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FINAL

WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY ON ENERGY DEVELOPMENT

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

STATE OF NORTH DAKOTA

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West-Central North Dakota Regional Environmental Impact Study

Suite 2, Capitol Place
1533 North Twelfth Street
Bismarck, North Dakota 58501

701/224-3144, 701/255-4011 x207, FTS 783-4207

Dear Citizen:

We are pleased to present the Final West-Central North Dakota Regional Environmental Impact Study on Energy Development. This study is one of the most comprehensive sources of information on the implications of coal development within North Dakota, and is also being recognized throughout the nation. Although this study is not a decision document, it provides an excellent baseline from which better planning can be done and against which changing conditions and new information can be measured in the future.

The state and federal team has utilized the comments on the Draft Study, issued in March 1978, to update information and to make changes in the analysis for the Final Study. They have also responded to the public's comments on the Draft Study. Since most of the original material in the Draft Study did not warrant a complete reprinting, the Final Study must therefore be used in conjunction with the Draft Study for a complete display of information and analysis. As a reminder, a sticker is included which should be placed on the cover of your copies of the Draft Study.

This cooperative study has shown that the state and federal government can effectively work together as equal partners for a common product that benefits all.

Sincerely,

Arthur A. Link
Governor
State of North Dakota

Edwin Zaidlicz
State Director
Bureau of Land Management

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REVISIONS TO DRAFT STUDY AND RESPONSE TO PUBLIC COMMENTS

TO BE USED WITH DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY ON ENERGY DEVELOPMENT

Prepared by

BUREAU OF LAND MANAGEMENT

STATE OF NORTH DAKOTA

OCTOBER 1978

CONTENTS

PART 2 - PUBLIC COMMENTS AND SPECIALISTS' RESPONSES

INTRODUCTION

INTRODUCTION

The Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development was prepared in September 1977 and released to the public in March 1978. The public review period (which was extended from 75 to 85 days) ended in June 1978. The large Draft Study was also accompanied by a Summary; and Technical Supplements on economic and social conditions, climate and air quality, land use, and the Fort Berthold Indian Reservation.

Three informational meetings and six formal public hearings were held throughout the seven counties. The comments from letters and testimony transcripts were helpful in identifying parts of the Draft Study that needed correction, clarification, or expansion. As necessary as some of the changes were, most information in the Draft Study is still accurate and complete. Many changes reflect additional research and analysis which modifies or supplements information in the Draft Study, but most of the original material did not warrant a complete reprinting (the notable exception is in Climate and Air Quality, where major changes reflect the Clean Air Act Amendments of 1977 and an expanded discussion of effects on human health, animals, and vegetation).

Therefore, the Final Study includes new information, changes in analysis, corrections, and responses to specific comments. The Final Study must be used in conjunction with the Draft Study for a complete display of information and analysis.

It was impossible to reflect all proposed action and legal changes throughout every aspect of the detailed analysis, especially since some conditions were changing even as the Final Study was being prepared. However, this study is not a decision document, but is a base from which better planning can be done and against which changing conditions and new information can be measured. The study is now being used to identify areas requiring further research for legislative conferences and is being used in hearings on industrial permit applications. It is also expected to be used in reaching state coal leasing decisions, in the state reclamation program (including determining lands unsuitable for coal mining), in state planning activities related to energy development, and in identifying potential coal development and supplies.

This Final Study is divided into two parts. Part 1, "Revisions to Draft Study," is arranged by major subject area (animals, vegetation, social conditions, proposed action, alternatives, etc.). Part 1 includes all changes resulting from public comments or internal reevaluation. Some of these changes are substantial. Part 1 also includes minor technical and editing corrections, clarification, modifications, new information, and revised visuals. Most of what is in Part 1 is also in Part 2 ("Response to Public Comments"), but Part 1 is for the convenience of the reader so that all changes can be found in one place without reading through all comments and responses in Part 2. The extent of changes made in Part 1 is in part an indication of the public concern shown for a particular subject during the review.

Part 2, "Response to Public Comments," is arranged by comment followed by response. Some duplication is caused by letters which accompanied verbal testimony. This duplication was not eliminated because in some cases (1) the written letter was more explicit than the verbal testimony, (2) the letter or testimony included additional information, or (3) the verbal testimony included panel discussion. The 11 repetitious introductions from the public hearings were not eliminated because of the paginated certified transcripts, and because we did not wish to tamper with public comments in any way. Some opinions were not addressed, nor could they be; but wherever possible, answers were given. Also, some of the answers in Part 2 which do not affect the Draft Study are not included in Part 1.

Minor changes on visuals are simply listed. Page size visuals which were reprinted are included in Part 1. Large "overprints" of color Map 2-36, "Endangered Species," Map 2-42, "Recreation Resources," and Map 2-49, "Transmission Systems" are included in the map packet at the back of this Final Study. Map 2-51, "Subsurface Ownership" is being revised by federal and state personnel and will be available at a later date.

Some of the notable changes in Part 1, or clarification in Part 2, as a result of public comments included:

(1) Major reassessment of air quality related to the Clean Air Act Amendments of 1977, and other major additions to the climate and air quality sections.

(2) Economic and population growth in Stark, Billings, and Dunn Counties.

(3) Clarification on state exclusion and avoidance areas for surface mining.

(4) Additional information on surface owner consent.

(5) Trends in surface owner choices of reclamation.

(6) Natural Gas Pipeline Company project status.

(7) Social attitudes research methodology.

(8) Recent oil and gas development in Stark, Dunn, and adjacent counties.

(9) Endangered species.

(10) Mined land reclaimability.

(11) Public health.

The North Dakota Regional Environmental Impact Study is not formally an environmental impact statement (EIS). However, a major objective of the study is to comply with the intent of the National Environmental Policy Act (NEPA) by presenting decisionmakers with information on the cumulative effects of proposals requiring federal and state actions. In addition, the public review program for the study was designed to solicit and evaluate comments from involved publics, including formal public hearings, in conformity with the public review goals of NEPA.

The regional study was not intended to replace the formal state or federal permit or environmental assessment requirements on specific proposals. These will be dealt with on a case-by-case basis or program basis according to individual agency procedures. The regional environmental study should provide useful information for these specific proceedings or EISs and provide decisionmakers with a better understanding of the broad regional implications of coal development.

A revised federal coal management program is currently being developed by the U.S. Department of Interior. This program includes the preparation of a nationwide programmatic environmental impact statement. Formal NEPA compliance regarding the leasing or management of federal coal must be consistent with the requirements of that policy once it is developed and issued. A new regional environmental impact statement is not likely to be needed simply to comply with formal NEPA procedures. Instead, NEPA requirements related to federal coal would most likely build upon the analysis already included in the regional impact study.

PART 1

REVISIONS TO DRAFT STUDY

TO BE USED IN CONJUNCTION WITH DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY ON ENERGY DEVELOPMENT

PROPOSED ACTION

INTRODUCTION

Comments received from several individuals, industries, and government agencies indicated corrections needed for project data. Some comments also requested clarification on transmission line mileage and acreage figures.

Corrections and errors in the text and tables were noted, and where significant numerical differences were found, they were passed on to resource specialists for use in their updates. A review was made of the acreage figures and clarification was given for the numbers and their relationship. The transmission line mileage was rechecked with each company, and the latest figures were shown.

Some individuals, one industry, and one environmental group questioned why the NGPL project was analyzed in Level 1 development. The basis for the projects selected for Level 1 development came from criteria established for each level of development prior to the study, and the fact that NGPL met all of this criteria for Level 1 development is repeated.

One state legislator and several other individuals commented on the need for clarity of the surface owner protection provisions of the state and federal acts. Also, some legal questions were raised on liability. A review was made of the state Surface Owner Protection Act and the surface owner consent provision of the Surface Mining Control and Reclamation Act. A summary now clarifies the concerns raised in the comments. The legal questions were reviewed by the Attorney General's office, but the information was insufficient for an appropriate response. Most of these legal personal questions should be referred to a private attorney.

A comment was received by an individual on the oil and gas development in Dunn and Stark Counties. Additional research on the extent of this development is included.

The "alternatives" chapter was commented on by one environmental group. A review of the alternatives was made based on each comment. Many of the comments appeared to be directed at the national issues and not at regional alternatives. These comments could not be addressed until some of the national programs and policies have been established. It should also be pointed out that the Draft Study does not repeat national alternatives analyzed elsewhere, but instead references them. Other comments appeared to be made after reading only the Summary. References were made to the text of the entire Draft Study.

MODIFICATIONS AND CORRECTIONS

Federal Coal Management Program

A Federal Coal Management Program is currently being developed by the U.S. Department of the Interior. This program includes a draft nationwide programmatic environmental impact statement, which was released for public review and comment December 15, 1978. After completion of the final impact statement, the Secretary of the Interior is expected to make a final decision on whether or not long-term federal leasing will resume and on the structure and operation of the Federal Coal Management Program on or about June 1, 1979.

Synthetic Natural Gas Production

As of June 1978, ANG Coal Gasification Company still planned to construct the project. However, because of the cost of gasification plants and the current financial situation, a consortium has been formed to construct the Great Plains Gasification Project. The group is currently made up of subsidiaries of American Natural Resources Company, Peoples Gas Company, Columbus Gas System, Inc., Tenneco, Inc., and Transco Companies, Inc.

The permits or approvals that were necessary for construction of the gasification projects which have been received (page 8 of the Draft Study) are modified to include:

ANG Coal Gasification Company

a. Mercer County Board of Commissioners - Conditional Use Permit, April 1977.

b. Public Service Commission - Site Compatibility Permit, November 1977.

c. North Dakota State Health Department - Permit to Construct, November 1977.

The ANG Coal Gasification Company project was originally scheduled to begin construction in 1978. This schedule has been delayed, and construction is scheduled for spring 1979.

Electric Power Generation

The two electric power generation plants, Coyote 1 and Antelope Valley, have received all of the permits necessary for construction. The Coyote 1 station started construction in October 1977 and the Antelope Valley Station began in July 1978.

Oil Production: Dunn and Stark Counties

The discovery of oil in Dunn County in 1976 indicated a potential for increased oil production in the area. The field which has shown great promise is the Little Knife field in Dunn, Billings, and McKenzie Counties. During 1977, this field produced 1,104,068 barrels of oil. As of December 1978, the field had 74 producing wells. In the summer of 1978, a gas plant was put in operation and the field should be producing about 9 million cubic feet of natural gas per day and between 8,000 and 20,000 barrels of oil per day. Another 60 wells are expected to be drilled in 1979.

Table 1-28 on page 23 of the Draft Study which presents oil production figures for Dunn and Stark Counties should be updated as follows:

REVISED TABLE 1-28

Oil Production: Dunn and Stark Counties

County	Field	Production (barrels) 1977 (Annual)	1978 (Through May) (shut-in first three months)
Dunn	Haliday	12,228	5,577
	Haystack Butte	0	6,085
	Killdeer	113,204	37,707
	Little Knife[1,2]	1,104,068	812,489
	Lost Bridge	34,988	18,804
	Oakdale	31,344	13,440
	Rattlesnake Point	33,117	34,407
	Russian Creek[3]	0	16,340
Stark	Buffalo Creek	18,964	7,899
	Dickinson	1,684,883	645,582
	Green River[4]	117,614	33,614
	Rocky Ridge[4]	135,746	50,396
	South Heart	105,117	24,929
	Zenith	122,587	40,696
TOTAL		3,513,860	1,747,965

SOURCE: North Dakota Geological Survey, May 1978

1/ Field covers portions of Dunn, Billings, and McKenzie Counties.

2/ Production was restricted to 100 barrels per day until summer 1978 when gas plant became operational.

3/ This field started production in January 1978.

4/ Field covers portions of Stark, Slope, and Billings Counties.

Other Changes

Draft Study

Map 1-1 preceding page 1 should be modified as follows:

1. Symbol number 4 in red representing the Coyote Station of Level 1 development should be an *Electric Power Plant* symbol.
2. The pipeline in McLean County for Level 1 development should be labeled 20 Inch Synthetic Natural *Gas*.
3. Item 3 of the black legend should read *Basin Electric Power Cooperative-Leland Olds Station.*
4. The definition of Level 1 Proposals in the red legend should read, "Projects proposed by industry, which would be expected to initiate construction within about 5 years, if approved."
5. The railroad symbol in the red legend should have cross ties.
6. The definition of Level 2 Proposals in the blue legend should read, "Projects proposed by industry, which would be expected to initiate construction by 1990, if approved."

On page 1, column three, the last sentence should read "(The Bureau of Reclamation's ANG *Final* Environmental Impact Statement (*1976*) has complete site specific details)."

On page 1, column four, the last sentence should read "(*Rural Electrification Administration's Environmental Impact Statement (1978) has complete site-specific details*)."

On page 2, column one, first paragraph, last sentence, "Statement" should be changed to "Study."

The figure on the page between pages 2 and 3 should be labeled "Figure 1-2" and show the following as the source: "AMAX Coal Company 1976."

On page 4, figure 1-6 should show the following source: "Western Gasification Company 1978."

On page 6, figure 1-11 should show the following source: "Modified from Otter Tail Power Company 1977."

On page 7, Table 13, under NGPL, the 397 for particulates and the 2,855 for nitrogen oxides should be on the line for Boiler Stacks.

On page 7, column one, paragraph six, line eight, "March 1977" should be "January 1978."

On page 8, column, 2, paragraph 2, add: "Of the 350 megawatts of power scheduled to be used within North Dakota, 160 megawatts will be used by ANG to produce synthetic natural gas for export."

On page 9, figure 1-19 should show the following source: "Otter Tail Power Company 1977."

On page 9, the emission data in Table 1-5 for Basin Electric Power Plant was taken from data supplied by Basin Electric Power Cooperative in their application for Permit to Construct. Since the publication of the Draft Study, revisions were made to take into account the Clean Air Act Amendments of 1977. The following is a tabulation of the emissions currently being used to reflect the 1977 amendments:

Antelope Valley Emissions
$(lbs/hr)^{1,2}$
(Mainstacks)

TSP	420
SO_2	3845
NO_x	4930

1/ Two 440 megawatt units.

2/ TSP and NO_x are maximum allowable as per New Source Performance Standards

On page 12, column one, paragraph four, line two, the word "or" should be "on."

On page 22, Figure 1-36 should show the following source: "Regional EIS 1977."

On page 10, Table 1-8, the mileage for the Basin Electric 500 kilovolt line should be "286" instead of "275." The 345 kilovolt line should read "52" instead of "50."

Summary

On page 5, under NGPL Coal Gasification Plant and AMAX Mine, the "southwest" on line 4 should be changed to "southeast."

On page 5, column 2, "per pound of coal" should be added after the 6,660 Btu's describing the heating value of lignite.

CLIMATE AND AIR QUALITY

INTRODUCTION

The importance of air quality to the citizens of North Dakota was evident in hearing testimony and the written comments submitted concerning the Draft Study. The interest shown in protecting North Dakota's air quality and related quality of life factors, as well as the time and effort these people put into reviewing the Draft Study, was evident in their review comments.

A need was expressed for updating the Draft Study to take into account the Federal Clean Air Act Amendments of 1977. This major piece of legislation was passed about the same time the Draft Study went to press and hence, it was not considered in the analysis of the proposed projects. The separate Climate and Air Quality Technical Supplement, which was written in December of 1977, did provide additional updated information; however, this document is no longer current. Full implementation of the provisions of the Clean Air Act Amendments of 1977 will continue to change, with time, probably through the 1980s. Updated information on the Clean Air Act Amendments, through October 1978, is now included.

Concerns were expressed over the magnitude of total emissions from the proposed Level 1 and Level 2 projects through their expected lifetime of operation. The magnitude of total emissions is indeed large. These emission totals, while providing emphasis on the atmospheric loading of pollutants, cannot be directly used to determine the extent of effect upon the environment of the seven-county study area. Effects upon the environment are determined from the ground level concentration of pollutants which result from these emissions.

The Draft Study made a number of summary references to the increase in air pollutant concentrations from Level 1 and Level 2 projects, "being well within the State Ambient Air Quality Standards which are equal to or more stringent than the Federal Standards." Although numerical comparisons were presented in Chapter 3 of the Draft Study, which demonstrated this conclusion, concerns were expressed questioning the adequacy of standards. These concerns are justified in view of news reports of Congressional testimony which noted air pollution effects occurring at pollutant concentrations below the National Ambient Air Quality Standards. Assuming that the studies referenced in this testimony are correct, the projected environmental concentrations of pollutants from Level 1 and Level 2 projects were compared and found to be less than the concentrations noted to cause problems. This is reviewed in more detail in the updated discussion on air pollution effects.

The effects of air pollution, in general, were referenced by a number of persons. Concerns included human and animal health; effects upon vegetation; long-term effects of trace elements; acid rain and radiation impacts; and effects upon materials, visibility, and weather. This Final Supplement takes these concerns into consideration and each environmental factor is discussed under "Air Pollution Effects."

The increase in ambient air quality concentrations resulting from Level 1 and Level 2 project emissions were evaluated in terms of expected effects upon the environment. The maximum impact area from Level 1 and Level 2 sources is projected to occur in Mercer and Oliver Counties, within eight miles of Beulah. No perceptible effects upon the environment are expected to occur in this maximum impact area, the broader area of the seven-county study area, or in the Fort Berthold Reservation, as a result of emissions of Level 1 and Level 2 sources.

The Draft Study focused on coal development in a seven county area in western North Dakota. It was quite appropriately recognized by a number of persons that effects upon air quality are not confined to political boundaries or only to coal development. Oil and gas development, which is occurring in western North Dakota within and beyond the seven-county study area, will influence the location and magnitude of future coal development in this state. This is also discussed in more detail herein.

Many studies have been conducted within the seven-county study area to evaluate the impacts of individual energy development facilities. This includes site-specific environmental impact statements, which have added to the knowledge of effects upon the environment from energy development. Although the effects upon the environment from Level 1 and Level 2 projects are not expected to result in adverse effects upon the environment, a better understanding of the environment of western North Dakota is indicated.

Other subjects of concern included trace elements, environmental radiation, acid rainfall, and synergistic effects of air pollution. The need for expansion of the environmental effects knowledge base is appropriate as it could influence future

energy development in western North Dakota beyond the Level 1 and Level 2 projects. Answers to these environmental questions will determine where and how much development will be allowed in western North Dakota.

MODIFICATIONS AND CORRECTIONS

List of Tables

List of Figures

List of Maps

Federal Clean Air Act Amendments of 1977

The Federal Clean Air Act Amendments of 1977 were signed into law on August 7, 1977. The writing of the Draft West-Central North Dakota Regional

Environmental Impact Study on Energy Development was completed about this same time. Therefore, many implications of the Federal Clean Air Act Amendments could not be considered. The Climate and Air Quality Technical Supplement, which was prepared in December of 1977, did discuss Prevention of Significant Deterioration of Air Quality, one of the major issues addressed in the Clean Air Act Amendments. However, regulations fully implementing this portion of the Clean Air Act Amendments were not promulgated by the U.S. Environmental Protection Agency until June 19, 1978. Applicable laws and subsequent rules, regulations, and standards change, thus requiring frequent updates of information.

The Clean Air Act Amendments of 1977 have had a dramatic influence on the climate and air quality portion of the Draft Study. One of the major considerations addressed was the Prevention of Significant Deterioration of Air Quality. This legislation established a detailed system of area classifications and air quality increments designed to protect air quality in areas which had cleaner air than that established by the National Ambient Air Quality Standards. Other provisions of this law affecting Level 1 and Level 2 projects include a more stringent definition of Best Available Control Technology; and recognition of the need for reexamination of the current National Ambient Air Quality Standards, both for the appropriateness of these standards and the pollutants included.

