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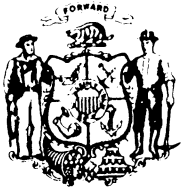
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~~LOWER STACKS~~



State of Wisconsin

DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

BOX 7921
MADISON, WISCONSIN 53707

January 25, 1984

1630 (Exxon)

Dear Interested Citizen:

On December 29, 1983, the Department of Natural Resources (DNR) sent Exxon Minerals Co., the second of several detailed letters reviewing Exxon's Environmental Impact Report (EIR) for their proposed zinc-copper mine near Crandon. Comments in this second letter supplement the first letter sent to Exxon May 11, 1983. The EIR was submitted December 22, 1982, and additional technical information continues to be received and reviewed.

The comments in the second letter are those of DNR staff, other governmental agencies, Indian Tribes, environmental groups and the general public.


Although this is a significant step in the project review, there remain several areas where information is still lacking. DNR and Exxon are working to resolve these issues.

Copies of the second letter will be available for public review at the 13 libraries serving as public repositories for project documents. Individual copies may be obtained by contacting William Tans, (608) 266-3524 or by writing Tans at DNR, Bureau of Environmental Impact, P.O. Box 7921, Madison, Wisconsin 53707.

Also available for public review are a number of reports, prepared by Exxon or their consultants, which provide the technical information upon which the EIR was based. These technical reports have been provided to the 13 library repositories. (See attached list of documents and the 13 libraries.) The DNR will accept public comments on these documents (indicating additional information which should be requested) and will include any appropriate comments in our next letter to Exxon. Any comments should be sent to William Tans by April 2, 1984.

For more information about comments in the review letter and the other documents, contact Robert Ramharter, Project Coordinator at (608) 266-3915 or Terry McKnight, DNR Rhinelander office, (715) 362-7616.

Sincerely,
Bureau of Environmental Impact


Howard S. Druckenmiller
Director

4504Y

cc: Repository Libraries

All of the above documents may be reviewed with other project documents at the following 13 libraries: Antigo Public Library, Vaughn Public Library (Ashland), Crandon Public Library, Brown County Public Library (Green Bay). City and County Library (Ladysmith), Madison Public Library, Milwaukee Public Library, Platteville Public Library, Rhinelander Public Library, Charles M. White Public Library (Stevens Point), Nicolet College Learning Resources Center (Rhinelander) and L.E. Phillips Memorial Library (Eau Claire).

Documents Written by Exxon or Exxon's Consultants Supporting Exxon's
EIR and/or Permit Applications Available at EIR Repositories

- B.C. Research, 1981. Assessment of the Acid-Producing Characteristics of Crandon Hanging Wall Material of Varying Sulfur Content.
- B.C. Research, 1982. Waste Characterization Studies of Typical waste Rocks from the Crandon Mineral Deposit, Project Report No. 2.
- CH2M Hill, Inc., 1982, Phase III water management study - Milwaukee, Wisconsin. Volume 1 - Water Management Study; Volume 2 - Conceptual Design; Volume 3 - Appendices
- Colorado School of Mines Research Institute, 1982. Characterization of Crandon Mill Tailings.
- Dames and Moore, 1977, Investigations of Feasibility of Dewatering and Other Alternatives for Open Pit Mine Options Near Crandon, Wisconsin.
- Dames and Moore, 1977, Results of Geologic, Geotechnical and Hydrologic Investigations of a Portion of the Proposed Exploration Ramp, Crandon Project.
- Dames and Moore, 1977, Site area selection study, mill facilities: Park Ridge Illinois.
- D'Appolonia Consulting Engineers, Inc. 1982. Soil attenuation study. Crandon Project, Crandon, Wisconsin. Volumes I and II. Exxon Minerals Company. Rhinelander, Wisconsin.
- Davy McKee. 1981. Crandon Project pyrite processing study. Phase I - Marketing, Transportation, Process Technology; and Phase II - Economics, capital costs, operating costs, revenues. (2489/03.) Exxon Minerals Company, U.S.A., Houston, Texas. Tampa, Florida.
- Davy McKee. 1981. Crandon Project pyrite processing study. Final Report, Summary and Appendices Exxon Minerals Company, U.S.A., Houston, Texas. Tampa, Florida.
- Ecological Analysts, Inc., July, 1983. Final Report; Water and Sediment Chemistry in Swamp Creek for the Crandon Project.
- Ecological Analysts, Inc., August 1983. Final Report on the Aquatic Biology of Swamp Creek for the Crandon Project.
- Exxon Minerals Company, September 21, 1982. Tailings Pond Seepage Quality History: letter from John Shafer, Houston, Texas to John Wright, Jr. D'Appolonia Consulting Engineers, Inc., Pittsburg, Pennsylvania.
- Exxon Minerals Company, 1982. Use of Natural Clay for the Liner and Reclamation seal. Rhinelander, Wisconsin, Final Revision, by C. C. Schroeder.

- Exxon Minerals Company, 1983. Crandon Project Mine Waste Disposal Facility System 41-114B Construction Aspects, Rev. April 21, 1983, by C. C. Schroeder.
- Exxon Minerals Company, 1983. Operating Aspects and Contingency Plans - Seepage Control System. Rhinelander, Wisconsin. Rev. July 1, 1983 by C.C. Schroeder.
- Exxon Minerals Company, 1983. Tailings Surface Dusting from Wind Erosion. Rhinelander, Wisconsin, by C. C. Schroeder.
- Exxon Minerals Company, 1983. Tailings Ponds Water Clarification Pools, Rhinelander, Wisconsin.
- Exxon Minerals Company - Personal communications. Assortment of correspondence, memoranda and meeting notes regarding asbestiform content of Crandon Ore Surplus.
- Foth & Van Dyke and Associates, 1982. Preliminary engineering mine/mill access road - Crandon Project. Unpublished report prepared for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin. Volumes 1 and 2 plus 8 1/2 by 11 map to Woodlawn, Siding Area to MWDF and 8 1/2 by 11 map of haul road from Mine/Mill site to MWDF, April, 1983.
- Foth & Van Dyke and Associates, 1982. Preliminary engineering mine/mill railroad spur - Crandon Project. Unpublished report prepared for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin. Volumes 1 and 2.
- Golder Associates, 1980. Interim siting report. Crandon Project. Golder Associates. Atlanta, Georgia.
- Golder Associates, 1981. Geotechnical review, Crandon project waste disposal system, Report No. 2. Volumes 1, 2, and 3 plus addendum.
- Golder Associates, 1981. Pump test and analysis, Crandon Project waste disposal system: Golder Associates, Inc., Atlanta, Georgia. Report #4.
- Golder Associates, 1981. Evaluation of prospective common liners. Crandon Project waste disposal system. Project Report 6.2. Golder Associates. Atlanta, Georgia.
- Golder Associates, 1981. Laboratory testing programs. Crandon Project waste disposal system. Project Report 5. Golder Associates. Atlanta, Georgia.
- Golder Associates, 1981. Crandon Project report No. 7, Report on Groundwater Potentiometric contours, Crandon Project Waste Disposal System. Golder Associates, Inc., Atlanta, Georgia.
- Golder Associates, 1981. Excess water discharge, Crandon Project, Atlanta, Georgia.
- Golder Associates, 1982. Geohydrologic site characterization, Exxon Minerals Company, Crandon Project: Report prepared for Exxon Minerals Company, Crandon Project, Golder Associates, Atlanta, Georgia.

- Golder Associates, 1982. Report on underdrain review-Crandon Project waste disposal system. Report No. 3.2. Unpublished report prepared for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin.
- Golder Associates, 1982. Report on miscellaneous details and analyses. Report No. 11. Unpublished report for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin.
- Golder Associates, 1982. Report on tailings pond reclamation cover, Crandon Project waste disposal system. Report No. 10. Unpublished report prepared for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin.
- Golder Associates, 1982. Report on parametric seepage rate estimates. Crandon Project waste disposal system. Project Report 3.1. Golder Associates. Atlanta, Georgia.
- Golder Associates, 1982. Addendum No. 1. Geotechnical review, Crandon Project, waste disposal system. Golder Associates. Atlanta, Georgia.
- Golder Associates, 1982. Report on Groundwater Impact Screening Model. Crandon project waste disposal system. Project Report No. 9. Golder Associates, Atlanta, Georgia.
- Golder Associates, May 3, 1983. Stability Analysis.
- Golder Associates, 1983. Systems development-Crandon project waste disposal system. Report No. 8. Golder Associates Atlanta, Georgia.
- Great Lakes Archeological Research Center, Inc. Archeological Inventory and Evaluation at Exxon Minerals Company, Crandon Project Site in Forest and Langlade Counties, January, 1982.
- Great Lakes Archaeological Research Center, Inc., 1983. Addendum to the Archeological Inventory and Evaluation Report.
- Hazleton Environmental Sciences, 1981. Radiological testing program. Crandon Project. Project No. 8007-100. Hazleton Environmental Sciences. Hazleton Laboratories America, Inc. Northbrook, Illinois.
- INDECO, Inc., 1982. Construction of waste disposal facilities, Crandon Project. Unpublished report prepared for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin, plus 3 flow sheets for INDECO (drain and liner material, cushion sand production) prepared by Universal Engineering Corporation plus 24" x 36" drawings, waste disposal system, site 41-11B, Erosion Control Phases 1-6, plus 24" x 36" drawings, construction and material volume schedule.
- Inman-Foltz & Associates, Inc., 1979. Mine site access route location study: Minocqua, Wisconsin.
- Interdisciplinary Environmental Planning, Inc., 1982. Supplemental wetlands assessment report, Crandon Project: Report prepared for Exxon Minerals Company, Crandon Project, by Interdisciplinary Environmental Planning, Inc., Wayland, Massachusetts.

