointee:

Doug Johnson – Former State Senator

Senator Mark Dayton Appointee:

Bob Bratulich – Assistant Director, District 11, United Steelworkers of America

Congressman James Oberstar Appointee:

Dr. Don Fosnacht – Director, Center for Applied Research and Technology Development, Natural Resources Research Institute

Governor's Committee on Minnesota's Mining Future: Summary of Goals, Strategies & Recommendations

GOALS

1) All types of mining:
- Improve Minnesota's government policies in ways that will not inhibit responsible and sustainable minerals business activity
- Strive to develop government policies that will enhance the overall competitiveness of Minnesota mining operations and encourage private investment in Minnesota's mineral resources

2) Ferrous industry:
- Taconite: Sustain 40 million tons per year of taconite concentrate production by capturing market share at United States and Canadian blast furnaces
- Value-Added Iron: Add 3 million tons per year of value-added iron production and become an iron-making technology center of excellence

3) Non-ferrous industry:
- Realize the potential of environmentally acceptable copper, nickel, PGM and other known non-ferrous resources in Minnesota
- Facilitate exploration and development of other non-ferrous mineral potential

4) Industrial minerals industry:
- Expand competitive aggregate and other industrial minerals production to meet Minnesota's development needs
- Become a regional multi-state supplier of industrial minerals

Strategy #1 **Government Policies -** Institute supportive policies for mining businesses that help them control production costs, as well as policies that encourage investment and growth.	**Strategy #2** **Environmental Quality -** Formulate environmental policies and land management strategies that facilitate exploration, encourage investment and sustain production while maintaining good land and environmental stewardship.	**Strategy #3** **Applied Research -** Maximize research and development incentives and financing for minerals exploration and commercialization of new technologies that allow mineral deposits to be developed in an economic and environmentally responsible way.	**Strategy #4** **Development and Commercialization -** Support the development and commercialization of mineral projects by partnering with other public and private entities to create a climate where private investment is encouraged and new technology and process innovation is supported.	**Strategy #5** **Transportation and Energy -** Initiate proactive measures to improve the transportation and energy infrastructure for all Minnesota industries to make Minnesota a more attractive location for investment by existing and new industries.
↓ Recommendations ↓	**↓ Recommendations ↓**	**↓ Recommendations ↓**	**↓ Recommendations ↓**	**↓ Recommendations ↓**
1. **Mining Taxes** – The Commissioners of Iron Range Resources and Revenue and the Chairman of the Iron Range legislative delegation should select a committee to recommend mining tax reductions to the Governor by December 15, 2004. ***Lead: Iron Range Resources***	6. **Mercury TMDLs** – The state should facilitate and help fund rapid development of appropriate Total Maximum Daily Loads (TMDLs) for mercury in the Lake Superior and Rainy River watersheds. ***Lead: Minnesota Pollution Control Agency (MPCA)***	9. **Geologic Mapping** – State funding for regional and detailed mapping should be increased for the Minnesota Geological Survey (MGS) and the Natural Resources Research Institute (NRRI) of the University of Minnesota - Duluth. ***Lead: MGS will lead the regional mapping and NRRI will lead the detailed mapping.***	12. **Rural Future Fund** – A new Minnesota's Future Fund should be created to encourage deployment of new technologies in rural Minnesota that add value to Minnesota's minerals, forest products and agricultural products. ***Lead: Iron Range Resources, in conjunction with DEED***	17. **Taconite Aggregate Transportation Study** – The state should commission a study to determine the facility and transportation needs to bring taconite aggregates to the Twin Cities metropolitan area. ***Lead: DNR, Iron Range Resources and NRRI, in conjunction with the Metropolitan Council***
2. **Environmental Review and Permitting** – A state team should be formed to recommend 2005 legislative changes that shorten review and permitting timelines while ensuring no reduction in environmental protection. ***Lead: Department of Employment and Economic Development (DEED)***	7. **Acid Mine Drainage Controls** – The state and federal government, working with industry, should investigate new control technologies and implement demonstration projects for containing and treating acid mine drainage that can be associated with non-ferrous mining. ***Lead: DNR***	10. **Minerals Exploration** – Iron Range Resources should continue its Drilling Incentive Grant (DIG) program. Similar public-private partnerships to support exploration and research into exploration concepts and technologies should be developed. ***Lead: Minerals Coordinating Committee (MCC)***	13. **Mine Modernization** – The state and federal governments should provide monetary support for demonstration projects of new technical developments that show good promise for enhancing the competitiveness of Minnesota mines. ***Lead: MCC***	18. **Transportation Infrastructure for New Rock Businesses** – The state should support transportation infrastructure for innovative new stone businesses in Minnesota that utilize stockpiled waste stone products for aggregate or other applications. ***Lead: DNR***

Governor's Committee on Minnesota's Mining Future: Summary of Goals, Strategies & Recommendations (Continued)

Strategy #1 **Government Policies**	**Strategy #2** **Environmental Quality**	**Strategy #3** **Applied Research**	**Strategy #4** **Development and Commercialization**	**Strategy #5** **Transportation and Energy**
↓ Recommendations ↓	**↓ Recommendations ↓**	**↓ Recommendations ↓**	**↓ Recommendations ↓**	**↓ Recommendations ↓**
3. **State EIS Project Manager** – A state agency project manager position should be established to coordinate permitting activities for mining projects that propose to deploy new mining technologies in Minnesota and require both a state and federal Environmental Impact Statement. ***Lead: Department of Natural Resources (DNR)***	8. **Sustainable Development Strategies** – Sustainable development strategies should be developed and deployed to enhance land-use planning, manage conflict concerning land uses, incorporate future land forms, lakes and wetlands into current permitting and planning, and make lands available for leasing and exploration. ***Lead: Iron Range Resources***	11. **Cost Effective Recovery Methods** – The Legislature should encourage mineral development by providing funding to the DNR and NRRI for basic research on the cost efficient processing and recovery of Minnesota's metals and industrial minerals. ***Lead: MCC***	14. **Value-added Iron Commercialization** – The state and federal government should continue to support value-added iron projects such as the "iron nugget" project. ***Lead: DEED, in conjunction with the MCC***	19. **Alternative Energy** – The state should support the use of alternative energy resources in mining and other industries through new tax incentives, money to support research in this area, investment funding for energy projects and improvements to environmental regulatory processes that make them more efficient. ***Lead: Iron Range Resources, in conjunction with the Department of Commerce***
4. **Taconite Aggregate Tax Policy** – The state should encourage use of taconite by-products by endorsing a policy of no production or special "sand and gravel" or aggregate tax for taconite aggregate. ***Lead: Iron Range Resources***			15. **Taconite Aggregate Marketing** – The state should support the NRRI proposal to assist in developing various markets for taconite by-products, in particular those that meet MnDOT specifications. ***Lead: NRRI, in conjunction with the MCC.***	
5. **Royalty Strategies** – The DNR, in partnership with the Minnesota Exploration Association, should conduct an evaluation of the non-ferrous royalty structure applicable to state leased minerals. ***Lead: DNR***			16. **Minerals Opportunities Meetings** – The state should support the MCC's proposal to sponsor a series of meetings to identify processes and strategies that could increase the probability of development of economically significant and environmentally responsible minerals industry sectors in Minnesota. ***Lead: MCC***	

State of the Industry: A Case for Action

Introduction

The mining industry is vital to Minnesota's economy. The industry is especially important to rural northeastern Minnesota but affects the entire state by supplying needed raw materials, creating direct and indirect jobs, providing funding for the state's schools and university system through royalties, and adding substantially to the state's gross domestic product and tax base.

Statewide mining is a two billion dollar industry that directly or indirectly employs over 16,000 of Minnesota's citizens. Additionally the mining companies in Minnesota purchase goods and services from businesses located in over 200 different communities located throughout Minnesota[1]. Taconite mining accounts for 75% of Minnesota's mining revenues. The industrial minerals industry, primarily aggregate production, contributes the remaining 25%.

Minnesota's mining industry is facing a strategic juncture with policy and investment decisions likely to influence the extent and vitality of this industry for years to come. A compelling case can be made for Minnesota to take action. Today's decisions either will result in a sustainable mining industry that continues to be a major economic driver in Minnesota, or result in missed opportunities to maximize the future value of mining to our economy and society. Some might argue that although mining has been an important part of Minnesota's history, it may not be an important part of its future. While the marketplace obviously will impact this outcome, actions the state and its citizens take also will be key to Minnesota's mining future.

Creating a climate that encourages private investment in Minnesota's mining industry is paramount to the goal of a sustainable mining industry. Modern mining is one of the most capital-intensive businesses, as measured by investment per worker. The capital requirements of the mining industry are extensive. Minnesota's six existing taconite facilities combined to spend over six hundred million dollars to maintain their production capacity over the past seven years. A new value-added iron facility in Minnesota would cost from one hundred million to over one billion dollars depending on the value-added product produced and infrastructure requirements. Moving a non-ferrous metal prospect to a commercial development would require a similar investment.

Minnesota has great potential for expanding its mining economy due to:

- An abundance of existing and potential mineral resources
- A well developed mining infrastructure
- Experienced workers
- Reliable and effective research capabilities
- Government support for sustainable mining
- Public understanding, at least on a local level, of the value of mining to our economy and to society in general
- A significant foothold in the Lower Great Lakes integrated steel market that has been developed and retained over the past century

In spite of its potential, mining is not necessarily on a path to growth in Minnesota. The impediments to industry development are cause for concern. The immediate need is to assure that Minnesota taconite producers are competitive in the Lower Great Lakes integrated steel market. Taconite producers will be making major decisions in the next 6-12 months about production levels and investment in their Minnesota operations. They will be weighing the costs and benefits of operating and investing in Minnesota, as well as assessing their ability to survive future downturns in the ever-cyclical steel market. At the same time, several mining companies are attempting to move forward with the development of non-ferrous deposits of copper, nickel, and platinum group metals (PGM). Environmental review and permitting is a major consideration as well as clarification of tax and royalty issues.

With that in mind, what can Minnesota state government, in conjunction with other industry stakeholders, do to enhance Minnesota's competitive standing as a place to conduct mining business or make mining-related investments?

Market changes, production costs, globalization, and investment climate are all factors that influence where industrial production will grow or where it will decline. Unfortunately, market changes and

[1] Employment is based on Minnesota's June, 2004, direct mining employment reported by the Department of Employment and Economic Development of 5,392 employees and an estimated three indirect employees for every one direct employee. Purchases from over 200 communities is based on surveys reported by the Minnesota Iron Mining Association.

globalization are factors over which state government has little influence. However, state policy can influence the production cost and investment climate within Minnesota. These two aspects become increasingly important as the industry responds to changes in markets and globalization, and changes are occurring in each principal sector of Minnesota's mining industry.

Minnesota's mining industry consists of four product or commodity sectors:

1. Ferrous (iron) ore,
2. Value-added iron production,
3. Non-ferrous and precious metals, and
4. Industrial minerals.

These individual sectors of the mining industry are in many respects quite different but also share many common problems. The following section describes each of Minnesota's mining sectors in terms of the market, product value, product cost and issues affecting Minnesota's competitiveness.

Minnesota's Mining Industry Sectors

Ferrous (Iron) Ore

Market - Minnesota has adequate iron ore reserves to supply the six existing taconite production facilities that will produce 40 million gross tons of taconite iron ore pellets in 2004. Figure 1 shows the location of Minnesota's iron ore production facilities.

Minnesota's iron ore facilities supply a regional market consisting of the integrated steel making blast furnaces in the United States and Canada. This market is cyclical, mature and slowly declining. A new blast furnace has not been built in the United States or Canada since the late 1970s. Fortunately the demand for high-grade iron ore pellets in the United States and Canada is large. Following is an estimate by geographic area of the annual demand for iron ore pellets in gross tons[2] per year:

Lake Superior	3 million
Chicago	20
Lake Erie	22
Inland	23
	68 million

[2] A "gross ton" or long ton is a ton of 2,240 pounds.

Minnesota's taconite companies compete directly with two iron ore pellet facilities in Michigan and three iron ore pellet facilities in Canada as well as a lesser amount of imported iron ore pellets predominantly from Brazil. The following is an estimate of the supply of iron ore pellets to the previous total demand in gross tons per year:

Minnesota	40 million
Michigan	13
Canada	10
Foreign Ore	5
	68 million

Product value – There are very few buyers and sellers of iron ore in the United States and Canada. Steel company equity interests control approximately three fourths of Minnesota's taconite capacity, or 30 million annual gross tons. This captive capacity is a cost center for integrated steel companies.

Cleveland-Cliffs controls the remaining one fourth of Minnesota's taconite capacity, or 10 million annual gross tons, and an additional 13 million annual gross tons of iron ore pellet capacity in Michigan and Canada. Cleveland-Cliffs sales are predominantly tied to long-term sales agreements.

The value of Minnesota's iron ore pellets is determined by the integrated blast furnaces in the United States and Canada. Blast furnace operators want a dependable supply of high quality pellets that are cost competitive to alternative sources from Michigan, Canada or Brazil.

Two companies largely determine the world iron ore price, CVRD in Brazil and Rio Tinto in Australia and

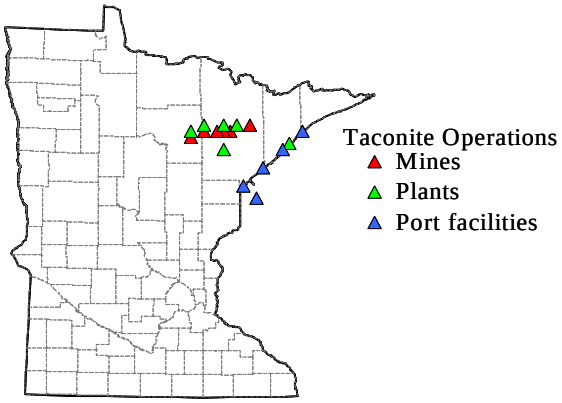


Figure 1 – Location of Minnesota's iron ore production facilities.

Canada. Together these two companies supply over 50 percent of the worldwide sea borne iron ore trade. The world iron ore price set by CVRD for 65% iron pellets freight on board (FOB) a Brazilian port has risen dramatically in the past two years, from $31.30 per gross pellet ton in 2002, to $40.20 per gross pellet ton today. Additionally the cost of ocean freight has tripled over the same period[3].

Since the cost of transporting pellets to market is a major factor in the delivered cost to the customer, this has had a dramatic effect on the cost competitiveness of Minnesota iron ore pellets, enabling Minnesota's potential market to expand to the Ohio River areas and inland Alabama.

The increase in the world iron ore price and ocean freight is largely due to increased demand for iron ore in China. CVRD, Rio Tinto and BHP (in Australia) have all announced individual plans for major iron ore capacity and infrastructure additions to meet China's growing demand.

Product cost – The major cost components of Minnesota taconite production in 2003 were reported by the Minnesota Department of Revenue[4] as:

Development	$ 1.10	per gross ton
Labor	4.30	
Supplies	15.40	
Depreciation & Interest	2.10	
Administration	3.70	
Royalty	1.20	
Taxes	1.80	
	$ 29.60	per gross ton

Energy cost is a large component of supplies. The cost of electricity to produce a gross ton of taconite is estimated to be $4.70. Natural gas in 2002 averaged $3.50 per million British Thermal Units[5] (MM BTU), which would equate to approximately $1.50 per gross ton. The cost of natural gas in Minnesota has risen dramatically to $6.15 per MM BTU today or $2.50 per gross ton. The high cost of natural gas has resulted in taconite companies switching fuels and exploring options for alternative fuels.

[3] FOB, or freight on board designation is a significant factor in comparing iron ore prices, as the cost of freight can represent a significant component of the landed cost to a steel mill. For example, a FOB Minnesota mine cost for a Chicago steel mill would not include rail, terminal or lake shipping costs, which would total over $10 per gross ton.