Ambient Air Quality Standards

The EPA, under the Clean Air Act Amendments of 1970, was required to establish National Ambient Air Quality Standards for air pollutants. National primary standards to protect health and secondary standards to protect public welfare were promulgated for six pollutants. The six pollutants are sulfur oxides (sulfur dioxide), particulate matter, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen dioxide (see Table 1). The states, under this law, can adopt and promulgate their own ambient air quality standards as long as they are equal to or more stringent than the Federal Ambient Air Quality Standards promulgated by the EPA. The North Dakota State Department of Health promulgated Ambient Air Quality Standards for the State of North Dakota. The State standards are equal to or more stringent than the Federal secondary standards for the six federal pollutants. In addition, the state has also adopted standards for settled particulates, coefficient of haze, reactive sulfur, suspended sulfates, sulfuric acid mist and sulfur dioxide, and hydrogen sulfide.

The purpose of the North Dakota Ambient Air Quality Standards is to control the quality of the air over North Dakota such that, (a) the health of sensitive or susceptible segments of the population will not be adversely affected; (b) concentrations of pollutants will not cause public nuisance or annoyances; (c) significant damage to animals, ornamental plants, forest and agricultural crops will not occur; (d) visibility will not be significantly reduced; (e) metals or other materials will not be significantly corroded or damaged; (f) fabrics will not be soiled, deteriorated, or have their colors affected; and (g) natural scenery will not be obscured. The North Dakota Ambient Air Quality Standards are presented in Table 2.

Generally, North Dakota's air quality is considerably better than the National Ambient Air Quality Standards. That is why the State Department of Health adopted ambient air quality standards in May of 1970 equal to the Federal secondary standards (the more stringent of the Federal standards) for total suspended particulates, carbon monoxide, photochemical oxidants, and hydrocarbons. With respect to sulfur dioxide and nitrogen dioxide, the state adopted standards which were more stringent than the Federal requirements. Prior to adoption of State Ambient Air Quality Standards, EPA air quality criteria (cause and effect) documents were reviewed. Since North Dakota's air quality is better than that addressed by Federal standards and in the absence of anti-degradation or prevention of significant deterioration legislation in 1970, the Department felt it prudent to adopt standards which were equal to the most stringent Federal standard or, as in the case of sulfur dioxide and nitrogen dioxide, a more stringent standard.

Testimony before Congress, in its consideration of amendments to the Clean Air Act of 1977, raised a number of questions including the adequacy of existing National Ambient Air Quality Standards, the limiting of the Federal standards to six pollutants, and the relative absence of standards addressing synergistic effects, trace metals, particle size, and derivative chemicals. These questions arose as a result of the introduction of study reports and testimony indicating the occurrence of environmental effects at air quality levels below the National Ambient Air Quality Standards. A more detailed discussion of cause and effect relationships related to the Level 1 and Level 2 projects is presented in "Air Pollution Effects."

Congress, in light of information which it received concerning air pollution effects, made a number of revisions to the Clean Air Act Amendments of 1970 related to ambient air quality standards. These revisions included a requirement that the Administrator of EPA complete a thorough review of criteria used in promulgating national ambient air quality standards, make revisions in criteria, and promulgate new standards as appropriate.

TABLE 1

FEDERAL PRIMARY AND SECONDARY AIR QUALITY STANDARDS

Air Contaminant	Averaging Time	Federal Primary Standard	Federal Secondary Standard
Nitrogen Dioxide[1]	Annual Average	100 $\mu g/m^3$ (0.05 ppm)	100 $\mu g/m^3$ (0.05 ppm)
Sulfur Dioxide	Annual Average	80 $\mu g/m^3$ (0.03 ppm)	---
	24-Hour	365 $\mu g/m^3$ (0.14 ppm)	---
	3-Hour	---	1,300 $\mu g/m^3$ (0.5 ppm)
Suspended Particulate	Annual Geometric Mean	75 $\mu g/m^3$	60 $\mu g/m^3$
	24-Hour	260 $\mu g/m^3$	150 $\mu g/m^3$
Hydrocarbons (corrected for Methane)	3-Hour 6-9 A.M.	160 $\mu g/m^3$ (0.24 ppm)[2]	160 $\mu g/m^3$ (0.24 ppm)
Photochemical Oxidants	1-Hour	160 $\mu g/m^3$ (0.08 ppm)	160 $\mu g/m^3$ (0.08 $\mu g/m^3$)
Carbon Monoxide	8-Hour	10 mg/m^3 (9 ppm)	10 mg/m^3 (9 ppm)
	1-Hour	40 mg/m^3 (35 ppm)	40 mg/m^3 (35 ppm)

SOURCE: 40 Code of Federal Regulations Part 50, July 1, 1976

NOTE: ppm = parts per million

$\mu g/m^3$ = micrograms per cubic meter

mg/m^3 = milligrams per cubic meter

[1] Nitrogen dioxide is the only one of the nitrogen oxides considered in the ambient standards.

[2] Maximum 3-hour concentration between 6-9 A.M.

TABLE 2

STATE OF NORTH DAKOTA AIR QUALITY STANDARDS

Air Contaminant (Units)	Averaging Time	Maximum Permissible Concentration
Total Suspended Particulates ($\mu g/m^3$)[1]	Annual Geometric Mean	60
	24-hour	150[2]
Settled Particulate - Dustfall (tons per square mile per month	3-month	15[3]
	3-month	30[4]
Coefficient of Haze (Coefficient of Haze per 1,000 linear feet)	Annual Geometric Mean	0.4
Sulfur Dioxide ($\mu g/m^3$)	Annual Average	60
	24-hour	260
	1-hour	715
Reactive Sulfur ($mg/100cm^2/day$)[5]	Annual Average	0.25
	1-month	0.50
Suspended Sulfates ($\mu g/m^3$)	Annual Average	4
	24-hour	12[6]
Sulfuric Acid Mist, Sulfur Trioxide or Combination ($\mu g/m^3$)	Annual Average	4
	24-hour	12[6]
	1-hour	30[6]
Hydrogen Sulfide ($\mu g/m^3$)	1/2-hour	45[7]
	1/2-hour	75[8]
Carbon Monoxide (mg/m^3)[9]	8-hour	10[2]
	1-hour	40[2]
Photochemical Oxidants ($\mu g/m^3$)	1-hour	160[2]
Hydrocarbons ($\mu g/m^3$)	3-hour (6-9 a.m.)	160[2]
Nitrogen Dioxide ($\mu g/m^3$)	Annual Average	100
	1-hour	200[10]

SOURCE: North Dakota State Department of Health Air Pollution Control Regulations 1976

1/ micrograms per cubic meter
2/ Maximum not to be exceeded more than once per year.
3/ Maximum in a residential area.
4/ Maximum in an industrial area.
5/ milligram sulfur trioxide per 100 square centimeters per day.
6/ Maximum not to be exceeded over 1% of the time.
7/ Maximum not to be exceeded more than twice in any five consecutive days.
8/ Maximum not to be exceeded over twice a year.
9/ milligrams per cubic meter.
10/ Maximum not to be exceeded over 1% of the time in any 3-month period.

The first review is to be completed by December 31, 1980, and at five-year intervals thereafter, although the Administrator may review and revise criteria and promulgate new standards more frequently than required. With respect to nitrogen dioxide and derivatives of nitrogen oxides, the Administrator was directed to promulgate a short-term (not more than 3-hour period) standard by August 7, 1978, unless found that there is not significant evidence that such a standard is necessary to protect public health.

Increased emphasis on air quality standards was seen in defining hazardous air pollutants as pollutants for which no ambient air quality standard is applicable and which, in the judgment of the Administrator, causes or contributes to air pollution which may reasonably be anticipated to result in an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness. This is a broadening of the definition found in the Clean Air Act Amendments of 1970. The Clean Air Act Amendments of 1977 specifically mentioned emissions of radioactive pollutants, cadmium, arsenic, polycyclic organic matter, and sulfates.

In general, there was an increased emphasis in the Clean Air Act Amendments of 1977 on review of air quality standards and air quality effects and the need to provide standards to protect public health and welfare. This emphasis formed the basis for the statutory establishment of the prevention of significant deterioration provisions of the Clean Air Act Amendments of 1977 which provides for limiting pollution increases in areas now cleaner than the National Ambient Air Quality Standards.

New Source Performance Standards

The Clean Air Act Amendments of 1970 provided for the establishment of standards of performance for new stationary sources reflecting the highest degree of air pollutant emission limitations achievable and adequately demonstrated, taking into account the cost of achieving those limitations. The Clean Air Act Amendments of 1977 expanded upon this section of the law by specifically identifying the stationary source category of fossil fuel fired sources. With respect to stationary sources in general (including non-fossil fuel fired sources), the Administrator is to publish a list of categories of stationary sources, which in his judgment, may reasonably be anticipated to endanger public health or welfare. The Administrator is to review, at least every four years, and revise such standards, if appropriate. The definition of the term "standard of performance" was changed to reflect the highest degree of emission limitation and percentage reduction achievable through application of the best technological system of continuous emission reduction which the Administrator of EPA determines has been adequately demonstrated for that category of sources. This determination by the Administrator is to consider the cost of achieving the emission reduction and any non-air quality health and environmental impact and energy requirements.

On September 19, 1978, EPA published Federal Register, Vol. 43, No. 182, page 42154 proposed rules concerning standards of performance for new electric utility steam generating units. These rules would apply to those units that are capable of firing more than 73 megawatts (250 million Btu/hour) heat input of fossil fuel and for which construction is commenced after September 18, 1978. Since the comment period on this proposed rule ends on November 20, 1978, it is possible that final action will be taken before this supplement is published.

The proposed standards of performance would limit emissions of sulfur dioxide, particulate matter, and nitrogen oxides from new, modified, and reconstructed electric utility steam generating units capable of combusting more than 73 megawatts (250 million Btu/hour) heat input of fossil fuel. The intended effect of this proposal is to require new, modified, and reconstructed electric utility steam generating units to use the best demonstrated systems of continuous emission reduction. This proposed standard of performance is one of many which will be reviewed and possibly revised in the years ahead to satisfy the provisions of the Clean Air Act Amendments of 1977.

Prevention of Significant Deterioration of Air Quality

One of the major actions of the Clean Air Act Amendments of 1977 was to provide a distinct statutory basis for Prevention of Significant Deterioration of Air Quality. The prevention of significant deterioration provisions of the Clean Air Act Amendments of 1977 have had a dramatic influence on Level 1 and Level 2 proposed projects. Although a prevention of significant deterioration review was conducted of Level 1 and Level 2 projects in the Draft Study, the Clean Air Act Amendments of 1977 changed some of the ground rules; thereby imposing additional restrictions upon these projects.

The EPA, in response to a May 30, 1972, court decision (Sierra Club vs. Ruckelshaus), affirmed in 1973 by the Supreme Court, promulgated regulations on December 5, 1974, to prevent the significant deterioration of air quality. The EPA prevention of significant deterioration regulations are effective nationwide because the EPA disapproved all state

implementation plans not containing adequate procedures for preventing significant deterioration in any portion of any state where the air is cleaner than the National Ambient Air Quality Standards.

The prevention of significant deterioration program is based on the principle that clean air is a natural resource of great importance and this resource's value cannot always by measured in terms of proven health and property damage. The regulations were the result of a detailed study and extensive public participation, including nationwide public hearings.

North Dakota was one of the first states in the nation to adopt a prevention of significant deterioration regulation. The State Department of Health felt that this regulation had merit because it could protect the air quality of this state which is better than the National Ambient Air Quality Standards. The North Dakota prevention of significant deterioration regulations adopted in January of 1976 were similar to the prevention of significant deterioration regulations promulgated by EPA in December of 1974. On May 26, 1977, EPA delegated responsibility for prevention of significant deterioration to the State of North Dakota.

Prevention of significant deterioration was one of the major issues addressed in the Clean Air Act Amendments of 1977. The legislation established a detailed system of area classification and air quality increments designed to prevent significant deterioration of air quality in clean air areas. The clean air areas were defined as those in which major pollutants were monitored at levels below the limits established by the National Ambient Air Quality Standards.

According to the Clean Air Act Amendments of 1977, certain prevention of significant deterioration provisions were effective immediately, with others delayed until such time as state implementation plans could be revised. New regulations proposed by the U.S. Environmental Protection Agency on November 3, 1977 (Federal Register, Vol. 42, No. 212) would establish an implementation date of March 1, 1978, for those prevention of significant deterioration regulations which were to have been delayed, pending revision of state plans. Final action on the proposed EPA prevention of significant deterioration regulations was taken on June 19, 1978. North Dakota's prevention of significant deterioration regulations and implementation plan were subsequently revised and took effect on July 1, 1978.

A prevention of significant deterioration analysis of proposed Level 1 and Level 2 projects was done for the Draft Study; however, these projects have been reexamined. The results of this reexamination, in light of the Clean Air Act Amendments of 1977, will be discussed later under "Analysis of Draft Study Proposed Level 1 and Level 2 Projects."

New Source Review Procedures

The prevention of significant deterioration regulations, in effect prior to enactment of the 1977 Amendments, identified 19 major stationary source categories as subject to prevention of significant deterioration preconstruction review procedures under EPA regulations. Twenty-one major stationary source categories were included in the then existing North Dakota regulations. The new Amendments expand these to include 28 major stationary source categories with the potential to emit more than 100 tons per year of any regulated pollutant. Also included are any sources with the potential to emit 250 tons per year of any regulated pollutant.

A more stringent definition of Best Available Control Technology is now required for all sources subject to the prevention of significant deterioration regulations. The Clean Air Act Amendments of 1977 include provisions for pollutants other than those for which National Ambient Air Quality Standards have been set (the six criteria pollutants). Best Available Control Technology will also be required for modifications or expansions of existing sources, if such sources are included among those specified by the legislation as being subject to prevention of significant deterioration requirements.

Best Available Control Technology is defined in the current North Dakota prevention of significant deterioration regulations as an emission limitation (including a visible emission standard) based on the maximum degree of reduction of each contaminant subject to regulation emitted from any major stationary source or major modification, which the Department of Health on a case-by-case basis (taking into account energy, environmental, and economic impacts and other costs) determines is achievable for such source or modification. In no event shall application of "best available control technology" result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard of performance. If the Department determines that technological or economic limitations on the application of measurement methodology to a particular class of source would make the imposition of an emission standard infeasible, the Department may instead prescribe a design, equipment, work practice, or operational standard, or combination thereof, requiring the application of best available control technology. Such standard shall, to the degree possible, set forth the emission reduction achievable by implementation of such design, equipment, work practice, or operation, and shall

provide for compliance by means which achieve equivalent results.

The prevention of significant deterioration review process allows opportunity for a public hearing before a final decision is made by a state regulatory agency on awarding of the permit. Applications for permits after August 7, 1978, by sources subject to prevention of significant deterioration review must be accompanied by an analysis of one year continuously measured air quality data for all criteria pollutants. Monitoring will not be required for nonmethane hydocarbons and for sources for which the increased potential emissions would not exceed 50 tons per year.

Preconstruction review requirements, as outlined above, would apply to any source which did not obtain a final prevention of significant deterioration permit before March 1, 1978. The EPA regulations state: "It is important to note that EPA's current prevention of significant deterioration regulations contemplate at least a 90-day period from completed application submission to permit issuance. Accordingly, sources which had not filed completed applications by December 1, 1977, should not assume that a final permit approval will be issued by March 1, 1978, and should therefore plan to be reviewed under the new rules." Sources obtaining final permit approval prior to the March 1 deadline, but not commencing construction before December 1, 1978, would also be subject to the prevention of significant deterioration review requirements.

Class I Areas in North Dakota

The Clean Air Act Amendments of 1977 set forth "effective immediately" more restrictive maximum allowable ambient air increments for particulate matter and sulfur dioxide in Class I, Class II, and Class III areas (see Table 3). Also, immediately effective is the requirement that each National Ambient Air Quality Standard (not just particulate matter and sulfur dioxide) shall act as an overriding ceiling to any otherwise allowable increment. It also provides that for any period other than any annual period, the applicable increment may be exceeded only during one such period per year at a given site.

Certain areas were classified on August 7, 1977, as Class I by Congress and thus are subject to the most stringent restraints on air quality deterioration. These areas include all international parks, all national wilderness areas which exceed 5,000 acres in size, all national memorial parks which exceed 5,000 acres in size, and all national parks which exceed 6,000 acres in size. This designation applies only to areas which were in existence on the date of enactment of the Clean Air Act Amendments of 1977. These areas may not be redesignated. In North Dakota, these areas include the Lostwood National Wilderness Area, a 5,577-acre area in the northwest corner of the Lostwood National Wildlife Refuge in Burke County; and the 69,675-acre Theodore Roosevelt National Memorial Park (which is now called the Theodore Roosevelt National Park).

Class III Provisions

Another immediately effective change involves three provisions concerning the redesignation of areas to Class III. First, certain areas cannot be reclassified as a Class III area. These include: (1) an area which exceeds 10,000 acres in size and is a national monument, a national primitive area, a national preserve, a national recreation area, a national wild and scenic river, a national wildlife refuge, a national lakeshore and seashore; and (2) a national park or national wilderness area established after the date of enactment of this Act which exceeds 10,000 acres in size. Second, before any area may be redesignated to Class III, specific approval must be received from the Governor, after consultation with the Legislature, and from the local governments representing a majority of the residents in the area which is to be redesignated. Finally, a Class III redesignation must not itself cause or contribute to concentrations of any air pollutant which exceeds the maximum allowable increase in another area.

Attainment and Nonattainment Areas

The sources subject to prevention of significant deterioration review shall continue to be reviewed in both attainment (air quality meets the National Ambient Air Quality Standards) and nonattainment (air quality in excess of National Ambient Air Quality Standards) areas regarding their long-range impact on an increment in any affected area. Also, best available control technology for sulfur dioxide and particulate matter is still required at any location. However, prevention of significant deterioration sources are not subject to any ambient air review for prevention of significant deterioration increments or National Ambient Air Quality Standards ceilings and regards the nonattainment area itself. In this regard, the "Emission Offset" Interpretative Ruling (40 CFR 55524, December 21, 1976) continues to control the construction of sources which cause or contribute to air quality concentrations in excess of any National Ambient Air Quality Standard. In North Dakota, there are no areas classified as nonattainment areas.

TABLE 3

NEW PREVENTION OF SIGNIFICANT DETERIORATION OF AIR QUALITY INCREMENTS AND CEILINGS
CLEAN AIR ACT AMENDMENTS OF 1977

Pollutants	Maximum Allowable Increase[1] (in micrograms per cubic meter)		
	Class I	Class II	Class III
Particulate Matter			
Annual Geometric Mean	5	19 (10)[2]	37
24-hour Maximum	10	37 (30)	75
Sulfur Dioxide			
Annual Arithmetic Mean	2	20 (15)	40
24-hour Maximum	5	91	182
3-hour Maximum	25	512	700

SOURCE: Clean Air Act Amendments of 1977
Title I, Part C, Section 163
August 7, 1977

1/ Maximum allowable increases over baseline concentrations not to be exceeded more than once per year except for annual where allowable increase over baseline may not be exceeded.

2/ The numbers in parenthesis ( ) are the corresponding State allowable increments.

Stack Height Limitations

The Clean Air Act Amendments of 1977 limits stack height for dispersion of emissions to good engineering practice, which is defined as that height necessary to avoid atmospheric downwash, wakes, and eddies. It indicates that good engineering practice should generally not exceed two and one-half times the height of the source (subject to exemption based on appropriate showing by the source).