- Interdisciplinary Environmental Planning, Inc., December, 1982. Hydrological Balance of Selected Wetlands.
- Knight and Piesold, Ltd., 1982. Tailings storage facility, report on conceptual design. Crandon Project. Exxon Minerals Company. Knight and Piesold, Ltd. Vancouver, British Columbia, Canada.
- Mitchell, R.J., Olsen, R. and Smith, J.D., 1982. Evaluation of surface affects, Crandon Project, Exxon Minerals Company, U.S.A. Unpublished report prepared by John D. Smith Engineering Associates for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin.
- Normandeau Associates, Inc. and Interdisciplinary Environmental Planning, Inc. 1982. Wetlands assessment report. Crandon Project. Volumes: (I) Wetlands assessment reports; (II) Wetlands assessment appendices; (III) Wetlands assessment maps; and (IV) Wetlands assessment inventory reports. Unpublished report prepared for Exxon Minerals Company, Rhinelander, Wisconsin by Normandeau Associates, Inc., Bedford, New Hampshire and Interdisciplinary Environmental Planning, Inc., Wayland, Massachusetts.
- Owen Ayres & Associates, Inc., 1982. Waste disposal facility reclamation cap Crandon Project water balance analysis. Unpublished report prepared for Exxon Minerals Company - Crandon Project, Rhinelander, Wisconsin.
- Pipeline Systems, Inc., August, 1982. Tailings Slurry and Solution Transport Pipeline Systems Conceptual Engineering Study.
- Pricket & Associates, 1982. Groundwater inflow model for the proposed Crandon mine: Report prepared for Exxon Minerals Company, Crandon Project, by Thomas A. Pricket & Associates, Champaign, Illinois.
- Rowe, R.G., 1982. Supergene weathering at the Crandon Deposit: Exxon Minerals Company, (April).
- Steigerwaldt, E.F., 1982. Forest inventory timber appraisal and forest management recommendations on 3,474 acres of the crandon Mine Project. July. Exxon Minerals Company. Edward F. Steigerwaldt and Sons, Consultant Foresters, Inc. Tomahawk, Wisconsin.
- STS Consultants, Ltd., 1982. Soil boring and laboratory test results of Little Sand Lake drilling project for the Exxon Crandon project mine development and location of STS Borings and Test Pits from EIR Appendix 2.2B.
- Tidel, L., September 18, 1982. Letter to James Winnen re: set of 3 plots and 1 table providing data obtained from alkaline leaching studies on samples 2, 3 and 5.
- Research and Planning Consultants, 1983. Forecast of Future Conditions, Socioeconomic Assessment, Crandon Project, and Data Summary.

Correspondence Regarding Exxon's EIR
between Exxon and the Department
Available at the EIR Repositories

DNR's May 11, 1983 initial review comments on Exxon's EIR

Exxon's response to DNR's initial comments on Chapter 1, including the following attachments:

1. CHAPTER 1.0, COMMENT NO. 39, ATTACHMENT NO. 1 - UTILITY PLOT PLAN
2. CHAPTER 1.0, COMMENT NO. 53, ATTACHMENT NO. 2 - PLOT PLAN FOR MINE/MILL FACILITIES
3. CHAPTER 1.0, COMMENT NO. 56, ATTACHMENT NO. 3 - DUST CONTROL SYSTEM FOR THE PRIMARY CRUSHER AND RELATED ORE HANDLING FACILITIES (5 drawings)
4. CHAPTER 1.0, COMMENT NO. 59, ATTACHMENT NO. 4 - PLOT PLAN FOR MINE/MILL SURFACE FACILITIES
5. CHAPTER 1.0, COMMENT NO. 59, ATTACHMENT NO. 5 - FUEL OIL STORAGE PLAN
6. CHAPTER 1.0, COMMENT NO. 70, ATTACHMENT NO. 6 - REAGENT STORAGE AND MIXING FACILITIES (2 drawings)
7. CHAPTER 1.0, COMMENT NO. 101, ATTACHMENT NO. 7 - GENERAL ARRANGEMENT OF THE ELECTRIC POWER SUBSTATIONS AND COMMUNICATIONS DUCT SYSTEM
8. CHAPTER 1.0, COMMENT NO. 109, ATTACHMENT NO. 8 - PRELIMINARY DESIGN FEATURES OF THE RECLAIM WATER PONDS, INCLUDING BASIC MATERIAL AND CONSTRUCTION SPECIFICATIONS (4 drawings)
9. CHAPTER 1.0, COMMENT NO. 125, ATTACHMENT NO. 9 - PAVING, GRADING AND DRAINAGE DETAILS IN THE MINE/MILL SITE (3 drawings)
10. CHAPTER 1.0, COMMENT NO. 129, ATTACHMENT NO. 10 - LOGS OF AUGER HOLES ALONG THE ACCESS ROAD AND RAILROAD SPUR. PRELIMINARY PLAN AND PROFILE DRAWINGS FOR THE ACCESS ROAD AND RAILROAD SPUR
11. CHAPTER 1.0, COMMENT NO. 131, ATTACHMENT NO. 11 - PRELIMINARY DESIGNS FOR THE CRANDON PROJECT SHAFT COLLARS (4 drawings)
12. CHAPTER 1.0, COMMENT NO. 139, ATTACHMENT NO. 12 - PROCEDURE FOR IN-SITU PERMEABILITY TESTING OF LANDFILL LINER/SEAL SOIL MATERIAL
13. CHAPTER 1.0, COMMENT NO. 143, ATTACHMENT NO. 13 - EXAMPLE OF PROCESS FLOWSHEETS AND DESCRIPTIONS FOR BATCHING AND MIXING OPERATIONS AND TYPE OF EQUIPMENT USED
14. CHAPTER 1.0, COMMENT NO. 145, ATTACHMENT NO. 14 - MINE WASTE DISPOSAL SYSTEM EROSION CONTROL - PHASES 1-6 (6 drawings)
15. CHAPTER 1.0, COMMENT NO. 176, ATTACHMENT NO. 15 - FINE ORE CRUSHING AND STORAGE CRUSHING AND SCREENING GENERAL ARRANGEMENT PLAN AND SECTIONS

Correspondence available at EIR Repositories, cont.

16. CHAPTER 1.0, COMMENT NO. 179, ATTACHMENT NO. 16 - PROCESS FLOW DIAGRAM ILLUSTRATING THE METHOD OF STORING AND HANDLING CYCLONED SANDS FOR MINE BACKFILL

Exxon's response to DNR's initial comments on Chapters 2 and 3, including the following attachments:

1. Chapter 2, Comment Number 1, Attachment Number 1 (a map delineating the areas that Exxon has mapped at varying scales)
2. Chapter 2, Comment Number 18, Attachment Number 2, Glacial Testing
3. Appendices Comment Number A19, Attachment A3, Benthic Macroinvertebrate Data
4. Appendices Comment Number 21, Attachment A4, Fish Length Frequency
5. Appendices Comment Number A1, Attachment A1, Grounwater Elevations List Computer Printout
6. Appendices Comment Number A4, Attachment A2, Water Quality Data, Duck Lake (a letter transmitted from Dames and Moore to Exxon regarding field and laboratory analysis of water samples from Duck Lake and adjacent areas)
7. Chapter 2 Comment Number 24, Attachment 3 (a letter from Skyline Labs, Inc., to Exxon outlining the procedures for handling and analyses of geologic samples)

DNR September 19 and October 10, 1983 review letter on Exxon's Mining Permit Application.

DNR October 28, 1983 review letter on Exxon's Wisconsin Pollution Discharge Elimination System (WPDES) Permit Application.

Exxon's November 11 response to DNR's October 11, 1983 Mining Permit Application comments.

Exxon's December 11, 1983 response to DNR's October 28, 1983 WPDES comments.

DNR's December 29, 1983 letter containing additional comments on Exxon's EIR.

Local Materials Collection
June 30, 1984

Status Report of
Department of Natural Resources Activities on the
Proposed Exxon Mine near Crandon, Wisconsin

June 30, 1984

Introduction and Statement of Purpose

In 1976, Exxon Minerals Company announced the discovery of an ore body near Crandon, Wisconsin containing significant amounts of zinc, copper, and lead ores. Following their announcement, Exxon conducted additional planning and technical investigations into the feasibility of mining the deposit and potential consequences to the local and regional environments. In December 1982 Exxon submitted to the Department of Natural Resources a mining permit application and other key permit applications, along with its environmental impact report, as required by law. In doing so, Exxon confirmed its intentions to pursue a permit to mine the mineral deposit and triggered the formal state agency review and environmental impact processes.

Exxon's proposal to mine the ore body is relatively complex. It involves construction, operations, and eventual reclamation and closure periods covering nearly 30 years. An estimated \$550 million would be spent by Exxon for construction of the underground mine, mill complex, and ancillary facilities before ore could be removed commercially; the project would involve an estimated 700 permanent operations workers for the duration of the mine.

Although the environmental impacts of the proposed project have not been fully determined, project development would result in impacts to the natural resources from groundwater drawdown, operations of a waste disposal site for mine tailings, emissions to the air, discharge of treated process water, and access and utility corridors. Socioeconomic impacts would include changes in regional employment, job competition, personal income, local property taxes, housing, and public services. These potentially significant impacts require a thorough analysis of the proposed project. The environmental impact statement on the proposed project will contain these analyses.

Substantial progress has been achieved in evaluating Exxon's environmental impact report and permit applications. The primary objective of this report is to briefly explain the status of these evaluations, identifying both the accomplishments and the areas where additional work is required. This includes a discussion of all significant issues and the approximate timetable for their resolutions.

In this report estimated dates for the completion and/or acceptance of the various permit reviews, Exxon's environmental impact report, and the environmental impact statement are provided. Completion dates are based on

estimates of the time required to obtain additional information from the applicant, resolve new issues which arise, review submitted information as well as write the environmental impact statement. The schedule dates, therefore, are tentative. The Department is making every effort to complete its review and writing responsibilities in as timely a fashion as possible.

Major Permit Requirements

The status report is organized according to the major permits which are required for the development of the Crandon mine. Exxon has applied for five major permits from the Department: solid waste operating license, high capacity well permit, Wisconsin Pollution Discharge Elimination System (WPDES) permit, air quality permit and mining permit. While numerous permits are required from the Department as well as federal, other state agencies, and local units of government, these are the most important permits on the basis of potential impacts to the environment.

1. Solid Waste Plan Approval and Operating License

A solid waste operating license is required for this project, and in addition, a feasibility study and final engineering plans for the proposed disposal facility are required to be reviewed in detail. The solid waste site, known as the mine waste disposal facility (MWDF), would provide permanent storage for waste materials that cannot be returned to the mine. It would encompass about 500 acres and is designed to contain 31 million cubic yards of wastes, chiefly rock in the form of finely ground tailings. The tailings contain significant amounts of sulfide minerals, mainly iron pyrite, which produce, when exposed to air, water, and specialized bacteria, a leachate contaminated with acid, heavy metals and other pollutants. For effective environmental protection, it is imperative to isolate the wastes from the surrounding environment. A low permeability liner with a leachate recovery system is proposed for the base of the MWDF. A similar low permeability final cover is proposed to isolate the MWDF contents from precipitation and the atmosphere. In the long-term, the effectiveness of MWDF final cover is very important, for to the extent that it limits water reaching the tailings, it will also limit leachate generation and contaminant movement. Exxon has indicated they may submit revised proposals for the design of the MWDF liner and final cover. Following receipt of that proposal, the Department will evaluate the capability of the proposed liner and final cover to control leachate generation and examine the potential chemical interactions between the tailings and leachate and the liner materials.