[4] The cost reported by Revenue is FOB mine and does not include rail transportation, lake vessel, or port/terminal charges.

[5] One British Thermal Unit (or BTU) is the energy required to raise one pound of water one degree Fahrenheit.

Competitive issues – Although the global market is large, Minnesota is only a dominant supplier in the United States and Canada. Therefore, the prospect for growth is slim as the Great Lakes customer base is shrinking. Achieving a sustainable mining industry in Minnesota requires maintaining Minnesota's production capacity. Minnesota also must be in a position to capture market share from Michigan, Canada or other imports when markets decline. To achieve that task, Minnesota must be the low cost supplier, producing high quality pellets, with the mix of standard and flux products that meet the needs of USA and Canadian blast furnaces.

A window of opportunity exists for Minnesota to attract private investment. Major projects are being considered by the private sector in the near future, which would help secure this industry segment. Projects include:

1. Restarting a pelletizing line at United Taconite.
2. Upgrading particulate control systems at US Steel – Minntac operations to meet new environmental standards.
3. Securing and developing a new ore body for Ispat Inland Mining Company.
4. Reopening Taconite Harbor (a port on Lake Superior) and upgrading and establishing new rail systems.
5. Installation of a scrubber at Keetac to meet new environmental standards.

Completion of item 1 would contribute to an increase in production levels in Minnesota. Completion of item 4 could help lower the costs of pellet transportation. If items 2, 3 and 5 are not completed, Minnesota production would decrease.

Value-Added Iron

Minnesota also must broaden its customer base by supplying value-added iron products. Steel demand in the United States of America is satisfied in three basic ways: the integrated steel industry which uses blast furnaces and basic oxygen furnaces, the mini-mill steel industry which melts steel scrap and /or steel scrap alternatives such as pig iron or direct-reduced iron in electric furnaces, and imported steel. Currently, Minnesota's iron mining industry only can supply the integrated steel industry with iron ore for steel production. Mini-mills cannot produce steel from iron ore. Figure 2 shows the source of steel consumption from 1982 through 2003.

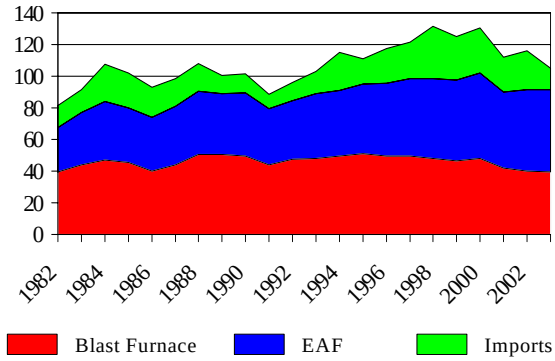


Figure 2 – Source of United States steel domestic consumption.

Product	2000 – 2004 Annual Averages			Current
	Low Year	High Year	Average 2000-2004	Monthly Average June 2004
Iron ore pellets (65% Fe-CVRD FOB port)	$32.08	$41.44	$35.15	$41.44
Steel scrap (#1 Heavy Melt-average delivered to Chicago, Pittsburgh, and Philadelphia)	$67	$225	$114	$226
Direct reduced iron	$100	$156	$121	$197
Pig iron	$118	$214	$139	$233
Semi-finished slabs	$194	$332	$278	$430
Hot rolled steel	$290	$430	$331	$515
Cold rolled steel	$357	$539	$418	$585

Iron is an abundant element in the earth's crust that is of little value until it becomes processed into such forms where it has value in use. Examples of value-added iron would include: direct reduced iron, pig iron, semi-finished steel, hot-rolled steel, and cold-rolled steel.

Market – The market share of steel produced from iron ore in the United States decreased from 63% of the market in 1989 to less than 50% of the market in 2003. This 13% decrease in market share is attributable to the significant increase in electric arc furnace production and semi-finished steel imports and corresponds to a decrease of 17.5 million tons of iron ore used in the manufacture of steel by United States steel producers.

Electric arc furnaces use steel scrap and value-added iron products. Approximately 6.5 million tons of the increase in electric arc furnace production was produced from imported direct-reduced iron (DRI) and imported pig iron. United States value-added iron imports increased from 2.5 million tons in 1989 to 13.5 million tons in 2002. Four million tons of pig iron imports came from Brazil in 2003.

Product Value – The iron and steel markets are cyclical and the value of iron and steel products fluctuate. Following are examples of different iron products and comparative annual values per gross ton of product over a five-year period (2000-2004)[6]:

Production Cost - The current cost to produce pig iron in Brazil is $80 per gross ton FOB Brazil. The average cost to produce pig iron in a blast furnace in the United States is currently $140 per gross ton FOB US mill. If pig iron could be produced in Minnesota using western US coal as the iron-reductant and energy source, the estimated production cost would be $95 per gross ton FOB Minnesota's iron range.

Competitive Issues - Minnesota's current taconite facilities are competitively disadvantaged for supplying the value-added iron market with current commercial direct reduction technology due to the high silica content of Minnesota's ores and the dependence of current commercial technologies on natural gas.

The largest producer of DRI in the world resides in Venezuela. Currently the cost of natural gas in Minnesota is approximately five times more than it is in Venezuela, which means the energy cost to produce a ton of DRI in Venezuela is currently $13 per ton and in Minnesota the energy cost is $65 per ton.

[6] The product value for iron ore pellets is as reported in Skillings Mining Review for CVRD blast furnace pellets FOB the port of Tubaro, Brazil and converted to gross tons averaging 65% Fe.

The product value for steel scrap is an average delivered price for #1 heavy melt delivered to Chicago, Pittsburgh and Philadelphia as reported in American Metal Market.

The product values for direct reduced iron, pig iron, semi-finished steel slabs, hot rolled steel and cold rolled steel were obtained from the United States International Trade Commission Interactive Tariff and Trade DataWeb at http://dataweb.usitc.gov. These values are the United States Landed Duty Value for the given product. The current values listed in the above table are values as of June 1, 2004. The values listed are average values for all products for the particular designation.

Minnesota must encourage the development of commercial technologies, such as iron nuggets and HIsmelt, that can handle the silica content of Minnesota's ores and can use coal as the iron-reductant and energy source in an environmentally responsible manner.

Another competitive issue is the time Minnesota's environmental review and permitting process takes compared to permitting a new facility in other states or nations. Minnesota's lengthy environmental review process is intended to identify and address environmental issues. However, due to the open administrative process and many diverse opinions on how certain environmental issues should be addressed, the process can be stalled or delayed over issues that lack regulatory clarity, often resulting in extensive review or even litigation, either of which can significantly increase the time required to complete permitting in Minnesota. This uncertainty impacts both ferrous and non-ferrous mining projects.

The Non-Ferrous Industry

Bedrock similar to Minnesota's bedrock has yielded significant non-ferrous and precious metal mineral wealth elsewhere in the world [7]. The greatest physical challenge to conducting exploration in Minnesota is the 10 to 150 meters of glacial drift that obscures a high percentage of Minnesota's bedrock. However, in the Duluth Complex seven copper-nickel deposits with varying amounts of gold and platinum group metals have been identified, at least three of which are believed to be commercial. The deposits that show the greatest near term commercial potential are PolyMet's NorthMet Project, Teck Cominco's Mesaba Project and the Beaver Bay Joint Venture Franconia Minerals Birch Lake project.

Figure 3 (see Page 12) shows the location of these deposits. (Although Teck Cominco recently announced that their Mesaba Project in Minnesota is on hold, they continue to hold their mineral leases in Minnesota.)

Each of these deposits are potentially commercial copper, nickel, and PGM projects with each project requiring additional financing, exploration, mineral processing development and feasibility analysis to proceed. Conventional smelting and refining technologies are not feasible for these ores. The deposits in Minnesota are world class with large total quantities but with difficult metallurgy and relatively low grades, which has proven to be an economic hurdle to past commercialization efforts. However, new technology now may make commercial development of these deposits economically and environmentally feasible.

Market – Non-ferrous metallic minerals are true commodities, subject to world supply and demand, but largely driven by demand. Prices are set internationally and international trade is extensive.

Product Value - Following are July 1, 2004, prices[8]:

Copper	$1.20 per pound
Nickel	$7.05 per pound
Platinum	$794 per troy ounce
Palladium	$216 per troy ounce

All four of these metals are considered to be "strategic" from a national perspective and nickel, platinum and palladium also are considered critical, because the United States is dependent on imports for 85% to 100% of its domestic consumption.

Prices are volatile. Metallic mineral companies typically require projects to at least break even in down markets and earn substantial returns in the current high market. Figure 4 is a graph of copper prices from American Metal Market illustrating price volatility and cycles from 1961 through 2003.

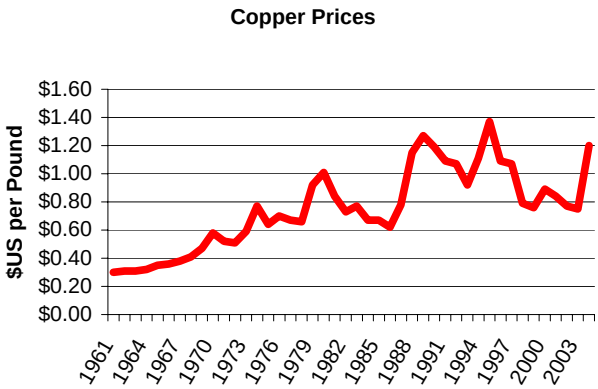


Figure 4 – Copper prices $US per pound 1961 through 2003.

Production Cost - The full cost of producing non-ferrous metallic minerals in Minnesota will remain unknown until the new hydrometallurgical mineral

[7] A prime example is the Canadian province of Ontario, Minnesota's neighbor on its northern border, where successful copper, nickel and precious metal mines exist.

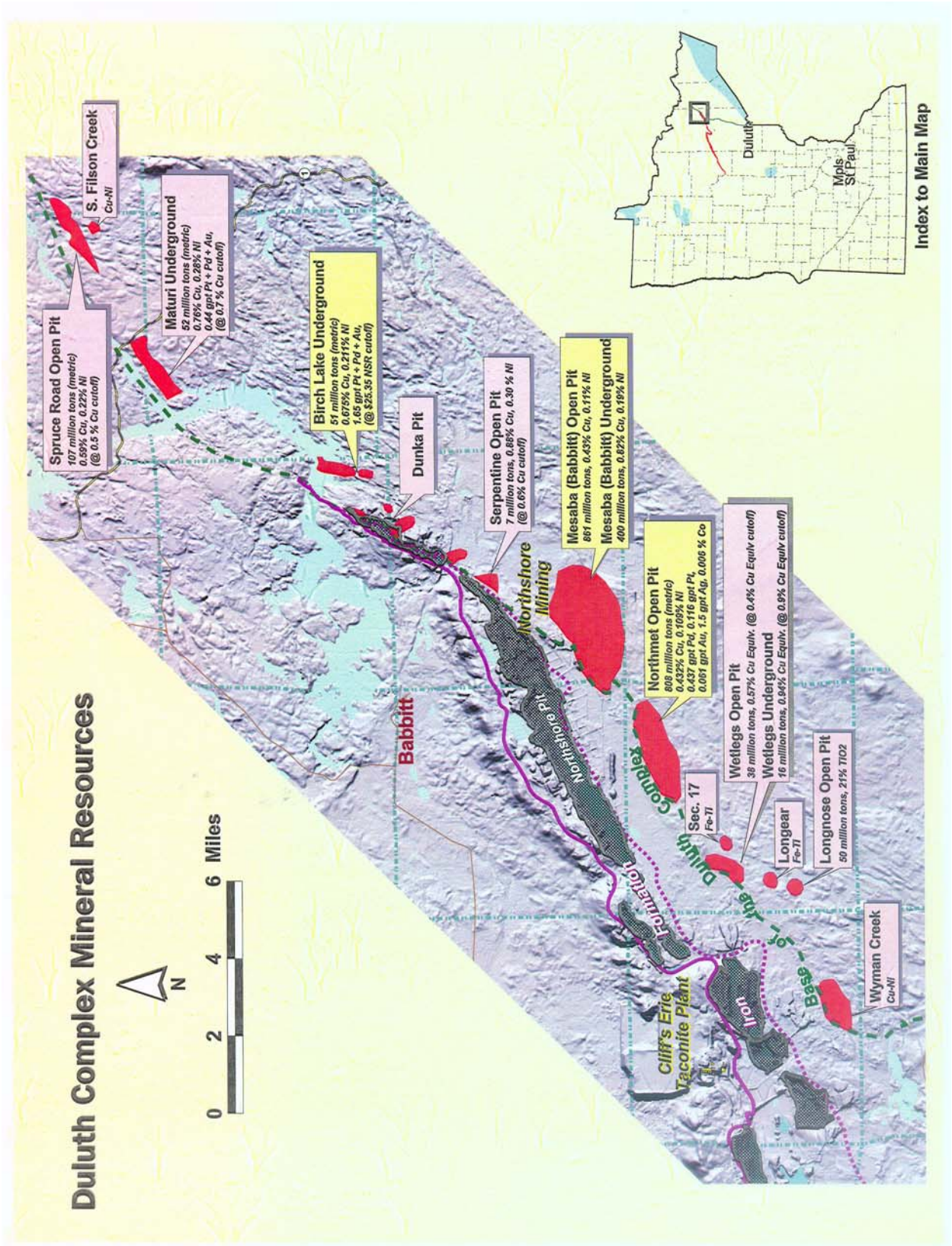
[8] American Metal Market is the source for these prices.

processing technology can be further demonstrated. Tax and royalty ambiguities also need to be resolved to fully assess the cost of development and production.

Competitive Issues – Identifying ways to streamline the environmental permitting and review process, clarifying ambiguities in the net proceeds tax and improving the royalty provisions in state non-ferrous metallic mineral leases would encourage the development of the PolyMet and Birch Lake projects.

To facilitate the development of the known copper-nickel-PGM deposits and exploration of Minnesota's excellent potential for other deposits of non-ferrous and precious metal deposits, Minnesota could help by financing geologic and geophysical mapping, providing better public access to information on land and mineral ownership in the state, opening up more state owned lands to mineral leasing and encouraging the federal government and private owners to do the same.

Figure 3 – Location of major, known Minnesota non-ferrous metallic mineral deposits.



The Industrial Minerals Industry

Minnesota's industrial minerals segment of the mining industry currently includes sand, gravel, crushed stone, limestone, peat, specialty silica sand, kaolin clay and dimension stone operations. Figure 5 shows the location of Minnesota's major industrial mineral operations, excluding sand and gravel which is produced and used in every county and region of the state.

The industrial mineral interests depicted in Figure 5 were not represented on this committee. Consequently, this committee focused largely on the potential of using current taconite waste products in the industrial mineral market with a focus on high quality aggregate.

Current state and private innovations and initiatives include: mapping aggregate resources in each county, research on developing and marketing iron range aggregates, and exploring higher value use such as landscape stone and dimensional stone, and developing new kaolin and ball clay mines.

Market - It is estimated that per capita consumption of aggregate material (sand, gravel and crushed stone) is 10.5 tons per year. Based on five million residents, Minnesota's aggregate consumption is over 50 million tons per year.

Product Cost/Value – Aggregate has one of the lowest unit values, on a dollar per ton basis, of all mineral commodities. The cost of transportation from the source to a construction site frequently is several times the cost FOB the pit or quarry.

Competitive Issues – About one-half of the aggregate consumed in Minnesota is used for public infrastructure. Keeping aggregate materials at a reasonable cost is in the public interest. A significant percentage of Minnesota's aggregate consumption occurs in the metropolitan area and yet urban and suburban development typically reduces the availability of local industrial mineral supplies, either from the development encumbering local resources or the local population restricting mineral development in the local community. However, sustaining local development projects is typically dependent on having access to economic aggregate materials.