Computer Dispersion Modeling

The Clean Air Act Amendments of 1977 state that the owner or operator of any proposed source or modification of an existing source must demonstrate that allowable emissions increases from the source or modification, in conjunction with all other applicable emissions increases or reductions, will not cause or contribute to air pollution in violation of any national ambient air quality standard in any air quality control region; or any applicable maximum allowable increase over the baseline concentration in any area.

All estimates of ambient concentrations required, as mentioned above, shall be based on the applicable air quality models, data bases, and other requirements specified in the "Guidelines on Air Quality Models" (OAQPS No. 1.2-080, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711, April 1978). Where an air quality impact model specified in the "Guidelines on Air Quality Models" is inappropriate, the model may be modified or other models substituted. A substitutional modification of a model shall be subject to public comment procedures. Written approval of the administrator must be obtained for any modification or substitution. Methods like those outlined in the "Workbook for the Comparison of Air Quality Models" (OAQPS No. 1.2-097, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711, April 1977) should be used to determine the comparability of air quality models (source: Federal Register Volume 43, No. 118, page 26386, Monday, June 19, 1978).

The preceding Federal Register Regulations referenced were promulgated by EPA to give some guidance in selecting modeling techniques and types of models in reviewing new sources by state and federal air pollution control agencies. It was the intent of the Clean Air Act Amendments of 1977 to give this guidance for uniformity because of the widespread use of models and modeling techniques by the private sector as well as state and federal air pollution control agencies. In essence, a standardization of all modeling procedures was mandated by the Clean Air Act Amendments of 1977.

A complete reference of the guideline series for air quality models is given below:

> *Guideline on Air Quality Models*, U.S. Environmental Protection Agency, Office of Air and Waste Management, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina 27711 (EPA-450/2-78-027, OAQPS No. 1.2-080), April 1978.
>
> *Workbook for Comparison of Air Quality Models*, EPA, Office of Air and Waste Management, Office of Air Quality Planning and Standards, Monitoring and Data Analysis Division, Research Triangle Park, North Carolina 27711 (EPA-450/2-78-0282, OAQPS No. 1.2-097), May 1978.
>
> *Workbook for Comparison of Air Quality Models--Appendices*, EPA, Office of Air and Waste Management, Office of Air Quality Planning and Standards, Monitoring and Data Analysis Division, Research Triangle Park, North Carolina 27711 (EPA-450/2-78-0286, OAQPS No. 1.2-097A), May 1978.

Table 4 outlines the models discussed in the guideline documents mentioned above. Footnote "1" on Table 4 shows the models primarily used in the North Dakota State Department of Health modeling program. Footnote "2" shows the additional models used in the updating of the Draft Study to demonstrate the impacts of the Clean Air Act Amendments of 1977. The CRSTER and RAM models were not available when the Draft Study was originally prepared. These models allowed a more detailed analysis of the impacts from the proposed Level 1 and Level 2 projects; particularly as these sources impact the reclassified Class I areas (specifically the Theodore Roosevelt National Park).

For a detailed description of the implication of the reclassified Class I areas, the modeling predictions and the overall impacts of the Clean Air Act Amendments of 1977 resulting from Level 1 and 2 projects, see "Analysis of the Draft Study Proposed Level 1 and Level 2 Projects."

TABLE 4

AIR QUALITY MODELS CONTAINED ON
THE UNAMAP COMPUTER MAGNETIC TAPE

Modeling Program Guide	Use
APRAC	urban model for vehicle-generated pollutants
Climatological[1] Dispersion Model (CDM)	an annual, seasonal urban model--can be modified for rural use
CDMQC	version of CDM with addition of source contribution output
CRSTER[1] [2]	model for estimating maximum 24-hr concentrations during a one-year period from a single rural plant
HIWAY	short-term multi-receptor roadway model
PAL	a short-term multi-receptor model for multi-point, area, and line sources
PTMAX, PTDIS[1]	Two short-term models for a single source in open country
PTMTP[1]	a short-term model for multiple sources and receptors
VALLEY	a model for estimating the upper limits of 24-hr concentrations from a single source in rural complex terrain
RAM[1] [2]	a short-term urban model for point and area sources.

SOURCE: National Technical Information Service
Computer Products Office
5285 Port Royal Road
Springfield, Virginia 22161
Phone: 703-557-4763
PB 277-193

1/ Models commonly used within the North Dakota State Department of Health.

2/ Models which were not available at the time the Draft Study was prepared.

Prevention of Significant Deterioration - Variance

If a proposed source cannot satisfy the maximum allowable deterioration increments for a Class I area (see Table 3), an opportunity is afforded to the owner or operator of this proposed source to seek a variance. Three possible variance routes are open to such a source. These would involve the federal land manager of the Class I area, the Governor of the state, and possibly the President of the United States.

The owner or operator of a proposed source may demonstrate to the federal land manager that the emission from the source will have no adverse impact on the air quality related values of the Class I area (including visibility), although the change in air quality resulting from source emissions will cause or contribute to concentrations which exceed the maximum allowable increases for a Class I area. If the federal land manager concurs with the demonstration and he so certifies to the State Department of Health, the Department may issue a restricted permit to construct provided the applicable requirements of the prevention of significant deterioration regulations are otherwise met. Restrictions on this type of permit to construct would include a requirement that the source comply with such emission limitations as may be necessary to assure that emission of sulfur dioxide and particulate matter will not exceed the maximum allowable increased over the baseline concentrations for such pollutants shown in Table 5.

TABLE 5

MAXIMUM ALLOWABLE CLASS I VARIANCE LIMITS

Pollutant	Maximum allowable increase (micrograms per cubic meter)
Particulate matter:	
Annual geometric mean	10
24-hour maximum	30
Sulfur dioxide:	
Annual arithmetic mean	15
24-hour maximum	91
3-hour maximum	325

SOURCE: The North Dakota State Department of Health Air Pollution Control Regulations 1978.

A variance from the maximum allowable sulfur dioxide Class I increments shown in Table 3 could be granted by the Governor, with the federal land manager's concurrence. If a request for a variance cannot be approved by the federal land manager, the owner or operator of the proposed source may submit a demonstration to the Governor, after notice and public hearing, that the source cannot be constructed by reason of any maximum allowable increase for sulfur dioxide for periods of 24 hours or less applicable to any Class I area. In the case of Federal mandatory Class I areas, it must also be demonstrated that a variance under this clause will not adversely affect air quality related values of the area (including visibility). The Governor, after consideration of the federal land manager's recommendation (if any) and subject to the federal land manager's concurrence, may grant a variance from such maximum allowable increase. If a variance is granted, the Department shall issue a restricted permit to such source provided the applicable requirements of the prevention of significant deterioration regulations are otherwise met. Restrictions on this type of permit to construct would include a requirement that the source comply with such emission limitations as may be necessary: (1) to assure that emissions of sulfur dioxide will not (during any day on which the otherwise applicable maximum allowable increases are exceeded) cause or contribute to concentrations which exceed the maximum allowable increases over the baseline concentrations shown in Table 6; and (2) to assure that the emissions will not cause or contribute to concentrations which exceed the otherwise applicable maximum allowable increases for periods of exposure of 24 hours or less for more than 18 days, not necessarily consecutive, during any annual period.

TABLE 6

MAXIMUM ALLOWABLE SULFUR DIOXIDE VARIANCE INCREASE IN CLASS I AREAS AS A FUNCTION OF LOW AND HIGH TERRAIN AREAS

Period of Exposure	Maximum allowable sulfur dioxide increase (micrograms per cubic meter) Low Terrain Areas[1]	High Terrain Areas[2]
24-hour maximum	36	62
3-hour maximum	130	221

SOURCE: North Dakota State Department of Health Air Pollution Control Regulations 1978

1/ Low terrain means any area other than high terrain.

2/ High terrain means any area having an elevation of 900 feet or more above the base of the stack of a facility.

The third possible variance route is a variance granted by the Governor with the President's concurrence. In any case, where the Governor recommends a variance to which the federal land manager does not concur, the recommendations of the Governor and the federal land manager shall be transmitted to the President. The President may approve the Governor's recommendation if the President finds that such variance is in the national interest. If such a variance is approved, the Department shall issue a restricted permit to construct; provided that the applicable requirements of the prevention of significant deterioration regulations are otherwise met. Restrictions on this type of permit to construct would include a requirement that such source comply with emission limitations on the permit as may be necessary to satisfy the increments and time periods allowed under a variance granted by the Governor, with the federal land manager's concurrence, as described in Table 6.

Analysis of Draft Study Proposed Level and Level 2 Projects

The Prevention of Significant Deterioration of Air Quality Analysis performed in the Draft Study preceded the enactment of the Clean Air Act Amendments of 1977. The Clean Air Act Amendments of 1977 has dramatically influenced the analysis of Level 1 and Level 2 projects. The major change in the analysis was due to Congressional establishment of mandatory Class I areas in North Dakota.

Computer dispersion modeling analysis by the North Dakota State Department of Health, indicated that the controlling factor in the Prevention of Significant Deterioration analysis is the Theodore Roosevelt National Park and the 24-hour maximum allowable increment (increase) for sulfur dioxide. This analysis was concurrent with the Department's review of permit to construct applications for the Coyote 1 Power Plant, the ANG Coal Gasification Plant, and Antelope Valley Power Plant Units 1 and 2. The three facilities were described in the Draft Study as Level 1 projects. The fourth Level 1 project, the NGPL Coal Gasification Plant, and the Level 2 Coyote 2 Power Plant also were analyzed, although no permit to construct applications have been filed with the Department for these two facilities.

Map 1 depicts the wind flow vectors from the three sources for which applications were filed for permits to construct. Although the prevailing wind flow in North Dakota is from the northwest, the winds toward the Theodore Roosevelt National Park were determined by the Department to be of sufficient frequency and duration to affect the Class I area maximum allowable increments available in the Park. The Coal Creek Power Plant, which is now completing construction, was included in this analysis since it was issued a permit to construct after January 1, 1975. In North Dakota, the baseline upon which increments are determined is January 1, 1975. The maximum or controlling case is predicted by computer dispersion modeling to occur in the South Unit of the Park.

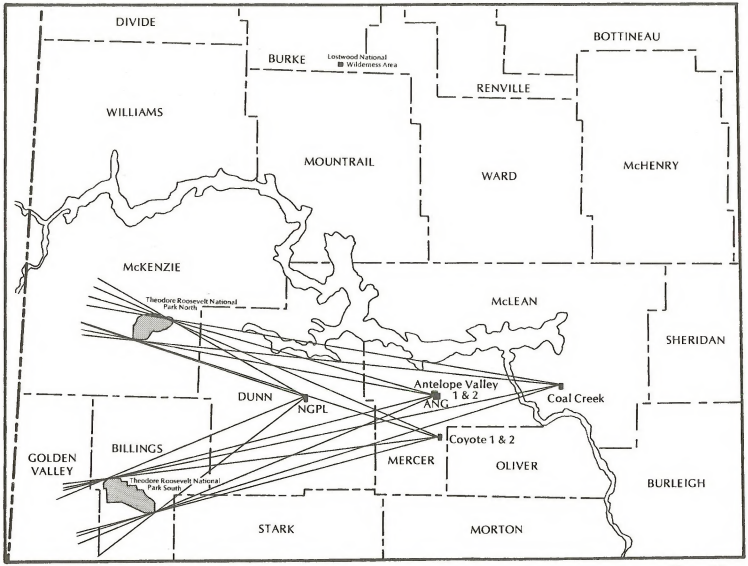
Sulfur Dioxide Emission Reductions

Following an extensive computer analysis, the predicted limiting case for the Level 1 and Level 2 projects was determined to be the 24-hour maximum sulfur dioxide increment or a maximum allowable increase of sulfur dioxide of 5 micrograms per cubic meter. The increment contributed by each source using the design information from the Draft Study is shown in Figure 1.

The computer predicted increment contributed by Antelope Valley Power Plant Units 1 and 2, when added to the increments from Coal Creek and Coyote Power Plants and the ANG Coal Gasification Plant, exceeds the maximum allowable combined increment of 5 micrograms per cubic meter. A permit to construct could not be granted for the Antelope Valley Units 1 and 2 unless the predicted sulfur dioxide increase was reduced from 4 to 1.3 micrograms per cubic meter. In order to accomplish this reduction in sulfur dioxide increment in the Theodore Roosevelt National Park, the sulfur dioxide emissions from Antelope Valley Units 1 and 2 had to be reduced by 67.5% below that which would have been normally permitted under the Clean Air Act Amendments of 1970. The owner of the proposed Antelope Valley Units 1 and 2 agreed to these additional restrictions. Following the completion of the Department's review and respective 30-day public comment periods, permits to construct were granted for Coyote 1, ANG Coal Gasification plant and Antelope Valley Units 1 and 2. These permits are conditioned to limit emissions such that the allowable individual contributions to the maximum 5 microgram per cubic meter restriction do not exceed those shown in Figure 2. These three Level 1 sources are now under construction.

MAP 1

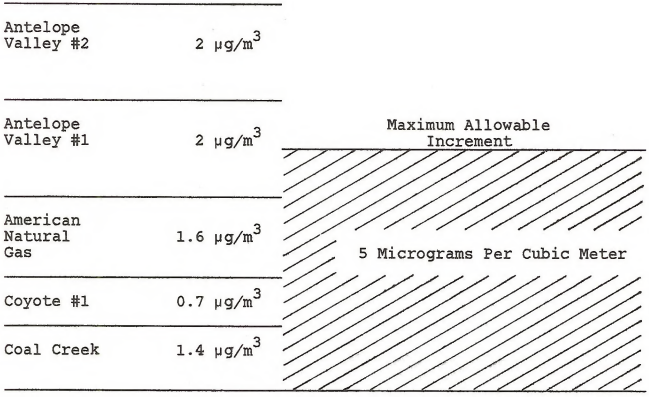
RELATIONSHIP OF LEVEL 1 AND LEVEL 2 SOURCES
TO THE THEODORE ROOSEVELT NATIONAL PARK WITH WIND FLOW VECTORS



SOURCE: North Dakota State Department of Health 1978.

FIGURE 1

INFLUENCE OF SULFUR DIOXIDE EMISSION SOURCES
UPON PREVENTION OF SIGNIFICANT DETERIORATION
CLASS I ALLOWABLE INCREMENTS
IN THE THEODORE ROOSEVELT NATIONAL PARK
(24-HOUR SULFUR DIOXIDE LIMITATION)
PRIOR TO CLEAN AIR ACT AMENDMENTS OF 1977

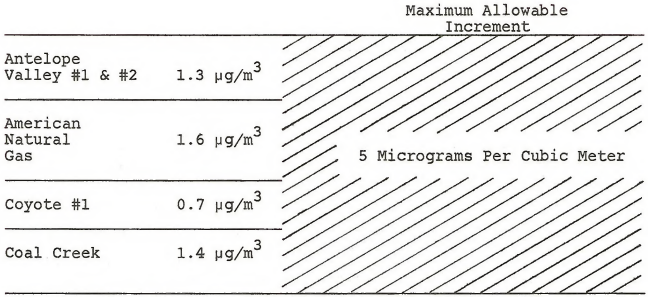


SOURCE: North Dakota State Department of Health using pre-Clean Air Act Amendments of 1977 emission data from the emission sources

NOTE: $\mu g/m^3$ = micrograms per cubic meter

FIGURE 2

INFLUENCE OF SULFUR DIOXIDE EMISSIONS FROM PERMITTED SOURCES
UPON PREVENTION OF SIGNIFICANT DETERIORATION
CLASS I ALLOWABLE INCREMENTS
IN THE THEODORE ROOSEVELT NATIONAL PARK
(24-HOUR SULFUR DIOXIDE LIMITATION)



SOURCE: North Dakota State Department of Health 1978

NOTE: $\mu g/m^3$ = micrograms per cubic meter

The sequence used by the Department in evaluating the increment available for future industrial and energy development is based upon the order in which permit to construct applications are received by the Department and/or permits to construct are issued. This sequence is evident in Figures 1 and 2 with the first source considered in the increment as Coal Creek and the last source the Antelope Valley Units 1 and 2. As in the case of the Antelope Valley Units 1 and 2, the last source considered in the allowable increment may have to provide emission reductions beyond that provided for under the emission control limitations of the new source performance standards. If it is not technologically feasible to achieve these reductions at the proposed facility a number of possible options are open to that facility. The options include: (1) finding an acceptable project site, (2) seeking a reduction of emissions from existing (pre-1975) sources, (3) seeking a Prevention of Significant Deterioration variance as previously described, or (4) abandon the proposed project.

Although the increment in the South Unit of the Theodore Roosevelt National Park is shown in Figure 2 to be filled, it is possible that future energy development could occur in western North Dakota depending upon the site location of that proposed development. Selection of a site such that the additive effect of the sources in Figure 2 is reduced could allow for additional development. The site location of future developments, therefore, becomes a significant factor in the prevention of significant deterioration analysis. A case-by-case review is necessary for each permit to construct application examining the combined effect of the new source and those permitted sources which preceded it.

As indicated earlier, the proposed NGPL Coal Gasification Plant (the fourth Level 1 project), has not applied for a permit to construct. However, a review of that project was conducted similar to the other three Level 1 sources using design data and information supplied by the company for preparation of the Draft Study. The computer dispersion modeling analysis predicted that the individual contributions of the other three Level 1 projects completely consume the maximum allowable 5 microgram per cubic meter increment in the Theodore Roosevelt National Park without an additional predicted 1.6 microgram per cubic meter of sulfur dioxide contributed by the Natural Gas Pipeline Company facility. If an application for a permit to construct the NGPL Coal Gasification Plant at the proposed Dunn County site were pending before the Department, this application would be denied. Furthermore, this plant probably could not be built anywhere in Dunn County since moving the site southward in this county would increase the additive effect of the three other Level 1 sources upon the South Unit of the Park. Moving the plant site northward in the county could make the North Unit of the Park the controlling Class I area; although the additive effect of the three other Level 1 projects is predicted to be less over the North Unit. From this analysis, the Natural Gas Pipeline Company will have to reevaluate the site location of its proposed gasification plant and have to consider a new site, probably outside of Dunn County and away from the additive effects of the other three Level 1 projects.

Consideration of the Prevention of Significant Deterioration implications as they relate to the major Level 2 project, Coyote 2, results in an analysis similar to that used with respect to the Antelope Valley Units 1 and 2. No application is currently pending for a permit to construct for Coyote 2. As in the case of the Natural Gas Pipeline Company proposed project, no increment is available for a Coyote 2. However, if the sulfur dioxide emissions from Coyote 1 were cut in half, Coyote 2 could then be considered for a permit to construct, such that the combined emissions of sulfur dioxide from Coyote 1 and 2 do not consume more than 0.7 micrograms per cubic meter of the maximum allowable increment in the South Unit of the Theodore Roosevelt National Park.

A comparison of the maximum allowable sulfur dioxide emissions as presented in the Draft Study and that resulting from the Clean Air Act Amendments of 1977 as shown in Table 7. These maximum allowable emissions, expressed in tons of sulfur dioxide per year, were reduced by 64,849 tons per year or a reduction of 56.8% from that which would have otherwise been allowed under the Clean Air Act Amendments of 1970.

The Natural Gas Pipeline Company sulfur dioxide emissions were not included in the total for the column "Under the Clean Air Act Amendments of 1977" since it would not be considered for a permit to construct at its present proposed Dunn County site. If another site is selected and approved outside of Dunn County, but within the seven-county study area, the total for Level 1 and Level 2 sources for the column "Under the Clean Air Act Amendments of 1977" would be 60,771 tons per year or a regionwide percent reduction of 53.2% in the sulfur dioxide maximum annual emissions.