A major concern is the gradual seepage of leachate and associated contaminants through the base and sides of the MWDF. Contaminant movement depends on several factors including the effectiveness of the liner and final cover, whether or not the glacial sediments beneath the MWDF are saturated, porosity and mineralogy of the soil particles, the nature of the contaminant, and the speed and direction of groundwater movement. The Department recognizes that no containment facility is completely water tight. Therefore, the Department is verifying, through reviews and computer modeling, Exxon's predictions of

how contaminants will move away from the MWDF and disperse. In order to verify Exxon's predictions on contaminant movement, the Department has required Exxon to provide additional information on the nature of the glacial deposits and groundwater beneath the MWDF and conduct additional computer analyses of contaminant transport.

An integral function of the MWDF is to isolate the wastes from atmospheric precipitation. Exxon predicts that most rainfall and snow melt will move laterally as runoff to the surrounding landscape rather than penetrate the final cover. The details of how runoff from the MWDF will be handled and where it will flow have not yet been completed by Exxon. Completion of these plans will be required before a construction and operation approval letter can be issued.

DNR review letters on the MWDF Feasibility Report were sent to Exxon on March 11 and November 14, 1983 and April 10, 1984 following Exxon's submittal of the MWDF feasibility report and additional requested information. In its most recent letter, the Department requested greater detail on the construction of the liner and final cover, evaluation of alternative designs, additional provisions for monitoring water quality around the MWDF, and more detail on contingency planning. The timetable for receiving additional requested information and eventual approvability determination is not known, however Exxon has indicated they will expedite the submittal of additional information.

2. High Capacity Well Permit

The ore body near Crandon lies below a thick mantle of glacial deposits including silts, sands and gravels. Portions of the deposits are saturated with groundwater and provide water for local wells and discharge to the surface in the form of springs or as base flow contributions to streams. In order to access the ore body, Exxon must penetrate this glacial aquifer and develop the mine far beneath the glacial deposits in the underlying bedrock. A permit for mine dewatering is required. An additional approval for potable water supply also is required, and Exxon submitted both applications in October 1983.

Pumping for mine dewatering will result in a large cone of depression in the groundwater. The cone of depression will reach its maximum extent several years after underground shaft development begins. Preliminary estimates of the size of the cone of depression indicate that it would extend up to several miles in diameter from the mine. To the extent that surface water features such as lakes, wetlands, and streams are connected to the groundwater table, the resultant cone of depression would cause reduced stream flows, lowered lake levels, and reduced water availability to wetlands and springs. Those surface water features perched above the groundwater table may not be impacted by the drawdown. The Department has requested additional information on the groundwater modeling effort, including a worst-case analysis of the cone of depression and model runs with varying assumptions.

The greater the amount of pumping for mine dewatering, the greater the potential impacts on surface water. Thus, an accurate estimate of the cone of depression is critical when evaluating the impacts of the project. The Department is carefully evaluating the mine inflow estimates developed by Exxon and has required additional computer modeling of these estimates.

In their environmental impact report, Exxon developed an analysis of impacts to the surface water features in the vicinity of the mine. Factors such as soil permeability, soil water storage, groundwater levels, and depth to bedrock, were important inputs to these analyses. In order to verify Exxon's calculations the Department has requested additional information on these critical factors. Exxon is now obtaining data through a series of hydrogeological investigations. These investigations involve drilling and sampling bottom sediments from Duck, Deep Hole, Skunk and Oak Lakes to test the permeability of bottom sediments. Analysis of these sediments will yield estimates of how mine dewatering may impact the water levels of those lakes. Exxon has estimated they will have gathered the required hydrogeological information by the middle of 1984; however, the completeness of their data can only be determined after analysis by Department hydrogeologists.

Drawdown of the groundwater level may impact drinking water wells in the vicinity of the mine. Depending on location, depth, type and other characteristics, certain wells may become dry or require modifications for continued service. In some instances water quality may be adversely affected, although not necessarily initially. For these reasons, the Department has instructed Exxon to conduct a thorough well inventory and a well water sampling program to determine the existing conditions of those wells likely to be impacted.

This inventory of water wells will provide a basis for determining if or when mine dewatering has impacted a given well. This will facilitate replacement of water service, of equal or better quality, by Exxon for those wells impacted by mine dewatering.

3. Wisconsin Pollutant Discharge Elimination System Permit

An integral part of the proposed project is the discharge of excess wastewater from the mine/mill complex and the associated wastewater treatment facility. Most of the wastewater from the tailings ponds and the reclaim ponds is recycled directly back into the mill. A small portion of this water as well as a portion of the contaminated mine water will be treated in the reverse osmosis treatment facility to enhance water quality in the mill circuit. The rest of the contaminated mine water will be treated in the lime precipitation process and then mixed with the uncontaminated mine water before discharge to Swamp Creek. An estimate 2000 gpm (3000 gpm max. flow) of treated contaminated mine water combined with untreated, uncontaminated mine water (intercepted groundwater) is proposed to be discharged through an underground pipeline into Swamp Creek, southwest of Rice Lake. State law (Ch. 147, Stats.) requires a Wisconsin Pollutant Discharge Elimination System (WPDES) Permit be obtained for the proposed discharge. State law (Ch. 144, Stats.)

also requires approval of engineering plans for the proposed wastewater treatment plant.

In December 1982, Exxon submitted the CH₂M Hill Phase III Water Management Study to the Department. This study provides part of the preliminary engineering for the wastewater treatment facility. After a thorough review, the Department requested that Exxon conduct pilot plant testing of certain treatment processes. This work will help verify whether the proposed lime precipitation treatment could achieve the desired effluent quality required prior to discharge. The information would also be useful in writing those sections of draft EIS pertaining to the wastewater treatment system, and would aid the Department in its review of engineering plans and specification under sec. 144.04, Stats. Exxon has initiated some pilot plant testing studies but additional work may be necessary. Formal comprehensive preliminary engineering plans have not yet been submitted.

In September 1983, Exxon submitted their WPDES permit application to the Department. The Department reviewed the application for completeness and is currently drafting portions of the permit. Effluent limitations will come from two sources. The U.S. Environmental Protection Agency has promulgated categorical effluent limits for cadmium, mercury, zinc, copper, total suspended solids (TSS) and pH for mine/mill complexes such as that proposed at Crandon. The second source will be water quality criteria proposed by DNR's Bureau of Water Resources Management in April, 1984 for the effluent as per ch. 144, Stats. These criteria are specific to Swamp Creek and ensure the protection of fish and aquatic life as well as the continued recreational use of Swamp Creek. As a result of the Department's stream classification for Swamp Creek, the criteria and resultant effluent limits will protect all aquatic organisms in the creek (the entire aquatic food chain). Criteria and water quality based effluent limits for arsenic, barium, cadmium, fluoride, lead, mercury, selenium, silver, copper, iron, zinc, chromium, cyanide, pH, total dissolved solids and biochemical oxygen demand (BOD) were developed by the DNR.

4. Air Quality Permit

Operation of the proposed Exxon Crandon Mine requires a permit for air emissions from the Department. A number of pollutants (e.g., particulates, sulfur dioxide, carbon monoxide, etc.) will be released during mining operations. The estimated air emissions for each pollutant are less than 250 tons per year, thus the project is exempt from federal prevention of significant deterioration regulations. This also means that the project would be classified as a minor source under Wisconsin regulations.

Exxon and Department personnel have recently completed discussions on needed changes in the air quality permit application and air impact analyses to be prepared by Exxon. A number of changes were made to air pollutant emissions and impact calculations based on Exxon's air pollution control changes and the Department's review comments on impact assumptions and air pollution calculations. As per the discussions Exxon is revising their air modeling

computer analyses and will submit revised model runs of projected maximum daily and average annual air quality impacts for particulates and other key air pollutants. Following review and approval by the Department of the air modeling results, Exxon will revise their air permit application for resubmittal to the Department.

An additional subject to be addressed by Exxon involves further testing of the tailings for asbestiform mineralization. Asbestos fibers are a known health hazard, and while they have not been detected in the ore body waste rock, the Department has requested additional testing by Exxon for confirmation.

It is anticipated that following asbestiform mineralization testing and revision of their air permit application, Exxon will have submitted all the required information to the Department for the air permit. If the information received is acceptable, the Department should be able to make a preliminary determination of the approvability of the application by late 1984. Actual approval can only occur after the Master Hearing.

5. Mining Permit

One requirement of the state mining law is that a mining permit be issued by the Department of Natural Resources prior to the operation of a mine. Before granting the permit, the Department must examine all pertinent aspects of the mining proposal, including review of mining plans and processes, construction and operations aspects, economic impacts to the region, and reclamation and closure plans. In addition, to determine compliance with the detailed requirements of the statutes and Wisconsin Administrative Code, the Department must: develop quality assurance requirements and data verification procedures; assure that wetlands disturbance would be minimal; review the site selection process for tailings disposal; and approve an environmental monitoring plan. The Department's Mine Reclamation Section in the Bureau of Solid Waste Management is responsible for administering the provisions of the state mining law. Comment letters were sent to Exxon on their mining permit application September 19 and October 20, 1983, and May 25, 1984, and review continues.

Master Hearing

The mine permit process culminates with a contested case hearing referred to as the Master Hearing. At the Master Hearing, testimony is presented on aspects of all DNR-required permits, licenses and approvals and on the contents of the environmental impact statement prepared by the Department of Natural Resources. Any person or agency (e.g., township, city, tribe, individual, or group) whose interest may be adversely affected by the action may become a participant in the Master Hearing. Based on the Master Hearing record, decisions on the permits and possible permit conditions are rendered in addition to a determination of whether the Department has complied with the Wisconsin Environmental Policy Act in preparing the environmental impact statement. Based on the information yet to be submitted by Exxon and the time needed to prepare the environmental impact statement, the Department estimates the Master Hearing could begin in late 1986 or early in 1987. It is possible

this schedule could be advanced with timely resolution of all issues and early submission of all required information.

Review of Exxon's Environmental Impact Report (EIR) and Preparation of DNR's Environmental Impact Statement (EIS)

Exxon submitted the initial portions of their environmental impact report (EIR) in December 1982. The purpose of the environmental impact report was to provide a description of the project, to provide baseline information on the affected environment, to discuss some of the alternatives considered by the applicant in designing the project, and to provide some numerical analyses of impacts. The Department is in the process of reviewing the EIR for adequacy and has solicited and received public comments. When the Department determines that sufficient information is available for its preparation of the environmental impact statement on the project, the EIR is declared to be "adequate."

The Department submitted detailed EIR comment letters to Exxon in May 1983 and December 1983. Exxon has provided detailed responses to both of those EIR comment letters and adequately addressed many of the comments and questions. Additional letters to Exxon commenting on the EIR will be sent as additional information is received and evaluated by the Department. While it is uncertain when the EIR will be finally determined to be "adequate," the current estimate is that this is likely to occur by May 1985.

