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INDUSTRIAL MINERALS: PROBLEM AREAS AND OPPORTUNITIES

R.K. COLLINGS AND P.R.A. ANDREWS

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INDUSTRIAL MINERALS: PROBLEM AREAS AND OPPORTUNITIES

by

R.K. Collings* and P.R.A. Andrews**

SYNOPSIS

An industrial minerals task group, established in CANMET in the fall of 1981, recommended that CANMET strengthen its R & D capability in the area of industrial minerals to better assist in the solution of problems peculiar to the industry and, further, that an approach be made to industry and government to more fully identify problem areas and opportunities.

In response to these recommendations, a two-page questionnaire on R & D needs and a covering letter were sent to 160 producers of industrial minerals in Canada. In addition, reviews were made of a CANMET paper on mineral processing, of the proceedings from a number of recent federal/provincial seminars on industrial minerals, and of a CANMET/ORF mineral filler symposium. This report summarizes the results of these studies and the appendices provide a list of government contacts and various federal assistance programs.

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PROBLÈMES ET ASPECTS FAVORABLES DES MINÉRAUX INDUSTRIELS

par

R.K. Collings* et P.R.A. Andrews**

RÉSUMÉ

Un groupe de recherche sur les minéraux industriels, établi au CANMET à l'automne de 1981, a recommandé que la Direction procède au renforcement de ses possibilités de R & D dans le domaine des minéraux industriels, afin de pouvoir mieux contribuer à la découverte de solutions aux problèmes propres à l'industrie. Ce groupe de recherche a également suggéré de demander à l'industrie et au gouvernement d'identifier de façon plus complète les problèmes et les aspects favorables des minéraux industriels.

En réponse à ces recommandations, on a envoyé à 160 producteurs de minéraux industriels au Canada un questionnaire de deux pages portant sur les besoins de R & D dans ce domaine, accompagné d'une lettre d'introduction. De plus, on a étudié un document du CANMET sur le traitement des minéraux, ainsi que les comptes rendus de divers séminaires fédéraux/provinciaux sur les minéraux industriels, et d'un symposium CANMET/ORF sur les remblayeurs minéraux. Le présent rapport résume les résultats de ces études; on y retrouve en annexe les listes des contacts du gouvernement et de certains programmes fédéraux d'aide à l'industrie.

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INTRODUCTION

In response to increased interest in industrial minerals by industry and provincial and federal governments, a task group was established in CANMET in the fall of 1981 to review and study industrial minerals, particularly with respect to R & D needs and problem areas. It further was charged with recommending a course of action for CANMET for identifying problem areas and initiating research to aid in the solution of problems and in the further development of the industrial minerals industry of Canada.

The task group's main recommendations were as follows:

- That current specific, as well as broader, R & D requirements be determined by contacting various segments of the industrial minerals industry and provincial and federal governments;
- That the identified R & D needs be summarized in an appropriate report to ensure a fuller awareness of problem areas by industry and government;
- That projects directed toward assisting in the solution of identified problems be initiated in CANMET with existing resources;
- That, to better assist in this area, CANMET strengthen its industrial minerals research capabilities and associated mineral processing facilities.

Coincident with the above and effective January 5, 1982, the Non-Metallic Minerals Section of the Mineral Processing Laboratory, CANMET, was assigned full responsibility for industrial mineral studies within CANMET and charged with taking action in the four areas recommended by the task group. This report primarily addresses the first two recommendations. The last two, including a thorough review of identified problem areas to more precisely identify specific areas for R & D by CANMET, are actively being pursued in house, within the limits of available personnel, equipment and a very tight budget.

R & D NEEDS - INFORMATION SOURCES

To update knowledge and awareness of R & D needs of the industrial minerals sector, two specific projects were initiated:

1. A questionnaire and explanatory letter were prepared and forwarded to most producers of industrial minerals in Canada. Copies of these are included in Appendix 1.
2. Reviews were made of a number of reports of recent seminars, meetings and discussion papers of industrial minerals, all concerned with more accurately identifying problem areas specific to the industry and seeking solutions, as follows:

- Background Paper - Mineral Processing, CANMET, September 1982 (1)
- Proceedings of 1st Federal (EMR)/Provincial Industrial Minerals Seminar, Ottawa, November, 1980 (2)
- Proceedings of 2nd Federal (EMR)/Provincial Industrial Minerals Seminar, Ottawa, October, 1982 (3)
- Proceedings of Ontario Ministry of Natural Resources Industrial Minerals Seminar, Ottawa, May 1982 (4)
- Proceedings of CANMET/ORF Mineral Filler Symposium, Toronto, October, 1981 (5)

RESULTS OF SURVEY AND STUDIES

A wide range of information was obtained from the survey and noted reports. This is discussed under each of the identified sources of information. Identified problem areas are categorized in appropriate tabulations.

INDUSTRIAL MINERALS QUESTIONNAIRE

The industrial minerals questionnaire, sent to 160 producers, was regarded as the major source of information on problem areas and R & D requirements of the industry. Although only about 60% of the questionnaires were returned, these were largely from the major producers. Thus the responses were believed to be representative of the industry as a whole. Many were well detailed and most provided significant information on problem areas and R & D requirements of specific segments of the industry.

To aid in categorizing and studying this information, a distinction was made between general and specific problem areas. General areas, summarized in Table 1, are common to more than one mineral; specific areas are those pertaining to individual minerals. Specific problem areas were subdivided into the following nine categories for the purpose of study and discussion:

1. Mineral resource
2. Mining
3. Processing and beneficiation
4. Specifications
5. Product development and modification
6. Markets and marketing
7. Environment, health and safety
8. Waste disposal and recycling
9. Energy

These categories are more fully described in Table 2. Areas in which assistance may be available from Energy, Mines and Resources and from other federal departments also are noted in Table 2. Problems specific to individual minerals, subdivided on the basis of these nine categories, are noted in Tables 3 to 20 and summarized in Table 21. The information in these tables was recorded essentially as received. Information believed to be of a confidential nature was not included.

BACKGROUND PAPER - MINERAL PROCESSING (1)

A background paper, contributed by the Mineral Sciences Laboratories, CANMET, to a mineral technology policy paper for submission to Cabinet in early 1983, included a 10-page summation on industrial minerals. In addition to highlighting problem areas relating to a number of specific minerals, this summation included brief sections on industrial minerals resource base, mineral fillers/extenders/additives, and mineral waste resources. They are given below. Problem areas relating to specific minerals were generally coincident with many of those identified in Tables 3 to 20.

Industrial Minerals Resource Base

Canada continues to import significant quantities of some minerals which, although available from domestic deposits, are not exploited to the degree possible, e.g., phosphate, fluorspar, kaolin, silica. An extensive CANMET R & D program on domestic silica resources is currently in progress (6). This should be followed by equally extensive studies of domestic resources of the other noted industrial minerals. The objective of such studies would be threefold:

- To develop a basic background on Canada's resources of these minerals and the technology required to utilize domestic resources;
- To identify existing or perceived problem areas re supply sources, beneficiation requirements, market opportunities, etc.;
- To undertake the R & D required to aid in ensuring optimum utilization of these minerals in the domestic and foreign market place.