These reductions in projected sulfur dioxide emissions subsequently resulted in reductions in predicted future ground level sulfur dioxide concentrations of the region. The major revisions to the information presented in the Draft Study were with respect to reduction of total sulfur dioxide emissions and predicted air quality effects of the Level 1 and Level 2 projects.

TABLE 7

MAXIMUM ALLOWABLE SULFUR DIOXIDE EMISSIONS
FROM LEVEL 1 AND LEVEL 2 SOURCES

	Tons of Sulfur Dioxide Per Year	
	Draft Study 1/	Under Clean Air Act Amendments of 1977
Level 1 Sources		
Coyote 1	21,959	21,959
American Natural Gas	12,275	12,275
Antelope Valley Natural Gas Pipeline	46,713 11,357	15,180 0
Level 1 Subtotal	92,304	49,414
Level 2 Sources		
Coyote 2	21,959	0
Level 2 Subtotal	21,959	0
Total Level 1 and 2	114,263	49,414

1/ Tons per year figures reflect proposed days of operation during the year for the facilities as outlined in the respective permit to construct applications; 7,968 hours (332 days) for American Natural Gas, 8,232 hours (343 days) for Coyote, and 7,896 hours (329 days) for Antelope Valley. In the case of Natural Gas Pipeline, the proposed emission rate is based upon design information supplied for the Draft Study.

The maximum annual average ground level concentration of sulfur dioxide from all proposed sources occurs in the vicinity of the Antelope Valley and ANG facilities under construction near Beulah in Mercer County. This predicted maximum annual ground level concentration of 2.5 micrograms per cubic meter is approximately half the predicted concentration of 5.0 micrograms found in the Bismarck-Mandan vicinity due to existing sources in that area, and due to other existing sources at Center, Stanton, and Coal Creek Station now nearing completion. Although the locations of maximum annual predicted ground level concentrations did not change significantly, the reduction in sulfur dioxide emissions from the Level 1 and Level 2 sources did reduce the magnitude of predicted concentrations across the region. A revised Map 3-2, Projected Annual Concentrations of Sulfur Dioxide from all Existing and Proposed Sources, is found under "Other Changes."

Reduction of sulfur dioxide emissions from Level 1 and Level 2 sources also resulted in reductions to the maximum short-term 24-hour, 3-hour, and 1-hour predicted ground level concentrations. Revised tables, accounting for the emission reductions, are included under "Other Changes." Relating these expected maximum ground level concentrations to effects upon human health, vegetation, and animals are discussed under "Air Pollution Effects." This section expands and updates the information presented in the climate and air quality impact portion of the Draft Study.

Revised Effects on Air Quality

As previously discussed, the combined maximum allowable annual emission of sulfur dioxide was reduced from 114,263 tons per year to 49,414 tons per year. Although this is a significant reduction in sulfur dioxide emission, the Level 1 and Level 2 projects still would emit a substantial amount of sulfur dioxide into the atmosphere. Examination of revised Map 3-2 shows the maximum projected concentration to occur within 8 miles of Beulah. The projected annual average concentration in this area is shown to range from 1.0 to 2.5 micrograms of sulfur dioxide per cubic meter. These projected annual average concentrations are well within the State standard of 60 micrograms per cubic meter and the Federal standard of 80 micrograms per cubic meter.

With respect to Prevention of Significant Deterioration of Air Quality, the Level 1 and Level 2 projects are located in a Class II area. The maximum allowable annual arithmetic mean increment is 20 micrograms per cubic meter in a Class II area; therefore, only 14% of the allowable annual increment would be consumed by the siting of Coyote 1 and 2, ANG Coal Gasification Plant, and the Antelope Valley Units 1 and 2 in this area. As discussed earlier, these projects would meet the Class I allowable annual increments in the Theodore Roosevelt National Park.

A range of values of 1.0 to 2.5 micrograms per cubic meter is not measurable today, even with the most sophisticated field sampling equipment. The average annual projected concentration is, however, made up of values, highs and lows, the highs of which are measurable and which occur throughout the year. Effects of air pollution may also occur with higher concentration exposures for shorter averaging periods. These shorter averaging periods (1-hour, 3-hour, and 24-hour) were referred to as short-term sulfur dioxide analysis in the Draft Study.

Table 8 shows a comparative reduction in the worst-case predicted maximum short-term ground level concentrations of sulfur dioxide due to Level 1 and Level 2 projects for atmospheric stability Classes A through F. The concentrations of sulfur dioxide shown in parenthesis are based upon the Draft Study sulfur dioxide emissions. As shown in Table 8, the reduction of sulfur dioxide emissions resulted in a reduction in the amount of increase of sulfur dioxide ambient air concentrations above background.

The maximum sulfur dioxide projected concentrations, which are shown in Table 8, meet the allowable increments in the Class II area and the State and Federal ambient air quality standards. Class A atmospheric stability yielded the greatest increase in projected ground level sulfur dioxide concentrations for the 1-hour, 3-hour, and 24-hour averaging periods. The increased ground level concentrations resulting from the Level 1 and Level 2 projects, when added to the background concentrations, represent the maximum future air quality concentrations expected to occur. Under Class A stability, the future maximum ambient air quality concentrations would be 32% of the state ambient air quality standard for a 1-hour averaging period and 9% of the Federal ambient air quality standard for a 3-hour averaging period. The State standard for a 1-hour averaging period is more restrictive than the Federal 3-hour standard, and therefore, the standard which would prevail in controlling source emissions. The State Ambient Air Quality Standard for a 24-hour averaging period is more stringent than the Federal and is therefore the controlling standard. The Level 1 and Level 2 projects would be expected to result in a future maximum 24-hour concentration which is 21% of the State Ambient Air Quality Standard.

TABLE 8

SHORT-TERM SULFUR DIOXIDE ANALYSIS
LEVEL 1 AND LEVEL 2 PROJECTS

Atmospheric Stability Class	Distance North of ANG/Antelope Valley Site Boundary Wind from South (miles)	Projected Increased Ground Level Concentrations (ug/m^3)[1] 1-hr	3-hr	24-hr	Background Concentrations (ug/m^3) 1-hr	3-hr	24-hr	Total Projected Concentrations (ug/m^3) 1-hr	3-hr	24-hr
A	Site Boundary	126.1 (331.3)[2]	78.5 (206.2)	30.8 (80.9)	105	35	25	231.1 (436.3)	113.5 (241.2)	55.8 (105.9)
B	0.8	63.8 (135.2)	39.7 (84.2)	15.6 (36.7)	105	35	25	168.8 (240.2)	74.7 (119.2)	40.6 (61.7)
C	Site Boundary	117.1 (230.9)	71.4 (140.8)	28.1 (55.4)	105	35	25	222.1 (335.9)	106.4 (175.8)	53.1 (80.4)
C	1.2[3]	122.6 (241.7)	74.8 (147.5)	29.5 (58.1)	105	35	25	227.6 (346.7)	109.8 (182.5)	54.5 (83.1)
D	8.1	88.9 (153.3)	55.0 (94.7)	21.9 (37.9)	105	35	25	193.9 (258.3)	90.0 (129.7)	46.9 (62.9)
E	36.0	84.2 (120.0)	51.9 (74.0)	20.7 (29.6)	105	35	25	189.2 (225.0)	86.9 (109.0)	45.7 (54.6)
F[4]	--	--	--	--	--	--	--	--	--	--
State Ambient Air Quality Standards								715		260
Federal Ambient Air Quality Standards									1300	365
State Class II Prevention of Significant Deterioration Allowable Increment			512	91						

SOURCE: North Dakota State Department of Health 1978

1/ micrograms per cubic meter

2/ Numbers in parenthesis are projected ground level concentrations based upon outdated emissions of sulfur dioxide presented in the Draft Study. These numbers are included for comparison purposes.

3/ These concentrations were estimated to occur with the wind from the north. Therefore, ground level concentrations south of the ANG/Antelope site boundary--thus no contribution from Coyote.

4/ The projected concentrations under F stability class were found to be lower than those concentrations under E stability class for all cases. Also the distances to the point of maximum concentrations are too great such that meteorological conditions are not likely to persist long enough for the plume(s) to travel that far. The stability class is a measure of the ability of the atmosphere to disperse emissions. Generally, Classes A, B, C, and D favor rapid dispersion where as the more stable Classes, E and F, are associated with poor dispersion.

The Level 1 and Level 2 projects are within the allowable maximum Prevention of Significant Deterioration increments in this Class II area. The maximum expected consumption is 15% of the 3-hour allowable increment and 34% of the 24-hour allowable increment in a Class II. As previously discussed, these projects would meet the allowable annual, 3-hour, and 24-hour increments in the Class I Theodore Roosevelt National Park.

The preceding discussion of projected or expected ambient air quality can be placed into perspective by an analogous situation. In the Stanton vicinity there are two coal-fired electrical generating stations, the Basin Electric Leland Olds Units 1 and 2 and the United Power Association Power Plant. Although the combined generating capacity (828 megawatts) of the Stanton facilities is less than the combined generating capacity of the Antelope and Coyote power plants (1,760 megawatts) near Beulah, the maximum annual combined sulfur dioxide emissions from the Antelope Vally and Coyote Power Plants and the ANG Coal Gasification Plant are approximately 1,500 tons per year less than from the sources in the Stanton area.

Table 9 presents sulfur dioxide sampling data from the rural Stanton air quality monitoring site which is approximately 6 miles from the two Stanton plants. At the Stanton rural air sampling site 96.6% of the continuous 1-hour samples contained less than a detectable concentration of sulfur dioxide; i.e., in the range of 0 to 26.2 micrograms per cubic meter. One of the difficulties in measuring ambient concentrations of sulfur dioxide at concentrations near the lower detection limit of sampling equipment is in computing an annual average measured concentration.

Computer projections as shown in the revised Draft Study Map 3-2 indicated a projected average sulfur dioxide annual concentration of between 1.0 and 1.5 micrograms per cubic meter in the vicinity of the Stanton air monitoring site south of Stanton. Future sampling with equipment which can measure concentrations of sulfur dioxide below present lower detectable limits (26.2 micrograms per cubic meter) will add to the knowledge of annual arithmetic sulfur dioxide concentrations. Such equipment has recently been developed but has not yet been acquired for use in North Dakota.

Similar difficulties in measuring these low sulfur dioxide concentrations in the Beulah vicinity can be expected. In any event, the projected concentrations of sulfur dioxide resulting from the emissions of sulfur dioxide from the Level 1 and Level 2 projects will be well within the ambient air quality standards (3 and 4% of annual State and Federal standards, respectively). The significance of these projected air quality impacts is discussed under "Air Pollution Effects."

Analysis of the measured data at the rural Stanton site indicates that the projected sulfur dioxide concentrations resulting from Level 1 and Level 2 sulfur dioxide emissions in the Beulah vicinity are probably conservative; i.e., higher than they should be. However, with respect to future air quality, it is the philosophy of the North Dakota State Department of Health to be cautious. A cautious approach affords protection of air quality, while preventing costly retrofit modifications to the Level 1 and Level 2 projects if the future projected increases in air quality were under-estimated.

Air Quality Influence of Oil and Gas Production

Concurrent with the writing of the Draft Study, significant oil and gas exploration and production was underway in the western edge and beyond the seven-county study area. Normally, oil and natural gas production would not involve major air quality considerations. However, much of the gas which has been discovered in this area is sour gas containing hydrogen sulfide ranging in concentration from less than 2% to 24%.

Sour gas presents potential air quality problems following development of these wells, and until the gas can be sweetened to pipeline-quality for distribution to consumers as natural gas. To allow some oil production with minimum waste of the state's natural gas, industry has cooperated with the State Industrial Commission in reducing oil production to 100 barrels per day per well until gas sweetening plants can be built to remove hydrogen sulfide from the natural gas.

The reduction of oil production to conserve natural gas has also served to reduce the potential impact upon air quality which would have otherwise occurred. For safety, in the absence of sweetening plants and given the concentration range of hydrogen sulfide, it is necessary to flare the sour gas. Flaring the gas converts the hydrogen sulfide to sulfur dioxide; therefore, any reduction in the amount of sour natural gas flared will reduce the amount of sulfur dioxide in the ambient air.

TABLE 9

1977 SULFUR DIOXIDE AIR QUALITY DATA
RURAL STANTON SAMPLING SITE

Month	Maximum Average Concentration Micrograms per Cubic Meter ($\mu g/m^3$) 1-Hour	3-Hour	24-Hour	Percent of Continuous 1-Hour Samples less than 26.2 $\mu g/m^3$ (%)	Percent Data Recovery
January	131.0	78.6	26.2	95	85
February	78.6	52.4	<26.2	98	96
March	78.6	52.4	<26.2	98	83
April	1/	1/	1/	1/	0
May	1/	1/	1/	1/	0
June	1/	1/	1/	1/	0
July	78.6	78.6	<26.2	89 2/	18 2/
August	52.4	26.2	<26.2	97	100
September	78.6	52.4	<26.2	98	99
October	104.8	78.6	<26.2	95	81
November	52.4	26.2	<26.2	96	93
December	52.4	26.2	<26.2	99	80
Annual Summary	131.0	78.6	26.2	96.6	61.3

Source: North Dakota State Department of Health 1978.

1/ No continuous air sampling data available. The sampling equipment was inoperative. Backup sampling equipment (24-hour bubblers) operating on a frequency of one 24-hour sample every 6 days indicated at maximum 24-hour average concentration of <26.2 $\mu g/m^3$.

2/ Sampling resumed on July 26, 1977.

Oil and Gas Production Potential

The Little Knife Field, which is located along the common boundary of Dunn and Billings Counties, has grown from a discovery well in late 1976 to 74 producing wells in December of 1978. This field is increasing at the rate of about one new production well per week. Only five dry holes have been drilled in this field, to date. It is estimated that the Little Knife Field will eventually contain 120 to 150 wells. The wells in this field produce both oil and gas. The gas in this field is primarily sour, although a few sweet gas wells have been drilled. The average hydrogen sulfide concentration in the gas was initially estimated at 12%.

In addition to the Little Knife Field, which is now well established, other oil and gas exploration wells being drilled in late summer of 1978 exploration wells could develop into additional fields. Two discoveries with potential air quality problems are oil and sour gas production wells located just north of the Prevention of Significant Deterioration Class I Theodore Roosevelt National Park South Unit and a sour gas well located just north of the Park North Unit. Although the sour gas concentration of hydrogen sulfide (4 to 6%) is lower than that in the Little Knife Field, the wells are located closer to the Class I Theodore Roosevelt National Park.

Air Pollution Control of Sour Gas

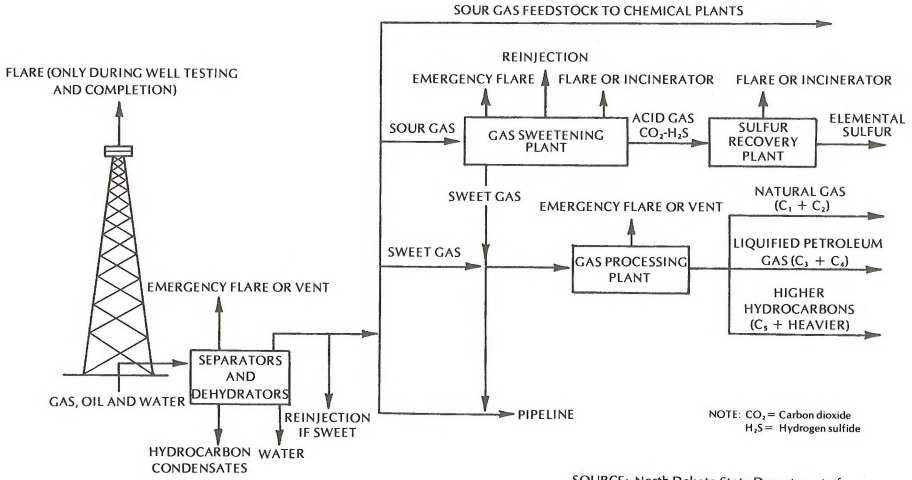
The generalized flow of natural gas and gas products from the well to consumers is shown in Figure 3. If the well gas is sweet, the gas either goes directly to a natural gas pipeline or to a gas processing plant to recover liquefied petroleum gas and higher hydrocarbons. However, if the well gas is sour, as in the Little Knife Field, the gas must be sweetened before it can enter the pipeline or gas processing plant. There are no major chemical processing plants in North Dakota so all of the sour gas goes to the gas sweetening plant. The sulfur in the hydrogen sulfide is removed in the sulfur recovery plant.

To allow for full production of oil from the wells of the Little Knife Field; i.e., more than 100 barrels per day per well, a gas sweetening plant was constructed with sulfur recovery. The first 5 million cubic feet per day phase of this plant began operation in July of 1978 with the second 10 million cubic feet per day phase operational in November of 1978. When the total plant capacity of 15 million cubic feet per day is reached, all of the present well gas from the Little Knife Field will be processed. With the expansion of this field it may be necessary to increase the capacity of this plant or build an additional gas sweetening/processing plant in or near the Little Knife Field.

The gas sweetening/processing plant referred to above is the Warren Petroleum Little Knife Gas Processing Plant. Existing state and federal regulations required a prevention of significant deterioration review of this facility and a permit to construct. An application for a permit to construct was filed by the Warren Petroleum Company with the North Dakota State Department of Health in October 1977. The application, along with supporting data, was reviewed by the Department with regard to expected emission and the effects of these emissions upon the ambient air quality and the nearby Class I area of the Theodore Roosevelt National Park.

FIGURE 3

GENERALIZED FLOW DIAGRAM OF THE NATURAL GAS INDUSTRY



SOURCE: North Dakota State Department of Health 1977 - Warren Petroleum Little Knife Gas Processing Plant Permit to Construct Application.

The permit to construct application provided a plant design which would handle 15 million cubic feet per day of natural gas. The plant was to be located in Billings County. Ninety-eight percent of the sulfur in the gas was to be removed as elemental sulfur and sold. The remaining sulfur in the form of hydrogen sulfide was to be ignited in a tail gas incinerator and changed to hydrogen and hydrogen sulfide. The primary air pollutant from the plant will be sulfur dioxide. Minor pollutants consist of carbon monoxide, oxides of nitrogen, and particulate.

In view of the Clean Air Act Amendments of 1977, this facility was reviewed for best available control technology. After due consideration was given to the environmental, economic, and energy impacts of the various control units, it was determined that the best available control technology for the Little Knife Gas Processing Plant would be represented by an emission limit that could be achieved with a sulfur recovery unit having a guaranteed efficiency of 98%. This 98% sulfur recovery reduced the emissions of sulfur dioxide from this plant from a potential 160.74 tons per day to 3.23 tons per day. The potential 160.74 tons per day was based upon the flaring of the acid gas without sulfur recovery. The total annual emissions of sulfur dioxide are 1,179 tons per year. All other pollutant emissions (particulate, carbon monoxide, oxides of nitrogen) from the boilers are less than 5 tons per year each.

The analysis of the effect upon air quality of the projected emission of 3.23 tons per day from the Warren Petroleum natural gas plant involved a review similar to that of the coal fired Level 1 and Level 2 projects. The emissions from the natural gas plant had to be such that no violations of the Ambient Air Quality Standards or allowable Prevention of Significant Deterioration Class I increments in the Theodore Roosevelt National Park would occur.

The major air pollutant produced by natural gas processing plants receiving sour gas is sulfur dioxide. Therefore, sulfur dioxide was the only air pollutant used in the modeling analysis. However, all air contaminants listed in the ambient air quality standards were examined to insure compliance with the standards and that no violations are expected. The estimated ground level concentrations of sulfur dioxide, predicted by the air dispersion modeling, were compared with the Ambient Air Quality Standards and the applicable Prevention of Significant Deterioration increments. Sulfur dioxide was modeled for both annual and short-term (time periods less than or equal to 24 hours) averaging time intervals.