Potential industrial mineral resources currently are generated as by-product waste from the taconite mining process (or are deposited in stockpiles resulting from past iron mining activities) as an alternative or supplement to existing pits and quarries. The cost of transportation is a key factor in development of a market for this resource. Many insiders of this industry segment believe that, as the market is developed for taconite by-product aggregate and stone products, solutions will be found to transportation issues that currently skew the economics of such products.

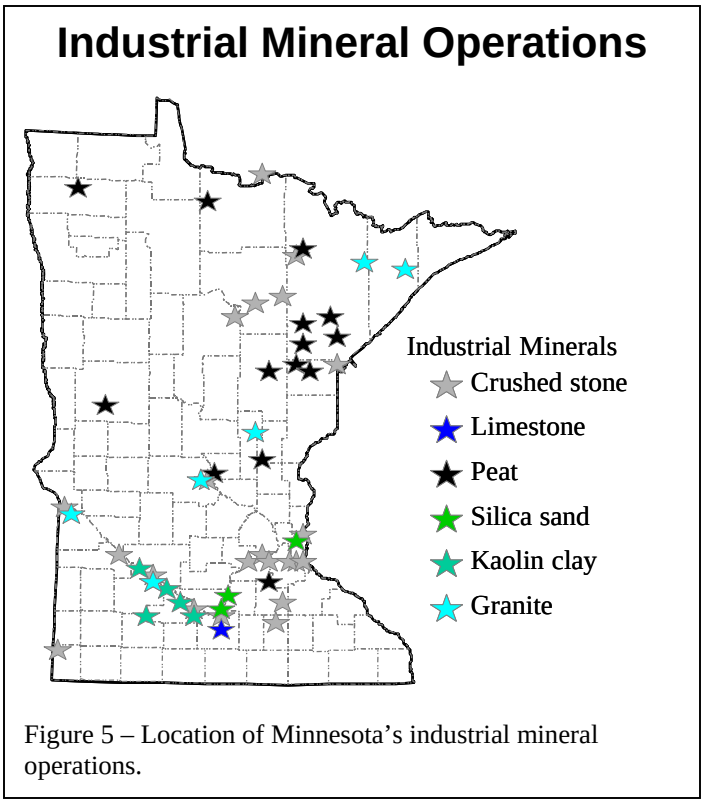


Figure 5 – Location of Minnesota's industrial mineral operations.

State support of testing, marketing and development initiatives of iron mining by-products could enhance commercialization opportunities.

Findings and Conclusions

After eight months of work, the committee formulated findings and conclusions about the status and strategies of the mining industry as a whole and its four key components - ferrous (iron ore) mining, which includes value-added iron production, and non-ferrous and industrial minerals mining. The state of each industry was assessed through presentations by public and private experts, an industry CEO survey, other industry information and committee member analysis at and between meetings.

Following is a summary of the committee's findings and conclusions.

Short-term challenge: For the **taconite** industry, the challenge is keeping Minnesota's taconite industry competitive. This requires maintaining the state's share in existing markets while the industry is under continuing production cost pressures and in the face of competition from North and South America.

Key challenges to competitiveness include:

- Meeting demand for iron ore pellets in the competitive market serving the United States and Canadian integrated steel industry
- Ability to provide a mix of standard and fluxed pellets to satisfy customer needs
- Ability to supply a competitively priced pellet in the United States and Canada, taking into account the costs of taxes, regulations, energy, transportation, as well as the escalating cost of employee benefits such as healthcare
- Entering the value-added iron industry
- Perceptions and realities of Minnesota's competitive position in regional and world markets
- Conflicts between community goals and mining industry needs

In the **non-ferrous** sector, the challenge is to move forward with development when investment interest is high, prices are strong, and new technology is available. Streamlining the environmental review and permitting process, as well as clarifying tax and royalty issues, are important short-term needs.

The **industrial minerals** sector, in cooperation with state agencies, the Metropolitan Council and local governments, needs to develop a plan to meet Minnesota's growing need for aggregate and how to resolve land use conflicts inherent in meeting the demand for aggregate products.

This committee also focused on the **potential of using current taconite waste products in the industrial minerals market** with a focus on high quality aggregate. The cost of transportation is a key factor and state support of testing, marketing and development initiatives could enhance commercialization opportunities.

Long-term need: Key challenges for industry expansion in **all sectors of the mining industry** include:

- The quality and extent of the mineralization compared to other alternative sources outside of Minnesota
- The need for substantial amounts of capital that are required to strengthen existing industries and "jump start" new mining
- Escalating and unpredictable energy costs
- Costly transportation of moving mined materials to market
- Uncertain time to complete and have definite final decision of the environmental review and permitting process
- Improving communications with, and balancing of, interests among various mining stakeholder groups
- The need for research to expand markets, develop new products, reduce costs and manage environmental impact
- Tax and royalty issues

For the **taconite** industry, sustaining a strong mining economy in Minnesota requires:

- Holding or increasing market share in established markets
- Increasing the state's share in the mature or declining integrated steel market
- Aggressively pursuing new markets and products

For the **non-ferrous** metals sector, specific long term needs include:

- Developing methods to encourage the investment community to finance non-ferrous exploration and development
- Improving coordination and increasing funding for mineral research, especially geologic mapping
- Increasing access to state and federally owned minerals for exploration and development

For the **industrial minerals** sector, the longer term needs include research and development of mineral resources other than traditional sources of aggregate and more cost effective transportation.

Public and Private Roles:

The Committee concluded that for mining to grow, successful financial and business models must be developed and implemented. Government can assist in this development by providing adequate support -- both in terms of physical infrastructure and sound public policy. It is up to the private sector to actually develop and implement project-specific business plans.

For a more detailed explanation of the roles of various public organizations, see Appendix – Page15: Roles of Public Organizations.

Table 1: Competitiveness for Iron Mining Investment

The Committee concluded that the state has substantial influence over several important areas impacting competitiveness – most notably production costs and investment environment. These two aspects are becoming increasingly important as the industry responds to global market conditions and trends. Table 1 summarizes findings of a benchmarking analysis of factors that affect Minnesota's Competitiveness for Iron Mining Investment relative to other competitor states and nations. Table 2 summarizes findings of a benchmarking analysis of factors that affect Minnesota's Perceived Competitiveness for Mineral Exploration Investment relative to other competitor states and nations. The colors and letter show at-a-glance how Minnesota compares to other benchmarked states and countries for each of the factors. "B" (better than Minnesota) in a red box indicates that the competitor has an advantage over Minnesota. "S" (about the same as Minnesota) in a yellow box indicates that the competitor is about equivalent to Minnesota. "W" (worse than Minnesota) in a green box indicates that the competitor is at a competitive disadvantage relative to Minnesota. "U" (unknown) in a white box indicates insufficient data for an overall rating.

	Ore Availability	Ore Grade	Product Silica	Strip Ratio	Mining Infrastructure	Taxes	Energy Availability and Cost	Environmental Permitting: Cost and Time	Labor Force	Capital Investment	Value Added Iron
Michigan	W	S	W	W	S	B	S	S	S	S	W
Canada	B	B	B	B	S	B	B	U	S	B	B
Brazil	B	B	B	B	S	B	U	U	U	B	B
Australia	B	B	B	B	S	B	B	U	U	B	B

B	= Better than Minnesota
W	= Worse than Minnesota
S	= Same as Minnesota
U	= Unknown

Prepared by the Minnesota Department of Natural Resources, Division of Lands and Minerals.

Compiled from data obtained from World Steel Dynamics, Skillings Mining Review, United States Geological Survey, "Iron Ore Comparisons on Worldwide Basis" by Richard Patelke and Donald Fosnacht of NRRI, and company reports.

Table 2: Perceived Competitiveness for Mineral Exploration Investment (Fraser Institute)

	Environmental Regulations	Regulatory Duplication and Inconsistencies	Taxation Regime	Uncertainty Concerning Areas Protected as Wilderness or Parks	Infrastructure	Political Stability	Labor Regulation-Employment Agreements	Geological Database	Mineral Potential Assuming Current Regulation/Land Use Policies	Mineral Potential Assuming NO Restrictions and Best Practice Standards
USA										
Alaska	B	B	B	B	W	B	B	W	B	B
Arizona	B	B	B	B	B	B	B	B	B	B
California	W	W	W	W	B	W	W	W	W	W
Colorado	W	B	B	W	B	W	W	W	W	W
Idaho	W	B	B	B	B	B	B	B	W	B
Montana	W	W	B	W	B	W	B	W	W	W
Nevada	B	B	B	B	B	B	B	B	B	B
New Mexico	B	B	B	B	B	B	B	W	B	W
South Dakota	W	W	B	B	W	B	W	W	B	W
Utah	B	B	B	B	B	B	B	B	B	B
Washington	W	B	B	W	W	W	B	W	W	W
Wisconsin	W	W	W	W	W	W	W	W	W	W
Wyoming	B	B	B	B	B	B	B	B	B	B
Canada										
British Columbia	B	B	B	W	W	B	W	B	B	B
Ontario	B	B	B	B	B	B	W	B	B	B
Quebec	B	B	B	B	B	B	B	B	B	B
Others										
South Africa	B	B	B	B	W	W	W	W	B	B
Western Australia	B	B	B	B	B	B	B	B	B	B

B = Better than Minnesota

W = Worse than Minnesota

Chart standing or ranking as reported by the Fraser Institute from a composite of 2003/2004 survey responses. The Fraser report is an annual survey by the Vancouver-based Fraser Institute of the management of selected members of the North American mineral exploration community (largely Canadian) of their perceptions of the business climate and mineral potential of Canadian provinces, selected US states and foreign jurisdictions. Many industry stakeholders in Minnesota do not necessarily agree with the Fraser Institute rankings for Minnesota; however, the report's conclusions are quoted in the public media, such as the Wall Street Journal, and in the trade press and, therefore, impact Minnesota's perceived competitiveness with potential investors.

Recommendations

Goals for Industry Development

Goals were established in four areas to achieve the objective of increasing Minnesota's share of the growing global markets for various types of minerals, total tonnage of mining outputs and diversity in types of mining.

1. For **all types of mining**: There is a need to improve Minnesota's government policies in ways that will not inhibit responsible and sustainable minerals business activity. Moreover, Minnesota should strive to develop government policies that will enhance the overall competitiveness of Minnesota mining operations and encourage private investment in Minnesota's mineral resources.

2. The **ferrous** industry:

    a. Taconite: Sustain 40 million tons per year of taconite concentrate production by capturing market share at United States and Canadian blast furnaces.
    b. Value-Added Iron: Add 3 million tons per year of value-added iron production and become an iron-making technology center of excellence.

3. **Non-ferrous** industry: Realize the potential of environmentally acceptable copper, nickel, and PGM and other known non-ferrous resources in Minnesota and facilitate exploration and development of other non-ferrous mineral potential.

4. **Industrial minerals** industry: Expand competitive aggregate and other industrial minerals production to meet Minnesota's development needs and to become a regional multi-state supplier of industrial minerals.

Priority Strategies for Industry Development

1. **GOVERNMENT POLICIES:** Institute supportive policies for mining businesses that help them control production costs, as well as policies that encourage investment and growth.

2. **ENVIRONMENTAL QUALITY:** Formulate environmental policies and land management strategies that facilitate exploration, encourage investment and sustain production while maintaining good land and environmental stewardship.

3. **APPLIED RESEARCH:** Maximize research and development incentives and financing for minerals exploration and commercialization of new technologies that allow mineral deposits to be developed in an economic and environmentally responsible way.

4. **DEVELOPMENT AND COMMERCIALIZATION:** Support the development and commercialization of mineral projects by partnering with other public and private entities to create a climate where private investment is encouraged and new technology and process innovation is supported.

5. **TRANSPORTATION AND ENERGY:** Initiate proactive measures to improve the transportation and energy infrastructure for all Minnesota industries to make Minnesota a more attractive location for investment by existing and new industries.

Following are 19 recommendations that fall under these five strategies:

Government Policies

1. **MINING TAXES –** ***The Commissioner of Iron Range Resources, the Commissioner of Revenue and the Chairman of the Iron Range legislative delegation should select a committee to recommend mining tax reductions to the Governor by December 15, 2004. Iron Range Resources will lead this effort.***

   Background – Mining taxes comprise a significant portion of the cost of taconite. Reducing taxes on taconite should be a goal, along with other cost reductions, to keep Minnesota taconite plants competitive.

   In addition, taxes on non-ferrous minerals need to be reviewed, as present statutory language regarding taxes on non-ferrous minerals is believed by industry to be ambiguous as it is applied to new processing or refining technology; and certain provisions may even discourage development of non-ferrous minerals.

2. **ENVIRONMENTAL REVIEW AND PERMITTING –** ***A state team should be formed to consider changes to environmental review and permitting that help ensure certainty of process and shorter timelines while ensuring no reduction in environmental protection. The team should develop recommendations for the 2005 legislative session. The Department of Employment and Economic Development (DEED) will lead this initiative.***

   Background – This is an issue that has been raised by many industrial sectors.

   The Mining Cabinet[9] should appoint a team consisting of members from DEED, Iron Range Resources, Minnesota Pollution Control Agency (MPCA), Department of Natural Resources (DNR) and the Environmental Quality Board (EQB), with the team leader being from DEED. This team, by itself, represents a wide variety of interests. In addition, the group is encouraged to solicit input from a variety of stakeholders outside of state agencies. A good source of such varied stakeholders would be the existing MPCA Metallic Mining Environmental Review and Permitting Workgroup, which consists of ferrous and non-ferrous representatives, environmental groups, environmental consultants and federal agencies; and the existing AQ Six Sigma Resource Workgroup, which consists of ferrous and non-ferrous representatives, forest products representatives, Minnesota Chamber of Commerce representatives and environmental groups. The team should consider the following:

   - Comparison of Minnesota's process with those in other states that have a mining sector
   - Certainty of time for completion of environmental review/permitting
   - Certainty of definite final decision for environmental review/permitting within that timeframe
   - Early and certain scoping of the environmental review and permitting processes
   - A reduced schedule for completion of environmental review/permitting
   - Expeditious completion of the mercury Total Maximum Daily Loads (TMDL) for the Lake Superior and Rainy River watersheds
   - Early public input to the environmental review/permitting process
   - Maintaining environmental protection
   - Ongoing EQB review of mandatory Environmental Assessment Worksheets (EAW)
   - Restriction of "standing" in legal challenges to those who participate in the scoping process or to significantly affected property owners
   - A requirement that challengers of agency decisions post bonds to compensate project sponsors for unwarranted delays
   - Consideration for changing the current requirement that existing plants that are changing from one production to another undergo mandatory reviews
   - Wetland replacement ratio requirements and potential exemptions for the mining industry

3. **STATE EIS PROJECT MANAGER –** ***A state agency project manager position should be established to facilitate coordination of permitting activities for mining projects, especially non-ferrous proposals, that: 1) propose to deploy mining technologies that are new to Minnesota; and 2) require both a state and federal Environmental Impact Statement (EIS). The Department of Natural Resources will lead this effort.***

[9] For a description of the Mining Cabinet, see Appendix – Page 15: Roles of Public Organizations

Background – One of the most challenging aspects of processing complex permit applications for projects that require both a state and federal EIS is the coordination of the various regulatory entities whose review, sign-off or approval is required. The proposed project manager would be approved by the Mining Cabinet commissioners, report to the commissioner of one of the Mining Cabinet agencies, but enjoy considerable freedom to act, subject to the oversight of the Mining Cabinet commissioners. A project proposer would request a project manager from the Mining Cabinet by providing a justification of need for such a position. The proposer also would agree to pay all the costs associated with the position, including salary, benefits, office and travel expenses.

4. **TACONITE AGGREGATE TAX POLICY –** ***The state should encourage use of taconite by-products by endorsing a policy of no production or special "sand and gravel" or aggregate tax for taconite aggregate. Iron Range Resources will lead this effort.***

   Background – A no-tax policy on taconite aggregates will support the development of an incremental revenue stream to the taconite producers and competitive new sources of aggregate to satisfy increasing market demand while avoiding potential land use conflicts associated with developing new aggregate reserves.