This present study addresses, in particular, the last two objectives.

Mineral Fillers/Extenders/Additives

Developing interest by industry in the use of additive materials to decrease consumption of more costly components in various systems is becoming increasingly evident. Examples include; mica and graphite flakes as fillers in plastics and rubber to decrease consumption of resin and latex, mineral wastes to decrease consumption of

bitumen in asphalt mixes, bentonite and other additives to aid pelletizing of iron ore and fertilizer prills. This wide and diverse usage has pointed to a need to more precisely characterize these materials, to study their precise function, and to improve that function where possible. Surface characteristics, particle size and shape, and size distribution all play important roles. Research in this area is mandatory to ensure a more precise understanding of the interaction of these materials in specific systems. Research by CANMET and others would contribute to the fuller development and utilization of mineral additives and fillers.

Mineral Waste Resources

Canada's diminishing resources of favourably located ore-grade reserves of many minerals - because of depletion, urban encroachment, etc. - is attracting attention to the possible economic use and recovery of minerals and mineral material from our substantial reserves of mineral waste, e.g., waste rock and mill tailings, slags, flue dusts, and chemical sludges. Such wastes are being produced at a rate in excess of 700 Mt annually with less than 0.5% being utilized. These mined and semi-processed mineral materials have been documented in CANMET's Mineral Waste Resources of Canada report series (7-14). CANMET should now embark on a long-term R & D project to examine select wastes in detail and to develop the technology necessary to ensure the reuse of such wastes, thus aiding conservation of our non-renewable energy and mineral resources.

FEDERAL/PROVINCIAL INDUSTRIAL MINERALS SEMINARS (2,3)

The two federal/provincial seminars on industrial minerals did not specifically address problems confronting the industry but rather reported on activities and interests regarding industrial minerals within the respective provinces. Speakers noted specific opportunities for the development of mineral resources and stressed the need for conducting more extensive appraisals and processing and beneficiation studies on some of the more promising deposits. Some of the more important items are noted in Table 21.

INDUSTRIAL MINERALS SEMINAR, ONTARIO MINISTRY OF NATURAL RESOURCES (OMNR) (4)

This seminar featured papers by federal and provincial government officials on mineral policy, geological exploration for industrial minerals, and opportunities in industrial minerals in Ontario. Also presented were papers by industry representatives and consultants on exploration activities and problems relative to the development, processing and marketing of industrial minerals. Specific problem areas were generally coincident with those in Tables 3 to 20. Comments on the papers are noted in Table 21.

CANMET/ORF MINERAL FILLER SYMPOSIUM

This symposium included papers and discussions on most of the commonly used fillers such as asbestos, calcite, clay, mica, nepheline syenite, as well as mineral wastes including asbestos tailings, fly ash, kiln dust, steelmaking waste and silica fume. Papers on several filler-consuming products also were presented including asphalt, paper, plastics and rubber.

The following areas in the mineral filler industry were highlighted as requiring an enlarged R & D effort:

- Energy conservation in mineral processing;
- Physical and chemical beneficiation of minerals;
- Processing of mica (wet and dry grinding, ultrasonics, etc.);
- Recovery and beneficiation of cenospheres from fly ash during primary processing and from dry and wet storage areas;
- Utilization of steelmaking dusts;
- Effect of grinding method and grinding additives (such as surfactants) on the surface characteristics of fillers and on their performance in specific products.

These areas were augmented by more specific information on particular minerals which is briefly summarized and commented on in Table 22.

DISCUSSION

Originally designed to achieve an updating of current problem areas in industrial minerals for later use as a base in developing meaningful R & D projects within CANMET, this project developed into a much broader study. Our review of data supplied by industry identified many problem areas in which assistance could be available from CANMET, as well as from other branches of Energy, Mines and Resources and from other federal and provincial government departments. With the broader picture in mind, various additional mini-studies were made of the several documents noted herein and problems and opportunities for further development of selected minerals are summarized in tabular form for the benefit of both industry and government.

Table 1 highlights problem areas common to many segments of the industrial minerals industry, e.g., productive capacity, market acceptance, expansion, competition, and high operating costs. Although marginal improvements are possible, particularly in the area of markets, to a large degree such improvements will depend on the aggressiveness of the individual companies or corporations. Advice and guidance in some areas, particularly with regard to market expansion, are available from government departments having interest and concerns in such matters. Where barriers in the form of tariffs interfere with the international trade of minerals, presentations by individual companies or groups of companies to the responsible government department could result in a review and eventual revision of restricting tariffs. Little immediate relief is possible in the areas of taxes, labour, and energy costs; however, the four-year, federal National Energy Program on energy conservation in industrial minerals processing, initiated at the close of 1982, should result in energy economies in certain areas, particularly comminution (15).

Tables 3 to 20 list problem areas specific to individual minerals subdivided into the nine categories noted in Table 2. This information is summarized in Table 21. Information and advice regarding such problems are available from provincial and federal government departments having responsibilities in these areas. Assistance also is available in the form of detailed studies and laboratory research on certain aspects of industrial minerals and, financially, through the various government funding agencies and programs noted in Appendix 3.

The federal/provincial seminar proceedings, summarized in Table 22, outline opportunities for the development of minerals in each of the noted provinces or territories and note briefly specific problems. More detailed information is available from the provinces and, to a lesser degree, from the federal government.

Papers presented at the OMNR industrial minerals seminar are briefly commented on in Table 23.

The CANMET/ORF mineral filler symposium proceedings, summarized in Table 24, outline opportunities for further research and development in the complex area of mineral fillers. Additional information is available from the symposium authors and from CANMET and the Ontario Research Foundation.

CONCLUDING COMMENT

This report categorizes and summarizes identified problem areas in the industrial minerals sector and notes where assistance in the form of advice and guidance, specific studies and laboratory research, and funding may be available within federal and provincial government departments. To aid in seeking assistance, contacts in various federal/provincial government agencies are listed in Appendix 2, and current federal assistance programs are outlined in Appendix 3.

The data developed in this study will be considered by CANMET in the development of future R & D projects, particularly in the broad field of industrial mineral processing and beneficiation.