The analysis of annual average ground level concentrations included consideration of the Coal Creek Power Plant near Underwood, the Coyote Power Plant, the ANG Coal Gasification Plant and the Antelope Valley Power Plant since these permitted stationary sources influence the Theodore Roosevelt National Park sulfur dioxide Prevention of Significant Deterioration increments. Therefore, their combined estimated concentrations were added to Warren Petroleum's projected concentrations. Map 2 shows the projected increase in annual sulfur dioxide ground level concentrations. The maximum predicted concentration increase is 2.7 micrograms per cubic meter. This is 18% of the State annual Prevention of Significant Deterioration Class II allowable increment of 15 micrograms per cubic meter. The estimated value of 2.7 micrograms per cubic meter, when added to an annual sulfur dioxide background level of 5.0 micrograms per cubic meter, gives a value of 7.7 micrograms per cubic meter which is 12.8% of the state annual ambient air quality standard of 60 micrograms per cubic meter.

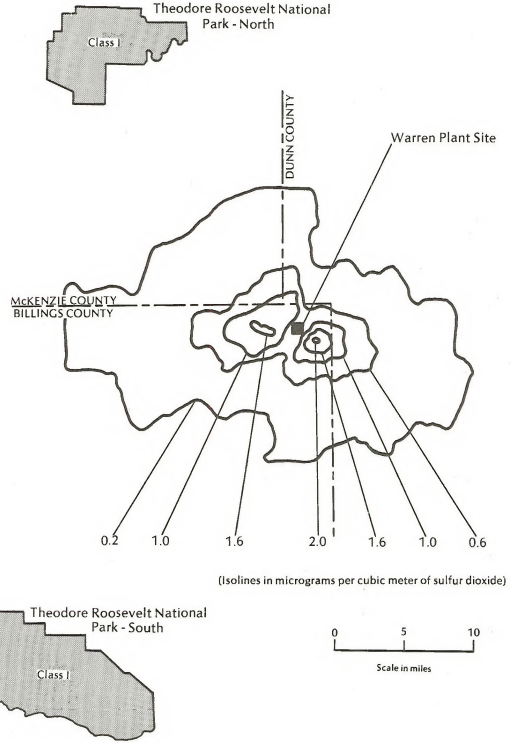
Results of the short-term sulfur dioxide averaging time intervals, i.e., the 1-hour, 3-hour, and 24-hour periods, are shown in Table 10. The maximum projected worst case short-term concentrations are expected to occur under the Class C atmospheric stability at 1.4 kilometers (0.87 miles) from the boundary of the Warren plant. The estimated values under Class C stability, when added to the respective 1-hour, 3-hour, and 24-hour background concentrations, are shown to be well within the ambient air quality standards. The 1-hour predicted maximum ambient air quality concentration of 337.4 micrograms per cubic meter is 47% of the corresponding State ambient air quality standard and the 3-hour projected concentration of 153.1 micrograms per cubic meter is 12% of the corresponding Federal ambient air quality standard. The State ambient air quality 1-hour standard of 715 micrograms per cubic meter is more stringent than the Federal 3-hour standard of 1,300 micrograms per cubic meter.

With respect to the maximum 24-hour predicted ambient air concentrations, a value of 62.5 micrograms per cubic meter would be 24% and 17%, respectively, of the State and Federal ambient air quality standards. Also, in the case of the projected 24-hour concentrations, the more stringent State standard would be the controlling factor.

The area surrounding the Warren plant is a Class II area. The allowable State and Federal increments above the January 1, 1975, baseline in this area are (shown in Table 10) 512 and 91 micrograms per cubic meter, respectively, for the averaging periods of 3-hour and 24-hour time intervals. Using the worst case values from the Class C atmospheric stability shows that the 3-hour value of 118.1 micrograms per cubic meter and the 24-hour value of 37.5 micrograms per cubic meter consume

MAP 2

COMBINED ANNUAL SULFUR DIOXIDE (SO_2) CONCENTRATIONS FROM WARREN PETROLEUM, COAL CREEK STATION, COYOTE STATION, AMERICAN NATURAL GAS AND ANTELOPE VALLEY STATION



SOURCE: North Dakota Department of Health 1978.

TABLE 10

WARREN PETROLEUM SHORT-TERM SULFUR DIOXIDE ANALYSIS

Stability Class	Distance From Boundary of Warren Plant (km)	Micrograms per Cubic Meter of Sulfur Dioxide: Projected Maximum Concentration[1] 1-hour	3-hour	24-hour	Background Concentration 1-hour	3-hour	24-hour	Total Concentration 1-hour	3-hour	24-hour
A	0.6	79.6 (0%)[2]	49.5 (0%)	19.5 (0%)	105	35	25	184.6	84.5	44.5
B	0.9	56.5 (0%)	35.1 (0%)	13.8 (0%)	105	35	25	161.5	70.1	38.8
C	1.4	232.40 (53%)	118.1 (44%)	37.5 (30%)	105	35	25	337.4	153.1	62.5
D	3.2	221.5 (55%)	112.2 (46%)	35.7 (32%)	105	35	25	326.5	147.2	60.7
E	7.6	133.2 (68%)	82.1 (68%)	32.8 (68%)	105	35	25	238.2	117.1	57.8
F	17.4	84.9 (68%)	52.4 (68%)	20.9 (67%)	105	35	25	189.9	87.4	45.9

State Ambient Air Quality Standards	715	260
Federal Ambient Air Quality Standards	1300	365
State and Federal PSD Class II Increments	512	91

SOURCE: North Dakota State Department of Health 1978.

1/ Projected maximum concentration includes consideration of other sulfur dioxide emissions including the Coal Creek Power Plant, the Coyote Power Plant, the ANG Coal Gasification Plant, and the Antelope Valley Power Plant as well as the Warren Plant.

2/ Number in parenthesis indicates the percentage of the projected maximum concentration due to source emissions other than from the Warren Plant.

23% and 41%, respectively, of the 3-hour and 24-hour increment available in the area surrounding the Warren plant. Under atmospheric stability Classes A and B, the meteorological conditions are such that there was no interaction of emissions of sulfur dioxide from the Warren plant with those from the other sources considered in this analysis. However, under atmospheric stability Classes C through F, a greater influence of long-range transport of sulfur dioxide is seen with the other sources accounting for 30 to 68% of the total maximum increase.

The effect of the Warren plant on the allowable Prevention of Significant Deterioration Class I area increments in the Theodore Roosevelt National Park was also examined. In the previous discussion of the air quality effects of Level 1 and Level 2 projects, the allowable increment of 5 micrograms per cubic meter for the 24-hour sulfur dioxide averaging period was shown to be filled. The 24-hour sulfur dioxide increment in that case was the controlling factor. As will be shown, the Prevention of Significant Deterioration review of new sources must be on a case-by-case basis.

On Map 3, the Warren Plant is shown to be outside of the major wind flow vectors to the Theodore Roosevelt National Park from the distant sources of Coal Creek, Coyote, ANG, and Antelope Valley. Furthermore, the Warren plant is much closer to both the North and South Units of the Park. Contrasted with the analysis of the long-range transport of sulfur dioxide from the four remote facilities, the 3-hour allowable increment will become a more limiting factor.

With the addition of the Warren plant into the prevention of significant deterioration analysis process, the interaction of sulfur dioxide emissions changed by virtue of the geographic locations of the five sources under consideration. The results of the computer dispersion modeling for the 24-hour averaging period are shown in Table 11. The prevention of significant deterioration regulations allow for one exceedance per year of the 24-hour Class I standard increment of 5 micrograms per cubic meter. However, as shown in Table 11, no values exceeding the 5 micrograms per cubic meter increment were found over both the North and South Units of the Theodore Roosevelt National Park as a result of the Warren plant emission interaction with other prevention of significant deterioration sources. It appears that the geographical orientation of Warren Petroleum Company, and the other prevention of significant deterioration sources with respect to the Class I areas in combination with the meteorological conditions are such that the emissions from the Warren Petroleum Plant would not cause violations of the Class I allowable increment.

The annual increased sulfur dioxide concentration over the Theodore Roosevelt National Park was predicted to be less than 0.2 micrograms per cubic meter which is 10% of the Class I annual increment of 2 micrograms per cubic meter. The controlling 24-hour concentration increase shown in Table 11 was predicted to be 2.5 micrograms per cubic meter of the air over the North Unit of the Park. This is 50% of the Class I allowable 24-hour increment of 5 micrograms per cubic meter of air.

The maximum 3-hour concentration increase over the North Unit of the Theodore Roosevelt National Park was predicted to be 21.8 micrograms per cubic meter, which is 87% of the allowable Class I, 3-hour, increment of 25 micrograms per cubic meter of air. Although the Warren Petroleum Plant is shown to meet all of the requirements of ambient air quality and prevention of significant deterioration Class I area (see Table 11) increments, the 3-hour Class I allowable increment is the most limiting factor in consideration of future expansion of the gas production capacity at this plant site. Following this air quality analysis and a subsequent 30-day public comment period, a Permit to Construct was granted for this facility.

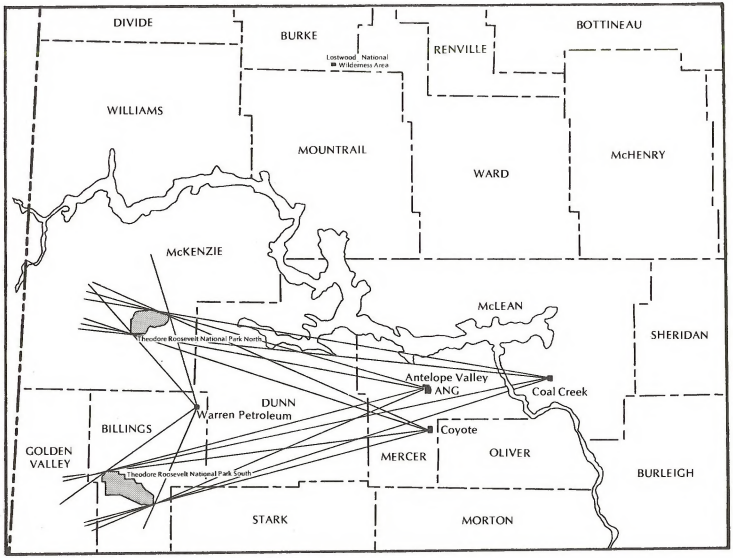
With respect to the oil and gas discoveries mentioned earlier (which are closer to the Theodore Roosevelt National Park and which represent possible field development), plans are now underway considering the utilization of gas processing plants similar to the Warren Petroleum Plant. The designs for these gas processing plants will be carefully reviewed to assure that the Class I allowable increments for sulfur dioxide in the Park are not exceeded.

Influence on Coal Development

Siting and air pollution control design considerations of future sour gas processing plants and future coal-fired facilities are major factors in the location and extent of possible further increases in energy development in western North Dakota. As has been shown earlier, the potential for future coal conversion plants east of the Theodore Roosevelt National Park in the seven-county study area has already been limited by the emission of sulfur dioxide from the coal-fueled Level 1 and Level 2 projects near Beulah. The Antelope Valley and Coyote (Unit 2, if built) power plants must reduce their sulfur dioxide emission in order to meet Theodore Roosevelt National Park Class I allowable increments. The denial of a Permit to Construct for the NGPL Coal Gasification Plant in Dunn County is expected because no Theodore Roosevelt National Park Class I sulfur dioxide 24-hour increment is available for this plant (given proposed emission levels and plant site location).

MAP 3

RELATIONSHIP OF LEVEL 1, LEVEL 2, AND WARREN PETROLEUM SOURCES TO THE THEODORE ROOSEVELT NATIONAL PARK WITH WIND FLOW VECTORS



SOURCE: North Dakota State Department of Health 1978.

TABLE 11

THEODORE ROOSEVELT NATIONAL PARK
ESTIMATED SULFUR DIOXIDE GROUND LEVEL CONCENTRATIONS
(MICROGRAMS PER CUBIC METER)

1964 Day	TRNMP Unit	Total[1/]	Coal Creek	Coyote	Basin 1	Basin 2	ANG	Warren Petroleum
34	North	2.5	0	0	0	0	0	2.5
300	North	4.1	0.7	0.2	0.4	0.4	1.0	1.4
23	South	3.6	0	1.9	0.2	0.2	0.8	0.5
318	South	2.2	0.7	0.5	0	0	0.1	0.9

SOURCE: North Dakota State Department of Health 1978

1/ Class I 24-hour sulfur dioxide increment is 5 micrograms per cubic meter. May be exceeded once only.

Availability of Class I increments in the Theodore Roosevelt National Park for future coal conversion plants anywhere in western North Dakota may be limited by oil and gas development since much of the gas is sour and the location of the sour gas wells and possible gas processing plants is nearer the North and South Units of the Park. Furthermore, oil and gas development moves at a more rapid pace. For example, the Warren Petroleum Plant was operational within approximately one year of filing of a Permit to Construct, and capable of processing 15 million cubic feet of natural gas per day. On the other hand, many years of design go into most coal-fueled plants before a Permit to Construct application is filed with the Department.

If gas containing hydrogen sulfide continues to be found in new wells around the Theodore Roosevelt National Park, the allowable increments possibly available for future coal development may be consumed in whole or part before coal-fuel plants are designed and Permit to Construct applications are filed. It would appear that mine-mouth coal utilization in western North Dakota has hit a plateau, at least east of the Park. In any event, careful attention to the site location and design of pollution control devices for major energy development projects in western North Dakota, whether coal or sour natural gas, will be required if energy development is to continue.

Oil and gas production in western North Dakota has unique characteristics which make the protection of air quality difficult. In addition to the rapid developments which have occurred, air quality analysis of this development is complicated by other factors. Review of coal-fueled projects are also involved and complicated. However, before coal development projects are constructed, there is an opportunity to review designs and specifications and have a resonable expectation of air pollutant emissions and their effects upon air quality.

Contrasted to this pre-design situation, it is not known until the oil or gas well is completed whether potential air pollution problems exist. When a new well is drilled it is not known if it will be a dry hole or a producer, if it is a producer whether it is oil and/or gas, if it produces gas whether it is sweet or sour gas, and if it is sour what is the concentration of hydrogen sulfide and quantity of gas. Many of the unknowns in the Little Knife Field have been resolved because of the degree of development which has occurred in that field. However, there are a number of unknowns yet to be determined with the drilling of exploration wells in closer proximity to the Theodore Roosevelt National Park.

Air Pollution Effects

In consideration of amendments to the Federal Clean Air Act, Congress received testimony, reports, and studies which raised doubts concerning the adequacy of present National Ambient Air Quality Standards and by association, the State Ambient Air Quality Standards. Questions included: (1) do the present standards really protect public health of all people including the sensitive or susceptible groups within the broader "healthy" population; (2) are standards for more pollutants needed to protect the environment, including cancer causing chemicals, derivative pollutants that change form in the environment (e.g., sulfur dioxide to sulfates), radioactive material and trace metals; and (3) should the standards be tightened in light of air quality effect studies on vegetation showing damage occurring at levels below the federal standards.

It is appropriate to question the adequacy of ambient air quality standards since this is the measure of acceptability or non-acceptability of future proposed actions. The Clean Air Act Amendments of 1977 reemphasize the need for greater attention to the cause-effect relationships of air quality, public health, and welfare. Specific tasks were detailed in this law which require the Administrator of the EPA to implement this reemphasis.

Air pollution control and prevention of future potential problems have been actively pursued in North Dakota since the 1969 passage of an Air Pollution Law by the State Legislature. Much has been accomplished in 10 years; however, as our knowledge advances, many unresolved environmental issues continue to surface. Some important issues must be examined in more detail in the years ahead: (1) the possibility of carcinogenic and other adverse impacts of man-made materials at low concentration levels over long periods of time; (2) analysis and monitoring of trace quantities of pollutants in the air, water and land environment; (3) synergistic interactions of pollutants in the environment; and (4) long distance atmospheric transport of pollutants. These are examples of issues discussed below which concern the relationship of energy development projects to effects upon the environment.

Ambient Air Quality Standards

Ambient air quality standards play an important role in evaluating the environmental impacts of proposed future energy development activities. This was the case in the Draft Study. Effects upon air quality were discussed in Chapter 3 of the Draft Study in terms of whether emissions from proposed

Level 1 and Level 2 projects would result in future air quality levels within the ambient air quality standards. The decision role of the ambient air quality standards was again shown in the discussion of mitigation in Chapter 4 of the Draft Study. The role of the ambient air quality standards in both Chapter 3 and Chapter 4 is one of determining the acceptability of the environmental air quality resulting from Level 1 and Level 2 projects, and to determine if additional mitigation measures will be needed to alleviate potential future environmental effects.

In the air quality environmental effects and mitigation portions of the Draft Study, the proposed major air emissions from Level 1 and Level 2 projects were found to be well within the ambient air quality standards even under the maximum or "worst case" conditions of expected emissions and meteorology. Statements following this analysis summarized this finding as, "Based upon current air quality standards, the impacts upon the air quality in the seven-county study area as a result of the proposed industrial developments would not be significant." In the interest of conserving paper in a document which already was quite large (even without the technical supplements), it was thought that the specialized reader could refer to the analysis results and evaluate the meaning of such results.

The assessment of the impacts of the proposed Draft Study projects was presented within the scope of the scientific knowledge base of relationships between air pollutants, human health, and the environment. Research in the future may clarify these relationships. In this event, air quality standards may be adjusted accordingly in the public interest, so that hazards to the health, safety, property, and welfare of North Dakota's citizens would not occur. Any proposed energy development, which presents a hazard to the health, safety, and welfare of the citizens of North Dakota through degradation of the air quality by the emissions of regulated air pollutants will not be allowed.

As described earlier, the State of North Dakota has been conservative and cautious in the adoption of ambient air quality standards by setting maximum allowable air quality standards which are equal to or more stringent than the National Ambient Air Quality Standards. The philosophy of the North Dakota State Department of Health, who promulgated the State Ambient Air Quality Standards in 1970, was that the air quality of this state, which is better than existing National Ambient Air Quality Standards, must not be allowed to degrade to the National Standards. This philosophy has been supported in recent years with the establishment of prevention of significant deterioration laws and regulations which are designed to protect air quality deterioration in areas now cleaner than the National Ambient Air Quality Standards. A side-by-side comparison of the State and Federal Ambient Air Quality Standards is shown in Table 12.

The state ambient air quality standards set maximum permissible concentrations for 12 air pollutants compared to six pollutants covered by the federal standards. Five of the 12 state standards relate sulfur with sulfur dioxide, its environmental derivative chemical compounds and hydrogen sulfide. Since particulate matter is the major air pollutant in North Dakota, i.e., approaching ambient quality standards, the state has three standards which address total suspended particulate matter, settled particulate matter, and coefficient of haze. The remaining four pollutants, carbon monoxide, photochemical oxidants, hydrocarbons, and nitrogen dioxide, are also addressed in the federal standards.

The federal standards are divided into primary and secondary categories. The more stringent of the federal standards are the secondary standards. The secondary standards were designed to prevent effects upon such things as vegetation, animals, and exposed materials. The federal primary standards were designed to protect against adverse health effects. The state philosophy of adopting conservative standards is evident in Table 12.