5. **ROYALTY STRATEGIES –** ***The DNR, in partnership with the Minnesota Exploration Association, should conduct an evaluation of the non-ferrous royalty structure applicable to state leased minerals. DNR will lead this effort.***

   Background – The state of Minnesota owns approximately 20% of the mineral rights in Minnesota for which it receives royalty payments when the properties are leased and under production. The state should continue to develop supportive royalty strategies that encourage development of non-ferrous minerals. State royalty formulas should be reviewed to assure that they are in line with accepted worldwide norms. Ambiguities in non-ferrous leases caused by new technologies should be eliminated. The DNR amended the state's non-ferrous royalty rates in 1995; however, a review of the rate structure is appropriate. (This evaluation, however, would not address the 80% of the mineral rights that are not state-owned.)

Environmental Quality

6. **MERCURY –** ***The state should facilitate and help fund rapid development of appropriate Total Maximum Daily Loads (TMDLs) for mercury in the Lake Superior and Rainy River watersheds. MPCA will lead this effort.***

   Background – Many lakes and streams in Minnesota have been deemed to be "impaired" with respect to their mercury content. This is especially true in the Lake Superior watershed where the allowable mercury discharge levels are set at an extremely low level of 1.3 parts per trillion. The Clean Water Act requires that the state develop TMDLs for such impaired waters or assure that water quality standards will be met by other means. The TMDLs would provide a plan for meeting the standard for point source discharges. Without a properly developed plan (which includes an appropriate level of public input) no new or increased discharge will be possible in these watersheds and all discharges from new or increased mining and other industrial or municipal sources will be prohibited. This would create an immediate and insurmountable barrier to environmentally acceptable economic development. Current financial and staff resources of the MPCA are inadequate to develop TMDLs in a timely manner. The lack of staff resources can be overcome by contracting TMDL development to qualified third parties (private or governmental) operating under the supervision of MPCA. Funding needs should be provided from state and industry sources.

   See Appendix – page 24 for other Mercury Emission Reduction Projects Proposed by the NRRI.

7. **ACID MINE DRAINAGE CONTROLS –** ***The state and federal government, working in cooperation with industry, should provide monetary support to investigate new control technologies and implement demonstration projects of technologies that appear to be effective at laboratory scale for containing and treating acid mine drainage that can be associated with non-ferrous mining. Such controls are critical to the successful***

development of a copper-nickel mining industry in Minnesota. The DNR will lead this effort.

Background – There has been a 25-year history of research by DNR on this issue and DNR is a nationally recognized authority. Non-ferrous projects will be required to have extensive programs on waste characterization and will do so in cooperation with DNR. Demonstration projects will take the form of actual waste treatment processes applied during development and early production.

8. **SUSTAINABLE DEVELOPMENT –** ***Sustainable development strategies should be developed and deployed to enhance land-use planning, manage conflict concerning land uses, incorporate future land forms, lakes and wetlands into current permitting and planning, and make lands available for leasing and exploration. Iron Range Resources will lead this effort.***

Background – Over the past several years, an ad hoc group of public and private mining stakeholders has formed the Laurentian Vision Partnership. The Laurentian Vision promotes the Mesabi Iron Range as a place to live and work by providing information, planning tools and options for its future that can enhance environmental vitality and economic stability. The data and concepts generated could mutually benefit mining and community interests by providing ways to continue economically viable mining in the long term while reclaiming lands left behind for alternative uses.

Proactive land use planning and conflict management should be instituted that encourages state, industry and local governments to use tools and strategies such as those developed by the Laurentian Vision Partnership to systematically identify and address conflicts that develop between mining and competing public and private land needs in order that conflicts can be systematically addressed, post-mining land use plans already required can be enhanced, and the land use implications for all types of mining can be explored. Future lakes and wetlands, resulting from and remaining after mining, could be incorporated into current permitting and land use planning. In addition, better public access to information on land and mineral ownership in the state should be provided, opening up more state-owned lands to mineral leasing and encouraging the federal government and private owners to do the same.

Applied Research

9. **REGIONAL AND DETAILED GEOLOGIC MAPPING –** ***State funding for regional and detailed mapping should be increased for the Minnesota Geological Survey (MGS) and the Natural Resources Research Institute (NRRI) of the University of Minnesota - Duluth. MGS will lead the regional mapping and NRRI will lead the detailed mapping.***

Background – The state should fund a ten-year program for completing regional and detailed geologic mapping of Minnesota generally at a scale of 1:24,000 but in no event at a scale of less detailed than 1:100,000 where less geologic complexity warrants. State mapping should be funded by appropriations for this purpose by the Legislature and/or the Legislative Commission on Minnesota Resources (LCMR). Such funding may also trigger matching grants from the US Geological Survey and other public and private sources. Mapping should include both conventional mapping of the surficial and bedrock geology and should include modern, 3-D digital innovations. Minnesota's competition in Canada both at the federal and provincial level has shown that this mapping work has a direct correlation to the amount of commercial exploration that occurs there. The Canadians have substantially increased governmental funding for this activity.

A solid base of available, well-constructed geologic maps at various mapping scales encourages industry to explore new areas and to re-explore other areas in light of ever changing geologic concepts. Such maps are also multipurpose, providing invaluable basic data for land use planning, hydrology, environmental assessments, exploration and mine permitting and many other uses.

10. **STATE SUPPORT OF EXPLORATION –** ***In addition to geologic mapping, Iron Range Resources should continue its Drilling Incentive Grant (DIG) program. Other organizations should develop and fund other similar public-private partnerships to support exploration and research into exploration concepts and technologies. The MCC will lead this effort.***

Background – The DIG program is an innovative program, perhaps unique in the nation, whereby Iron Range Resources funds up to 40% of a company's direct drilling cost of the first drill hole on a "wildcat," new exploration target. The data developed is made available, on a temporarily confidential basis, to Iron Range Resources and the Lands and Minerals Division of DNR. It eventually becomes public information.

Other state agencies and state institutions should develop similar joint public-private research programs designed to develop or apply new exploration concepts and exploration technologies. Candidates for such partnerships might include regional or smaller size geophysical and geochemical surveys. LCMR should provide appropriate support for these efforts through Iron Range Resources, NRRI, MGS or the University of Minnesota. These efforts also can be supported through initially modest legislative "state special" appropriations to the MGS and NRRI.

11. **STATE SUPPORT OF COST EFFECTIVE RECOVERY METHODS –** ***The state should encourage mineral development through funding of basic research on the cost efficient processing and recovery of Minnesota's metals and industrial minerals. The DNR and the NRRI should be provided funding by the Legislature and the LCMR for this purpose. More advanced research and engineering of specific processes should be done by the agencies through public-private partnerships. The MCC should continue to coordinate these efforts.***

    Background – Prime examples of the need for such research and development exist in the need to further develop several parts of the currently proposed hydrometallurgical processes that are being considered for treatment of the state's copper-nickel-PGM resources. Other immediate needs are in respect to Minnesota's titanium and clay resources. The success of such an approach is exemplified by the University of Minnesota's success in developing treatment methodology for low-grade taconite ores in the 1930s and 1940s.

Development and Commercialization

12. **MINNESOTA'S FUTURE FUND –** ***Creation of a new, statewide Minnesota's Future Fund to encourage deployment of new technologies in rural Minnesota should be explored. The goal would be to establish a revolving loan fund that would foster innovation and entrepreneurship and finance piloting, demonstration and commercialization of innovative new technologies that add value to Minnesota's natural resources, including ferrous and non-ferrous minerals, forest products and agricultural products. Iron Range Resources and DEED will spearhead this initiative.***

    Background – The Minnesota Minerals 21st Century Fund was an innovative approach to jumpstart the commercialization of new technology and has helped to attract private sector interest in development of Minnesota mineral resources; however, this fund soon will be depleted. In addition, the fund's singular emphasis on mineral processing facilities precluded its use on other promising natural resource or agricultural opportunities. A new, statewide fund should be created.

13. **FEDERAL FUNDS FOR MINE MODERNIZATION –** ***The state and federal governments should provide monetary support for demonstration projects of new technical developments that show good promise for enhancing the competitiveness of Minnesota mines. There is a clear need to help modernize current processing flow sheets. The state should be prepared to provide matching funds if federal resources can be secured for the program. The MCC should continue to champion these efforts.***

    Background – The taconite industry is proposing $40,000,000 worth of projects at Minnesota plants for near-term technology improvements. It's proposed that there would be a 60% Federal cost share ($24,000,000 over three years) in these improvements. An additional concept for a synthetic gas plant at Minntac would increase the project scope by $150,000,000. Funding of this project at similar support levels would require a $30,000,000 state match, with another $30,000,000 coming from private industry.

    See Appendix –Pages 17-20 for a listing of Proposed Taconite Technology Implementation Projects. These demonstrations would greatly

facilitate cost reduction at Minnesota's existing taconite plants.

14. VALUE-ADDED IRON COMMERCIALIZATION – ***The state and federal government should continue to support value-added iron projects such as the "iron nugget" project. DEED, working with the MCC, should seek funding for new, value-added iron initiatives.***

Background – The work at the Coleraine Minerals Research Laboratory of NRRI and the Mesabi Nugget Pilot Demonstration Research and Development Plant show that value-added iron products potentially can be made from Minnesota iron ore concentrate. The state should encourage continued research, development and commercialization of this technology, as well as other technologies that encourage the development of commercial iron and steel opportunities for Minnesota.

15. TACONITE AGGREGATE MARKETING DEVELOPMENT – ***The state should support the NRRI proposal to assist in developing various markets for taconite by-products, in particular those that meet MnDOT specifications. The MCC should continue to monitor and promote this project.***

Background – The MCC and MnDOT should continue to work together to test specific rock layers from other taconite mines in addition to the LC8 rock layer at United Taconite to demonstrate that those materials make high quality construction aggregate. MnDOT should be encouraged to continue the current testing of taconite materials at its MnRoad testing facility with a goal of reporting results from within three months of program completion. This report should contain the following key points:

a. Quantification of the attributes of taconite aggregate based pavement
b. Description of the added value to road performance due to the use of taconite materials in road applications
c. Comparison of the performance of the taconite to other typically used aggregate materials
d. Recommendations as to the future use of the materials in Minnesota road applications

The report and results should be used to help develop markets for the products in other states in the Midwest Region.

16. MINERALS OPPORTUNITIES MEETINGS ***– The state should support the MCC's proposal to sponsor, in cooperation with other groups and agencies, a series of meetings to identify processes and strategies that, if undertaken, would increase the probability of the development of economically significant and environmentally responsible minerals industry sectors in Minnesota. The MCC will lead this effort.***

Background – Due to increasing scientific knowledge, changing technologies and competitive market demands for known or potential commodities, the MCC believes it is appropriate to periodically re-examine the range of potential opportunities associated with Minnesota's minerals resources. Proposed meeting subjects include natural gas, diamonds, synthetic rutile and titanium production, industrial clays, rock quarries for landscape stone, dimensional stone or aggregate, copper-nickel-PGMs, adding value to taconite, and iron mining by-products as construction aggregates.

See Appendix – Pages 25 - 28 for additional details regarding Mineral Opportunity Meetings.

Transportation and Energy

17. DEVELOPMENT OF INFRASTRUCTURE AND TRANSPORTATION LOGISTICS TO MOVE TACONITE AGGREGATE TO THE TWIN CITIES METROPOLITAN AREA – ***The state should commission a study to determine the facility and transportation needs to bring taconite aggregates to the Twin Cities metropolitan area. DNR, Iron Range Resources and NRRI should work in conjunction with the Metropolitan Council to lead this initiative.***

Background – The state should consider designation of facilities in the metropolitan area to allow the greatest freedom for access to taconite aggregate materials by all potential end users. The report should consider both private and public ownership of the reception and load-out facilities. The study participants should include: DEED, Canadian National Railroad, Burlington Northern Railroad, Mn DOT, NRRI, IMA and end-user companies.

This study should examine the following key issues:

- Requirements for reception and load-out of materials in the metropolitan area
- Options for other facility placement that would facilitate market use of taconite aggregate in key state locations
- Avoidance of switching charges between rail carriers in order to facilitate economic transport of the materials to the end users
- How permitting for a load-out site can be expeditiously done

18. STATE SUPPORT OF TRANSPORTATION INFRASTRUCTURE SERVING NEW ROCK BUSINESSES – ***The state should support private industry's efforts to develop innovative new stone businesses that utilize the variety of stone resources in Minnesota, or re-use waste stone products such as those described in a DNR inventory at the former LTV Mine (now Cliffs Erie). Additional DNR inventories of stockpile materials, including the Cuyuna Range, also should be done to promote their re-use for aggregate or any other applications. The DNR should lead these efforts.***

Background – New private business partnerships to distribute large volumes of rock products via rail to the Twin Cities metropolitan area and other cities statewide are being established. The State should support locating, identifying, and inventorying stone stockpiles that currently exist on the Cuyuna and Mesabi Ranges. Location mapping, photography and material identification of stockpiles would be performed by the DNR. Approximately 1 billion tons of rock is contained in more than 1,500 stockpiles that cover 63 square miles between Grand Rapids and Babbitt. The state and counties own many of the stockpiles. Some stockpiles are owned by the Permanent School or University Trust Fund, which would benefit from sales. There currently is a statewide demand for construction aggregate, landscape stone and landscape boulders that partially could be filled with material from these existing stockpiles. An inventory with maps and photos is a practical and powerful marketing tool to promote rock sales. It will allow the seller to match a buyer with the material needed. This will promote business development and investment, both large and small. The re-use of stone stockpiles is economically efficient and conserves resources, both of which are sound public policies. State support for new rail facilities to unload rock products also will be a key to getting these products to Minnesota markets.

19. STATE SUPPORT OF ALTERNATE ENERGY – ***The state should support the use of alternative energy resources in mining and other industries through new tax incentives, money to support research in this area, investment funding for energy projects and development of more efficient environmental regulatory processes. Iron Range Resources and the Department of Commerce should collaborate on this effort.***

Background – The state and federal governments should work with private industry to find ways to implement new "Clean Coal" technologies in energy production. The proposed Excelsior Energy Integrated Gasification Combined Cycle (IGCC) project is one example of such an initiative. Coal is a long-term energy resource with stable pricing that could benefit industrial as well as residential customers.

In addition, the state should support usage of Xcel Energy or similar funds for demonstration of biomass energy projects at the various mine locations. The mines are uniquely located in areas that are heavily logged for the forest products industry. Both industries would benefit if logging biomass residues were routinely used to displace natural gas usage at Minnesota taconite mines.

The mining industry also is a major consumer of gasoline and diesel fuels. Therefore, development and testing of alternative, lower-cost replacement fuels for on and off-road mining equipment also could assist industry cost reduction efforts.