ACKNOWLEDGEMENTS

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TABLES

Table 1 - General problem areas: specific minerals

Problem area	Mineral												
	AGGREGATE	ASBESTOS	BARITE	BENTONITE	CALCITE	CEMENT	GYPSUM	LIME	LIMESTONE	SALT	SILICA	SODIUM SULPHATE	TALC
1. Excess production capacity		X				X							
2. Market acceptance				X									
3. Market expansion													
(a) domestic	X				X				X		X		
(b) foreign	X				X	X			X		X		
4. Market competition													
(a) domestic						X	X	X		X			X
(b) foreign			X	X	X	X	X	X		X	X		X
(c) general	X	X											
5. Costs													
(a) overburden removal							X						
(b) transport		X	X	X	X	X	X	X	X		X		
(c) labour							X			X			
(d) energy		X				X	X	X	X	X		X	
(e) taxes							X		X				

Table 2 - Specific problem areas: subdivision categories

Category	Comment
1. Mineral resource	— Relates to problems concerning the specific resource, e.g., low grade, impurities, need to locate higher grade deposits. Advice and information in some areas are available from EMR, particularly CANMET and the Mineral Policy Sector.
2. Mining	— Relates to problems concerning actual mining, e.g., excessive overburden and its removal, variation in grade of the mineral deposit, increased recovery of ore. Advice and assistance in some areas are available from CANMET, particularly Mining Research Laboratories.
3. Processing and beneficiation	— Relates to problems pertaining to the processing and beneficiation of ores and minerals. Advice and assistance in some areas are available from CANMET, particularly Mineral Sciences Laboratories.
4. Specifications	— Relates to the impurity levels in end products and the requirement, by consumers, of specification materials.
5. Product development and modification	— Relates to the development of new products and the modification of existing products. Advice and assistance are available from Industry, Trade and Commerce. Limited assistance is available from Energy, Mines and Resources.
6. Markets and marketing	— Relates to the development and expansion of markets and to trade and tariffs. Advice and assistance are available from Energy, Mines and Resources, particularly the Mineral Policy Sector, and from Industry, Trade and Commerce.
7. Environment, health and safety	— Relates to problems concerning the environmental effects of mining and mineral processing operations. Advice and assistance are available from Environment Canada, Health and Welfare Canada, and from CANMET.
8. Waste disposal and recycling	— Relates to the disposal of wastes from mining and mineral processing operations. Assistance, especially in the area of recycling, is available from CANMET.
9. Energy	— Relates to energy use and conservation. Advice and assistance are available from Energy, Mines and Resources, especially within the framework of the National Energy Program on conservation of energy in industrial minerals processing.

Table 3 - Asbestos: identified problem areas

Category	Problem area
*1. Mineral resource	- Evaluation of ore in place (grade/resources)
2. Mining	- Improved recovery from open pits by increasing wall slopes - Secondary blasting and hang-ups at draw points
3. Processing and beneficiation	- Improved screening of damp fibre - Improved and more efficient separation of fibre at 75 µm - Separation of mica from asbestos fibre - Development of techniques for filtering and drying fibre without degradation - Improved techniques for characterizing and evaluation of fibre - Development of wet treatment processes for fibre recovery - Improved screening capacity and life of screens by use of rubber-covered screen grids - Tendency of damp fibre to adhere to processing equipment - Improved filtration for asbestos-cement systems
5. Product development and modification	- Development of new uses and products based on asbestos - Development of automatic screen control equipment - Dust control, development of more efficient filters
8. Waste disposal and recycling	- Use of tailings as soil additive and fertilizer
9. Energy	- Energy efficient methods for drying fibre

* Numbers are related to category as set out in Table 2.

Table 4 - Barite: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Beneficiation of eastern Canadian deposits with special regard to separation and removal of quartz, fluorite and siderite - Sink-float beneficiation of barite to 4.2, the relative density required by the oil-well drilling industry - Dry sizing in the 74 to 37 µm range - Removal of impurities, especially silicates, from the ground, 74 to 37 µm product
5. Product development and modification	- Development of alternative uses for barite, e.g., as mineral filler - Production of barium-based chemicals - Substitution characteristics of ilmenite and hematite for barite in high temperature/pressure environments

Table 5 - Bentonite: identified problem areas

Category	Problem area
5. Product development and modification	- Re-evaluation as an air-dropped forest-fire control retardant - (It has been used for this purpose in the past.) - Use as a carrier for sodium selenite - Required developments include a reliable method for analysis of selenium, an acceptable means of introducing selenium into the bentonite carrier, and an acceptable method of measuring the release rate. Sodium selenite is used on grazing land by New Zealand sheep farmers and could be similarly employed in eastern Canada
7. Environment, health and safety	- Use as an absorbent of uranium in the storage of uranium wastes - (What chemical reactions could occur between bentonite and uranium?) - Use as a sealant in the environmental control of wastes, e.g., in landfills, lagoons, tailings dumps, ponds, spillways

Table 6 - Calcite: identified problem areas

Category	Problem area
3. Processing and beneficiation	- The removal of impurities, e.g., iron and magnesium silicates, by colour sorting, magnetic separation, etc., to enable production of higher grade material for fillers, cosmetics, and pharmaceutical applications
5. Product development and modification	- The production of ultra-fine material for the mineral filler market - Study of quality/quantity of finely divided calcite for use as filler/coater by the paper industry - Calcite is used for this purpose in Europe and is finding increased acceptance in North America

Table 7 - Cement: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Improved crushing of raw limestone to produce finer size material as feed to raw milling circuit - Grinding of slag cements
5. Product development and modification	- New applications for portland cement concrete, e.g., precast, fireproofing, special finishes - Use of cement substitutes in concrete, e.g., blast-furnace slag and fly ash - Use of kiln dust in agriculture and as a supplement stock feed - Feasibility of increasing the percentage of limestone interground with portland cement above the current 5%
7. Environment, health and safety	- Control of particulate emissions to meet regulations
9. Energy	- Energy consumption and conservation, especially in the wet process, and in crushing, grinding and calcining - Use of alternative fuels to replace coal, oil, and gas, e.g., woodchips, sawdust, municipal solid waste, and other waste materials

Table 8 - Graphite: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Beneficiation of eastern Ontario graphite ores which can range from 1 to 22% graphite but average about 6% - Milling problems associated with graphite - Production of a wide variety of graphite products to meet consumer demand

Table 9 - Gypsum: identified problem areas

Category	Problem area
1. Mineral resource	- Variation in rock purity; high silicate in some ore causes excessive wear on crushing/grinding machines; high chlorite content causes problems in gypsum board manufacture
3. Processing and beneficiation	- Blasting, crushing, grinding to minimize fines production (minus 10 mm) - Gypsum/anhydrite middling product in heavy media processes - Crushing of gypsum; although the rock is not hard or abrasive it is more difficult to crush than many harder rocks; crusher types, sizes - Study on pelletizing of fines - Process monitoring and control
5. Product development and modification	- Product improvement and development of new products - Reduction of weight of gypsum board - Markets for fines, possibly as soil additive in salt-water flooded area - Feasibility of use of byproduct gypsum from desulphurization and neutralization processes - Reduction of radioactivity of phosphogypsum to permit utilization
8. Waste disposal and recycling	- Recycling of waste gypsum/gypsum board to offset disposal cost
9. Energy	- Energy cost, especially in grinding, calcining, and drying

Table 10 - Limestone: identified problem areas

Category	Problem area
1. Mineral resource	- Rock quality in certain areas necessitates the removal of dolomite and dyke rock during processing to permit improved recovery of product and to extend quarry life
5. Product development and modification	- Control and utilization of dust and sludge from precipitators and collecting systems - Use as a fertilizer in blending systems for soil nutrients to provide optimum mix and release
7. Environment, health and safety	- Use of limestone in SO_2 control