There is a tendency to treat the ambient air quality standards as a fine dividing line between expected effects and no effects. This is often referred to as a threshold concept. Another premise which holds more scientific validity is that of the linear (no threshold) concept in which effects increase with increased concentration and the only true "no effect" level occurs at zero contamination. One of the most difficult aspects of setting realistic and effective standards is that effects may not be measurable or observable at concentrations above zero contamination. It then becomes a problem of finding the most susceptible element of the environment and setting the air quality maximum concentration and period of exposure to that concentration, such that damage to the susceptible element is not observed. Congress, in recognition of some of the difficulties in setting proper air quality standards and, in view of the questions raised concerning the adequacy of standards, placed a high priority on air quality in the Clean Air Act Amendments of 1977. Congress has asked the Administrator of EPA for reassurance that the standards are adequate and, if reassurance could not be demonstrated, for appropriate action to correct the situation.

The Clean Air Act Amendments of 1977 contained a number of specific provisions related to air quality standards including: (1) changes in wording

TABLE 12

STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS

Air Contaminant	Averaging Period	Maximum Permissible Concentration: North Dakota	Federal Primary (Health)	Federal Primary (Welfare)
1. Total Suspended Particulate (ug/m^3)[1]	Annual Geometric Mean	60	75	60
	24-hour	150[2]	260	150
2. Settled Particulate-Dustfall (units tons per square mile per month)	3-month (residential)	15	-	-
	3-month (residential)	40	-	-
3. Coefficient of Haze (units of Coefficient of Haze per 1,000 linear feet)	Annual Geometric Mean	0.4	-	-
4. Sulfur Dioxide (ug/m^3)	Annual Average	60	80	-
	24-hour	260	365	-
	3-hour	-	-	1300
	1-hour	715	-	-
5. Reactive Sulfur ($mg/100\ cm^2/day$)[3]	Annual Average	0.25	-	-
	1-month	0.5	-	-
6. Suspended Sulfates (ug/m^3)	Annual Average	4	-	-
	24-hour	12[4]	-	-
7. Sulfuric Acid Mist, Sulfur Trioxide or Combination (ug/m^3)	Annual Average	4	-	-
	24-hour	12[4]	-	-
	1-hour	30[4]	-	-
8. Hydrogen Sulfide (ug/m^3)	1/2-hour	45[5]	-	-
	1/2-hour	75[6]	-	-
9. Carbon Monoxide (mg/m^3)[7]	8-hour	10[2]	10	10
	1-hour	40[2]	40	40
10. Photochemical Oxidants (ug/m^3)	1-hour	160[2]	160	160
11. Hydrocarbons (ug/m^3)	3-hour (6-9 a.m.)	160[2]	160	160
12. Nitrogen Dioxide (ug/m^3)	Annual Average	100	100	100
	1-hour	200[8]	-	-

SOURCES: North Dakota Air Pollution Control Regulations
Federal Standards - 40 CFR Part 50, 1976

1/ micrograms per cubic meter.
2/ Maximum not to be exceeded more than once per year.
3/ milligram sulfur trioxide per 100 square centimeters per day
4/ Maximum not to be exceeded over 1% of the time.
5/ Maximum not to be exceeded more than twice in any five consecutive days.
6/ Maximum not to be exceeded over twice a year.
7/ milligrams per cubic meter.
8/ Maximum not to be exceeded over 1% of the time in any 3-month period.

which broaden the role of the EPA Administrator in setting National Ambient Air Quality Standards; (2) a required determination of the need for a short-term (less than 3-hour) standard for nitrogren dioxide; (3) establishment of a minimum frequency for review of air quality criteria and National Ambient Air Quality Standards; (4) creation of an independent scientific review committee to review the air quality criteria and National Ambient Air Quality Standards; and (5) review of pollutants such as radioactive pollutants, cadmium, arsenic, and polycyclic organic matter which are not currently regulated under the air pollution control regulations.

Various changes in wording in the Clean Air Act Amendments of 1977 have broadened the role of the Administrator of EPA in setting national primary and secondary standards. One example of this is the wording change in Section 108.(A.) of the Clean Air Act Amendments of 1970 which stated that ". . . each air pollutant - (A) which in his judgment has an adverse effect on public health and welfare." The Clean Air Act Amendments of 1977 changed this to read ". . . each air pollutant - (A) emissions of which in his judgment, cause or contribute to air pollution which may reasonably be anticipated to endanger public health or welfare;." The importance of statements such as this is that a physical demonstration of effects is no longer necessary in making these judgments, but rather a reasonable anticipation of the pollutant to endanger public health and welfare.

Congress requested the Administrator of EPA to revise and reissue criteria relating to concentrations of nitrogen dioxide over such period (not more than three hours) as deemed appropriate. This criteria is to include a discussion of nitric and nitrous acids, nitrites, nitrates, nitrosamines, and other carcinogenic and potentially carcinogenic derivatives of oxides of nitrogen. A number of important air quality questions are evident in this congressional action. These questions relate the need for short-term nitrogen dioxide standards, in addition to the current federal annual standard, to examine cancer causing potential, and to provide a new focus on derivative chemicals. The derivative chemicals are those which change chemical composition; for example, the conversion of nitrogen dioxide to nitrates in the ambient air. This criteria document was to be issued not later than February 7, 1978. The Administrator of EPA was also required to promulgate by August 7, 1978, a national primary air quality standard for nitrogen dioxide (for averaging periods of not more than 3 hours), unless he finds that there is no significant evidence that such a standard is necessary to protect public health. The criteria document and the Administrator's decision as to necessity for this standard had not been published as of October 1, 1978.

The Clean Air Act Amendments of 1977 established the minimum frequency for review of air quality criteria and National Ambient Air Quality Standards changing the frequency from "time-to-time" to "not later than December 31, 1980, at 5-year intervals thereafter." The Administrator could review and revise the criteria or promulgate new standards earlier or more frequently than the required 5-year interval.

An independent scientific review committee was created by the Clean Air Act Amendments of 1977. This committee, appointed by the Administrator of EPA, is to be composed of seven members including at least one member of the National Academy of Sciences, one physician, and one person representing state air pollution control agencies.

Not later than January 1, 1978, and at 5-year intervals thereafter, the committee must complete a review of air quality and the National Primary and Secondary Ambient Air Quality Standards and recommend to the Administrator any new National Ambient Air Quality Standards and revisions of existing criteria and standards as may be appropriate. This committee must also advise the Administrator of areas in which additional knowledge is required to appraise the adequacy and basis of existing, new, or revised National Ambient Air Quality Standards; describe the research efforts necessary to provide the required information; advise the Administrator on the relative contribution to air pollution concentrations of natural as well as anthropogenic activity; and advise the Administrator of any adverse public health, welfare, social, economic, or energy effects which may result from various strategies for attainment and maintenance of such National Ambient Air Quality Standards.

In consideration of amendments to the Federal Clean Air Act, questions were raised concerning pollutants which were not currently addressed under air pollution regulations. Congress responded to these questions by requesting the Administrator of EPA to review all relevent information and determine whether or not emissions of radioactive pollutants, cadmium, arsenic, and polycyclic organic matter into the ambient air will cause, or contribute to air pollution which may reasonably be anticipated to endanger public health. If the Administrator finds that any of these substances need air pollution regulation, he is to, simultaneously with this determination, include this substance either under a list for air quality criteria and National Ambient Air Quality Standards or National Emissions Standards for Hazardous Air Pollutants. The determination by the Administrator concerning cadmium, arsenic, and polycyclic organic matter was to be completed by August 7, 1978; however, this was not completed as of October 1, 1978. The determination, with re-

spect to radioactive pollutants, is due by August 7, 1979.

The Administrator, in this section of the Clean Air Act Amendments of 1977, was also to conduct a study, in conjunction with other appropriate agencies, concerning the effect on the public health and welfare of sulfates, radioactive pollutants, cadmium, arsenic, and polycyclic organic matter which are present or may reasonably be anticipated to occur in the ambient air. This study is to include a thorough investigation of how sulfates are formed and how to protect public health and welfare from the injurious effects, if any, of sulfates, cadmium, arsenic, and polycyclic organic matter.

All of the preceding are examples of the importance which Congress placed upon ambient air quality and the need to have standards which will protect public health and welfare. The setting of appropriate standards is not a simple matter. It requires careful scientific analysis. Some of the complexities involved in this analysis will be pointed out in the following discussion.

Comparisons of air quality impacts of Level 1 and Level 2 projects with the Ambient Air Quality Standards are presented in Table 13. The major air pollutant emissions from Level 1 and Level 2 projects are particulate matter, sulfur dioxide, and oxides of nitrogen. The increases in concentration and resulting expected maximum ambient air quality values are compared to the ambient air quality standards. It should be noted that these maximums occur at the facility boundaries or within eight miles of the Level 1 and Level 2 project sites in the Beulah vicinity.

The greatest air quality impact of Level 1 and Level 2 projects on air quality will be in Mercer and Oliver Counties. The following discussion will relate the expected air pollution effects of Level 1 and Level 2 project emissions to this maximum impact area, and specifically the Beulah vicinity. An analysis of the maximum effect conditions and the acceptability of Level 1 and Level 2 projects, in that area, would indicate expected effects at a lower level in the rest of the seven-county study area, the Fort Berthold Indian Reservation, and the Knife River Indian Villages National Historic Site near Stanton.

Human Health Effects

Contamination of the environment with air pollutants influences the health of persons living within the environment. Clearly, this has been demonstrated in historical urban air pollution episodes which have been attributed to cause-increased hospital admissions, serious illnesses, and deaths. Conversely, as the ambient air quality in major urban areas of the United States has improved, the seriousness and frequency of respiratory diseases related to pollution has reduced. Attaining the National Ambient Air Quality Standards has resulted in decreases in the incidence of emphysema, asthma attacks, and other respiratory diseases.

How much contamination of the environment with air pollutants can be allowed and still protect public health (the susceptible and chronically ill, as well as healthy people) is a major question related to the establishment of ambient air quality standards. The current ambient air quality standards, established in the early 1970s, were promulgated based upon the scientific evidence available at that time and with the presumption that the standards provided a factor of safety. The National Ambient Air Quality Standards provide standards for six criteria pollutants, and North Dakota Standards, promulgated at about the same time, increased the list of pollutants covered. Further, with respect to sulfur dioxide and nitrogen dioxide, North Dakota set standards which are more restrictive than the national standards, as shown in Table 12.

Testimony in consideration of the Clean Air Act Amendments of 1977 questioned the existence of the factor of safety with reports that the public health is being harmed to some extent, perhaps seriously, at pollutant concentrations less than the national standards. Other questions were raised concerning the limiting of the National Ambient Air Quality Standards to the six criteria pollutants since other pollutants have the potential for health effects.

The factor of safety in preventing health effects has been questioned in terms of indications that deaths have occurred at pollution levels not far above the Federal primary 24-hour standard for sulfur dioxide (365 micrograms per cubic meter). The comparable state ambient air quality sulfur dioxide standard is 260 micrograms per cubic meter which gives greater protection of public health than the current national standards. The projected maximum increase of 30.8 micrograms per cubic meter (Table 13) of sulfur dioxide (24-hour averaging period) resulting from Level 1 and Level 2 projects is expected to result in a maximum ambient air concentration of 55.8 micrograms per cubic meter.

Furthermore, the application of prevention of significant deterioration increments for a Class II area in North Dakota has the effect of establishing an upper limit (below the ambient air quality standard) on the amount of pollution which will be permitted. In the case of sulfur dioxide, which is one of two pollutants regulated under prevention of significant deterioration regulations (particulate matter is the other), the maximum North Dakota allowable increment for a 24-hour averaging period is 91 mi-

TABLE 13

SUMMARY OF PROJECTED AMBIENT AIR QUALITY
CHANGES DUE TO LEVEL 1 AND LEVEL 2 PROJECTS

Air Pollutant and Concentration Averaging Period	Ambient Air Concentrations Micrograms Per Cubic Meter (1) Projected Maximum Increase Due to Level 1 and Level 2 Projects[1]	(2) Estimated Existing Background[8]	(3) Expected Maximum Air Quality (1) & (2)	(4) Ambient Air Quality Standard
Total Suspended Particulates				
Maximum annual mean[2]	3.0	25.0	28.0	60
24-hour maximum[3]	7.0	80.0	87.0	150
Sulfur Dioxide				
Maximum annual mean[4]	2.5	5	7.5	60(80)[10]
24-hour maximum[5]	30.8	25	55.8	260(365)
3-hour maximum[5]	78.5	35	113.5	(1300)
1-hour maximum	126.1	105	231.1	715
Nitrogen Dioxide				
Maximum annual mean[8]	5.8	5	10.8[9]	100[11]
1-hour maximum[7]	203.1	55	258.1	200

SOURCE: North Dakota State Department of Health 1978

1/ Maximums noted are expected to occur at plant boundaries or within 2 miles of the Level 1 and 2 projects located in the Beulah vicinity.
2/ Geometric mean.
3/ Maximum concentration not to be exceeded more than once per year.
4/ Arithmetic mean.
5/ Averaging period for federal secondary standard. Ambient air quality standard is not to be exceeded more than once per year.
6/ Arithmetic mean.
7/ Maximum concentration not to be exceeded over 1% of the time in any 3-month period.
8/ Estimated existing background concentrations were derived from North Dakota State Department of Health air quality monitoring stations are representative of existing air quality in the seven-county study area.
9/ This concentration is expected to occur not more than 0.001% of the time on an annual basis and therefore within the averaging periods described in footnote 7 above.
10/ Numbers in parenthesis are the Federal Standards. These are presented in those instances where the State ambient air quality standard is more stringent.
11/ There is currently no Federal standard for nitrogen dioxide other than for the annual mean averaging period. This matter is currently under study by the U.S. Environmental Protection Agency for possible promulgation of a short-term (less than 3-hour) standard.

crograms per cubic meter. This 91 micrograms per cubic meter maximum increase of sulfur dioxide effectively sets the expected maximum air quality concentration at 116 micrograms per cubic meter including the estimated existing maximum concentration. The 91 micrograms per cubic meter increment allows for some additional future local development beyond the ANG Coal Gasification Plant, Coyote 1 and 2, and Antelope Valley Units 1 and 2 (hereafter referred to as "Level 1 and Level 2 Beulah projects"); however, the 116 micrograms per cubic meter ambient air quality concentration level is now the limit on major industrial growth in that area.

Another factor which may further limit the amount of major industrial contamination of air in Mercer and Oliver Counties is the federal designation of the Theodore Roosevelt National Park and the Lostwood National Wilderness Area as Class I prevention of significant deterioration areas. The emissions of sulfur dioxide from the major sources in Mercer County and other applicable interacting sources cannot exceed the allowable Class I area increments. As discussed previously, the allowable increments in the Theodore Roosevelt National Park have been filled with the three Level 1 and Level 2 Beulah projects.

The questions of the public health factor of safety in the national primary standards, although important to resolve, do not appear to be urgent with respect to Level 1 and Level 2 projects since prevention of significant deterioration Class I and Class II regulations are providing a factor of safety for the air quality of the seven-county study area. The current expected sulfur dioxide maximum 24-hour ambient air quality concentration of 55.8 micrograms per cubic meter would be considerably better than both the respective state and federal standards of 260 and 386 micrograms per cubic meter.

Similarly, the other current federal air quality standards have been questioned as to the factor of safety they afford in protecting the health of vulnerable groups including infants, the very old, persons with heart and lung disease, and those who are pregnant. These groups could require a better ambient air quality than now provided by the National Ambient Air Quality Standards.

The short-term, i.e., other than annual, maximum concentrations shown in Table 13 do not take into account such factors as frequency of occurrence. Further, these maximums should not be construed as those which would occur throughout the seven-county study area. Experience in sulfur dioxide air monitoring by the State Department of Health, near the existing Stanton power plants (which have a somewhat greater sulfur dioxide emission rate than that proposed for the Level 1 and Level 2 Beulah projects), illustrates this point. It was shown in Table 9 of this supplement that 96.6% of the continuous 1-hour sampling for sulfur dioxide near Stanton indicated less than detectable concentrations of sulfur dioxide, i.e., less than 26.2 micrograms per cubic meter.

In North Dakota, the existing air quality is much better than that provided for currently under the National Ambient Air Quality Standards. Therefore, the addition of the six criteria pollutants to the ambient air from Level 1 and Level 2 projects should not result in a perceptible increase in health damage to individuals in Mercer and Oliver Counties and in the broader seven-county study area as a result of these pollutants.

Perceptible health effects, human or animal, are a function of the kind of pollutant, its concentration, frequency and/or duration of this concentration, and the state of health of the pollutant receptor. The current standards have been derived from epidemiological investigations and extrapolation of animal effects in controlled experiments to man. Both routes of effects analysis are useful in the episodic sense with high pollution concentrations, for short exposures, or at a high frequency of elevated concentrations. However, examination of the amount of risk to the public health from prolonged exposure to low pollutant concentrations with a relatively low frequency of occurrence is a problem for which no answers presently exist. Various attempts have been made to estimate public health risk from low concentrations of pollutants; however, the results of these studies have, to date, been inconclusive.

In view of the inclusiveness of these studies of low level pollutant exposure, the State Department of Health has considered the setting of ambient air quality standards and the granting of new source permits to construct, on the premise that a "no effects" level of pollution does not exist, and prudent management of air quality is indicated for protection of public health and prevention of future health effects. This philosophy embodies the principle that for every pollutant there is some effect. Whether effects will be perceptible at relatively low concentrations of pollutants, remains to be resolved by more concentrated scientific study and evaluation. A similar approach was taken by Congress in consideration of the Clean Air Act Amendments of 1977, as discussed under "Ambient Air Quality Standards."

Concerns over cancer and other chronic illnesses were expressed in testimony before Congress in consideration of the Clean Air Act Amendments of 1977. No new revelations were presented in this testimony which would directly aid in the

standards setting process. It did emphasize, however, that attention must be paid to the potential for increases in cancer and other chronic illnesses as a result of pollutants in the atmosphere. Suggested as possible cancer inducing agents were the pollutants arsenic, cadmium, polycyclic organic matter, sulfur dioxide, sulfates, nitrates, n-nitrosamines, nitrites, and radioactive materials. One problem in defining the role of air pollutants in chronic (low concentration-long exposure) illnesses is that the onset of these diseases takes many years. Another significant problem in defining this role is that cancer and other chronic illnesses have been related to many other causes.

Some problems involved in analysis of chronic illness were exhibited by William Weiss, M.D., in a paper entitled "Lung Cancer Mortality and Urban Air Pollution" (American Journal of Public Health, August 1978, Vol. 68, No. 8). Although information presented in this was "consistent with the hypothesis that air pollution is a factor in the causation of lung cancer, interpretation of a cause-and-effect relationship is unjustified because other important factors have not been taken into account. Smoking and occupational disease are the most significant of these." The assessment of risk in an urban setting from an epdemiological standpoint is desirable in some respects, most notably when there is a statistically sufficient population base to evaluate effects. However, the problems of dealing with pollution cause-and-effect relationships, regardless of urban or rural environment, are many-fold.

Mortality studies involving death rates and cause of death are important and must be performed. These studies, although difficult, are easier than morbidity studies, which examine illnesses less serious than death but certainly which affect the well-being of a person. The morbidity studies also must be performed.

There are many environmental factors which can be related to chronic diseases such as cancer. These environmental factors include substances in food, air, and water, and a person's habitats or lifestyle. Much of the attention to chronic diseases has been from the standpoint of setting standards of quality for these factors to reduce, if not eliminate, the risks to public health linked to these factors.

A sophisticated risk analysis was and still is beyond the scope of the Draft Study. The studies which have been performed, thus far, do not relate to the quality of life which is generally found throughout the seven-county study area. Another aspect which makes this analysis difficult and perhaps very judgmental is determining which pollutant has the greatest risk to public health. This is one of the pitfalls in much of the epidemiological work which has been performed thus far.