Appendix

Committee Staff

Iron Range Resources
Jaimie Bloomquist
Jean Dolensek
Laureen Hall
Brian Hiti
Sheryl Kochevar
Gary Larson
Jack LaVoy

Department of Natural Resources
William Brice
Pete Clevenstine
John Engesser
Dennis Martin
Marty Vadis

Minnesota Pollution Control Agency
Ann Foss

Natural Resources Research Institute – University of Minnesota – Duluth
David Hendrickson
Larry Zanko

Presentations to the Committee

"History of Mining" – PowerPoint presentation by William Brice, Minnesota Department of Natural Resources, Lands and Minerals Division, summarized milestones in the history of mining in Minnesota as well as the locations, uses and industry highlights for currently mined minerals. (January 22, 2004)

"Taconite Overview" – PowerPoint presentation by Pete Clevenstine, Minnesota Department of Natural Resources, Lands and Minerals Division, presented an in depth history of ferrous or iron mining in Minnesota, its role in Minnesota's economy, the status of the taconite industry in the domestic and international marketplace and current initiatives and challenges in the industry. (January 22, 2004)

"Value Added Iron" – PowerPoint presentation by Marty Vadis, Minnesota Department of Natural Resources, Lands and Minerals Division, discussed new technologies currently being developed to extract and process iron from taconite. (January 22, 2004)

"Minnesota's Iron Ore Reserves" – PowerPoint presentation by William Brice, Minnesota Department of Natural Resources, Lands and Minerals Division, discussed iron deposits and the economic factors that determine when and if these resources become classified as production reserves. (February 5, 2004)

"Minnesota's Platinum Group Metals and Copper-Nickel Potential" – Overhead presentation by Ernest Lehmann, Minnesota Exploration Association, described the history, current potential/constraints and future directions for non-ferrous exploration and industry development. (February 5 and March 18, 2004)

"Overview of Minnesota's Industrial Minerals Industry" – PowerPoint presentation by Dennis Martin, Minnesota Department of Natural Resources, Lands and Minerals Division, provided an overview of the industrial minerals industry. (March 18, 2004)

Integrated Steel (Blast Furnace/Basic Oxygen Furnace) Industry – Presentation by John Mang, Vice President and General Manager, Burns Harbor, Inc, International Steel Group. (March 18, 2004)

Electric Furnace Industry – Presentation by Mark Millett, Vice President and General Manager, Flat Roll Division, Steel Dynamics, Inc. (March 18, 2004)

Mesabi Nugget Update – Presentation by Larry Lehtinen, President, Mesabi Nugget, LLC. (March 18, 2004)

"Minnesota's Mining and Mineral's Initiatives" – PowerPoint presentation by Jean Dolensek, Iron Range Resources, provided an overview of a summary report developed by Iron Range Resources, Lehmann Exploration Management, Inc., Minnesota Department of Natural Resources, Minnesota Pollution Control Agency, and the Natural Resources Research Institute. This report introduces efforts currently underway in emerging ferrous technologies, taconite industry, non-ferrous and industrial minerals; initiatives in mineral exploration, environmental initiatives and other support initiatives such as the Mining Tax Study; existing partnerships and programs established by the Legislature including the Cooperative Environmental Research program, Minerals Coordinating Committee and Metallic Mining Environmental Review and Permitting Workgroup. (March 18, 2004)

"Exploration Opportunities – Minerals Coordinating Committee" (March 18, 2004)

"Smart Screen Systems" – Presentation by Jim Swearingen, on behalf of Daryoush Allaei, President and CEO, Smart Screen Systems, Inc. (March 18, 2004)

"Mining Tax Study" – PowerPoint presentation by Lynn Reed, Executive Director, Minnesota Taxpayers Association, shared the final results and report of an independent review of mining taxes. The study was prepared under a Professional and Technical Services Contract between the state of Minnesota (through the Commissioner of Revenue) and the Minnesota Taxpayers Association. (April 1, 2004)

Additional Documents

"Helping to Create a More Competitive Taconite Iron Mining Industry" – PowerPoint presentation by Don Fosnacht, Natural Resources Research Institute of the University of Minnesota - Duluth, summarized new technology demonstrations at Minnesota iron ore operations.

"Vision for the Future for Minnesota Taconite Mining" – PowerPoint presentation by Mining Steering Committee for the Industries of the Future for Taconite Mining, shared thoughts on the vision, goals and future direction of the Minnesota taconite industry and should be viewed as a tool in reaching a consensus on how the key stakeholders can direct the future to assure prosperity for this vital Minnesota industry.

"Aggregates from Taconite Mining" – PowerPoint presentation by Don Fosnacht, Natural Resources Research Institute of the University of Minnesota - Duluth, provided a summary of establishing mining by-products as a preferred aggregate source.

"Paradigm Shifts in the Steel Industry" – PowerPoint presentation by John Surma, President and COO, United States Steel Corporation.

"Presentation to the Society of Mining Engineers" – PowerPoint presentation on the economics of Class A aggregate in the Twin Cities Metropolitan Region: Today and in the Future by David Edmunds, Edward Kraemers & Sons, Inc.

"Minnesota Taconite as a Microwave Absorbing Road Aggregate Material for De-icing and Pothole Patching Applications" – PowerPoint presentation by Dave Hopstock, consultant, and Larry Zanko, Natural Resources Research Institute of the University of Minnesota - Duluth.

"A Comparative Economic Analysis of the Impact of Taxes and Royalties on Potential Non-Ferrous Mining Projects: Minnesota's Rank – Nationally and Internationally – at the start of the 21st Century" – Draft Recommendations to the Minerals Coordinating Committee by Lawrence Zanko and Jill Peterman.

CEO Survey

List of Corporate Officials Surveyed

Taconite Corporate Officials surveyed:

Madhu Ranade – Inland Steel Flat Products Company
John Brinzo – Cleveland-Cliffs Inc
John Surma – US Steel Corporation
John Mang – International Steel Group
James Alfano – Stelco Inc
Jim Thompson – North Star Steel, Inc.
Carl Valdiserri – Rouge Industries Inc.
James Wainscott – AK Steel Corporation
Wally Mahnke – ME International

Value-added Iron Corporate Officials surveyed:

Larry Lehtinen – Mesabi Nugget, LLC
Stephen Hicks – Minnesota Steel Industries, Inc.
Robert Mann – Tecnored Ironmaking Project
Mark Millett – Steel Dynamics, Inc.
John Brinzo – Cleveland-Cliffs Inc
Naoya Kobayashi – Midrex Enterprises Inc.

Non-ferrous Corporate Officials surveyed:

William Murray – PolyMet Mining Corporation
Richard Mondie – Teck Cominco American Incorporated
Ernest Lehmann – Lehmann Exploration Management, Inc.
Aaron Regent – Falconbridge US Inc.
Bob Johnson – Kennecott Exploration Co.
Thomas Quigley – Minerals Processing Corporation
Peter Webster – North Mining Inc.
James Trusler – Platinex, Inc.
Mark Hall – Wallbridge America Corporation

Industrial Minerals Corporate Officials surveyed:

Dave Edmunds – Edward Kraemers and Sons, Inc.
Brad Gerlach – North American Cliffstone
Don Vry – Meridian Aggregate Co.
Steve Hedberg – Hedberg Aggregate, Inc.
George Schnepf – Cold Spring Granite Co.
Patrick Groff – Aggregate Industries – North Central Region
Jerry Bauerly – Bauerly Companies
Fred Corrigan – Aggregate Ready-Mix Association
Ron Degner – Minnesota River Valley Coalition of Kaolin
Richard Wolters – Minnesota Asphalt Pavement Association
Mark Snyder – Concrete Paving Association of Minnesota

Sample CEO Surveys

GOVERNOR'S COMMITTEE ON
MINNESOTA'S MINING FUTURE
MARCH 2004

CEO Survey: Taconite

Background

The Governor's Committee on Minnesota's Mining Future has been formed to advise Governor Tim Pawlenty on actions that can be taken to strengthen and develop a sustainable, more diversified mining and minerals industry in Minnesota. The committee will develop and provide advice on public policy strategies aimed at enhancing the growth of the mining and minerals industry, retaining and creating mining-related employment, sustaining the viability of Minnesota's mining and minerals industry in the global marketplace, promoting innovation and the development of new technologies. This survey is an important part of the committee's information gathering process.

Doing Business in Minnesota

1. What are the primary reasons your company is doing business in Minnesota? What advantages do you see in conducting mining operations here?

2. What challenges has your company encountered in doing business in Minnesota? What challenges do you see for the future of mining in Minnesota?

3. What are your company's goals for capital investment or further development of your Minnesota operations? What factors will influence these decisions?

Please rate Minnesota's mining business climate from 1 to 5, *with "5" being the most desirable and "1" being the least desirable:* _____ Comments:

Minnesota's Markets

4. In which domestic markets can Minnesota iron mines be competitive?

Please rate the competitiveness of Minnesota's iron ore products in the lower Great Lakes market from 1 to 5, *with "5" being very competitive and "1" being least competitive:* _____ Comments:

Please rate the competitiveness of Minnesota's iron ore products in the Mississippi and Ohio River systems markets from 1 to 5, *with "5" being very competitive and "1" being least competitive:* _____ Comments:

5. In which international markets can Minnesota iron mines be competitive? It appears that Minntac and possibly United Taconite pellets can be sold to Chinese steel makers. How long do you see this "window of opportunity" for Minnesota pellets remaining open, and do you see other such opportunities for Minnesota mines?

Please rate the competitiveness of Minnesota's iron ore products in the international market from 1 to 5, *with "5" being very competitive and "1" being least competitive:* _____ Comments:

6. Currently, the customers for Minnesota's taconite pellets are the blast furnaces of lower Great Lakes steel makers located in cities such as Chicago, Detroit and Cleveland. What future do you see for these blast furnaces?

Minnesota's Future

7. What factors will have the greatest impact on the future of mining in Minnesota? (Please check and comment)

- ☐ External Market Developments
- ☐ Regulations
- ☐ Taxes
- ☐ Mineral Royalties
- ☐ Environmental Permitting
- ☐ Research & Development Incentives
- ☐ Financing for Capital Improvements or Business Expansions
- ☐ Other Factors

8. What other comments do you have regarding Minnesota's mining industry?

Please rate the potential of Minnesota's mining future from 1 to 5, *with "5" being great potential and "1" being limited potential:* _____ Comments:

Please respond by March 16, 2004, to:

Sandy Layman, Commissioner
Iron Range Resources
P.O. Box 441
Eveleth, MN 55734
218-744-7403 (FAX)
Sandy.Layman@ironrangeresources.org.

GOVERNOR'S COMMITTEE ON
MINNESOTA'S MINING FUTURE
March 2004

CEO Survey: Value-Added Iron

Background

The Governor's Committee on Minnesota's Mining Future has been formed to advise Governor Tim Pawlenty on actions that can be taken to strengthen and develop a sustainable, more diversified mining and minerals industry in Minnesota. The committee will develop and provide advice on public policy strategies aimed at enhancing the growth of the mining and minerals industry, retaining and creating mining-related employment, sustaining the viability of Minnesota's mining and minerals industry in the global marketplace, promoting innovation and the development of new technologies. This survey is an important part of the committee's information gathering process.

Doing Business in Minnesota

1. What are the primary reasons your company is doing business in Minnesota? What advantages do you see in conducting operations here?

2. What challenges has your company encountered in doing business in Minnesota? What challenges do you see for the future of mining in Minnesota?

3. What are your company's goals for capital investment or further development of your Minnesota operations? What factors will influence these decisions?

Please rate Minnesota's mining business climate from 1 to 5, *with "5" being the most desirable and "1" being the least desirable:* _____ Comments:

Minnesota's Markets

4. In which domestic markets can Minnesota value-added iron products be competitive?

Please rate the competitiveness of Minnesota's iron products in the lower Great Lakes market from 1 to 5, *with "5" being very competitive and "1" being least competitive:* _____ Comments:

Please rate the competitiveness of Minnesota's iron products in the Mississippi and Ohio River systems markets from 1 to 5, *with "5" being very competitive and "1" being least competitive:* _____ Comments:

5. In which international markets can Minnesota value-added iron products be competitive? It appears that Minntac and possibly United Taconite pellets can be sold to Chinese steel makers. How long do you see this "window of opportunity" for Minnesota pellets remaining open, and do you see similar opportunities for Minnesota value-added iron products?

Please rate the competitiveness of Minnesota's value-added iron products in the international market from 1 to 5, *with "5" being very competitive and "1" being least competitive:* _____ Comments:

Minnesota's Future

6. What factors will have the greatest impact on the future of mining in Minnesota? (Please check and comment)

- ☐ External Market Developments
- ☐ Regulations
- ☐ Taxes
- ☐ Mineral Royalties
- ☐ Environmental Permitting
- ☐ Research & Development Incentives
- ☐ Financing for Capital Improvements or Business Expansions
- ☐ Other Factors

7. What other comments do you have regarding Minnesota's mining industry?

Please rate the potential of Minnesota's mining future from 1 to 5, *with "5" being great potential and "1" being limited potential:* _____ Comments:

Please respond by March 16, 2004, to:

Sandy Layman, Commissioner
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Sandy.Layman@ironrangeresources.org.

GOVERNOR'S COMMITTEE ON
MINNESOTA'S MINING FUTURE
MARCH 2004

CEO Survey: Non-Ferrous

Background

The Governor's Committee on Minnesota's Mining Future has been formed to advise Governor Tim Pawlenty on actions that can be taken to strengthen and develop a sustainable, more diversified mining and minerals industry in Minnesota. The committee will develop and provide advice on public policy strategies aimed at enhancing the growth of the mining and minerals industry, retaining and creating mining-related employment, sustaining the viability of Minnesota's mining and minerals industry in the global marketplace, promoting innovation and the development of new technologies. This survey is an important part of the committee's information gathering process.

Doing Business in Minnesota

1. What are the primary reasons your company is interested in doing business in Minnesota? What advantages do you see in conducting mining operations here?

2. What challenges has your company encountered in developing a business in Minnesota? What challenges do you see for the future of mining in Minnesota?

3. What are your company's goals for capital investment/development of a mining project in Minnesota operations? What factors will influence these decisions?

   Please rate Minnesota's mining business climate from 1 to 5, ***with "5" being the most desirable and "1" being the least desirable:*** **_____ Comments:**

Minnesota's Future

4. What factors will have the greatest impact on the future of mining in Minnesota? (Please check and comment)

   - ☐ External Market Developments
   - ☐ Regulations
   - ☐ Taxes
   - ☐ Mineral Royalties
   - ☐ Environmental Permitting
   - ☐ Research & Development Incentives
   - ☐ Financing for Capital Improvements or Business Expansions
   - ☐ Other Factors

5. What other comments do you have regarding Minnesota's mining industry?

   Please rate the potential of Minnesota's mining future from 1 to 5, ***with "5" being great potential and "1" being limited potential:*** **_____ Comments:**

Please respond by March 16, 2004, to:

Sandy Layman, Commissioner
Iron Range Resources
P.O. Box 441
Eveleth, MN 55734
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GOVERNOR'S COMMITTEE ON
MINNESOTA'S MINING FUTURE
MARCH 2004

CEO Survey: Industrial Minerals

Background

The Governor's Committee on Minnesota's Mining Future has been formed to advise Governor Tim Pawlenty on actions that can be taken to strengthen and develop a sustainable, more diversified mining and minerals industry in Minnesota. The committee will develop and provide advice on public policy strategies aimed at enhancing the growth of the mining and minerals industry, retaining and creating mining-related employment, sustaining the viability of Minnesota's mining and minerals industry in the global marketplace, promoting innovation and the development of new technologies. This survey is an important part of the committee's information gathering process.

Doing Business in Minnesota

1. What are the primary reasons your company is doing business in Minnesota? What advantages do you see in conducting mining operations here?

2. What challenges has your company encountered in doing business in Minnesota? What challenges do you see for the future of mining in Minnesota?

3. What are your company's goals for capital investment or further development of your Minnesota operations? What factors will influence these decisions?

Please rate Minnesota's mining business climate from 1 to 5, ***with "5" being the most desirable and "1" being the least desirable:*** **_____ Comments:**

Minnesota's Markets

4. How do you see the marketplace for Minnesota's industrial minerals changing? Do you forsee a shortage of any industrial minerals in Minnesota or elsewhere?