Table 11 - Lime and quicklime: identified problem areas

Category	Problem area
5. Product development and modification	- Development of refractory kiln materials to withstand heat and abrasion during calcining - Development of abrasion-resistant metals or coatings for induction and combustion fans - Use of byproduct gypsum from the lime/limestone flue gas desulphurizing process
7. Environment, health and safety	- Control of sulphur and magnesium contents to maintain quality and satisfy emission standards - Use of lime to control SO_2 emissions - Lake liming to combat acid conditions could be expanded
9. Energy	- Fuel cost and efficiency of kilns could be improved by kiln modification and use of cheaper type of fuel - Improved flame control in rotary kilns to minimize fuel consumption and maximize emission control and product quality; heat reclaimers to reduce fuel consumption - Development of alternative fuels, e.g., waste byproducts, municipal solid waste, pulverized coal, petroleum-coke mixtures

Table 12 - Mica: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Beneficiation, applicability of magnetic separation, gravity separation, leaching, flotation and air classification - Mica grinding and delamination to produce a higher aspect ratio flake for use as reinforcing agent in plastics - Delamination and breakage of ultra-thin flakes in the mixing/dispersion/coupling process - Classification of mica - Feasibility of the recovery of quartz, kyanite, staurolite and associated minerals as coproducts from Ontario mica deposits
5. Product development and modification	- Development of mica coatings to improve compatibility with plastic resins - Reactivity of mica with coupling agents - Dispersion and mixing with resins

Table 13 - Nepheline syenite: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Reduction of Fe_2O_3 in hornblende nepheline syenite - Development of methods of ultra-fine classification, especially in 16 μm range
6. Markets and marketing	- Develop uses and markets for tailings, in particular, biotite in the tailings - Increased use of nepheline syenite in the plastics industry

Table 14 - Phosphate: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Beneficiation studies of Canadian resources - Development of ore-associated, potential byproduct minerals (Ontario deposits), e.g., vermiculite, clay minerals, quartz

Table 15 - Potash: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Development of dry methods for potash recovery, e.g., electrostatic separation - Potash flotation; computer control in flotation circuits - Compaction of potash fines - Recovery of KCl salts by brine evaporation - Development of instruments to analyze for KCl - Loss of potash values to waste salt
5. Product development and modification	- Production of $MgCl_2$ salts from brine
8. Waste disposal and recycling	- Develop uses for waste salt

Table 16 - Salt: identified problem areas

Category	Problem area
2. Mining	- Stability of roof in underground mining
3. Processing and beneficiation	- Excess production of fines during rock salt crushing operations - Improved compaction of fine salt and salt fines - Development of dry separation processes to remove finer sizes of impurities
5. Product development and modification	- Crystal growth studies; the development of larger crystals to replace more costly fused salt, e.g., in water softeners
7. Environment, health and safety	- Reduction of NO_2 generated during blasting operations - Reduction of diesel emissions in underground mining

Table 17 - Silica: identified problem areas

Category	Problem area
1. Mineral resource	- Domestic sources of high purity sand/sandstone for glass manufacturing and foundry applications needed - Domestic sources of high purity quartz/quartzite for silicon metal manufacture needed
3. Processing and beneficiation	- Grinding and classification of sandstone, especially tertiary grinding to achieve more effective reduction of sandstone to natural grain size without grain fracture and overproduction of fines - Beneficiation of sand to glass-sand purity, especially dry beneficiation processes for removal of pyrite and shale - Reduction of iron in silica sand to 0.005% Fe_2O_3 for optical glass - Beneficiation of silica fines to 'chemical' standards - Production of ultra-high purity silica/silicon for silicon chip manufacture - Reduction of quartzite/sandstone to free impurities; removal of impurities followed by agglomeration for specialty, high-purity uses, e.g., silicon production (probably too costly in view of relatively low price for high purity, lump silica) - Excessive wear on crushing and grinding equipment
4. Specifications	- Standardization of specifications for silica in various uses and applications

Table 18 - Sodium sulphate: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Problems relating to the harvesting of sodium sulphate - Soil entrapment in the salt crystal

Note: One respondent reported that problems were peculiar to the industry, were well known and understood, and adequately researched both now and in the past by the Saskatchewan Research Council.

Table 19 - Talc: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Beneficiation: magnetic separation, gravity concentration, leaching, flotation, air classification - Removal of iron, chlorite, and dark mineral particles to upgrade and improve brightness of product - Grinding, particularly wet pebble mill grinding, prior to flotation - Fine grinding and delamination to 90% minus .5 µm for use in filler applications
5. Product development and modification	- Product development, especially as filler in paint, plastics, and paper

Table 20 - Vermiculite: identified problem areas

Category	Problem area
3. Processing and beneficiation	- Evaluate identified Canadian sources of vermiculite to determine quality, grade and feasibility of displacing exports

Table 21 - Summary of information from Tables 3 to 20

Problem area	ASBESTOS	BARITE	BENTONITE	CALCITE	CEMENT	GRAPHITE	GYPSUM	LIMESTONE	LIME/QUICKLIME	MICA	NEPHELINE SYENITE	PHOSPHATE	POTASH	SALT	SILICA	SODIUM SULPHATE	TALC	VERMICULITE
1. Mineral resource																		
Characteristics																		
- hardness/softness							X								X			
- impurity content							X	X										
- handling	X						X											
New resources																		
- requirement						X						X			X			X
- beneficiation studies						X		X				X			X			X
2. Mining																		
Breaking																		
- overproduction of fines							X											
- roof stability														X				
3. Processing and beneficiation																		
Crushing																		
- overproduction of fines							X	X										
- damp material	X	X																
Dry processing/beneficiation		X		X		X	X			X	X		X					
Wet processing/beneficiation													X				X	
Fine grinding		X								X							X	
Beneficiation of finely ground material		X								X	X			X	X		X	
Classification/sizing															X			
Sizing of finely ground material	X	X								X	X							
Byproduct recovery										X		X						
Fines compaction							X						X	X	X			
Chemical treatment for ultra-pure material															X		X	

Table 21 (cont'd)

Problem area	ASBESTOS	BARITE	BENTONITE	CALCITE	CEMENT	GRAPHITE	GYPSUM	LIMESTONE	LIME/QUICKLIME	MICA	NEPHELINE SYENITE	PHOSPHATE	POTASH	SALT	SILICA	SODIUM SULPHATE	TALC	VERMICULITE
4. Specifications		X													X		X	
5. Product development																		
and modification																		
New uses																		
- general	X	X	X	X	X	X	X		X	X	X		X					
- filler		X		X														
- chemical treatment								X										
- fines							X	X										
6. Markets and marketing											X							
7. Environment, health and safety																		
Health hazard	X														X		X	
Dust/emissions control	X				X									X				
SO_2 abatement								X	X									
Soil contamination													X					
8. Waste disposal and recycling																		
Storage													X					
Waste utilization	X										X		X					
Substitute materials					X													
Byproduct gypsum							X		X			X						
9. Energy																		
Crushing/grinding					X													
Drying/calcining	X				X		X											
Fuel costs									X									
Alternative fuels					X				X									