The Environmental Impact Statement (EIS) is prepared in cooperation with other state agencies but coordinated by the Department of Natural Resources. The EIS includes much of the information in the EIR such as the description of the proposed action and a description of the affected environment. However, the EIS contains independent analyses of the potential positive and negative impacts resulting from the project and an analysis of alternatives and their impacts also. Before the final EIS is prepared, a draft EIS is circulated for public and agency review. The Department is currently preparing the initial portions of the draft EIS on those portions of the project for which adequate information is available. While the exact date of completion of the draft and final EIS are not known, the Department currently anticipates completing the draft EIS in late 1985 or early in 1986 and the final EIS by approximately the middle of 1986. These dates are tentative, and the draft and final EIS will be written in a timely manner as soon as the required information is available from Exxon.

Consultants Retained by The Department of Natural Resources

The proposed Exxon Crandon mine would have potential impacts on a variety of local and regional human and natural environments. Analysis of these potential impacts is especially challenging because of the magnitude and complexity of the project. Therefore, the Department of Natural Resources has retained a number of consultants to help in the analysis of impacts of the project as well as to verify the baseline data and analyses that Exxon has gathered and performed.

The Department has developed contracts with the United States Geological Survey, the Wisconsin Geological and Natural History Survey and a private consultant to aid in reviewing the hydrogeological analyses and impacts of the project. The Department has also asked the United States Geological Survey to review work conducted by Exxon on wetlands. This review includes examining the wetland hydrology model used to calculate wetland impacts, reviewing stream flow characterization including low flow and annual flow calculations, and aiding the Department in the analysis of the impacts of the wastewater discharge to Swamp Creek.

A consultant was hired for soil chemistry analyses, which includes a review of waste characterization studies, the contaminant attenuation capabilities of the glacial material beneath the mine waste disposal facility, and to review leachate testing. The purpose of the leachate testing is to determine the nature of the contaminants likely to be picked up by groundwater as it moves beneath the tailings disposal area.

The Department hired a consultant to review and verify Exxon's work on mine waste by-product marketing, especially sulfur, a component of pyrites in the tailings. In addition, because the project would have noise and vibration impacts on the local area, the Department also contracted with a consultant to review Exxon's environmental impact report and other submittals by Exxon and verify analyses of noise predictions. A socioeconomic consultant has been retained to review the socioeconomic portions of the EIR and to help develop the draft EIS and the final EIS.

These consultants will provide their expertise to the Department on specific subjects and will aid the Department in preparing certain sections of the environmental impact statement. They also will be available to provide testimony on their particular area of expertise at the Master Hearing.

All costs incurred by the Department for preparing the environmental impact statement, including the costs of environmental consultants for the Exxon project, are reimbursed to the general fund (Section 23.40, Stats.) by Exxon.

Socioeconomics

Exxon has conducted socioeconomic studies in the region of the proposed mine. The results of those studies are contained in two major documents, the "Report on Current Conditions" (August 1981) and the "Forecast of Future Conditions" (November 1983), as well as numerous supporting documents and appendices. The report on the current condition in the region provides background information on population, housing, personal income, employment and government and services (e.g., schools, police and fire protection, roads, water supply and wastewater treatment). The "Forecast of Future Conditions" is Exxon's estimate of what changes may occur in the region with the development of the mine and, in contrast, without the mine. The difference between these two sets of estimates are Exxon's predicted socioeconomic impact of mine development.

The Department must arrive at its own estimate of what the potential socioeconomic impacts would be. In doing so, the Department will use portions of the Exxon "Future Conditions Report," as appropriate, but has retained a socioeconomic consultant (Denver Research Institute) to carry the major responsibility for developing the forecasts. This consultant will also review the adequacy of the "Report on Current Conditions."

The socioeconomic portion of the EIS will address the following major areas of significant impacts: economics and business conditions; population, including current residents and newcomers likely to be attracted by the mine; housing and land use; government services; taxes; transportation; and sociocultural concerns, including a discussion of the special impacts likely to be felt by the Native Americans near the mine site.

Verification Activities of the Department

Verification is one of the important functions of the Department in evaluating the adequacy of an Environmental Impact Report (EIR). The Department is required by law to insure that the information included in the EIR is thorough and provides adequate data for assessing the potential impacts of the proposed action on the environment. The need for verification is particularly crucial for a project of the size and complexity of the proposed Exxon mine because of the types of impacts expected and the need to project long-term impacts in some instances.

Information supplied by Exxon in the EIR and permit applications is being verified in two ways. The first relies upon the professional judgement of Department technical staff to determine adequacy. Most of the information has been verified in this fashion. The second requires independent sampling and quality control checks to assure the validity of the data. Various techniques such as independent field surveys, split samples, laboratory and field procedure inspections and the use of independent laboratories have been used. Fisheries, surface water and groundwater quality and quantity, and soil chemistry concerns have required extensive verification work by the Department. In some of these areas, verification activities continue because additional data are being gathered by Exxon.

Although the amount of verification depends on the subject, the overall goal is to assure the accuracy of the data by a representative sample. When the data from Exxon or their consultants have been independently verified, they are then considered to be acceptable for use in the environmental impact statement and for review of permit applications.

Public Input to Department Review of Exxon's Project

Throughout the Exxon project review, it has been the Department's objective to involve the public to the maximum extent practical. By necessity, the information exchange between the Department and the general public must be a two-way exchange. It is the Department's responsibility to explain the permit review and the environmental impact processes in the context of the project

proposed. The permit review and environmental impact process are designed so that members of the general public who may be impacted by the project and who chose to become involved may do so in an effective manner and at the best time. On the other hand, the input of municipalities, Native American tribes, and the potential newcomers is essential in "scoping" the issues, that is, identifying the important as well as unimportant concerns.

To encourage public input into the review process, the Department established a network of 14 public libraries across the state where Exxon's environmental impact report and associated consultant reports are located. In addition, all significant correspondence and publications are routinely sent to the libraries and will continue to be sent throughout the project duration. The public libraries maintained as repositories are the public libraries located in Antigo, Ashland, Crandon, Eau Claire, Green Bay, Hayward, Ladysmith, Madison, Milwaukee, Platteville, Rhinelander (including Nicolet College), Stevens Point, and Wausau. Complete Exxon file information is also available for public use at both the Madison and Rhinelander Department offices. All information in the Department's Exxon files is public information and accessible to anyone during normal working hours.

Within the past year the Department conducted two public meetings in the Crandon area where Department technical staff were present to answer questions on the mining proposal. Periodically, North Central District staff and Madison personnel have met with municipal leaders, local mining impact committees, tribal leaders and individuals to discuss mining issues and their concerns about the project. The Department will continue to hold both official and informal meetings on a periodic basis or as requested in order to maintain an effective project dialogue. Comments from the general public on Exxon's consultant reports were requested, and when the draft environmental impact statement is completed, comments will be requested again.

For further information from the Department contact:

For technical questions:

Rhinelander District Office
(715) 362-7616

Robert Ramharter
Project Coordinator
(608) 266-3915

Citizen participation:

Gen Bancroft
(608) 267-7758

William Tans
(608) 266-3524

4818Y

EXXON MINERALS COMPANY**REFERENCE**

P. O. Box 813, RHINELANDER, WISCONSIN 54501

CRANDON PROJECT

November 9, 1984

Mr. Robert H. Ramharter
Department of Natural Resources
GEF II
P.O. Box 7921
Madison, Wisconsin 53707

Dear Mr. Ramharter:

During the August 14, 1984 DNR/Exxon ground water meeting Dr. Charles Fetter indicated the Towns of Nashville and Lincoln were interested in knowing the approximate location of the 0.33 m (1.0 foot) ground water drawdown contour. IT-D'Appolonia has recently completed this additional work and we are providing you with the information.

Attached Figure 1 depicts the locations of the 1 m (3.3 foot) and 0.33 m (1.0 foot) drawdown contours at Project year 28 for the expected mine inflow value for the middle recharge case (8.5 inches). Project year 28 has been used in EIR Appendix 4.1.A to portray steady-state conditions for mine inflow and ground water drawdown effects. Other study work associated with the preparation of Appendix 4.1.A determined that the drawdown changes were approximately the same for all three (low, middle, and high) recharge cases.

Any use of the location information for the 0.33 m (1.0 foot) drawdown contour should be made with some considered judgment. The presentation in Appendix 4.1.A of the 1.0 m (3.3 foot) drawdown contour as the limit of the zone of influence was made because of consideration of the accuracy of the estimates at the outer limits of the zone of influence. Projecting the 0.33 m (1.0 foot) drawdown is beyond the accuracy of the model parameters and other modeling criteria.

In addition to the question of accuracy for the small drawdown values from the mine inflow, these changes have to be superimposed on a ground water surface that is constantly fluctuating in position from normal influences. Our studies have indicated that the ground water surface normally fluctuates to over 1.0 m (3.3 feet) in the upland areas of the site to smaller values (0.2 m [0.7 feet]) or less

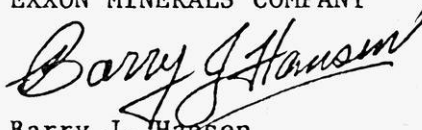
November 9, 1984

in the outer lowland ground water discharge areas. As a practical consideration during operations monitoring, beyond the 1.0 m (3.3 foot) drawdown contour it will become increasingly difficult to distinguish the mine inflow effect from normal ground water fluctuation.

I hope this information will meet your and Dr. Fetter's needs. If you require any additional detail please let me know.