Minnesota's Future

5. What factors will have the greatest impact on the future of mining in Minnesota? (Please check and comment)

   □ External Market Developments □ Regulations

   □ Taxes □ Mineral Royalties

- ☐ Environmental Permitting
- ☐ Research & Development Incentives
- ☐ Financing for Capital Improvements or Business Expansions
- ☐ Other Factors

6. What other comments do you have regarding Minnesota's mining industry?

Please rate the potential of Minnesota's mining future from 1 to 5, *with "5" being great potential and "1" being limited potential:* _____ Comments:

Please respond by March 16, 2004, to:

Sandy Layman, Commissioner
Iron Range Resources
P.O. Box 441
Eveleth, MN 55734
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Sandy.Layman@ironrangeresources.org

Survey Results

CEO SURVEY TALLY
As of Tuesday, March 30, 2004

	Non-ferrous	Value-Added Iron	Taconite	Industrial Minerals	Totals
Surveys **sent**	9	6	9	11	**35**
Surveys **returned**	5	3	4	4	**16 or approx. 43%**
Rate MN's mining **business climate** (↓1-↑5)	3.2 Average	2.3 average	2.25 average	2.75 average	**2.63 overall average**
Rate **potential** of MN's mining future (↓1-↑5)	3.6 average	4 average	2.6 average	3.9 average	**3.53 overall average**
Rate Competitiveness					
Great Lakes Area		4 average	4 average		**4 overall average**
Mississippi/Ohio River Systems		3.5 average	2.5 average		**3 overall average**
International Market		3 average	1.6 average		**2.33 overall average**
Factors with greatest impact on mining future (# of √) *					**Total number of √ as a factor**
External Market Developments	3 of 5	2 of 3	1 of 3*	1 of 4	**7**
Regulations	3 of 5	1 of 3	1 of 3	3 of 4	8
Taxes	1 of 5	1 of 3	3 of 3	2 of 4	**7**
Mineral Royalties	3 of 5			2 of 4	**5**
Environmental Permitting	5 of 5	3 of 3	2 of 3	3 of 4	**13**
Research & Development			1 of 3	1 of 4	**2**
Financing for Capital Improvements or Business Expansions	3 of 5	1 of 3	2 of 3	1 of 4	**7**
Other Factors			1 of 3	1 of 4	**2**

* Only 3 taconite surveys received responded to factors question

Roles of Public Organizations

Minerals Coordinating Committee

The Legislature established the Minerals Coordinating Committee (MCC) in 1987 to manage the Minerals Diversification Program. The MCC creates long-term plans for minerals research, allocates Minerals Diversification research funds, and submits biennial budget requests for minerals research to the Legislature. Members include representatives of the Department of Natural Resources, Minnesota Geological Survey, Minnesota Pollution Control Agency, Natural Resources Research Institute, University of Minnesota Institute of Technology, United Steelworkers of America, Iron Range Resources, iron ore and taconite industry, non-ferrous metallic minerals industry, and industrial minerals industry.

Mining Cabinet

The Mining Cabinet is an ad hoc group of state agency commissioners involved in or impacted by mining. The group is co-chaired by the commissioners of Iron Range Resources and the Department of Employment and Economic Development. Other members include the commissioners of the Departments of Natural Resources, Revenue and Finance and the Minnesota Pollution Control Agency. The group meets as needed to discuss mining issues and projects.

Minnesota Department of Natural Resources – Division of Lands and Minerals

The division implements land policy on state-owned lands and provides fiduciary oversight in managing real estate and mineral transactions. The division administers about five million acres of land and about 12 million acres of state-owned and tax-forfeited mineral rights. In addition, the division has regulatory authority to ensure that reclamation is conducted at metallic mineral and peat mines and it is a principal proponent of environmentally sound mining practices.

Real estate functions include purchases, sales, and exchanges of state lands thereby implementing the strategic resource management plans of the department by purchasing sensitive habitat and strategically important natural resources lands, and exchanging or selling lands to meet natural resource management objectives.

The primary mineral responsibilities include managing state mineral leases for exploration and mining, negotiating lease rates, and collecting revenue from mining activities. In addition, the division provides technical assistance to local governments on mineral resources and mining issues.

The division also manages three minerals research programs that are intended to maintain the competitiveness of the taconite industry, diversify the state's minerals industry, and address environmental issues related to mining. These programs are typically co-funded with non-state monies and are currently supported with corporate monies and by non-state agencies such as the US Bureau of Land Management, US Environmental Protection Agency, and Western Lake Superior Sanitary District. Projects supported by Iron Ore Cooperative Research have led to 23 installations and process changes that have resulted in cost savings, product improvements, and environmental improvements at Minnesota taconite facilities. Minerals Diversification projects, which are selected by the Minerals Coordinating Committee, have been directed toward promoting increased mineral exploration in Minnesota, assisting Minnesota counties with aggregate resource planning, and researching taconite waste as an aggregate source. Environmental Cooperative Research projects are directed at solving current or anticipated environmental problems associated with mining. Projects have included: studies on characterization and mitigation of acid mine drainage associated with sulfide mineral deposits; use of biosolids and papermill wastes for reclamation of coarse tailings; gravel pit restoration; hydrological studies of mine pits; and in-pit disposal of tailings.

An example of current research that is being funded through the Iron Ore Cooperative Research and Environmental Cooperative Research with assistance from the US EPA, the Minnesota MPCA, and the taconite industry is a study of mercury emissions (water and air) from taconite processing facilities to determine how mercury release from

these facilities can be reduced. Work to date is promising and both the regulatory community and industry are offering further support. Additionally, the division supports research within its base budget.

Minnesota Geological Survey

The Minnesota Geological Survey (MGS) was established by legislative act as a unit of the University of Minnesota to ensure the availability of the up-to-date geological mapping that is required to ensure stewardship of our mineral, land, and water resources. MGS therefore conducts the basic and applied earth-sciences research that is required by the people of Minnesota, and conveys resulting maps, reports, databases, and outreach to all levels of government, business, and the public. The detail and usefulness of this ongoing mapping is steadily increasing as science and technology progress. These investigations support the competitiveness of our mineral sector, are needed to map sand and gravel, are used in environmental assessment, are essential for groundwater management, guide selection of protected lands, and are needed in guiding road construction, pipeline integrity, fiber optic cabling, and waste disposal.

Studies have shown that there is a direct relationship between government geoscience and the level of industry investment that leads to discovery of new mineral deposits that can be mined in a responsible manner using new clean mining techniques. The ongoing availability of adequate geological mapping therefore will more and more be a critical factor in the future success of Minnesota's mineral economy. Countries are becoming more competitive in this regard, and discoveries are increasingly being made by small companies that cannot fund regional studies and therefore invest where good public domain geoscience is available. But there is a large gap between the current pace of mapping and the effort that would be required to maintain our competitive position. And there is a need for new investment as mineral exploration and groundwater protection increasingly utilize digital 3-D methods, and promising techniques such as airborne gravity and new geochemical methods are coming available steadily.

This geologic mapping that will be so critical for the ongoing well-being of our mineral sector will be most efficiently done by taking advantage of existing mechanisms for multi-agency cooperation, so that multiple applications will be supported simultaneously.

Natural Resources Research Institute of the University of Minnesota - Duluth

The Natural Resources Research Institute of the University of Minnesota - Duluth (NRRI) focuses on assisting the University of Minnesota with its land grant research mission. Specifically, NRRI has the University's principle mineral's processing research capabilities. In its Coleraine laboratories, NRRI has scientists, laboratories and pilot facilities that are generally rated among the best in the country. Given its University status, NRRI qualifies for federal research grants and at the same time has become an important research arm under contract to the taconite industry. NRRI participates in state organizations such as the Minerals Coordinating Committee and Iron Ore cooperative, both proposing research and responding to requests for research. Working closely with collaborators, particularly from industry, NRRI also deploys University Permanent Trust funds dedicated to the institute's research efforts.

Within the University, NRRI shares geological research responsibilities with the Minnesota Geological Survey (MGS). Generally MGS focuses on statewide or regional mapping while NRRI's Economic Geology Group focuses on more detailed mapping, frequently working directly with exploration companies on deposits with economic potential.

Proposed Taconite Technology Implementation Projects

	Title	Description	Cost	Annual Savings
1A	**Synthetic Gas Energy Center at Minntac**	**Construct a state of the art full-scale coal gasification facility**	**$150,000,000**	**$15,000,000 - $21,000,000 / yr**
1B	**Installation of Smart Screen Technology at Minntac**	**Install Smart Screens in the concentrating plant to increase line productivity, lower product silica, lower plant noise levels, and lower maintenance costs**	**$6,500,000**	**$3,000,000/yr**
1C	**Installation of the Belt Sizer Fines Removal System at Minntac**	**Install CMRL developed fines removal system utilizing conveyor belt type technology**	**$4,000,000**	**$3,750,000/yr**
1D	**Modify Minntac's Concentrating flow sheet**	**Install modifications to concentrating flow sheet where the primary ball mill discharge is magnetically upgraded before the cyclone classification step**	**$9,000,000**	**$12,000,000/yr**
2	**Heated concentrate project using waste heat at Hibtac**	**Install newly designed heat recovery systems through the installation of a heat recovery tower and associated piping**	**$2,200,000**	**$425,000/yr**
3	**Install advanced screening equipment at United Taconite**	**Replace cyclone classification systems with advanced screening equipment utilizing new urethane screen technology and new multiple stacked screen design configurations**	**$4,000,000**	**$3,100,000/yr**
4A	**Install Screening and Dry Cobbing System at Keewatin Taconite**	**Demonstrate the use of combined screening and dry cobbing to upgrade crude ore feed grade to milling operations in taconite**	**$4,500,000**	**$3,700,000/yr**
4B	**Install Smart Screen Technology at Keewatin Taconite**	**Install Smart Screens in the concentrating plant to increase line productivity, lower product silica, lower plant noise levels, and lower maintenance costs**	**$2,500,000**	**$1,000,000/yr**
4C	**Install Belt Sizer Fines Removal System at Keewatic Taconite**	**Install CMRL developed prototype pellet fines removal system utilizing conveyor belt type technology**	**$1,500,000**	**$1,250,000/yr**
5	**Install Vertimills to Enhance Concentrator Productivity at Ispat Inland Mining**	**Demonstrate the use of vertimills as an application of state of the art grinding technology to optimize throughput**	**$4,000,000**	**$2,100,000/yr**
6	**Installation of Beltsizer Fines Removal System at Northshore Mining**	**Install CMRL developed prototype pellet fines removal system utilizing conveyor belt type technology**	**$2,000,000**	**$2,500,000 to $5,000,000/yr**
Total	**Without Syngas plant**		**$40,200,000.00**	
Total	**With Syngas plant**		**$190,200,000.00**	

Proposed Technology Implementation Projects
Minnesota Taconite Operations
July 29, 2004

1) Minntac
Minnesota Ore Operations
U.S. Steel
Mt. Iron, Minnesota

a) Synthetic Gas Energy Center

Construct a state of the art full-scale coal gasification facility. This facility would produce low BTU synthetic gas as a replacement for expensive natural gas in both the main burner and/or preheat burners. These synthetic gas products have substantially lower caloric heating value (BTU/cubic foot) than does natural gas. This project also would verify if these low BTU gases would technically work in a grate kiln application.

Installation Costs: $150,000,000

Cost Savings: $1.00 - $1.40 /ton or higher based on savings of $6,000,000 / 15,000,000 tons / year per each $1.00 / Million BTU increase in natural gas pricing above $3.50 / Million BTU. Estimates for natural gas pricing in 2005 are $6.00 - $7.00 / MillionBTU

Savings: $15,000,000 - $21,000,000 / yr

Application to multiple taconite plants:
Findings applicable to all other taconite plants

b) Installation of Smart Screen Technology

Install Smart Screens in the concentrating plant to increase line productivity, lower product silica, lower plant noise levels, and lower maintenance costs. Plant pilot testing has confirmed that the use of this new screening technology will provide significant cost savings in the overall iron ore concentrating process as compared to the existing fine screens.

Installation Cost: $6,500,000

Savings: $0.20 / ton based upon 15,000,000 tons/year
$3,000,000 / yr

Application to multiple taconite plants:
Findings applicable to all other taconite plants

c) Installation of the Belt Sizer Fines Removal System

Install CMRL developed pellet fines removal system utilizing conveyor belt type technology. This technology has the advantage of removing pellet fines for a fraction of the capital investment required for pellet screening operations. A scale-up size system is being developed and tested by CMRL. Minntac would like to install a full-scale belt sizer fines removal system to remove pellet fines from its final product. This system would significantly increase the quality of its shipped pellets making the product more valuable to its customers.

Installation Costs: $4,000,000

Cost Savings: $0.25 / ton based on 15,000,000 tons/year
$3,750,000 / yr

Application to multiple taconite plants:
Findings applicable to all other taconite plants

d) Modify Minntac's Concentrating flow sheet

Install modifications to Minntac's concentrating flow sheet where the primary ball mill discharge is magnetically upgraded before the cyclone classification step. This would require the installation of new magnetic separators as well as new hydro cyclones. Modeling completed by CMRL has indicated that this upgrade could potentially increase line productivity and lower silica. These changes have the potential to significantly lower the cost of upgrading taconite in the overall concentration process.

Installation Costs: $9,000,000

Cost Savings: $0.80 / ton based upon 15,000,000 tons/yr
$12,000,000 / yr

Application to multiple taconite plants:
Not applicable to other taconite plants

2) Hibbing Taconite Company
Hibbing, Minnesota

a) Heated Concentrate Project Using Waste Heat
Install newly designed heat recovery systems through the installation of a heat recovery tower and associated piping. Incoming concentrate would be pre-heated to balling from the energy of the furnace exhaust system. Benefits would include improved furnace throughput (higher productivity), lower energy consumption, and higher total furnace output. This installation would occur on one of three furnace lines and upon successful operation, it would be applied to the two remaining furnace lines in future years.
Installation Cost : $ 2,200,000
Cost Saving: $0.05/ton based on 8,500,000 tons/year
$425,000/ yr
Application to multiple plants :
Findings applicable to all other taconite plants

3) United Taconite Mining Company
Eveleth, Minnesota

a) Install Advanced Screening Equipment in Plant
Replace Cyclone Classification Circuits with Advanced Screening Systems (Derrick Stacksizers) Utilizing New Urethane Screen Technology and New Multiple Stacked Screen Design Configurations to Produce a state-of-the-art Particle Size Separation System at EVTAC Mining.
Benefits for this new technology include improved classification efficiency, reduced fine iron losses, improved silica control, and reduced electrical power consumption in grinding.
Installation Costs : $ 4,000,000
Cost Savings : $ 0.70 / ton based on 4,300,000 tons/year
$3,100,000 / yr
Application to Multiple Plants : Findings applicable to all other taconite plants as well as many other types of mining operations.