Table 22 - Federal/provincial seminars: opportunities for development

Province	Mineral	Opportunity or comment
Newfoundland	Dolomite	- Deposits suitable for metallurgical use located on the west coast
	Fluorspar	- Significant deposits remain at St. Lawrence
	Limestone	- Deposits suitable for cement manufacture located on the west coast
	Salt	- Large reserves of salt indicated east of St. Georges Bay area
	Silica	- Significant deposits situated at La Scie, Grey River and Fortune
New Brunswick	Feldspar, clay, and shale	- Commercial evaluation required
	Gypsum	- Deposits in the Moncton and Cumberland sub-basins economically important,
	Limestone, dolomite, and silica	- Deposits need to be evaluated to provide industry with alternative sources and government with information to determine where more work is required
Ontario	Chlorite	- A large mass occurs in the Cargill township area (potential use as filler)
	Extenders and fillers	- Potential for development of barite, dolomite, calcium carbonate, kaolin, mica, silica, and talc deposits to serve local markets and for export to the United States
	Graphite	- There is interest in the Algonquin region deposit
	Magnesite	- Huge reserves found in the Timmins area (beneficiation is required to lower the high iron content)
	Phosphate	- Large reserves of carbonatite at Martison lake; rare earths associated with the phosphates; Cargill phosphates contain associated vermiculite
	Silica	- Less reliance on imported sand

ERRATA SHEET FOR CANMET REPORT 83-5E - INDUSTRIAL MINERALS: PROBLEM AREAS AND OPPORTUNITIES

Table 22 - Federal/provincial seminars: opportunities for development

Province	Mineral	Opportunity or comment
Nova Scotia	Barite, fluorite	- Large, potentially commercial deposits occur in Lake Ainslie area, Cape Breton
	Celestite	- Proven reserves identified in Loch Lomond area of Cape Breton
	Clay	- Deposits of low- to heavy-duty refractory clay (PCE 17 to 33) are known
	Limestone, dolomite	- Large reserves of metallurgical- and cement-grade stone occur near Clencoe
	Silica	- A number of deposits with potential for glass sand recovery occur throughout the province
	Zeolites	- Evaluation studies needed for Bay of Fundy occurrences, e.g., North Mountain
Quebec	Chromite	- Inventory of Quebec deposits available from Quebec government
	Dolomite	- Deposit, Harve St. Pierre area, potential source of material for iron ore pelletizing and for ferruginous dolime manufacture for BOF furnace
	Feldspar	- Current interest, Johan Beetz occurrence, north shore of St. Lawrence
	Graphite	- Current interest in Buckingham-Mont Laurier occurrences. Report of magnetic/electro-magnetic survey available from Quebec government
	Granite	- Current expansion of dimension stone industry; many new quarries opened to meet domestic/export markets
	Olivine	- Mont Albert, Gaspé deposit, reportedly second largest known in world
	Phosphate	- Study of Chicoutimi area deposits indicated recovery of concentrate grading 33% P_2O_3
	Silica	- Co-operative study by CANMET/Centre de recherches minérales of a number of deposits is in progress
	Talc	- Inventory of talc deposits available from Quebec government

NOTE: THIS PORTION OF TABLE 22, PAGE 22, SHOULD HAVE BEEN INCLUDED AFTER NEW BRUNSWICK.

Table 22 (cont'd)

Province	Mineral	Opportunity or comment
Manitoba	Chromite	- Deposits found in the Bird River sill area
	Gypsum	- Potential for the building industry
	Limestone	- High calcium limestone deposits known in the Dawson Bay area
	Silica	- Potential for the glass industry
Alberta	Clays and shales	- Resource potential for use in brick, stoneware and related industries
	Phosphate	- Needs to be established as a resource potential and as a possible source of uranium
	Silica	- Less reliance on imported silica sand for the glass industry
Saskatchewan	Kaolinite	- Removal of the locked iron from the crystal structure would be necessary to further beneficiate kaolinite
	Pumicite	- The St. Victor deposit appears to be bentonitic; uses for pumicite include abrasives, asphalt constituent, paint filler, pozzolans; the Duncairn and Rock Glen deposits appear to be the purest
	Silica	- High grade deposits that occur along the Red Deer River near Armit are suitable for the glass industry
British Columbia	Barite	- Less reliance on imported barite
	Fluorite	- Significant tonnages occur in the Quesnel Lake area but only at 12% CaF_2
	Magnesite, talc, and marble	- Potential for development
	Mica	- Mica schist occurs near Valemount
Yukon & Territories	Bentonite	- Large reserves in the area east of the Mackenzie Delta
	Soapstone	- New sources are needed to support Inuit carvings industry

Table 23 - OMNR* industrial minerals seminar: comments on papers

Title/author	Comment
Industrial Mineral Processing J. Kriens, I.M.D. Laboratories Ltd., Toronto	- This paper highlights the need for a strong interface between geology, mineralogy,processing, marketing, and the end user of the products.
Industrial Mineral Opportunities in Ontario D.G. Minnes, Industrial Minerals Section, OMNR, Toronto	- Deposits of many minerals, not now produced in Ontario, are of interest and worthy of further study from the standpoint of future production. These include: refractory clay and kaolin, potash feldspar, fluorspar, limestone, graphite, kyanite, lithium, magnesite, marble, muscovite and phlogophite, phosphate, silica, tremolite and actinolite, vermiculite and stone. OMNR has many active programs designed to encourage evaluation and production of Ontario's industrial mineral resources. Two such programs are BILD, the Board of Industrial Leadership and Development, and OMEP, the Ontario Mineral Exploration Program.
Graphite in Eastern Ontario V.C. Papertzian, OMNR, Tweed	- Past mining has demonstrated a capability for sustained production of high grade flake graphite in Ontario. Market conditions appear appropriate for a Canadian (Ontario) entry, and prices would appear to be most encouraging. A review of the history of graphite production in eastern Ontario is given.
Calcium Carbonate Development in Eastern Ontario G.E. Wood, Steep Rock Iron Mines Ltd., Toronto	- A review of the development of the Tatlock marble deposit near Perth, with particular emphasis on markets and economics.
Talc Occurrences in Eastern Ontario A.F. Young, OMNR, Brockville	- This study concludes that at least seven individual deposits of talc warrant additional work in eastern Ontario; because most talcs must be beneficiated to meet high quality standards, lower quality sources could be utilized to produce an acceptable talc product.

* Ontario Ministry of Natural Resources, Toronto

Table 23 (cont'd)

Title/author	Comment
The Cargill Phosphate Complex D.G. MacKinnon, Sherritt Gordon Mines Ltd., Toronto	- Of the several Cargill-type phosphate deposits in northern Ontario, none offers the same attractive features of location, grade, and stripping ratio as Cargill. Feasibility studies are being updated and will include the possible co-production of vermiculite, kaolin, and quartz sand.
Ontario Muscovite and Its Potential as Mineral Filler P.W. Kingston,	- The occurrence and development with respect to the Kaladar and Clarendon townships deposits are described along with problems inherent in the processing and evaluation of mica, particularly with regard to its potential use as filler in plastics. Specific problems noted included the concentration of mica, delamination, the production of high aspect ratio flake having a value of 100 or greater, separation and sizing of flakes, etc.
Industrial Minerals in the 1980's D.H. Stonehouse, Mineral Policy Sector, EMR, Ottawa	- Regarding the development of natural resources, a major EMR policy paper was brought forward in late 1981 - "Mineral policy - A discussion paper". A study of consumption data and consumer specifications for industrial minerals is planned by the Mineral Policy Sector, EMR.
Industrial Minerals in CANMET R.K. Collings, CANMET, Ottawa	- An updating of the present activities in industrial minerals in CANMET, plus a brief outline of the National Energy Program on energy conservation in industrial minerals.