Very truly yours,

EXXON MINERALS COMPANY

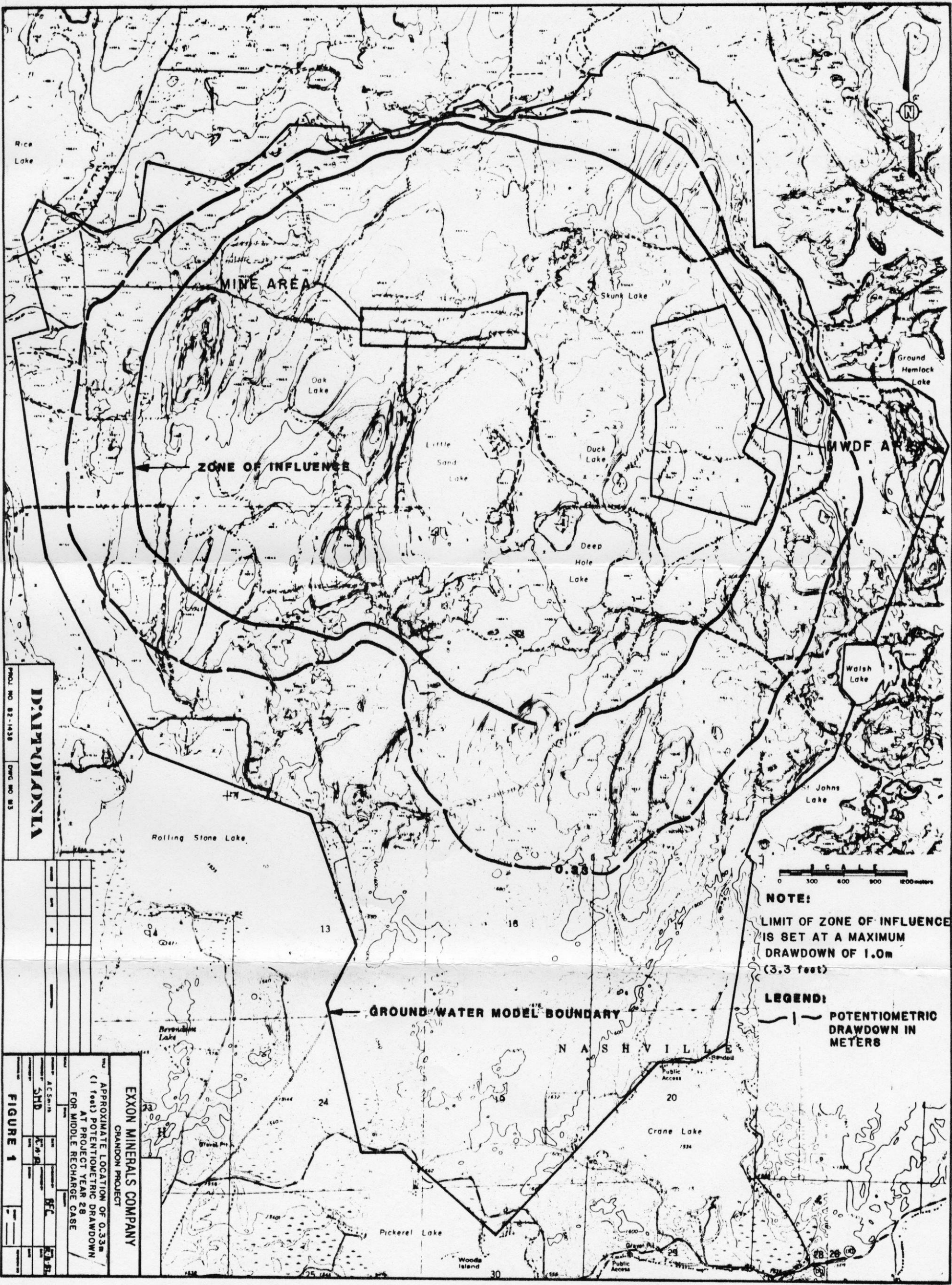


Barry J. Hansen
Permitting Manager

BJH:CCS:sjq

Attachment

xc: w/attachment
T. C. McKnight



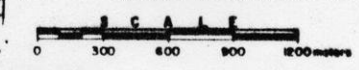
MINE AREA

ZONE OF INFLUENCE

MWDF AREA

GROUND WATER MODEL BOUNDARY

NASHVILLE



NOTE:
 LIMIT OF ZONE OF INFLUENCE
 IS SET AT A MAXIMUM
 DRAWDOWN OF 1.0m
 (3.3 feet)

LEGEND:
 ——— POTENTIOMETRIC
 DRAWDOWN IN
 METERS

PROJ. NO. 82-1438 DMC NO. 83
DIPLOMA

EXXON MINERALS COMPANY
 GRANDON PROJECT
 APPROXIMATE LOCATION OF 0.33m
 (1 foot) POTENTIOMETRIC DRAWDOWN
 AT PROJECT YEAR 28
 FOR MIDDLE RECHARGE CASE

FIGURE 1



State of Wisconsin

DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny
Secretary

BOX 7921
MADISON, WISCONSIN 53707

December 28, 1984

IN REPLY REFER TO: 4400

Mr. Barry J. Hansen, Permitting Manager
Exxon Minerals Company
P.O. Box 813
Rhinelander, WI 54501

Re: Completeness Check and Preliminary Review; Feasibility Report of the
Crandon Project Mine Waste Disposal Facility; Forest County

Dear Mr. Hansen:

The Bureau of Solid Waste Management, Department of Natural Resources, has reviewed the document entitled, "Feasibility Report - Mine Waste Disposal Facility - Exxon Minerals Company" for completeness under NR 182, Wisconsin Administrative Code. The document is dated October, 1984 and was received by the Department on October 17, 1984. Review also included the Reclamation Plan dated November, 1984 excluding, however, those portions of reclamation applicable to the rest of the Exxon Crandon project. Supporting documents listed in the bibliographies of each document were also reviewed. Based on this review, the Department has determined that the Feasibility Report does contain the minimum information required under NR 182.08, Wisconsin Administrative Code, and is complete. Additional information may be required should more detailed technical review by the Department indicate that a site feasibility determination cannot be made without such additional information. This letter is not an approval of site feasibility but does confirm that minimum feasibility report information required by NR 182.08 has been received.

It is our intent to continue the technical review of the MWDF Feasibility Report and supporting documentation. Continued review of the project and interchange with Exxon on design details will be conducted in order to develop a basis for the Department's position at the Master Hearing.

The Department has expressed concerns about several areas of the MWDF design during the last year. Many of the conceptual issues and engineering details which were noted in the letter dated April 10, 1984 on Feasibility Report completeness were addressed in the Feasibility Report dated October, 1984. We would like to use this letter to address some results of more detailed technical review of the October report. It should also be noted that more detailed review of the contaminant modeling documentation may make it necessary for Exxon to provide additional modeling documentation. Accordingly, the following comments address some of our review concerns.

1. The use of bentonite amended soil for liner and final cover seal layers has been better defined by the field visits, technical documentation, and laboratory work conducted by Exxon and Department staff over the last nine months. It had become apparent that the details of application in the historical use of amended soil liner technology had not been well defined in prior projects. Information generated by your staff and consultants and contained in recent technical literature did significantly contribute to our review of this project. The information available is sufficient for Department staff to preliminarily accept amended soil as a legitimate land disposal liner technology for this project. Some of the following points are raised so as to take advantage of ongoing work by your staff and consultants.
 - a. We would like to acknowledge receipt of the report entitled "Laboratory Testing of Tailings", by STS Consultants, Green Bay, Wisconsin, dated June 20 and received December 20, 1984. This document was requested verbally and appears to have information of use in reviewing consolidation of tailings. You may be interested in the contents of a recent ASCE conference proceedings entitled Sedimentation/Consolidation Models: Predictions and Validation, Raymond N. Yong and Frank C. Townsend, editors, October 1, 1984. This document provides comparison data for tailings characteristics and can be obtained from the ASCE Publications Department.
 - b. We understand that a Phase III report is still being prepared on liner testing. This report is a successor to "Laboratory Testing Program Involving Soil/Bentonite Liner Study for Crandon Mine Waste Disposal Facility located in Crandon, Wisconsin", by STS Consultants, Northbrook, IL, dated September 20, 1984. A more extensive write-up of the Phase II data is suggested in order to better define liner quality control measures. We suggest that the upcoming Phase III report address:
 - i. Minimum proposed project soil liner bentonite content.
 - ii. Use of Atterberg limits as quality control tests.
 - iii. Use of an appropriate permeability test for quality control.
 - iv. Discussion of the unusually low permeability test results for non-amended till soil in the Phase II testing.
 - v. Use of the Methylene Blue test or an equivalent test for a rapid field determination of bentonite content.
 - vi. Bentonite quality and indices that can be used for project specifications, such as polymerized versus unamended bentonite, and granular versus powdered gradation.

(Information on this level of detail will also be needed in the future for HDPE membrane definition.) For additional suggestions, see the letter dated August 20, 1984 to Barry Christopher, John Wallace and

Carlton Schroeder. In general, we would like to suggest that emphasis should be put on defining index properties of bentonite/amended soil as well as on defining suitable field permeability tests.

2. The details of the Reclamation Plan dated November, 1984 specific to the disposal site were reviewed by both the Mine Reclamation and the Residuals Management and Land Disposal Sections, since MWDF closure under NR 182 must also be consistent with NR 132. We have some concerns with the plan which we would like to discuss with your staff. We propose that a meeting be held in January, 1985 for this purpose.

One suggestion which we would like to discuss is the use of an early reforestation program for cells 1 and 2 of the MWDF. This may provide a seed dispersion center for the reclamation of the Reclaim Pond area and cells 3 and 4. Staff have also some concerns on the revegetating of the 3:1 sideslopes of the MWDF. This is especially true of those areas with extended slope lengths. It may be possible to take advantage of the soil stored on the sideslopes for use in cell closure. In general, more detailed information is needed on erosion control for both the top and the sideslopes of the MWDF. Methods should be developed to reduce the energy of surface runoff, particularly on longer slope lengths.

We are also concerned about construction methods of placing the protective soil cover over the drain layer on the MWDF. There are factors which may affect both the integrity of the geomembrane below the drain and the suitability of the protective soil cover but which are not made clear in the Reclamation Plan. Some of these include level of compaction, desired soil density, potential for stratification and soil structure development, and use of topsoil or suitable soil amendments. These factors may also affect soil protective cover infiltration, permeability, and runoff and erosion potential.

3. Contracted project reviews have been completed for the Department on waste characterization and soil attenuation and on waste reuse. These are "Review of the Mining and Milling Waste Materials and Interaction of the Tailings Leachate with the Mine Waste Disposal Facility Liner and Subsoils for a Zinc-Copper Mine Proposed by Exxon Corporation near Crandon, Wisconsin" by Dr. Phillip A. Helmke, dated December 7, 1984 and "Review of the Crandon Project Reports submitted by Exxon Minerals Company Assessing Possible Uses for Pyrite Tailings", by Dr. Andres A. Trevino, dated December 21, 1984. These reports are attached for your use and review. (The appendices to Dr. Helmke's report will follow in the near future). These reports will be useful for our technical review and will provide EIS writers with confidence in the data and information developed by Exxon's contractors.

If you wish to discuss the report's contents with Department staff and the contractors, please advise us. As indicated in the meeting held on November 8, 1984, Department staff will use the final reports as the basis for deciding whether and what kind of additional information is needed to complete Department review. Some information may be available from your files and if needed, could be supplied perhaps with a minimum of preparation.