4) Keewatin Taconite
Keewatin, Minnesota

a) ***Install Screening and Dry Cobbing System***
Demonstrate the Use of Combined Screening and Dry Cobbing Systems to Upgrade Crude Ore Feed Grade to Milling Operations in Taconite as taconite operations are faced with mining lower grade ore, new methods of upgrading crude ore grade need to be implemented to reduce overall operating costs, improve energy efficiency, and increase plant throughput.
Minus two inch material being delivered to the milling operations will be dry cobbed prior to milling.
Installation Cost : $ 4,500,000
Savings : $0.74 / ton based on 5,000,000 tons/year
$3,700,000 / yr
Application to Multiple Plants : Findings applicable to all Taconite plants

b) Installation of Smart Screen Technology
Install Smart Screens in the concentrating plant to increase line productivity, lower product silica, lower plant noise levels, and lower maintenance costs. Plant pilot testing has confirmed that the use of this new screening technology will provide significant cost savings in the overall iron ore concentrating process as compared to the existing fine screens.
Installation Cost: $2,500,000
Savings: $0.20 / ton based upon 5,000,000 tons/year
$1,000,000 / yr
Application to multiple taconite plants:

Findings applicable to all other taconite plants

c) Installation of the Belt Sizer Fines Removal System

Install CMRL developed prototype pellet fines removal system utilizing conveyor belt type technology. This technology has the advantage of removing pellet fines for a fraction of the capital investment required for pellet screening operations. A scale-up size system is being developed and tested by CMRL. Keewatin Taconite would like to install a full-scale belt sizer fines removal system to remove pellet fines from its final product. This system would significantly increase the quality of its shipped pellets making the product more valuable to its customers.
Installation Costs: $1,500,000
Cost Savings: $0.25 / ton based upon 5,000,000 tons/year
$1,250,000 / yr
Application to multiple taconite plants:
Findings applicable to all other taconite plants

5) Ispat Inland Mining Company
Virginia, Minnesota

a) Install Vertimills to Enhance Concentrator Productivity

Demonstrate the Use of Vertimills as a Application of State of the Art Fine Grinding Technology to Optimize Throughput for Taconite Operations Utilizing Conventional Rod Mill / Ball Mill Grinding. Benefits of this new technology include increased
plant throughput, increased concentrate production and improved electrical energy efficiency.
Installation Costs : $4,000,000
Savings : $0.75/ton based upon 2,800,000 tons/year
$2,100,000/yr
Application to Multiple Plants : Findings applicable to 4 of the 6 plants utilizing conventional Rod Mill / Ball Mill Grinding Operations

6) Northshore Mining Company
Silver Bay, Minnesota

a) Installation of the Belt Sizer Fines Removal System

Install a state-of-the-art Pellet Screening Plant Utilizing New Screening Technology Recently Invented and tested at the Natural Resources Research Institute of the University of Minnesota - Duluth. Benefits of this new technology include increasing the value of the product to blast furnace operations, reducing particulate emissions and improving plant throughput.
Installation Cost : $2,000,000
Savings : $0.50 - $1.00/ton based on 5,000,000 tons/year
$2,500,000 - $5,000,000/yr
Application to other plants : Findings applicable to all Taconite plants

Websites

American Institute of Mining, Metallurgical and Petroleum Engineers - www.aimeny.org

American Iron Ore Association - www.aioa.org

American Iron and Steel Institute - www.steel.org

Coleraine Minerals Research Laboratory - www.nrri.umn.edu/coleraine

Department of Employment and Economic Development – www.state.deed.mn.us

Iron Mining Association of Minnesota – www.taconite.org

Iron Range Resources – www.IronRangeResources.org

Minnesota Department of Natural Resources – www.dnr.state.mn.us

Minnesota Department of Revenue - www.taxes.state.mn.us

Minnesota Environmental Quality Board – www.eqb.state.mn.us

Minnesota Geological Survey - www.geo.umn.edu/mgs/

Minnesota Pollution Control Agency – www.pca.state.mn.us

Minnesota Taxpayers Association – www.mntax.org

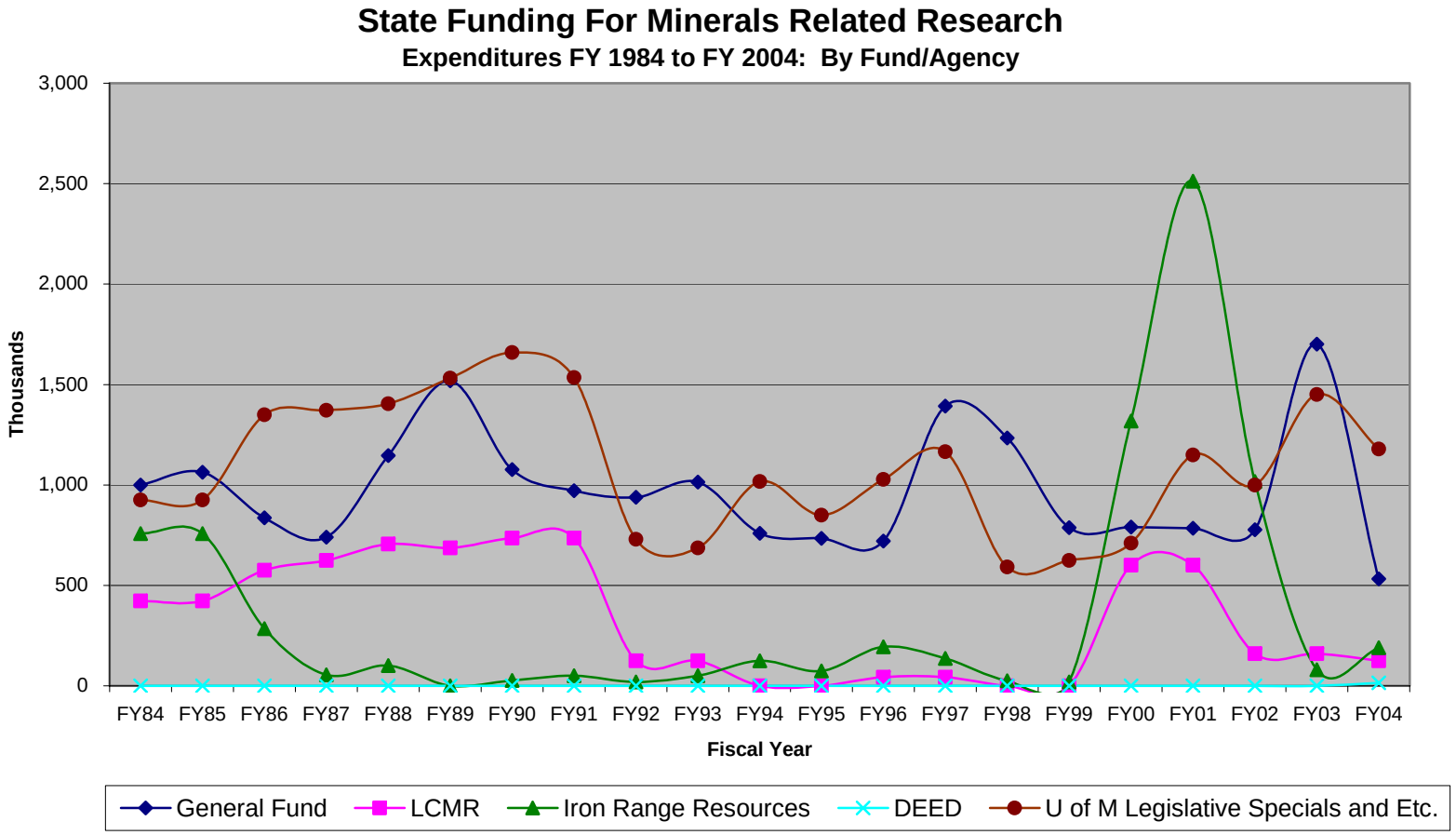
National Mining Association - www.nma.org

Natural Resources Research Institute of the University of Minnesota - Duluth– www.nrri.umn.edu

Society for Mining, Metallurgy and Exploration (SME) - www.smenet.org

US Geological Survey - www.usgs.gov

State Funding for Minerals Related Research



Note: This graph does not include the $8 million convertible loan to Mesabi Nugget, LLC by Iron Range Resources or the $8 million loan to Mesabi Nugget, LLC by DEED

Environmental Review and Permitting

When companies make changes at existing mining facilities or propose to build new facilities, environmental review and permitting may be required prior to construction.

1. Environmental Review – The Environmental Review program assigns a unit of government – the Responsible Governmental Unit – to conduct a review using a standardized public process designed to disclose information about environmental effects and ways to minimize and avoid them. The review is conducted prior to permit issuance and is a source of information and must be integrated with other permitting and approval processes. There are two levels of environmental review. The first is an Environmental Assessment Worksheet (EAW), which is designed to set out the basic facts necessary to determine whether an Environmental Impact Statement (EIS) is required. Its primary legal purpose is to provide the information needed to determine whether a project has the potential for significant environmental effects. The second level is an EIS. An EIS provides information about the extent of potential environmental impacts and how they may be avoided or minimized. A key point: the EIS is not a means to approve or disapprove a project, but is simply a source of information to guide the approval decision process. There are mandatory EAW and EIS categories set forth in Minnesota Rules but a discretionary or voluntary EAW or EIS may be conducted.

2. Permitting – Permitting is dictated by Minnesota statute, rule and Federal regulation. Permits summarize all of the applicable regulations for a facility, any site-specific requirements and provide mechanisms to ensure the facility stays in compliance with the permit. These permits are enforceable by various state agencies and sometimes the federal government. Permits are many times required prior to construction. If environmental review is required on a project, the permits should reflect the environmental review and cannot be issued prior to completion of environmental review.

3. Concerns have been raised about the predictability of requirements, timeliness and certainty of both the environmental review and the permitting process. For projects that require an EIS, it could take at least 2 years for completion of this process. For the first copper-nickel project, it will take longer. Timing of investments and the realized production are key to the investment payback period. With such long timeframes, some investors choose to go elsewhere.

The current environmental regulatory system makes it difficult to deal with such issues since there is no clear "right" answer. This results in legal disputes that can lengthen the review/permit process.

Mercury Emission Reduction Projects Proposed by the NRRI

Mercury Reduction from Taconite Mining – Significant research has been completed to characterize the distribution of mercury components in various taconite outflows (water, tailings, and flue gases) by NRRI through projects funded by the Iron Ore Co-operative and Permanent University Trust Funds. This work shows that reduction of mercury species from mining plant induration flue gases will have the biggest impact on mercury emissions from taconite mining. In addition, NRRI in cooperation with Minnesota Power, has been conducting a research program at the Cohasset Power Plant to remove mercury from live flue gas atmospheres through funds provided by the Economic Development Administration. This work has shown that inorganic sorbents have great potential for attaining substantial mercury reductions from the flue gas.

NRRI and its Coleraine Minerals Research Laboratory (CMRL) propose to evaluate various processes to release oxidized mercury from the fine iron particles that adsorb the mercury species contained in the off-gas. Stack gas sampling and analysis for vapor phase oxidized and elemental mercury also will be accomplished to evaluate stack gas removal technologies.

NRRI/CMRL also would utilize bench scale and pilot scale sorbent injection equipment being used in power plant stack gas research for a similar evaluation of sorbent injection technologies to remove vapor phase mercury species from taconite stack gas emissions. Mercury removal tests will be done at each individual taconite operation as the mercury research work is considered highly site specific with individual plants potentially needing different removal processes.

In addition to in-plant testing, individual plant concentrates will be balled and indurated in test equipment at CMRL to evaluate if varying the gas composition can affect mercury sorption and/or release into the gas phase.

The total cost of this work is estimated to be $750,000. The University will commit to funding 20% of this total from its Permanent University Trust Fund.

Characterize the Distribution of Mercury Species in Non-Ferrous Mineral Materials – NRRI through its Economic Geology Group and CMRL has conducted past research on the anticipated mineralogy of materials that will be processed in a non-ferrous venture in northeastern Minnesota. In addition, they have characterized the various intermediate and final products that will be generated during the application of the anticipated flowsheets for Minnesota ores. The capture of metallic values from the flowsheets will be achieved through hydrometallurgical means and formation of flue gases will be avoided. Thus, the mercury emissions will be primarily concentrated in water and solids outflows from the processing plant. Previous work on iron ore mining by NRRI and DNR have indicated that these outflow types should have minimal adverse harm to the environment. It is important to confirm this through actual testing of the anticipated outflow streams. This can be accomplished using the pilot scale processing equipment at NRRI.

NRRI/CMRL proposes to evaluate the distribution of mercury species in various crude ore, flotation concentrate, and tailings samples produced in previous copper/nickel testwork done at CMRL for northern Minnesota ore samples to look for opportunities for removal in individual unit processes. Mercury samples also would be analyzed for mercury species in various copper/nickel deposits being evaluated for future mining in northern Minnesota.

The estimated cost for this characterization program is $250,000. The University will commit to funding 20% of this total from the Permanent University Trust Fund.

Mineral Opportunity Meetings

Mineral industries currently contribute nearly two billion dollars annually to Minnesota's economy. This contribution is dominated by taconite mining and processing but other commodities contribute -- including construction aggregate, dimension stone, peat, clay and industrial sand. Each must compete locally, nationally, and internationally and continue to evolve based on changing economics, technology, and regulations. The MCC [10] believes that to keep these industries vibrant, this evolution needs at least periodic review to assess research and development opportunities and the effect of governmental policy and actions.

MCC also recognizes that the geology of Minnesota holds significant potential for the production of a variety of other commodities which it may be possible to develop in an environmentally responsible manner to add to the state's GDP, diversify its economy and create jobs. These include known, but currently undeveloped, deposits of titanium, manganese, copper-nickel, platinum, gold and clays. Based on geologic analogies, scientists believe potential exists for the occurrence of deposits of other valuable minerals including diamonds, natural gas, and base metals. These opportunities exist statewide.

With increasing scientific knowledge, changing technologies and competitive market demands for each of the known or potential commodities, MCC believes it is appropriate to periodically re-examine the range of the state's development or enhancement opportunities of the existing or potential mineral industry.

With this in mind, MCC proposes to sponsor, in cooperation with other groups and agencies, a series of meetings to identify processes and strategies that, if undertaken, would increase the probability of the development of economically significant and environmentally responsible minerals industry sectors in Minnesota.

The format of the meetings will vary. Some meetings will be one-day sessions bringing together a small group of industry specialists and state government representatives to discuss a specific commodity or type of deposit and to determine research or regulatory needs and opportunities. Others will be larger, public meetings with a series of presentations, aimed at an industry segment, such as the aggregate industry, to examine directions the industry and government should follow to foster development of that particular sector. In either case, the emphasis will focus on developing an action plan for the state and industry with respect to the particular commodity sector.

Initially, the limited, small group, one-day session format best lends itself to hosting by MCC in cooperation with agencies and organizations involved for the following initially selected commodities and deposit types:

- Natural Gas in the Mid-Continent Rift
- Diamonds
- Titanium
- Industrial Clay
- Landscape and Dimensional Stone

The following topics may be best evaluated in a broader context such as the Governor's Committee on Minnesota's Mining Future:

- Copper-Nickel-Platinum Group Metals (PGM) Mining
- Adding Value to Taconite
- Use of Iron Mining By-products as Aggregate

[10] The Legislature established the Minerals Coordinating Committee (MCC) in 1987 to manage the Minerals Diversification Program. The MCC creates long-term plans for minerals research, allocates Minerals Diversification research funds, and submits biennial budget requests for minerals research to the Legislature. Members include representatives of the Department of Natural Resources, Minnesota Geological Survey, Minnesota Pollution Control Agency, Natural Resources Research Institute, University of Minnesota Institute of Technology, United Steelworkers of America, Iron Range Resources, iron ore and taconite industry, non-ferrous metallic minerals industry, and industrial minerals industry.

MCC proposes to partner with others to organize, conduct and fund these sessions. Potential partners include:

- MCC
- Minnesota Exploration Association
- Iron Range Resources
- Minnesota Power
- Blandin Foundation
- Natural Resources Research Institute
- Industry sponsors

The following is a brief description of each of the proposed meetings.

Natural Gas in the Mid-Continent Rift
The Mid-continent rift, a continental scale geologic structure that underlies a large part of eastern Minnesota is a geologically recognized prime area for "frontier" level exploration for major deposits of natural gas. A one-day meeting of government and industry representatives will examine the realistic potential and initiate steps to encourage industry exploration through focused research and reduction of institutional impediments at the state level. The meeting will feature a technical presentation by professional petroleum geologist, Susan Landon, a recognized expert on the natural gas potential of the Rift, followed by a structured discussion of potential actions by the state and others to foster environmentally responsible development.

Diamond Exploration
The world diamond industry is a multi-billion dollar industry that has, for over the last 12 to 20 years, increasingly focused on exploration and development of deposits in the Pre-Cambrian "Canadian" shield. This successful exploration has resulted in several new and developing mines in northern Canada with over one billion dollars in new capital investment. These geologically favorable terrains underlie all of Minnesota and are at reasonably shallow depths in the northern half of the state. Limited, low profile exploration by companies related to DeBeers, Ashton (an Australian diamond producer) and others has occurred in the upper Midwest, including Minnesota. Diamond bearing structures have been identified in Michigan. Favorable indicators and areas are known in Minnesota. A one day session led by Dr. Harvey Thorliefson, the MGS director and a recognized expert on diamond exploration, and Brooks Clement, VP of Ashton, will provide decision makers with background on Minnesota's diamond potential and will be followed by a consideration of appropriate research and policy strategies to foster more active and fruitful industry exploration in Minnesota.