Table 24 - CANMET/ORF mineral filler symposium: filler minerals and comments

Title/author	Comment
Remarks on Ontario's Mineral Fillers D.G. Minnes, Ontario Ministry of Natural Resources, Toronto	- A study of filler and extender applications for barite, calcite, dolomite, kaolin, mica and talc is being conducted for the Ontario Ministry of Natural Resources. A review of early work at CANMET, particularly magnesia, could be made to augment this study and to determine whether further R & D is required.
Clay and Fillers I.H. Joyce, Ontario Research Foundation, Mississauga	The trend towards more plastic components in automobiles could boost the use of clay as filler in plastics. There is no production of high-purity kaolin in Canada but there are a number of deposits of interest. A review of past work on these occurrences would indicate whether further study is required or justified at this time.
Mica as Fillers M. Fenton, Marietta Resources Limited, New York	- The use of mica as a filler, extender, and reinforcing agent is growing in many areas and especially in plastics. Unfortunately most ground micas have aspect ratios under 30; more finely ground mica with higher aspect ratios are desirable. A study of fine-grinding techniques to increase the aspect ratio could be worthwhile. The use of surfactants to disperse and reduce energy requirement represents a field for further R & D studies.
Mineral Wastes as Potential Mineral Fillers R.K. Collings, CANMET, Ottawa	- A brief study of filler usage and mineral waste occurrences within a 250-km radius of Toronto and Montreal.
Asbestos Mine Tailings as Fillers M. Cossette, University of Sherbrooke, Sherbrooke, Québec	- Tailings contain as much as 40% fine fibre which is potentially recoverable. There are many potential uses for these tailings, some of which are currently being researched.

Table 24 (cont'd)

Title/author	Comment
Cement and Lime Kiln Dusts L. Kraszewski, St. Lawrence Cement Company, Mississauga, and J. Emery, Trow Ltd., Toronto	- Kiln dusts are finding increasing use in the stabilization of sludges. Other potential applications include use as a fertilizer, as a source of chemicals, as a soil conditioner and neutralizer, in aggregate and masonry manufacture, etc. Many applications require further R & D to develop fuller utilization. Cement kiln dust is being utilized in asphalt mixes; with more mix design work, CKD probably could replace 15 to 25% of the bitumen in the mix.
Fly Ash D.B. Oates, D.B.O. Marketing Limited, Mississauga	- Identification of the individual components of fly ash, e.g., carbon, lime, cenospheres, iron, etc., and the development of techniques to separate these could be an area of interest. Potential uses for fly ash are many and most require additional R & D. Use of high-lime fly ash in SO_2 stabilization and for acid effluent neutralization could be worthy of study, and significant energy economics have been reported in using fly ash as a source of silica in cement and brick manufacture.
Silica Fume P.C. Aitcin, University of Sherbrooke Sherbrooke, Québec	- Use of silica fume, a byproduct of silicon/ferro silicon manufacture, in various applications requiring high-purity silica is an attractive alternative to fine grinding natural minerals; however, the extremely fine particle size of about 0.1 µm average renders handling difficult. Agglomeration studies by the University of Sherbrooke were quite successful in producing a more stable product. Further studies in this area could be considered.
Steelmaking Wastes A.A. Schuldt, Stelco Inc, Hamilton	- Many potential uses. Raw dust (iron oxide) contains zinc which prevents its being recycled. R & D in this area would be worthwhile.
Mineral Fillers in Asphalt K. McCallum, Tremco Ltd., Toronto	- Asphaltic compounds of the future will use more mineral filler to counteract increasing prices and shrinking supplies of bitumen. Mica and other minerals are being considered as replacements for asbestos in asphalt. More research is required.

Table 24 (cont'd)

Title/author	Comment
Filler in Plastics R.T. Woodhams, University of Toronto, Toronto	- Recent forecasts predict a sixfold increase in filler usage in plastics by the year 2000. Calcium carbonate and mica are important fillers in plastics. Calcium carbonate may contain excessive silicates or grit and the aspect ratio of mica often falls below the critical value of 30. Research to reduce impurities in calcium carbonate and to increase the aspect ratio of mica is required.
The Role of Mineral Fillers in Pigmented Coatings G.G. Davis, Glidden Company, Toronto	- Three pigment extenders, apart from titanium dioxide are used; calcium carbonate, talc, and clay. These minerals are largely imported. R & D on known Canadian sources is required to develop these deposits for domestic consumption and export.
Fillers in Rubber D.A. MacKillop and M. Myhre, Dunlop Research Centre, Mississauga	- Kaolin, carbon black and fumed silica are important but costly fillers in rubber. As fine grinding techniques for minerals are improved, and lower cost coupling agents are developed, minerals other than the above could be used. Research in these areas is required.
Canadian Waste Exchange Program R.G.W. Laughlin, Ontario Research Foundation, Mississauga	- A brief review of the history and function of this waste exchange service.

APPENDIX I

Energy, Mines and Resources Canada
Research and Technology
Canada Centre for Mineral and Energy Technology,
555 Booth Street
Ottawa, Ontario
K1A 0G1

Énergie, Mines et Ressources Canada
Recherche et technologie
Centre canadien de la technologie des minéraux et de l'énergie,
555, rue Booth,
Ottawa (Ontario)
K1A 0G1

Your file *Votre référence*

Our file *Notre référence*

June , 1982

Dear

CANMET is in the process of strengthening its research and development commitment to the industrial minerals sector of the Canadian mineral industry.

To ensure a fuller awareness of problem areas in the industry and R&D requirements, we solicit your help, asking that you carefully complete and return the attached five questions, particularly noting those areas relative to your own operation(s). Information from this survey will aid in the development of useful R&D projects within CANMET. We have made every effort to make the information sheet both short and to the point.

The aggregate results of this survey will be compiled in a report which will highlight problem areas of the industrial minerals industry and sectors thereof to focus attention on the industry's problems and needs. Problems specific to a particular operation will not, of course, be included. R&D support with regard to specific problems may be available under existing federal government programs, e.g., unsolicited proposals, research contracts, Industry Research Assistance Program (IRAP-NRC), Enterprise Development Program (EDP-IT&C), etc., or through joint CANMET-industry projects.

The success of this survey, to a large degree, will depend on the cooperation of all producers of industrial minerals in Canada. Your assistance is sincerely appreciated. A copy of our report will be sent to you upon completion of this study.

Yours sincerely,

(signed)

W.G. Jeffery
Director-General

Encl.

Canada

QUESTIONNAIRE

Industrial Minerals Information Sheets

Company name _____

Mine/mill location (separate sheet for each location)_____

Principal mineral product(s)_____

Problem areas (please list/describe fully under the following headings)

1. Mining, e.g., are ore reserves adequate, ore quality satisfactory, etc.

2. Processing/beneficiation, e.g., are there specific problems re primary crushing, grinding, sizing (wet/dry), magnetic/electrostatic/gravity separation, leaching, flotation, filtration, mineral impurities, etc.