4. As was indicated in the meeting with your staff on September 12, 1984, the contingency plan and monitoring plan are of sufficient detail to be considered complete. We will contact you once it has been determined how the regulatory codes (NR 132 and NR 182) apply to the questions of how the contingency plan should deal with long-term circumstances and of the location of the compliance boundary with regard to the Reclaim Ponds.
5. Our preliminary opinion is that the sodium sulfate salt cake is not amenable to land disposal due to its high solubility. As a worst case, the temporary, covered storage of the salt cake outside of the MWDF should be considered. We recommend that vigorous effort be made to insure the salt cake is of suitable quality for reuse in paper or detergent manufacture. Dr. Trevino's report has a more extensive discussion of the factors that formed this opinion.

Also, we are still concerned about the quality of the sludges to be disposed of in the MWDF. If pilot plant work is not sufficient to address sludge quality and leachability, we suggest use of data from other operating mills.

6. We are concerned about the proposal to use the MWDF active cell as a water storage and surge pond. This may only be possible up to the maximum elevation of the cell liner. While the liner should not be damaged by cell usage to hold moderately contaminated water, it is important that the liner be completed high enough on the cell side slopes to supply needed capacity. This should be a consideration in cell construction schedule.
7. It is not clear to us why the drain pond for the waste rock pad cannot be drained to the Reclaim Pond R-1 during years 1 through 4 of the construction schedule. There seems to be little advantage to having a holding pond of one year's capacity of water for a facility which will be in existence for three years prior to the completion of cell T-1.

We suggest use of large collection basin lysimeters under the waste rock pad. Data from such a lysimeter would be particularly valuable, as both the waste rock pad and the preproduction ore facility are much more likely to produce a contaminated acidic leachate than are the tailings (as is also confirmed by Dr. Helmke's work). This lysimeter data would then be available for three years prior to cell T-1 being put into use and would provide useful feedback to site construction and quality control.

8. We see some additional need for detail in measures taken to extend and protect piezometers, underdrain discharge pipelines, and lysimeter access pipes on the interior embankments of the MWDF. Part of the interior embankments are taken up by the waste rock pad. As presently designed, all of the interior embankments are likely to be covered by several feet of rock and soil during closure work.
9. We suggest that MWDF cell base grades be redesigned to slope to the exterior side of each cell. This should have the effect of directing leachate flow in the drain layer to those sides of each cell where the underdrain discharge pipelines may be more easily maintained after closure of each cell.

We also suggest use of a larger sump for the underdrain discharge pipeline pump location than the sump capacity provided for in the present design. Presently, leachate is proposed to be stored in the low end of the underdrain discharge pipeline and in the collection system. It should be possible to use a rock-filled sump with sufficient void volume to facilitate efficient pump operation.

10. We have some concerns with the routing of surface water on the final cover and of water within the drain layer in the final cover. Water which overflows the seep zone and reaches the exterior of the site is presently designed to surface at the exterior crest of the embankments. Some provisions should be made for a non-eroding channel for surface water discharges on the sideslopes of the embankments. In addition, a greater level of detail is needed regarding methods of routing water off of the reclaimed top of the MWDF and down the embankments.

Several of the Exxon contractor reports have identified soil layers in the MWDF area with a lower permeability than is desirable for efficient water movement through the embankments. Surface silt layers and cemented soil layers need to be eliminated from the base of compacted embankments. This is necessary to assure that water infiltrated into the crest of each embankment continues its vertical travel to the water table rather than being diverted to the embankment exterior toe by a low permeability layer.

11. It is not clear whether the construction support area will be moved to the top of cell 2 prior to or after the seal layer has been installed. A geomembrane liner under the construction support area may face a more demanding environment than that under the vegetated final cover, due to the presence of heavy equipment and vehicle traffic on the cell T-2 surface. We suggest that additional design features on soil protection may be needed in this area to prevent puncture of the membrane.
12. As noted in our April 10, 1984 letter, common features of the MWDF and Reclaim Pond design should be coordinated and reconciled in order to facilitate regulatory review and site construction. Staff of both the Industrial Wastewater and the Residuals Management and Land Disposal Sections are interested in the leak detection system design below the Reclaim Pond membrane liner.
13. The Department will not be able to accept the estimated permeability of the underdrain made through a Hazen approximation. This method is only suitable for well-sorted materials. If you wish to use a design permeability greater than 1.0×10^{-3} cm/sec, the Department recommends that documented laboratory testing of the proposed underdrain materials be submitted.

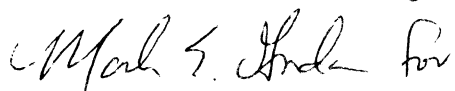
The professional work efforts by your staff and consultants to date have been very helpful in reviewing the details of your project. We believe that it would be advantageous to begin discussions on these items in the near future, particularly if you plan on initiating work on the plan of operation in 1985. However, the meetings between Exxon and Department staff should be scheduled to discuss first the Helmke and Trevino reports and the Reclamation Plan.

Mr. Barry J. Hansen - December 28, 1984

6.


If you have any questions regarding this letter, please call Robert Grefe at (608)266-2178, Ken Wade at (608)267-9387, or Archie Wilson at (715)362-7616.

Sincerely,
Bureau of Solid Waste Management



Richard G. Schuff, P.E., Chief
Residuals Management and Land Disposal Section

APPROVED:


Paul P. Didier, P.E., Director
Bureau of Solid Waste Management

12/28/84
Date

RGS:jms/4921Q

Attachments (Contractor reports only to names marked with *. Reports plus 664 page Appendices A and B to names marked with **.)

cc: Robert Ramharter - EA/3**
Lyman Wible - ADM/5
Gordon Reinke - SW/3**
Mike Witt/Sue Bangert - WW/2*
Robert Krill/Roger Gerhardt - WS/2
Archie Wilson - NCD**
Gary Kulibert - NCD*
Jim Anklam - Antigo**
Chuck Hammer - LEG/5
Chuck Connors - EE/5
James Derouin - Madison
Terry McKnight - NCD
Susan Steingass - Madison*
Don Zuidmulder - Green Bay*
Raymond Huber - Wausau*
Wally Arts - DOJ*
Kevin Lyons - Milwaukee*
Exxon Office - Madison
C.W. Fetter/James Hoffman - Oshkosh*
Systems Mgt. Section - SW/3



State of Wisconsin

DEPARTMENT OF NATURAL RESOURCES

File

Carroll D. Besadny
Secretary

BOX 7921
MADISON, WISCONSIN 53707

April 30, 1985

IN REPLY REFER TO: 4530

Mr. Barry J. Hansen
Permitting Manager
Exxon Minerals Company
P.O. Box 813
Rhineland, Wisconsin 54501

Dear Mr. Hansen:

The Engineering and Surveillance Section, Bureau of Air Management of the Department of Natural Resources has preliminarily reviewed the air pollution control permit application for the proposed underground zinc, copper and lead mine, ore processing mill and associated surface facilities to be located five miles south of Crandon, Wisconsin.

The Section has prepared an analysis of the proposed project and has made a preliminary determination that it is approvable. The analysis and preliminary determination indicate that the following emission limitations and special permit conditions should be included in any permit which may be issued by the Department.

Emission Limitations

1. Construction of the mine and surface facilities

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(2)	See Note 1
Sulfur Dioxide	Sec. 144.394(6), Wis. Stats.	209.6 tons per year*
Nitrogen Oxides	Sec. 144.394(6), Wis. Stats.	18.8 tons per year*
Carbon Monoxide	Sec. 144.394(6), Wis. Stats.	79.8 tons per year*
Hydrocarbons	Sec. 144.394(6), Wis. Stats.	186.7 tons per year*
Hydrogen Sulfide	Sec. 144.394(6), Wis. Stats.	74.2 tons per year*
		0.5 tons per year*

Note 1: Fugitive Dust: No person shall cause, allow, or permit any materials to be handled, transported, or stored without taking precautions to prevent particulate matter from becoming airborne. Nor shall a person allow a structure, a parking lot, or a road to be used, constructed, altered, repaired, sand blasted or demolished without taking such precautions.

(a) Such precautions shall include, but not be limited to:

1. Use, where possible, of water or chemicals for control of dust in the demolition of existing buildings or structures, or construction operations.

2. Application of asphalt, oil, water, suitable chemicals, or plastic covering on dirt roads, material stockpiles, and other surfaces which can create airborne dust, provided such application does not create a hydrocarbon, odor, or water pollution problem.
3. Installation and use of hoods, fans, and air cleaning devices to enclose and vent the areas where dusty materials are handled.
4. Covering or securing of materials likely to become airborne while being moved on public roads, railroads, or navigable waters.
5. Conduct of agricultural practices such as tilling of land or application of fertilizers in such manner as not to create pollution.
6. The paving or maintenance of roadways or parking lots so as not to create air pollution.

*This emission limitation is set in order to document the allocation of the available air resources. It represents the maximum emissions expected during the project construction phase.

2. Underground mine operations venting through the east and west exhaust raises.

For purposes of determining an applicable emission limitation, the underground mine operations are treated as a process. The applicable limitation for a process is either Sec. NR 154.11(3)(a)1.a. based on the process weight rate, or Sec. NR 154.11(3)(b)1.m., Wis. Adm. Code based on the exhaust gas flow rate, whichever is more restrictive. In this case, the former of the two is more restrictive.

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(3)(a)1.a. Sec. 144.394(6), Wis. Stats.	E = 17.31 P ^{0.16} and 27.4 tons per year*
Sulfur Dioxide	Sec. 144.394(6), Wis. Stats.	8.0 pounds per hour, 17.7 tons per year**
Nitrogen Oxides	Sec. 144.394(6), Wis. Stats.	40.9 pounds per hour, 79.2 tons per year**
Carbon Monoxide	Sec. 144.394(6), Wis. Stats.	59.8 pounds per hour, 81.1 tons per year**

*E represents the allowable emission rate in pounds per hour, and P, represents the total weight of materials introduced to the process, excluding liquid and gaseous fuels and air, in tons per hour. In this case, for a maximum process weight rate of 1,213 short tons per hour, (the weight of material brought to the surface by to the hoisting skip), the allowable TSP emission rate is 53.9 pounds per hour. A yearly emission limit of 27.4 tons per year is set in order to document the allocation of available air resources. This is the maximum particulate emissions expected from mine operation.

**These emission limits are set in order to document the allocation of available air resources. These represent the maximum emissions expected from mine operation.

3. Fine ore crushing and screening operations

As this is a process, the applicable limitation is either Sec. NR 154.11(3)(a)1.a., or Sec. NR 154.11(3)(b)1.m., Wis. Adm. Code. In this case, Sec. NR 154.11(3)(b)1.m. - 0.2 pounds per 1000 pounds of exhaust gas - would be more restrictive.