Synthetic Rutile and Titanium Metal Production
Titanium oxide produced from the mineral ilmenite and from both natural and synthetic rutile is the predominant white pigment used in paints, paper and plastics is a multi-billion dollar market in the United States. The substantially smaller titanium metal market is a growth market with growing applications where a high strength to weight ratio is required (as in aircraft) or where high corrosion resistance is required (as in processes such a hydrometallurgical treatment of copper-nickel ores). Large, potentially commercial, ilmenite-bearing deposits have been identified and tested in northeastern Minnesota. Development attempts to date have failed because of metallurgical treatment difficulties encountered. Recent process developments indicate that it is timely to assess the state of knowledge of process technology in relation to the known Minnesota deposits to determine if additional applied research is warranted and to examine mechanisms to foster such research by industry and government. A one-day meeting is planned to initiate a dialog between industry experts and state decision makers to examine the status of process technology and outline the proper role for state institutions and agencies in fostering appropriate development.

Industrial Clay Exploration and Development
Industrial clay deposits ranging from low value ball clays to potentially high value kaolin deposits are wide spread throughout Minnesota. The existing clay industry in the state could be expanded in size and product range through activities ranging from geologically guided exploration through clay characterization to identify new markets and improve clay beneficiation processes. A one-day review meeting of industry participants, local and national technical experts and local and state government economic development agencies is planned. The meeting will focus on outlining the current state of knowledge on raw material resources, needed improvements in the raw materials

data base, existing and potential markets and how to expand them and current processing issues and needed areas for process improvements.

Rock Quarries for Landscape Stone, Dimensional Stone or Aggregate
A growing market exists for decorative "specialty" stone products in landscaping, construction, sculpture, monuments and a variety of other uses. Minnesota has a wide variety of existing and potential sources for such stone throughout much of the state. The general public perception, however, of locating quarries in their vicinity is negative and local government authorities are often reluctant to provide for such operations in their land use plans or to issue required permits to operators. MCC will sponsor a one-day meeting of quarry operators, marketers of such stone products, users of stone and local government officials to begin a dialog and make recommendations on how to improve and expand the industry and facilitate dispersed economic development, especially in out-state Minnesota.

Copper-Nickel-Platinum Group Metals Exploration and Development
The Duluth Complex is one of the world's largest mafic intrusive complexes, bodies of rocks with which the world's principal copper-nickel and PGM deposits are associated. From 1950 to 1974, non-ferrous mineral exploration in Minnesota focused largely on copper-nickel deposits in the area of the basal contact of the Duluth Complex. This exploration indicated the presence of a world-class resource of copper and nickel in a series of deposits along the basal contact, totaling an estimated 4 billion tons with a grade of about 0.66% copper and 0.2% nickel. In the 1980's potentially economic platinum group metal (PGM) concentrations in the Complex were identified at Birch Lake. This also led to a re-evaluation of the basal copper-nickel deposits and low but significant PGM contents were identified in these deposits. In the last decade, geologic understanding of the Complex has markedly improved. Hydrometallurgical developments now show promise for economically treating the complex copper-nickel-PGM ores. MCC proposes a meeting involving knowledgeable geologists, engineers, financiers and high level government officials to identify, consider and recommend strategies for exploration and development of PGM-copper-nickel deposits of the whole of the Duluth Complex and of outlying mafic rock deposits elsewhere in Minnesota.

Adding Value to Taconite
Value-added iron imports (direct reduced iron, pig iron, and steel slabs) into the US increased from 2 million tons during 1989 to nearly 14 million tons during 2002. The 2002 value-added iron imports included approximately 2 million tons of direct reduced iron, 4 million tons of pig iron, and 8 million tons of semi-finished steel. Most of these imports were used in electric-furnace steel production. From 1989 through 2002, US electric furnace steel production increased by 14 million tons and integrated steel production decreased by 5 million tons. During this same time frame, the use of iron ore pellets by US integrated steel mills decreased by 7.5 million tons. Currently, the only market that exists for Minnesota taconite is for use in integrated steel production. 14 million tons of value added iron is equivalent to 21 million tons of iron ore pellets. Minnesota may need to produce value-added iron in order to maintain its current level of taconite mining and production.

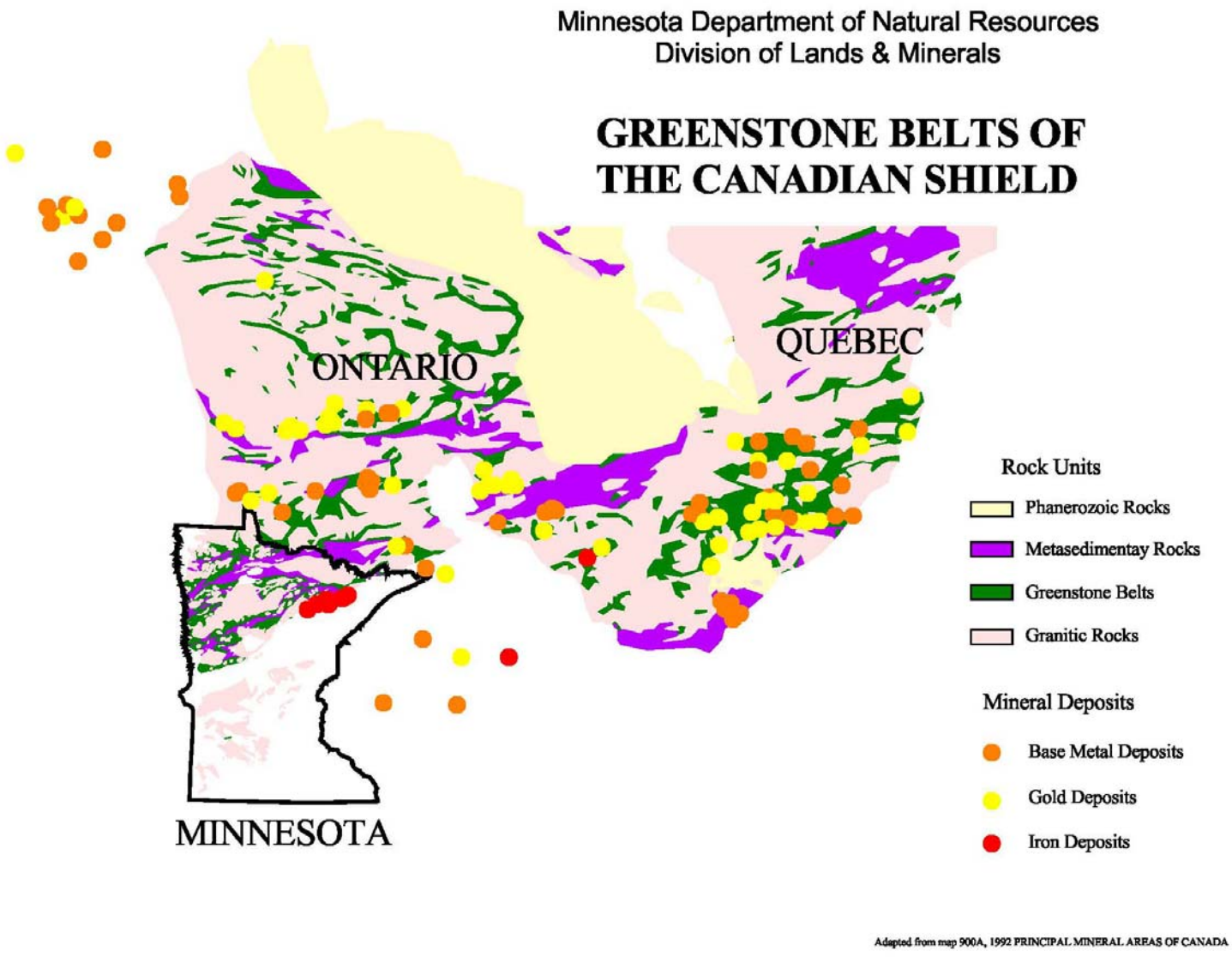
Development of Iron Mining Byproducts as Construction Aggregates
Construction aggregate resources are the materials we use for our homes, offices, schools, stores, factories, trails, and our road and bridge system. There are emerging opportunities to sell taconite waste rock in large quantities to markets across Minnesota and other states. The multi-state demand for construction aggregates, especially for high-quality, coarse-size, durable stone continues to grow with our increase in population, replacement of our road and bridge system, and our expanding urban areas. At the same time, the future local supply of raw materials for the Twin Cities area is declining due to difficulties in obtaining new mining permits, competing land uses, the depletion of some resources, and increasing quality specifications. A one-day meeting of government, industry, and transportation representatives will provide up-to-date information, promote the opportunities, and continue discussions of the future role of the MCC or other government agencies. There are many potential public benefits to Minnesota for the development of this emerging industry.

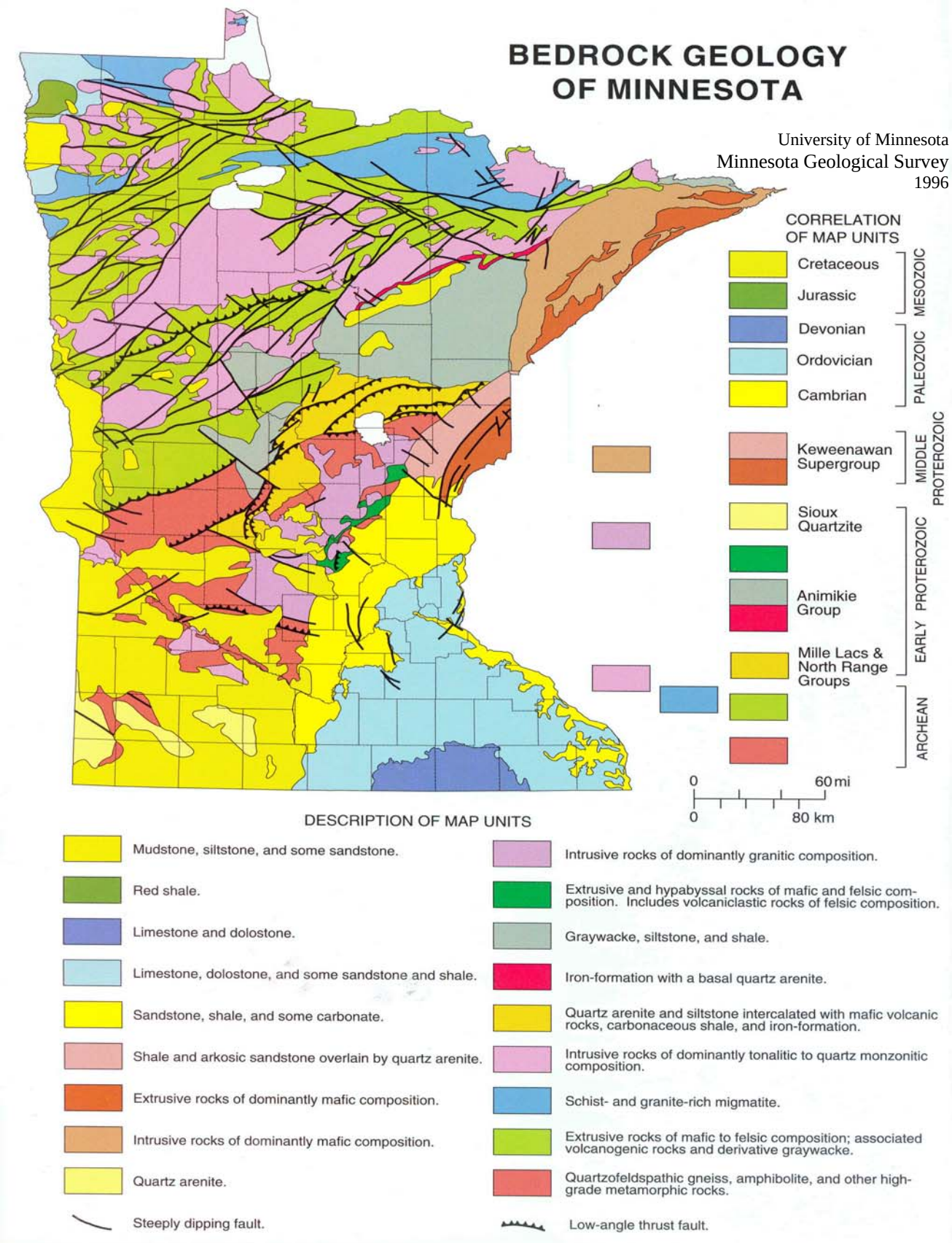
Minerals Coordinating Committee

Budget Proposal: Mineral Opportunity Meetings

	Meeting Room	Speakers	Lunch	Mid-Day Breaks	**Total**
Natural Gas in the Mid-Continent Rift	$0	$1,750	$360	$210	**$2,320**
Diamond Exploration	0	1,500	360	210	**2,070**
Synthetic Rutile and Titanium Metal Production	0	4,500	480	280	**5,260**
Industrial Clay Exploration and Development	100	3,000	600	350	**4,050**
Landscape and Dimensional Stone	100	1,500	600	350	**2,550**
Copper-Nickel-Platinum Group Metals Mining	100	4,500	900	525	**6,025**
Adding Value to Taconite	0	4,500	480	280	**5,260**
Use of Iron Mining Byproducts as Aggregates	100	0	600	350	**1,050**
	$400	**$21,250**	**$4,380**	**$2,555**	**$28,585**

Maps


Minnesota Department of Natural Resources
Division of Lands & Minerals
GREENSTONE BELTS OF
THE CANADIAN SHIELD
ONTARIO
QUEBEC
MINNESOTA
Rock Units
Phanerozoic Rocks
Metasedimentay Rocks
Greenstone Belts
Granitic Rocks
Mineral Deposits
Base Metal Deposits
Gold Deposits
Iron Deposits
Adapted from map 900A, 1992 PRINCIPAL MINERAL AREAS OF CANADA


BEDROCK GEOLOGY
OF MINNESOTA
University of Minnesota
Minnesota Geological Survey
1996
CORRELATION
OF MAP UNITS
Cretaceous
Jurassic
Devonian
Ordovician
Cambrian
Keweenawan
Supergroup
Sioux
Quartzite
Animikie
Group
Mille Lacs &
North Range
Groups
MESOZOIC
PALEOZOIC
MIDDLE
PROTEROZOIC
EARLY PROTEROZOIC
ARCHEAN
0
60 mi
0
80 km
DESCRIPTION OF MAP UNITS
Mudstone, siltstone, and some sandstone.
Red shale.
Limestone and dolostone.
Limestone, dolostone, and some sandstone and shale.
Sandstone, shale, and some carbonate.
Shale and arkosic sandstone overlain by quartz arenite.
Extrusive rocks of dominantly mafic composition.
Intrusive rocks of dominantly mafic composition.
Quartz arenite.
Steeply dipping fault.
Intrusive rocks of dominantly granitic composition.
Extrusive and hypabyssal rocks of mafic and felsic composition. Includes volcaniclastic rocks of felsic composition.
Graywacke, siltstone, and shale.
Iron-formation with a basal quartz arenite.
Quartz arenite and siltstone intercalated with mafic volcanic rocks, carbonaceous shale, and iron-formation.
Intrusive rocks of dominantly tonalitic to quartz monzonitic composition.
Schist- and granite-rich migmatite.
Extrusive rocks of mafic to felsic composition; associated volcanogenic rocks and derivative graywacke.
Quartzofeldspathic gneiss, amphibolite, and other high-grade metamorphic rocks.
Low-angle thrust fault.