In "field" environmental studies, as contrasted with closely controlled laboratory experiments, the selection of pollutants measured against effects in the environment is critical to the evaluation of cause-and-effect relationships. If, for example, sulfur dioxide and particulate sulfate data are available in an area and this data is compared with disease in appropriate affected and control populations showing an apparent health effect, there are uncertainties in equating the concentrations of sulfur and sulfates to these health results. Although sulfur dioxide and sulfates may be linked to the health effect noted in the study, another pollutant, for example arsenic, may be the cause of the health effect; but since there was no measurement of arsenic, the cause-and-effect relationship is attributed only to sulfur dioxide and its derivative, sulfate. Environmental field studies must be carefully designed and executed to establish a valid cause-and-effect relationship.

The cause of a given disease may be due to a single identified pollutant, or possibly a group of pollutants, in a synergistic effect. Synergistic effects are due to the action of several pollutants, such that their combined effort is greater than the sum of their individual effects. Synergistic effects are possible; however, even less scientific information is available on this project.

Currently, North Dakota is a relatively healthy place to live. This relationship is shown in Tables 14 and 15, and environment no doubt plays an important role in this relationship. One general indication of well-being of the population is a comparison of average life expectancy at birth for various demographic sub-groups or geographic areas. A comparison of life expectancies for the United States, North Dakota, and the seven-county study area is presented in Table 14. Average life expectancy at birth for the State of North Dakota and for five of the seven counties equals or exceeds the national norm. The lowest life expectancy (69.54 years in Morton County) exceeds the comparable figure in nine states and the District of Columbia.

Another comparison includes overall and cause-specific death rates. However, direct comparisons may often be misleading due to differentials in the age distribution of the areas under study. To ameliorate this problem, such rates are often age-adjusted (i.e., rates are adjusted to approximate their true values assuming the age distribution of the areas under study are equal). In short, age is controlled in analyzing the direct comparison of age-adjusted death rates for all causes and selected leading causes for the United States, North Dakota, the seven-county study area, and selected groupings of counties.

TABLE 14

AVERAGE LIFE EXPECTANCY AT BIRTH
NORTH DAKOTA, UNITED STATES, AND IMPACT COUNTIES
TOTAL POPULATION
1969 - 1971

Area	Average Life Expectancy At Birth (in years)
United States	70.75
North Dakota	72.79
Burleigh County	72.59
Dunn County	70.75
McLean County	71.88
Mercer County	71.46
Morton County	69.54
Oliver County	69.75
Stark County	71.68

SOURCES:

1. United States and North Dakota -- "North Dakota State Life Tables," Vol. II, No. 35, DHEW Publication No. (HRA) 75-1151, National Center for Health Statistics, HRA, PHS, DHEW, June 1975.

2. Impact Counties -- "Abridged Life Tables for North Dakota Counties, 1970," unpublished manuscript, James P. Beneteau, 596 Demography, University of North Dakota, undated.

TABLE 15

DEATHS AND AGE ADJUSTED DEATH RATES
ALL CAUSES AND LEADING CAUSES
NORTH DAKOTA, UNITED STATES, AND SELECTED IMPACT AREAS

Area	All Causes		Heart Disease		Malignant Neoplasms		Cerebrovascular Disease	
	Deaths	Rate	Deaths	Rate	Deaths	Rate	Deaths	Rate
United States	1,892,438	844.93	716,065	320.66	365,768	165.43	194,016	86.81
North Dakota	5,482	785.75	2,162	305.86	925	131.85	589	81.77
7 County Impact Area	842	744.12	355	314.35	147	131.13	82	71.80
Burleigh - Morton	454	712.83	165	263.03	65	151.23	51	80.45
Stark - Dunn	199	814.12	89	362.60	30	124.37*	21	85.07*
Mercer - Oliver - McLean	189	756.76	101	394.32	22	88.55*	10	38.14*

* Based on less than 30 observations

SOURCES:

Population -

1. Unpublished estimates of county populations, prepared by Bureau of Census for NCI, 1978.
2. "General Population Characteristics," PC(1)-B1-US Summary, 1970 Census of Population, US Bureau of Census, US Department of Commerce, January 1972.
3. "Estimates of the Population of the United States, by Age, Sex, and Race: July 1, 1974 to 1976," Population Estimates and Projection, Series P-25, No. 643, US Bureau of the Census, US Department of Commerce, January 1977.

Vital Statistics -

1. Unpublished tabulations for calendar year 1975, Office of Statistical Services, North Dakota State Department of Health.
2. "Advance Report - Final Mortality Statistics, 1975," Monthly Vital Statistics Reports, Publication No. (HRA) 77-1120, Vol. 25, No. 11, Supplement, National Center for Health Statistics, HRA, PHS, DHEW, February 11, 1977.

As shown in Table 15, all areas under study exhibit an age-adjusted death rate below that of the United States as a whole. The rate for the seven-county study area is significantly below that for the United States. All but two of the areas (Stark-Dunn and Mercer-Oliver-McLean) exhibit heart disease death rates below the national norm. All areas exhibit age-adjusted rates below national levels for deaths from malignant neoplasms and from cerebrovascular diseases. The rates for Stark-Dunn and Mercer-Oliver-McLean for malignant neoplasm and cerebrovascular disease are based on a limited number of deaths. However, the total number of deaths observed for the above-mentioned causes for these areas are consistent with long-term trends for the counties.

Since public health risks cannot be directly assigned to changes in air quality resulting from Level 1 and Level 2 projects, public health risks can be placed in better perspective by examination of the existing environment. The existing air quality is a function of natural and man-generated pollutants present in this seven-county study area. The existing air quality influences public health.

All of the air pollutants mentioned in consideration of the Clean Air Act Amendments of 1977 are found in the study area, with the exception of polycyclic organic matter which has not been reviewed. With the exception of sulfur dioxide and nitrogen dioxide, all of the pollutants are naturally occurring, including radioactive material. Environmental radiation impacts, of Level 1 and Level 2 projects, are discussed under "Radiation Impacts."

Referring to Table 13, the maximum expected sulfur dioxide and nitrogen dioxide ambient air concentrations, combined with a projected low frequency of occurrence, will result in a low risk to public health, with the greatest health risk occurring in Mercer and Oliver Counties. Comparing life expectancy by county in Table 14 and cause of death in Table 15 shows a similar pattern. From this comparison, it appears that the existing power plants located in Center and Stanton have had no perceptible effect upon public health in these counties when compared to the other four counties of this region.

There are presently no ambient air quality standards for arsenic, cadmium, and other trace metals; however, concern has been expressed in testimony before Congress that the emissions of these metals has a potential for chronic health effects, including cancer. In the absence of a standard of comparison, public risks from emission of arsenic and cadmium will be examined in a simplified fashion to relate these emissions to an expected increase of these pollutants in the ambient air.

The coal to be used by Level 1 and Level 2 projects contains arsenic and cadmium. Table 16 presents the average concentration of 14 trace elements and sulfur for lignite from four mines in this region. As seen in Table 16, these concentrations vary from mine-to-mine, and further, the concentrations vary with the samples collected at the individual mines. For purposes of a "worst-case" analysis, the arsenic concentration of 3.5 micrograms per gram from Mine C-IV and the cadmium concentration of 0.16 micrograms per gram from Mine C-III will be used.

As shown in Maps 3-1 and 3-4 of the Draft Study, the maximum annual average predicted concentration of suspended particulate increase in the ambient air in the seven-county study area is approximately one microgram per cubic meter from the Level 1 and Level 2 projects in the Beulah area, exclusive of the mines associated with these projects. The total annual emission of particulate matter from Level 1 and Level 2 sources, other than mining, is 7,075 tons per year (from Tables 3-1 and 3-20 of the Draft Study). This annual particulate emission rate is an average rate of 19.4 tons per day or 1.76×10^{13} micrograms per day. The maximum average annual concentration of one microgram per cubic meter results in a dispersion reduction factor of $5.68 \times 10^{-14}(m)^{-3}$ day. Table 17 shows the average daily emission of arsenic and cadmium of 9.8×10^{8} and 6.2×10^{7} micrograms per day which results in expected average concentrations in the ambient air of 5.6×10^{-5} and 3.5×10^{-6} micrograms per cubic meter, respectively. These are very small concentrations and beyond normal detection limits in a 24-hour sampling period. There is no data which indicates perceptible effects for either arsenic or cadmium at either of these concentrations.

Soil includes a mixture of chemical elements, including trace elements. Table 18 shows a comparison of the representative concentrations of 14 trace elements and sulfur in the soil, with the average concentrations in lignite coal from four mines in this region. The soil averages were determined from soil sampling in the eastern portion of the seven-county study area and should not be construed as average throughout the region because of geochemical variations. They will be used in a relative sense to estimate possible increases in ambient air quality levels of arsenic and cadmium.

As shown in this comparison, only cadmium, fluoride, nickel, zinc, and possibly lead are higher in the soil than the coal. Windblown soil is the major source of the estimated background particulate air quality concentration of 25 micrograms per cubic meter (on an annual average basis). Using the soil representative averages of 0.42 and 0.44 microgram per gram, respectively, for arsenic and cadmium, the expected average concentration of arsenic

TABLE 16

AVERAGE TRACE ELEMENT CONCENTRATIONS OF
FOUR LIGNITE COAL MINES IN CENTRAL NORTH DAKOTA

Element[1/]	Coal Mine C-I	C-II	C-III	C-IV	Arithmetic Mean
Arsenic	2.2	1.60	0.96	3.5	2.07
Beryllium	0.9	1.06	0.17	0.86	0.75
Cadmium	0.13	0.12	0.16	0.11	0.13
Chromium	2.10	1.28	0.49	1.3	1.29
Copper	3.42	3.77	1.63	2.7	2.88
Fluoride	11.8	21.0	12.33	17.0	15.53
Lead	0.16	0.18	0.18	0.51	0.26
Mercury	0.02	< 0.02	< 0.02	0.09	3/
Molybdenum	1.46	1.63	1.53	1.9	1.63
Nickel	0.33	2.40	.065	0.35	0.93
Selenium	0.29	0.49	0.18	0.22	0.30
Uranium	0.59	0.33	0.30	0.65	0.47
Vanadium	3.33	3.73	1.91	1.8	2.69
Zinc	1.41	2.37	1.17	5.3	2.56
Sulfur[2/]	0.62	0.72	0.60	0.95	0.72

Source: North Dakota State Department of Health - Trace Element Effects of Energy Conversion Facilities - November 1977.

1/ Concentration in micrograms per gram.
2/ Concentration percent by weight.
3/ Greater than 30% of samples less than detectable limit, resulting in arithmetic mean of <0.02. Sulfur is not a trace element; however, it was included as part of the analysis.

TABLE 17

PROJECTED ARSENIC AND CADMIUM
EMISSIONS FROM LEVEL 1 and LEVEL 2
PROJECTS IN THE BEULAH VICINITY BURNING AN
"AVERAGE"[1/] LIGNITE COAL

	Arsenic	Cadmium
Concentration in Coal (Micrograms/Gram)	2.07	0.13
Quantity in Coal Burned[2/] (Tons per Year)	39.3	2.5
Emission as Particulate[3/] (Micrograms per day)	9.8×10^8	6.2×10^7

Source: North Dakota State Department of Health 1978

1/ Averages based upon the average composited lignite coal from four mines in this region.

2/ Based upon a total of 19 million tons per year of coal. From Table 1-12 of Draft Study including the ANG coal gasification plant, Antelope Valley power plant, and the Coyote power plant.

3/ As particulate it is assumed that 99% removal will occur in the pollution control devices of the respective projects.

TABLE 18

COMPARISON OF REPRESENTATIVE CONCENTRATIONS OF TRACE ELEMENTS IN THE SOIL WITH THOSE FOUND IN LIGNITE COAL

	Micrograms per Gram (µg/g)	
	Soil Representative Average	Coal Arithmetic Mean
Arsenic	0.42	2.07
Beryllium	0.21	0.75
Cadmium	0.44	0.13
Chromium	0.52	1.29
Copper	0.70	2.88
Fluoride[2/]	172.44	15.53
Lead	[4/]	0.26
Mercury	[4/]	[4/]
Molybdenum	[4/]	1.63
Nickel	4.27	0.93
Selenium	[4/]	0.30
Uranium	[4/]	0.47
Vanadium	1.03	2.69
Zinc	7.22	2.56
Sulfur[3/]	0.04%	0.72%

Source: North Dakota State Department of Health 1977.

1/ Soil sampled to a depth of 3 inches. The averages indicated represented soil concentrations in the eastern portion of the seven-county study area.
2/ Data presented as total fluoride.
3/ Data presented as total sulfur, % weight.
4/ Greater than 30% of samples less than detectable limit giving a mean of less than (<) 0.01 limit for Uranium, <0.20 for Selenium, <0.40 for Molybdenum, <0.10 for Mercury, and <0.4 for Lead.

and cadmium in the ambient air would be 1.05×10^{0} and 1.10×10^{-5} micrograms per cubic meter.

Although this analysis shows that emissions of arsenic would result in a projected five-fold increase in average arsenic ambient air concentration, the significance of this increase is not currently measurable in terms of public health risk because of the low concentrations (in the range of 10^{-5} micrograms per cubic meter) and assumptions made in this analysis. This would also apply to cadmium, although the fraction in ambient air due to soil is projected to be about 4 times that due to coal burning in the Level 1 and Level 2 projects near Beulah.

The size of particles in the ambient air and the pollutants within or adhering to the particle surface are important to any analysis of health effects. Typically, pollution control devices, such as electrostatic precipitators, catch more of the larger particles than the smaller or submicron size (less than 1 micron in diameter) particles. Concern over the smaller particle sizes is due to the entrance and capture of these particle substances in the deeper portions of the lungs, as opposed to the larger particles (greater than 3 microns in diameter) which are filtered out in the nose and throat and removed from the body via the gastrointestinal system.

In a performance test of an electrostatic precipitator at the Minnkota Power Plant located near Center, the emissions had a particle mass distribution with 50% of the particles smaller than 3.3 microns and 10% less than 1.3 microns. With a total annual particulate emission of 7,075 tons per year from Level 1 and Level 2 gasification and electrical generation plants near Beulah, the total annual atmospheric loading over Mercer and Oliver Counties would be 3,538 tons with a particle size of less than 3.3 microns and 708 tons with a particle size of less than 1.3 microns. From Map 3-4, a fairly uniform distribution of particulate matter is seen, neglecting the influence of localized maximums occurring in the mines associated with these projects.

Examination of the atmospheric loading of particulate matter from areawide sources in Mercer and Oliver Counties (as shown in Table 19) yields a total loading of 40,041 tons per year or 5.7 times the particulate emissions from the Beulah Level 1 and Level 2 facility projects. Unpaved roads, wind erosion, and soil cultivation account for much of the particulate matter in the seven-county study area and generally throughout North Dakota.

Very little past data exists concerning the size of particles in the ambient air of North Dakota. In 1977, however, annual particle size data was collected at a commercial site in Bismarck, a rural site north of Bismarck, and a rural site south of Stanton. Figure 4 summarizes the Stanton data for this period. Approximately 90% of the mass of the particles was less than 3.3 microns in diameter and approximately 66% was less than 1.3 microns. This is a comparatively high percent mass distribution.

Using the areawide source information from Table 19, the atmospheric loading over Mercer and Oliver Counties, due to areawide sources, would be 36,037 tons of particulate matter less than 3.3 microns in diameter and 26,427 tons of particulate matter less than 1.3 microns in diameter. The increase in atmospheric loading of fine particulate matter from Level 1 and Level 2 projects using this analogy would be 9.8% for particles smaller than 3.3 microns and 2.7% for particles smaller than 1.3 microns. This relatively small increase in atmospheric loading of fine particulates should present a negligible effect upon public health in Mercer and Oliver Counties, with a more negligible effect in the broader seven counties.

Based upon the preceding analyses, it can be concluded that the probability of perceptible health effects from emissions of pollutants from Level 1 and Level 2 projects is extremely low. Although estimations and assumptions were used in these analyses, they were conservative; i.e., placing the impacts in a worst or maximum case condition. The impacts on ambient air quality are projected to be small, and with respect to many of the pollutants (other than sulfur dioxide and nitrogen dioxide), the amount of increase of contamination is small in comparison to that already in the environment. The estimations and assumptions used in the analysis of effects upon human health, although believed conservative, should be validated by real-time field studies.

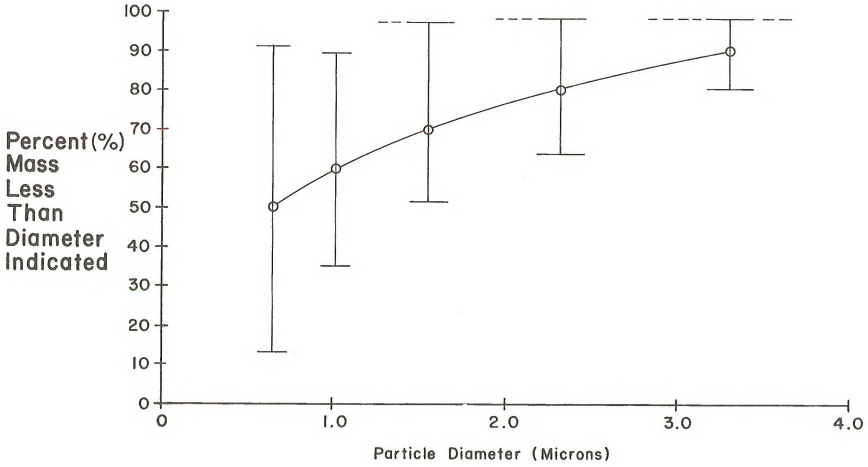
The quality of North Dakota's ambient air is currently good across the total seven-county study area. Increases in pollutant ambient air concentrations in the maximum impact area, Mercer and Oliver Counties, are not expected to either perceptibly increase the incidence or seriousness of air quality related chronic diseases. Factors of safety are provided in the Class II prevention of significant deterioration allowable increments within the seven-county study area and the designation by Congress of Class I areas in the Theodore Roosevelt National Park and the Lostwood National Wilderness Area.

Vegetation Effects

Adverse air pollution effects upon vegetation are important to North Dakota because agriculture is the major industry in the state, and adverse effects could impact the economy. Further, adverse effects upon vegetation would result in a reduction in the

FIGURE 4

WEIGHTED AVERAGE MASS PARTICLE SIZE DISTRIBUTION STANTON RURAL AIR SAMPLING SITE - 1977



SOURCE: North Dakota Department of Health 1978.

TABLE 19

ESTIMATED 1980 PARTICULATE EMISSION FROM AREA-WIDE SOURCES IN MERCER AND OLIVER COUNTIES

Source	Tons Per Year	
	Mercer County	Oliver County
Unpaved Roads	16,180	10,240
Agriculture	3,439	2,551
Construction	835	0
Mining	4,904	1,256
Paved Roads	220	110
Other Sources	205	101
TOTAL	25,783	14,258

Source: U.S. Environmental Protection Agency - North Dakota Air Quality Maintenance Area Analysis (EPA 908/1-76-009) June 1976.

production of food and fiber for use by people in other areas of the United States and the world.

It has been reported in the news media that a 15% reduction in wheat yield has occurred at air contamination levels below the National Ambient Air Quality Standards. The basis for this news account was testimony before Congress. Given the fact that the cost of wheat production has risen with inflation while the market price for this commodity has not, a 15% reduction in wheat yield (barring hail, rust, and other risks associated with wheat farming) would be a substantial economic loss. This specific example was referenced to in the Legislative History of the Clean Air Act (U.S. Code, Congressional Administrative News, 95th Congress, 1st Session 1977, Legislative History). To quote from page 1207 of this Legislative History:

> The evidence is strong that air pollutants have damaging effects on crops at levels below the National Standards. For example, studies show that important agricultural crops suffer leaf damage, growth inhibition, or increased mortality resulting from sulfur dioxide levels lower than the national ambient air quality standards. These effects may result in a substantial economic impact such as the reported 15% reduction in wheat yield at a sulfur dioxide exposure level of less than half the national standard (Guderian, R. and H. Shatmann, Forschungsber, Landes Nordrhein-Westfaler 1920:3, 1968). Since much of the United States where wheat is grown has sulfur dioxide pollution levels below half the national standard, the importance of not allowing air quality to deteriorate to the standard is clear.