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(3)(b)1.m. Sec. 144.394(3), Wis. Stats.	0.05 grams per dry standard cubic meter*
Visible Emissions	Sec. NR 154.11(6)(a)1.	20% opacity

*This process would normally be subject to the emission limit of Sec. NR 154.11(3)(b)1.m., Wis. Adm. Code of 0.2 pounds per 1000 pounds of exhaust gas (0.24 grams per dry standard cubic meter). However, this process is also subject to the federal New Source Performance Standards (NSPS) for metallic mineral processing plants of 40 CFR Part 60 Subpart LL. In anticipation that these standards will be adopted into Chapter 440, Wis. Adm. Code, the more restrictive NSPS of 0.05 grams per dry standard cubic meter is applied.

4. Fine ore bin loading and unloading operations

As this is a process, the applicable limitation is either Sec. NR 154.11(3)(a)1.a., or Sec. NR 154.11(3)(b)1.m., Wis. Adm. Code. In this case, Sec. NR 154.11(3)(b)1.m. - 0.2 pounds per 1000 pounds of exhaust gas - would be more restrictive.

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(3)(b)1.m. Sec. 144.394(3), Wis. Stats.	0.05 grams per dry standard cubic meter*
Visible Emissions	Sec. NR 154.11(6)(a)1.	20% opacity

*This process would normally be subject to the emission limit of Sec. NR 154.11(3)(b)1.m., Wis. Adm. Code of 0.2 pounds per 1000 pounds of exhaust gas (0.24 grams per dry standard cubic meter). However, this process is also subject to the federal New Source Performance Standards (NSPS) for metallic mineral processing plants of 40 CFR Part 60 Subpart LL. In anticipation that these standards will be adopted into Chapter 440, Wis. Adm. Code, the more restrictive NSPS of 0.05 grams per dry standard cubic meter is applied.

5. Concrete batch plant

As this is a process, the applicable limitation is either Sec. NR 154.11(3)(a)1.a., or Sec. NR 154.11(3)(b)1.i., Wis. Adm. Code. In this case, Sec. NR 154.11(3)(b)1.i. - 0.3 pounds per 1,000 pounds of exhaust gas - would be more restrictive.

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(3)(b)1.i.	0.3 pounds per 1,000 pounds of exhaust gas.
Visible Emissions	Sec. NR 154.11(6)(a)1.	20% opacity

6. Facility heating

This includes all fuel usage for surface facility space heating, water heating and water treatment.

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(4)(a)1.	0.01 pounds per million
	Sec. 144.394(3), Wis. Stats.	BTU heat input*
Sulfur Dioxide	Sec. 144.394(6), Wis. Stats.	0.9 tons per year**
	Sec. 144.394(6), Wis. Stats.	0.10 tons per year**
Nitrogen Oxides	Sec. 144.294(6), Wis. Stats.	10.3 tons per year**
Carbon Monoxide	Sec. 144.394(6), Wis. Stats.	1.5 tons per year**
Hydrocarbons	Sec. 144.394(6), Wis. Stats.	0.3 tons per year**

* This alternate limitation represents the maximum emissions expected. Sec. NR 154.11(4)(a)1., Wis. Adm. Code, allows 0.15 pounds per million BTU heat input.

**These emission limitations are set in order to document the allocation of the available air resource. Yearly emissions are based on a maximum total natural gas usage of 171,032,000 standard cubic feet per year for surface facilities heating.

7. Diesel and Gasoline Storage

This includes diesel and gasoline storage and handling emissions from the two 15,000 gallon diesel fuel oil storage tanks, the 3,000 gallon diesel and gasoline storage tanks at the facility service station, and the mine diesel storage tanks.

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Organic Compounds	Sec. NR 154.13(3)(f)2.	See Note 1
	Sec. 144.394(6), Wis. Stats.	1.56 tons per year*

Note 1: The gasoline storage tank shall be equipped with a permanent submerged fill pipe with a discharge opening which is entirely submerged when the liquid level is 6 inches above the tank bottom.

* This limitation is set in order to document the allocation of the available air resource. Yearly emissions are based on a maximum diesel fuel oil usage of 2.1 million gallons per year, and gasoline usage of 175,000 gallons per year.

8. Emergency diesel generators

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(4)(a)1. Sec. 144.394(6), Wis. Stats.	0.15 lbs/MMBTU heat input 1.8 tons per year*
Sulfur Dioxide	Sec. 144.394(6), Wis. Stats. Sec. 144.394(6), Wis. Stats.	27.7 pounds per hour, 4.9 tons per year*
Nitrogen Oxides	Sec. 144.394(6), Wis. Stats.	230.4 pounds per hour, 40.8 tons per year*
Carbon Monoxide	Sec. 144.394(6), Wis. Stats.	59.9 pounds per hour, 10.6 tons per year*
Hydrocarbons	Sec. 144.394(6), Wis. Stats.	6.5 pounds per hour, 1.1 tons per year*
Visible emissions	Sec. 154.11(6)(a)1.	20% opacity

*These emission limits are set in order to document the allocation of the available air resource. Yearly emissions are based on a maximum diesel fuel usage of 163,365 gallons per year for testing and emergency operation.

9. Surface facilities operation fugitive dust

<u>Pollutant</u>	<u>Applicable Wis. Adm. Code</u>	<u>Limitation/Requirement</u>
Particulates	Sec. NR 154.11(2) Sec. 144.394(6), Wis. Stats.	See Note 1 174.4 tons per year*

Note 1: Fugitive Dust. No person shall cause, allow, or permit any materials to be handled, transported, or stored without taking precautions to prevent particulate matter from becoming airborne. Nor shall a person allow a structure, a parking lot, or a road to be used, constructed, altered, repaired, sand blasted or demolished without taking such precautions.

(a) Such precautions shall include, but not be limited to:

1. Use, where possible, of water or chemicals for control of dust in the demolition of existing buildings or structures, or construction operations.
2. Application of asphalt, oil, water, suitable chemicals, or plastic covering on dirt roads, material stockpiles, and other surfaces which can create airborne dust, provided such application does not create a hydrocarbon, odor, or water pollution problem.
3. Installation and use of hoods, fans, and air cleaning devices to enclose and vent the areas where dusty materials are handled.
4. Covering or securing of materials likely to become airborne while being moved on public roads, railroads, or navigable waters.
5. Conduct of agricultural practices such as tilling of land or application of fertilizers in such manner as not to create pollution.
6. The paving or maintenance of roadways or parking lots so as not to create air pollution.

*This emission limitation is set in order to document the allocation of the available air resources. It represents the maximum emissions expected from access road and in-plant road usage, tailings pond construction activities and waste rock handling operations, or reclamation activities.

Special Permit Conditions

- a. This permit does authorize an initial operation period of 180 days for equipment shake-down, testing and Department evaluation of operation to assure conformity with the permit conditions. Permanent operation of the source(s) covered by this permit after the initial operation period is prohibited until a release has been issued by the Department.
- b. Source performance tests shall be conducted within 90 days after the start of initial operation to prove compliance with the particulate limitations for the underground mine operations, fine ore crushing and screening operations, and fine ore bin loading and unloading operations while operating at 80% or greater capacity and using U.S. EPA tests methods identified in 40 CFR 60 Subpart LL. The Department shall be informed at least 10 working days prior to the tests so a Department representative can witness the testing. At the time of notification, a stack test plan following the provisions set forth in Section NR 154.06(5), Wisconsin Administrative Code, shall also be submitted for approval.

Two copies of the report on the tests shall be submitted to the Department for evaluation within 30 days after the tests or at least 15 working days prior to the expiration of the initial operation period. Release for permanent operation will be issued only upon proof of compliance.

- c. The wet scrubbers used to control particulate emissions from the fine ore crushing and screening operations, and the fine ore bin loading and unloading operations shall be equipped with monitoring devices for pressure drop across the scrubber and scrubbing liquid flow rate as required under the new source performance standards for metallic mineral processing plants (40 CFR 60 Subpart LL). The pressure drop monitoring device must be certified by the manufacturer to be accurate within ± 1 inch water (± 250 pascals) gage pressure and must be calibrated on an annual basis in accordance with manufacturer's instructions. The scrubbing liquid flow rate monitoring device must be certified by the manufacturer to be accurate within $\pm 5\%$ of design scrubbing liquid flow rate and must be calibrated on at least an annual basis in accordance with manufacturer's instructions.

Quarterly reports shall be submitted to the Department of occurrences when the scrubber pressure drop and scrubbing liquid flow rate differ more than $\pm 30\%$ from those measurements recorded during the most recent performance test.

- d. Records shall be kept indicating daily ore and waste rock production rates, and explosive and diesel fuel oil usage rates for the mine. Production rates should be for those materials removed from the mine.
- e. Prior to expiration of the project shakedown period, a malfunction prevention and abatement plan shall be submitted to and approved by the Department. This shall include a specific plan for control of fugitive dust during surface facilities operation.
- f. All open burning of cleared trees and brush shall use air curtain destructors. Burning rates shall not exceed 500 pounds per hour.
- g. Not later than 180 days after initial start-up, no ore processing related fugitive emissions shall exhibit an opacity greater than 10 percent using U.S. EPA Method 9 as required for the NSPS for metallic mineral processing plants (40 CFR 60 Subpart LL).
- h. Diesel fuel oil usage by the mill backup generators shall not exceed 163,365 gallons per year.
- i. Prior to expiration of the project shakedown period, emissions data acceptable to the Department shall be submitted which verifies the emergency diesel generators used for this project comply with the applicable particulate emission limitation.

The Department will now accept public comments on the proposed underground mine project as required by Sections 144.392(9) and 144.835, Wisconsin Statutes. All public input received before and during the mining permit hearing will be used to render a final decision on the issuance of an air pollution control permit. This decision will be made within 90 days after the completion of the public hearing record.

Please be advised that this is only a preliminary determination. Construction and operation of this project cannot commence until an air pollution control permit is received from the Department. If you have any questions regarding this matter, please feel free to contact me at (608) 267-7540.

Sincerely,
Bureau of Air Management



Steven Klafka, Environmental Engineer
Engineering & Surveillance Section

SK:cn

cc: [REDACTED]
M. DeBrock - NCD
D. Theiler - AM/3
R. Herbst - Exxon
W. Arts - DOJ

EXXON MINERALS COMPANY

P. O. Box 813, RHINELANDER, WISCONSIN 54501

CRANDON PROJECT

May 17, 1985

Revised Response To DNR Comment
On The Noise Reports

Mr. Robert H. Ramharter
Department of Natural Resources
Bureau of Environmental Review and Analysis
EAR/3
P. O. Box 7921
Madison, Wisconsin 53707

Dear Mr. Ramharter:

Enclosed are 40 copies of a revised response to one of the DNR's comments on EMC's noise baseline and impact analysis reports. This revised response is for comment No. A28 contained in the response package submitted to you on October 31, 1984.