3. Markets/marketing, e.g., is production adequate and of satisfactory quality to meet market demand; could domestic/export markets be expanded; is there significant competition from domestic/foreign suppliers, etc.

Research and Development

4. R&D needs - please identify and explain specific R&D needs relative to your operation and, if possible and on a confidential basis, related current R&D projects by your company.

5. Industry R&D - note areas or developments relative to the industry as a whole that should receive increased attention now or in the future.

Comments

Signature:_____ Telephone number: _____

Position or Title:_____ Date: _____

Please return to:

Mr. R.K. Collings
Head, Non-Metallic Minerals Section
Mineral Processing Laboratory, CANMET, EMR
405 Rochester Street
Ottawa, Ontario K1A 0G1 Telephone: 613-996-5046

APPENDIX 2

FEDERAL/PROVINCIAL GOVERNMENT CONTACTS - INDUSTRIAL MINERALS SPECIALISTS

Federal Government	Contacts
CANMET, Energy, Mines and Resources, 405 Rochester Street Ottawa, K1A 0G1	George W. Riley, Manager, Mineral Processing Laboratory Telephone 613-996-5619 Ron K. Collings, Head, Non-Metallic Minerals Section Telephone 613-992-8794 Ken E. Bell, Head, Ceramic Section Telephone 613-996-5041 V. Mohan Malhotra, Head, Construction Materials Section, Telephone 613-996-5449 R.M. (Mac) Buchanan, Head, Mineralogy Section Telephone 613-996-8394
Mineral Policy Sector, Energy, Mines and Resources, 580 Booth Street, Ottawa, K1A 0E4	Jean-Yves Tremblay, Director, Industrial Minerals Division Telephone 613-995-9466 George S. Barry Bruce W. Boyd Michael Prud'homme Don S. Stonehouse Helen R. Webster G. Oliver Vagt, Industrial Minerals Division Telephone 613-995-9466
Geological Survey of Canada 601 Booth Street, Ottawa, K1A 0E8	Dave F. Garson, Economic Geology Section Telephone 613-996-3399
Provincial Governments	**Contacts**
Newfoundland	
Department of Mines and Energy, 95 Bonaventure Ave., St. John's, A1C 5T7	Paul L. Dean, Mineral Development Division Telephone 709-737-2769
Nova Scotia	
Department of Mines and Energy, 1690 Hollis Street, Halifax, B3J 2X1	John Fowler Telephone 902-424-6732
New Brunswick	
Department of Natural Resources P.O. Box 6000, Fredericton, E3B 5H1	Donald E. Barnett Telephone 506-453-2206

Provincial Governments	Contacts
Quebec	
Ministère de l'Energie et des Ressources 1620, boul de l'Entente, Québec, G1S 4N6	Conrad Paré Telephone 418-643-7513
Ontario	
Ministry of Natural Resources, Room 4646, Whitney Block, 99 Wellesley Street, West Toronto, M7A 1W3	Sheralyn E. Yundt, Supervisor, Industrial Minerals Telephone 416-965-1172 D. Geoffry Minnes, Telephone 416-965-3128
Ontario Geological Survey, Room 1029, 77 Granville Street, Toronto, M5S 1B3	Max A. Vos Telephone 416-965-4261
Ontario Geological Survey, South Boundary Road, Kemptville, K0G 1J0	Mike A. Klugman Telephone 613-258-3413
Manitoba	
Department of Energy and Mines, Mines Branch, 993 Century Street, Winnipeg, R3H 0W4	B. (Barry) Bannatyne Telephone 204-633-9543 David M. Watson Telephone 204-633-9543
Saskatchewan	
Department of Mineral Resources, 1914 Hamilton Street, Regina, S4P 4V4	Paul Guliov Telephone 306-565-2521
Alberta	
Alberta Research Council, 4445 Calgary Trail South, Edmonton, T6H 5R7	Wylie N. Hamilton Telephone 403-438-0555
British Columbia	
Ministry of Energy, Mines and Petroleum Resources, Mineral Resources Branch, Parliament Bldgs., Victoria, V8V 1X4	Z.D. (Danny) Hora Telephone 604-387-1301

APPENDIX 3

APPENDIX 3

GOVERNMENT ASSISTANCE PROGRAMS

The federal government makes available a wide range of programs and services to assist the development and expansion of the Canadian economy. These are outlined in a publication, ABC - Assistance to Business in Canada, which is available from the Department of Industry, Trade and Commerce, Office of Information and Public Relations, Ottawa, K1A 0H5.

A number of programs and services of particular interest to the industrial minerals sector of the Canadian mineral industry are herewith summarized with sponsoring department and ABC catalogue number, under the following three headings:

1. RESEARCH INNOVATION AND PRODUCT DEVELOPMENT
2. ASSISTANCE TO SPECIFIC SECTORS
3. ADJUSTMENT TO CHANGE

1. SUMMARY: RESEARCH, INNOVATION AND PRODUCT DEVELOPMENT

Program or service and department	Purpose and form of assistance	Catalogue number
(a) Information and Services		
Canadian Institute for Scientific and Technical Information (CISTI), National Research Council, Ottawa, K1A 0R6	- Collects scientific information and makes it available at very little cost for specific requirements; tailored research reports available to individual firms.	B201
Technical Information Service, National Research Council, Ottawa, K1A 0R6	- Provides in-plant technological assistance and information services and in-plant studies and advice.	B202
National Research Council (NRC), Ottawa, K1A 0R6	- Assists and advises business on technological and scientific problems; also provides testing and research facilities; assistance is on request basis for problems in which NRC has expertise.	B204
Energy, Mines and Resources, Ottawa, K1A 0E4,	- Provides information and assistance on mineral and energy resources in Canada; information, advice, guidance, studies, and laboratory investigations.	B317 B318
(b) Financial Support for Industrial Research, Innovation and Product Development		
Enterprise Development Program (EDP), Industry, Trade and Commerce, Ottawa K1A 0H5	- Assists with product development costs, including high-risk innovative projects, proposal preparation, and industrial design; grants of up to 75% of costs.	A302

Program or service and department	Purpose and form of assistance	Catalogue number
(b) (cont'd)		
Industrial Research Assistance Program (IRAP) National Research Council, Ottawa, K1A 0R6	- Aids industrial research in Canada and finances projects with high technological and economic pay off. IRAP supports in-house projects, and projects for smaller companies undertaken in research organizations; pays salaries, involving about 50% of research project costs.	A503
Industrial Energy Research and Development Program (IERD), Industry, Trade and Commerce, Ottawa, K1A 0H5	- Encourages research on products and processes which reduce energy consumption; grants of up to 50% of project costs.	A504
(c) Government Research and Technology Transfer		
Program for Industry/Laboratory Projects (PILP), National Research Council, Ottawa, K1A 0R5	- Promotes transfer to industry of government research results and development of their commercial potential; financial and other assistance up to full underwriting of company's project/product development costs.	A505
Unsolicited Proposals Program, Supply and Services, Ottawa, K1A 0S6	- Funds research proposals developed independently by private sector that further government research objectives; proposals are reviewed and may be funded initially by DSS for a sponsoring department.	A509
Contracting-out, Supply and Services, Hull, K1A 0S5	- Encourages private sector research for government requirements; DSS manages contracting system and maintains lists of potential contractors.	B114

2. SUMMARY: ASSISTANCE TO SPECIFIC SECTORS

Program or service and department	Purpose and form of assistance	Catalogue number
(a) Manufacturing		
Industrial Development Support, Enterprise Development Program (EDP) Industry, Trade and Commerce, Ottawa, K1A 0H5	- Financial assistance to firms modernizing, adjusting to industrial change, and innovating; loan insurance; grants up to 75%.	A302
Regional Development Incentives Program, Regional Economic Expansion, Ottawa, K1A 0M4	- Financial assistance to firms wishing to locate, modernize or expand in slow-growth areas; grants and loan guarantees.	A401
(b) Energy		
Industry Energy Research and Development Program (IERD), Industry, Trade and Commerce, Ottawa, K1A 0H5	- Research and development to reduce energy consumption; grants of up to 50% of the total estimated cost of approved projects.	A504
Energy Research and Development, National Energy Program, Energy, Mines and Resources, Ottawa, K1A 0E4	- To increase R & D in several areas relating to energy use and conservation; contracts to industry.	A512

Program or service and department	Purpose and form of assistance	Catalogue number
(c) Resource-based Minerals		
Industry Development Support Federal/Provincial Mineral Agreements	- Resource development.	A400 series
Canada Centre for Mineral and Energy Technology (CANMET), Energy, Mines and Resources, Ottawa, K1A 0G1	- Research and development; CANMET responds to industry requests on a cost-recovery basis.	B317
Natural Resources Information, Energy, Mines and Resources, Ottawa, K1A 0E5	- Technical and scientific advice.	B318
National Mineral Inventory, Energy, Mines and Resources, Ottawa, K1A 0E4	- Records available on reserves and significant deposits; information.	B320
Canada Centre for Geoscience Data, Energy, Mines and Resources, Ottawa, K1A 0E4	- Indexing of non-renewable resources in Canada; geoscience information.	B320

3. SUMMARY: ADJUSTING TO CHANGE

Program or service and department	Purpose and form of assistance	Catalogue number
(a) Capital Adjustment		
Enterprise Development Program (EDP), Industry, Trade and Commerce, Ottawa, K1A 0H5	- Lender of last resort, it provides financial assistance packages and insures loans for companies seeking to adjust to changing markets; loan insurance for mergers, working capital or acquisition/construction/conversion of plant and equipment; grants of up to 75% of cost for productivity improvement, innovation, and market feasibility.	A302
Regional Development Incentives Program (RDIP), Regional Economic Expansion, Ottawa, K1A 0M4	- Provides financial assistance to firms establishing, expanding, or modernizing in slow-growth areas; grants, loan guarantees.	A401

OPINION POLL

The opinion of concerned readers may influence the direction of future CANMET research.

We invite your assessment of this report - No._____

Is it useful?	Yes_____	No_____
Is it pertinent to an industry problem?	Yes_____	No_____
Is the subject of high priority?	Yes_____	No_____

Comments_____

_____

_____

Please mail to: CANMET Editor, EMR, 555 Booth Street,
Ottawa, Ontario, K1A 0G1

A complimentary copy of the CANMET REVIEW describing CANMET research activity will be sent on request.

CANMET REPORTS

Recent CANMET reports presently available or soon to be released through Printing and Publishing, Supply and Services, Canada (addresses on inside front cover), or from CANMET Publications Office, 555 Booth Street, Ottawa, Ontario, K1A 0G1:

Les récents rapports de CANMET, qui sont présentement disponibles ou qui le seront bientôt peuvent être obtenus de la direction de l'Imprimerie et de l'Edition, Approvisionnements et Services Canada (adresses au verso de la page couverture), ou du Bureau de vente et distribution de CANMET, 555, rue Booth, Ottawa, Ontario, K1A 0G1:

81-13E MA-2: A certified gold reference ore; H.F. Steger and W.S. Bowman;
Cat. No. M38-13/81-13E, ISBN 0-660-11149-7; Price: $2.50 Canada, $3.00 other countries.

82-1E Silica fume in concrete - preliminary investigation; G.G. Carette and V.M. Malhotra;
Cat. No. M38-13/82-1E, ISBN 0-660-11181-0; Price: $6.50 Canada, $7.80 other countries.

82-2E Impact of excessive aromatics in oil sand syndrudes on production and quality of middle distillate fuels; M.F. Wilson;
Cat. No. M38-13/82-2E, ISBN 0-660-11157-8; Price: $2.75 Canada, $3.30 other countries.

82-4E The chemistry, generation and treatment of thiosalts in milling effluents - A non-critical summary of CANMET investigations 1976-1982; edited and compiled by M. Wasserlauf and J.E. Dutrizac;
Cat. No. M38-13/82-4E, ISBN 0-660-11276-0; Price: $9.00 Canada, $10.80 other countries.

82-6E BL-2a and BL-4a: Certified uranium reference ores; H.F. Steger, W.S. Bowman and G. Zechanowitsch and R. Sutarno;
Cat. No. M38-13/82-6E, ISBN 0-660-11179-9; Price: $4.95 Canada, $5.95 other countries.

82-7E Small-scale continuous selective flotation of a New Brunswick massive sulphide ore; A.I. Stemerowicz, T.F. Berry, R.H. Bredin and G.W. Leigh;
Cat. No. M38-13/82-7E, ISBN 0-660-11247-7; Price: $5.50 Canada, $6.60 other countries.

82-8E Canadian R&D studies of partially briquetted coke oven charges; J.T. Price, J.F. Gransden and W.R. Leeder;
Cat. No. M38-13/82-8E, ISBN 0-660-11217-5; Price: $4.50 Canada, $5.40 other countries.

82-9E CANMET Review 1981-82; Staff of Technology Information Divison;
Cat. No. M38-13/82-9E, ISBN 0-660-11310-4; Price: $5.00 Canada, $6.00 other countries.

82-9F Revue de CANMET 1981-82; Staff of Technology Information Divison;
Cat. No. M38-13/82-9F; ISBN 0-660-91054-3; Price: $5.00 Canada, $6.00 other countries.

82-11E Summaries of CANMET energy research contracts; compiled by T.P. Lanzer;
Cat. No. M38-13/82-11E; ISBN 0-660-11327-9; Price: $6.75 Canada, $8.10 other countries.

82-14E MP-1a: A certified reference ore; H.F. Steger and W.S. Bowman;
Cat. No. M38-13/82-14E; ISBN 0-660-11234-5; Price: $2.50 Canada, $3.00 other countries.

83-3E Certified reference materials; compiled by H.F. Steger;
Cat. No. M38-13/83-3E; ISBN 0-660-11338-4; Price: $5.25 Canada, $6.30 other countries.

83-3F Matériaux de référence; compilé par H.F. Steger;
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