Alan Haas, Howard, Needles, Tammen and Bergendoff, requested clarification of the example calculations and the figure presented in part 2) Blasting, of the response. The basis for the example calculations and the relationship to the figure are more fully explained in this revised response. The other parts of this response have not been changed.

Howard Lewis of our staff has informed Steve Klafka of this revision and a copy of the revised response is being sent to Messers. Klafka and Haas. One copy of the response is also being transmitted to Terry McKnight at the North Central District office.

Please contact me if you have any questions on this revised response.

Yours truly,

EXXON MINERALS COMPANY


Barry J. Hansen
Permitting Manager

BJH:HSL:ef
Enclosure

xc/w/enclosure: Alan Haas, HNTB
Steve Klafka, DNR
Terry McKnight, DNR

Instantaneous Noises - Noise levels for instantaneous noise sources are not presented; i.e., warning horns, blasting.

Response:

The Project will produce some noises that are instantaneous in nature but not unlike those of any similar mining operation. In fact, the short duration of these noise sources is similar to that of intermittent auto, snowmobile, or airplane noise already present in the site area. Examples of the sources capable of emitting instantaneous noise are provided below:

- 1) Warning Horns - OSHA requirements regulate activities such as blasting. OSHA requires that surface construction blasting be conducted according to 1926.909, Table U-1, which includes the following requirements:
 - a. Warning Signal - A one-minute series of horn's sound five minutes prior to Blast Signal.
 - b. Blast Signal - A series of short horn sounds one minute prior to explosives detonation.
 - c. All Clear Signal - A prolonged horn sound following the inspection of the area for detonation.
- 2) Blasting - Surface blasting is not planned as part of the Project construction phase activities for the development of the facilities such as the mill, main office building and MWDF. However, large boulders may be encountered in the glacial till during construction activities and may have to be reduced in size by blasting. Blasting will be required, however, when bedrock is encountered during shaft sinking.

Sound pressure levels associated with blasting for both of these circumstances will be highly variable and directly related to the geometry of material blasted and quantity of explosives used. They will also occur over a very brief period of mine construction activities. Blasting within the mine will have lower noise levels than what will occur during shaft construction because of their location in the interior of the mine.

Estimated noise levels generated from a confined shaft blast at different depths (plus 4000 m [13200 feet]* from the shaft collar) are presented below based on the following equation**:

$$P = 82 \left(\frac{R}{W^{0.33}} \right)^{-1.2}$$

where P = psi (overpressure)
R = feet (distance)
W = pounds (explosives) per delay

*This distance was selected to represent possible receptors located approximately 4.0 km (2.5 miles) from the shaft blasting.

**Source: duPont Company. 1977. Blaster's handbook. Explosives Products Division, E. I. duPont de Nemours & Co., Inc., Willmington, Delaware.

Example calculations:

- a. For the start of main shaft blasting at the 34-m (110-foot) depth (i.e., the glacial soil [overburden] and bedrock interface), attached Figure 26-H:

$$\text{Overpressure} = P = 82 \left(\frac{110 + 13200}{32^{0.33}} \right)^{-1.2} = 3.64 \times 10^{-3} \text{ psi at 4000 m (13200 feet).}$$

Using the formula from EIR Section 2.8: Sound pressure level

$$(\text{dB}) = 20 \log_{10} \frac{P}{P_0} \text{ (converting the psi value to a unit consistent with the formula).}$$

This overpressure corresponds to a dBL of 122.0, and

Unweighted sound pressure level at 13200 feet	122.0
A-weighting for 20 Hz ^(a)	-50.5 ^(b)
A-weighted result at 13200 feet ^(c)	71.5 dBA.

- b. For the middle of main shaft blasting at a 435-m (1425-foot) depth, from attached Figure 26-H:

$$\text{Overpressure} = P = 82 \left(\frac{1425 + 13200}{32^{0.33}} \right)^{-1.2} = 3.25 \times 10^{-3} \text{ psi at 4000 m (13200 feet).}$$

Using the formula from EIR Section 2.8: Sound pressure level

$$(\text{dB}) = 20 \log_{10} \frac{P}{P_0} \text{ (converting the psi value to a unit consistent with the formula).}$$

This overpressure corresponds to a dBL of 121.0, and

Unweighted sound pressure level at 13200 feet	121.0
A-weighting for 20 Hz ^(a)	-50.5 ^(b)
A-weighted result at 13200 feet ^(c)	70.5 dBA.

- c. For the bottom of main shaft blasting at the 837-m (2745-foot) depth, from attached Figure 26-H:

$$\text{Overpressure} = P = 82 \left(\frac{2745 + 13200}{32^{0.33}} \right)^{-1.2} = 2.93 \times 10^{-3} \text{ psi at 4000 m (13200 feet).}$$

Using the formula from EIR Section 2.8: Sound pressure level

$$(\text{dB}) = 20 \log_{10} \frac{P}{P_0} \quad (\text{converting the psi value to a unit consistent with the formula}).$$

This overpressure corresponds to a dBL of 120.1, and

Unweighted sound pressure level at 13200 feet	120.1
A-weighting for 20 Hz ^(a)	-50.5 ^(b)
A-weighted result at 13200 feet ^(c)	69.6 dBA.

-
- (a) The peak blast frequency is typically observed around 20 Hz (Source: duPont Company. 1977. Blaster's handbook. Explosives Products Division, E.I. duPont de Nemours & Co., Inc., Willmington, Delaware.)
- (b) Source: Beranek, L. L. 1971. Levels, decibels and spectra, in Noise and Vibration Control, edited by L. L. Beranek: McGraw-Hill, Inc., New York.
- (c) Blasting operations will produce short duration, intrusive type noise. Therefore, the L_{eq} (averaged over a 1 second time interval) will be lower than what is presented above.

- 3) Backup Alarms - OSHA Regulations No. 1926.602(a)(9)(ii). No employer shall permit earthmoving or compacting equipment which has an obstructed view to the rear to be used in reverse gear unless one of the following conditions is met: (1) the equipment has in operation a reverse signal alarm distinguishable from the surrounding noise level or (2) an employee signals to the operator that it is safe to move in reverse gear.

Sound pressure levels for excavation equipment range from 80 to 92 dBA and would likely have alarms 5 to 10 dB greater than the A-weighted sound pressure level of the equipment. The exact levels for the construction equipment are not presently available. However, construction and operation excavation activities will likely occur under this category.

- 4) Startup Alarms - Remotely started and stopped equipment may also require alarms. These types of alarms probably will be operated at the minimum noise level consistent with safe operations.

Most alarm devices are high frequency in nature so that maximum benefit can be achieved from atmospheric absorption. This will lessen annoyance to off-site, noise-sensitive locations. Further, the alarm systems on the trucks and other construction phase mobile equipment will be checked to ensure that their sound levels do not exceed the amount required for safety.

(FIGURE 26-H FOR THE RESPONSE TO COMMENT NO. A28)

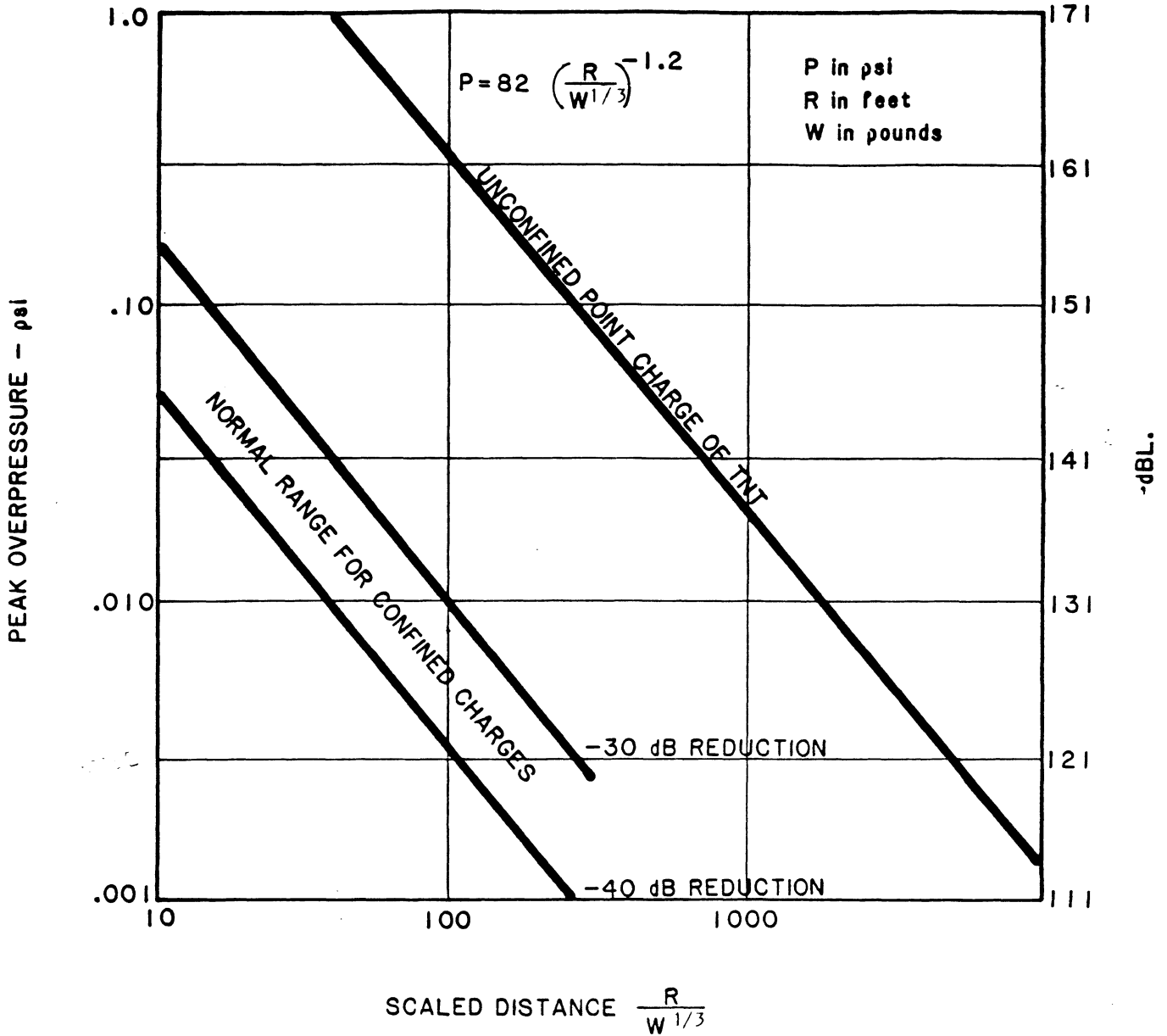


Figure 26-H. Air blast overpressure as a function of distance and charge weight for the unconfined and confined charges. P is expressed in psi, R in feet, and W in pounds.