Concern over the question of a 15% wheat yield reduction from levels of sulfur dioxide at half the allowable national level is justified particularly in view of media accounts which relate this "alarming" information to the Great Plains States where the "massive" use of coal is scheduled. The reader is left with the impression that this sort of cause-and-effect relationship will occur in the Great Plains, and North Dakota specifically. The concern is justified; however, the presumption of this cause-and-effect relationship is not indicated.

Various species of vegetation appear to be more sensitive than others. Other factors to be considered in predicting cause-effect injury to vegetation from air pollution is the environment in which the plants are growing, the expected pollution concentration, and the fequency and duration of exposure. There are many environmental factors which affect vegetation response and growth, including climatic factors, light quantity and quality, temperature, relative humidity, soil type, and soil nutrition. Various species of vegetation may be more sensitive to one pollutant than another pollutant. The interaction of more than one pollutant acting in a synergistic effect should also be considered.

Much attention in the scientific literature on vegetation effects has been directed to sulfur dioxide and other phenomena such as acid rainfall. (A following section will consider the effects of acid rainfall. This discussion of vegetation effects will focus on sulfur dioxide.) Table 20, which shows agricultural damage, has been reproduced from the Legislative History (page 1208) of the Clean Air Act. There are a number of crops in this table that are of special interest to North Dakota.

The summary of sulfur dioxide concentration-duration-effects shown in Table 20 was derived from studies, the validity of which may be subjected to scientific review. To examine the vegetation effects of sulfur dioxide emissions from Level 1 and Level 2 projects, it will be assumed that the study results are valid.

With respect to sulfur dioxide ambient air quality standards, the North Dakota standards are more stringent than Federal standards. A side-by-side comparison of standards was shown earlier in Table 12. The concentration-duration for apparent prevention of slight leaf necrosis in barley would be above the state's 1-hour standard of 715 micrograms per cubic meter and, therefore, the state standard should prevent such effect. The other effects noted, assuming the study results are valid, would occur at concentrations-durations lower than the present State ambient air quality standards.

In the Draft Study, the point was made that the projected increase of sulfur dioxide in the atmosphere from Level 1 and Level 2 emissions was well within State ambient air quality standards. This followed a detailed analysis of how much increase was projected. The expected maximum ambient air quality values, including projected increases due to emission of sulfur dioxide, were shown in Table 13. These maximum sulfur dioxide values are 7.5 micrograms per cubic meter--maximum annual mean; 55.8 micrograms per cubic meter--24-hour maximum; 113.5 micrograms per cubic meter--3-hour maximum; and 231.1 micrograms per cubic meter--1-hour maximum. The time periods referred to are the averaging periods.

The expected maximum ambient air concentrations noted above from Level 1 and Level 2 projects are well below the concentration-duration values shown in Table 20. It should be noted that these maximum concentrations are expected to occur in Mercer and Oliver Counties and within approximately 8 miles of Beulah. Further, these are maximum values with the average short-term (less than annual) values less than those shown in Table

TABLE 20

AGRICULTURAL DAMAGE AT SULFUR DIOXIDE LEVELS BELOW THE NATIONAL EXPOSURE

Ref.	Plant	Sulfur Dioxide Concentration (ug/m^2) 1/	Duration of Exposure	Effects
4	Oats	26.2	Growing season	Slight leaf necrosis.
3	Barley	967.0	2 to 3 hours	Slight leaf necrosis 2d day.
3		362.0	4 hours	Slight leaf necrosis 4th day.
5	Wheat	39.2	Growing season	15 percent decrease in grain yield weight.
1	Peanut	2.4-78.6	4 to 5 hours	Slight leaf chlorosis.
1		131.0-314.0	4 to 14 hours	Slight leaf discoloration.
9	Soybean	131.0	4 hours	Do.
4,5	Alfalfa	23.6	Growing season	Leaf discoloration & necrosis.
3	Kidney bean	131.0	4 hours	2 percent leaf discoloration.
9	Radish	131.0	do	Slight leaf necrosis and chlorosis.
5	Potato	39.3	Growing season	Decrease in tuber yield weight.
4	Spinach	23.6	do	Leaf necrosis.
4	Red clover	23.6	do	Do.
4	Orange	39.3-62.9	do	Decrease in yield quantity and in thickness growth.
5	Sour cherry	62.9	do	Decrease in yield weight.
4	English oak	62.9	do	Decrease in thickness and cross-sectional growth area.
7	Spruce	55.0	8 months	Leaf injury.
7		62.9	Growing season	Decrease in thickness growth.
2	Pine	21.0	10 year growing season	2.5 to 37.5 percent leaf injury, increase in mortality.
6		23.6	do	6.0 to 43.2 percent leaf injury.
6		44.5	do	21 to 77 percent leaf injury, leaf abscission decrease in yield volume, increase in mortality.
8	Tobacco	665.0	2 hours	Damage.

SOURCE: U.S. Code, Congressional Administrative News, 95th Congress, 1st Session 1977, Legislative History - page 1208.

NOTE: For reference, National Ambient Air Quality Standards for sulfur dioxide are: Primary--80 ug/m^3 annual average, 365 ug/m^3 annual maximum. Secondary--1,300 ug/m^3 3-hour annual maximum.

1/ The sulfur dioxide concentration units are presented as they are found in the source. It is believed that the units should be ug/m^3 rather than ug/m^2 indicated.

ug/m^3 = micrograms per cubic meter

REFERENCES TO TABLE

1---Applegate, H.G. & L.C. Durant, Environ. Sci. Technol., 3(8):759, 1969.
2---Dreisinger, B.R., Proc. Air Poll. Control Ass. Annv. Meeting, 58th, Toronto, 1965.
3---Fiala, V. and P. Hautke, Rostlinna Vyroba (Prague) 8"1043, 1962.
4---Guderian, R. and H. Shatmann, Forschungsber., Landes Nordrhein-Westfalen, 1118:5, 1962.
5---Guderian, R. and H. Shatmann, ibid., 1920:3, 1968.
6---Linzon, S.N., J. Air Pollution Control Ass., 21(2):81, 1971.
7---Materna, J., Proc. Conf. Eff. Ind. Emiss. forest, Janske Lazne, Czech., p. 111-I, 1966.
8---Macdowell, F. D. H. and A. F. W. Cole, Atm. Environ., 5(7):553-559, 1971.
9---Tingey, D. T. etal, Phytopathology, 61:1506, 1971.

13. This is evident in Table 9 which found that 96.6% of the 1-hour continuous samples were in the range of 0 (not absolute zero) to 26.2 micrograms per cubic meter (below the detection level). Further, sulfur dioxide emissions from the Stanton plants are approximately 1,500 tons per year more than the Level 1 and Level 2 projects in the Beulah vicinity.

Specifically, with respect to the question of reduction in wheat yield, no perceptible reduction in wheat yield is expected to result from the emission of sulfur dioxide from the Level 1 and Level 2 Beulah projects. The expected annual average ambient air concentration of 7.5 micrograms per cubic meter (including the Beulah projects) is considerably less than the 39.2 micrograms per cubic meter value shown in Table 20 for wheat. The respective State and Federal annual mean standards are 60 and 80 micrograms per cubic meter, respectively. Even taking into account the fact that the growing season for wheat is from May through August (a shorter averaging period than annual), and perceptible wheat yield reduction would not be expected in the maximum impact area of Mercer and Oliver Counties or in the broader seven-county study area.

The particulate and nitrogen dioxide emissions from the Level 1 and Level 2 projects would, likewise, not be expected to result in a perceptible effect upon vegetation in the seven-county study area, given the concentrations projected and the expected frequency of occurrence and duration.

A number of other pollutants have been linked to vegetation effects including ozone, hydrogen chloride, ethylene, ammonia, carbon monoxide, and heavy metals. These fall into the category of minor pollutants from the Level 1 and Level 2 projects in the Beulah vicinity. Although a perceptible effect upon vegetation is not expected due to these pollutants in the ambient air of the seven-county study area, additional monitoring, study, and analyses of potential effects is indicated. The long-term effects of heavy metals (trace elements) is now currently under study by the North Dakota State Department of Health.

The knowledge of effects upon vegetation from the synergistic interaction of multiple pollutants at the present time is, at best, inconclusive and fragmentary. These interactions are complex and not readily determined. Examination of the apparent lack of perceptible vegetation effects in the vicinity of the Stanton facilities would indicate a low risk of vegetation effects in the vicinity of Beulah where the maximum air quality impact is expected to occur.

The quality of North Dakota ambient air is currently good across the total seven-county study area. Increases in pollutant ambient air concentrations in the maximum impact area, Mercer and Oliver Counties, are not expected to result in perceptible vegetation damage. Factors of safety are provided in the Class II prevention of significant deterioration allowable increments within the seven-county study area and the designation by Congress of Class I areas in the Theodore Roosevelt National Park and the Lostwood National Wilderness Area.

Animal Health Effects

Historical air pollution effects upon animals have been documented. These problems were due to gross contamination of the environment over relatively few years of operation of various pollutant sources. A characteristic of these sources was inefficient pollution control equipment, by today's standards. Further, the effects were observed to occur near the polluting source.

In view of the projected increases, shown in Table 13, of the major pollutants (particulate matter, sulfur dioxide, and nitrogen dioxide) resulting from emissions from Level 1 and Level 2 projects in the Beulah area, there is no indication of potential health effects. A comparison of the sulfur dioxide expected ambient air concentration in the Beulah area with measured concentrations near Stanton would indicate no effects upon animal health due to sulfur dioxide. As was pointed out earlier, the atmospheric loading of sulfur dioxide from existing Stanton power plants is approximately 1,500 tons per year more than the Level 1 and Level 2 projects near Beulah. No animal health effects have been observed in the vicinity of the Stanton power plants from exposure of animals to sulfur dioxide.

As was discussed earlier under Human Health Effects, the quantity of particulate matter from the Level 1 and Level 2 projects is much less than the atmospheric loading of particulate matter from the areawide sources of unpaved roads and agricultural operations. Further, the sizing of particulate matter from areawide sources showed a high percentage in the respirable and submicron range.

Although the expected maximum nitrogen dioxide ambient air concentration (including the Level 1 and Level 2 projects) is shown to be high, this maximum is expected to occur only 0.001% of the time. An animal health effect would not be expected to occur at this concentration-duration of nitrogen dioxide. Further, the maximums are expected to occur within eight miles of Beulah.

Animal health, like human health, is influenced by the environment. Also, like humans, animals are

subject to chronic diseases. Factors in the environment which relate to an animal's health and nutritional growth include substances in food, air, and water; and physical stress caused by changes in weather, severe weather, insects, and other related aspects.

Since a large sector of the agricultural economy of the seven-county study area is dependent upon cattle raising, concerns have been expressed about animal health effects of Level 1 and Level 2 projects. Concern has been specifically directed to molybdenosis and selenium-responsive diseases in cattle. Although direct animal health effects are not expected from the three major pollutant emissions of Level 1 and Level 2 projects, it is appropriate to examine questions related to animal diseases such as molybdenosis and selenium-responsive diseases.

Both referenced and animal diseases are not due to a direct acute reaction to pollutants in the environment. Rather, these animal health effects are related to the animal's food chain, in the case of molybdenosis, with an apparent similar relationship in the case of the selenium-responsive diseases. The North Dakota State Department of Health has been actively involved in both of the referenced cases and is currently researching the trace element effects of energy conversion facilities. This research activity is discussed under "Trace Element Effects."

As with human health, animal health is a function of nutrition. Trace elements play a major role in the growth and maintenance of an animal. Trace elements have been defined in various ways, for example, any chemical element in a substance with a concentration of less than 1,000 parts per million. This then, depending upon the substance of interest, could include many of the 92 naturally occurring chemical elements. Trace elements are in the air, soil, water, and everything which lives in the environment. Some trace elements have been referred to as "essential trace elements;" i.e., essential to the nutrition of the animal. These chemical elements, if they are in proper balance within the animal, will result in a healthy animal. Conversely, if an imbalance in the essential chemicals is occurring, the result is an unhealthy animal. Too much of an essential element can cause a toxic reaction; whereas, not enough of the chemical can cause a deficiency reaction. Either of these reactions can result in poor health and even death of animals.

Molybdenosis in animals is a prime example of a toxic/deficiency disease. The problem in North Dakota was caused by an excess of molybdenum in the food chain which resulted in an apparent copper deficiency. This problem is described in a report prepared by the North Dakota State Department of Health (Christianson and Jacobson 1970).

In September of 1968, the North Dakota State Department of Health was contacted by an attorney in Bowman and asked to evaluate an unusual problem which had arisen on a farm in that vicinity. Animals on this farm were stated to be in poor condition with excessive weight loss and severe diarrhea. Further, the cattle on this farm were changing color, from black to gray. The State Department of Health was called, since the farm in question surrounded a plant site used to ash uraniferous lignite coal, a low grade coal with high uranium content.

The plant operation consisted of the stockpiling of lignite coal from the Cave Hills area of South Dakota and upgrading the uranium content in the lignite coal by "ashing" in rotary kilns. The three kilns had a total capacity of 225 to 250 tons of material per day. This plant operated at this site from July of 1963 to May of 1967. This ash was shipped out-of-state for further processing to nuclear power reactor fuel.

The symptoms described had the vague semblance of radiation involvement with the severe intestinal disturbance and change in hair color. The Department initially approached this problem from the standpoint of environmental radiation exposure of the farm animals. The levels of external radiation exposure to the animals and the radioactive materials in the animal diet did not indicate a problem related to radiation. This was followed by investigation of the possibility of an infectious disease or chemical involvement. A chemical, specifically molybdenum, was shown, subsequently, by the Department to have caused the disease in the animals on this farm.

The Bowman molybdenosis syndrome found in the Department's investigation was determined to result from soil contamination by the uraniferous ashing plant. The contamination of the soil used for the grazing of cattle and sheep on this farm and the subsequent entrance into the animals via forage uptake resulted in losses both in deaths of animals and lost revenues through weight loss of the surviving animals. The short-term economic losses to the farming operations on this farm are assessable; however, there still remain some unanswered questions to this problem. It is not known how long this condition of soil contamination will remain a problem to this farm.

It is possible that this farm can eventually return to normal through depletion of the molybdenum concentration in the soil with crop removal, leaching action within the soil, or reduced availability through soil complexing of the molybdenum. In any

event, a sophisticated study to determine answers to these questions is not within the financial resources of the State Department of Health. Interim grazing operation on this farm suggests the employment of copper glycinate injections or substitution of pasture grazing on this farm for the drylot feeding of oured hay and feeds.

The uraniferous lignite ashing plant operated at this site for approximately four years. It began operation approximately seven years before North Dakota had an air pollution control law. A uraniferous lignite facility designed with the pollution control devices, such as were used at this facility, would not be allowed to construct in North Dakota under the present rules and regulations of the Department. Another uraniferous lignite ashing facility operated with better pollution control equipment at about the same time in the Belfield vicinity without apparent animal effects. The Belfield facility, although utilizing better air pollution control devices, probably would not meet today's requirements under the State's air pollution control rules and regulations.

The soil of the Bowman farm apparently is still contaminated with molybdenum, making management of cattle and sheep expensive and difficult. If the present State Air Pollution Law, rules, regulations, and standards had existed in 1963, this problem probably would not have occurred.

Very little is known about the chemical composition of the uraniferous lignite coals other than the uranium concentration, which is discussed under "Radiation Impacts." All that remained at the Bowman plant when the Department was called was a partially disassembled plant and no coal. Samples of ash material remaining in the dust collectors of this plant were found to contain 3,200 parts per million of molybdenum. Although it is questionable that this is a representative sample, it clearly indicates a high concentration of molybdenum in the ash and very likely in the coal.

The characteristics of the uraniferous lignites processed in these ashing plants would not be suitable for use as fuel in the Level 1 and Level 2 energy conversion facilities. These coals were highly mineralized and found in veins varying in thickness from one-half inch to four feet. After the overburden was removed, the mining operation involved hand shovels and small front-end loaders. The coal varied in rank from 1,000 to 5,000 Btu/lb compared to an average of approximately 7,000 Btu/lb proposed for use in the Level 1 and Level 2 Beulah projects. Natural gas had to be used in the ashing plants to assist the burn and drive off the 32 to 52% moisture content present in these coals.

The lignite coals proposed for use in the Level 1 and Level 2 projects, as might be expected, do contain molybdenum; however, by comparison to the uraniferous lignites, the concentration is very low. Lignite coal sample analysis from four mines in central North Dakota, done by the State Department of Health (Trace Element Effects of Energy Conversion Facilities 1977), yielded a coal molybdenum concentration range of 0.64 to 6.4 micrograms per gram with an arithmetic average of 1.63 micrograms per gram. For purposes of comparison, the maximum value of 6.4 micrograms per gram will be used.

With a molybdenum concentration of 6.4 micrograms per gram, an assumed ash content of 6%, and assuming that the molybdenum is concentrated in the fly ash, the molybdenum in the Level 1 and Level 2 project ash would be 10.67 micrograms per gram or 10.67 parts per million. This is about 1/300 of the concentration in the ash found at the Bowman plant. It should again be emphasized that the Bowman plant had a relatively inefficient pollution control system in comparison to the devices designed for use on the Level 1 and Level 2 projects. It is highly unlikely that any emission of molybdenum from Level 1 and Level 2 projects would result in molybdenosis in livestock in the Beulah vicinity, the maximum air quality impact area, even though the coal utilization would be greater and the plants would be expected to operate for 40 years.

There is considerable documentation of direct acute effects of air pollutant emissions upon human health, materials, and vegetation. Cause-and-effect relationships form the foundation of federal and state air pollution control regulations. Indirect effects, to date, have generally received less attention due to the complexity of analysis and the lack of definitive documentation of cause-and-effect relationships. In order to satisfy energy needs without severe and unnecessary impacts upon the environment, the indirect as well as direct cause-and-effect relationships must be examined for possible mitigation actions, as appropriate.

All of the proposed sites for energy conversion facilities in North Dakota are located in rural areas. A major focus of the North Dakota Department of Health is the environmental effects of energy conversion facilities upon these rural areas and subsequently upon the agricultural economy of these areas.

In recent years there has been a clinical manifestation of a cattle disease in newborn calves which demonstrates skeletal-muscle myopathy (white muscle disease) in localized areas of western North Dakota. Preliminary investigation, performed over the last four years by a practicing veterinarian, has revealed that the occurrence of

this disease may be due to the interaction of sulfur and selenium as they relate to animal health and nutrition.

Two cattle ranching operations approximately 65 kilometers (40 miles) apart (shown as Ranch A and B on Map 4) have experienced losses of newborn calves: 10-30% at one ranch and approaching 100% at the other before a selenium responsive disease was diagnosed. Normal expected calf losses are on the order of 2-3%. In both cases the dead calves displayed, by gross pathology and histopathology, a similar skeletal myopathy. The myopathy is associated with a metabolic deficiency of selenium, as element which is a part of the body enzyme, glutathione peroxidase. Subsequent to diagnosis of selenium disease, these problems were reversed with an injection of a selenium pharmaceutical (selenium plus vitamin E). The animal disease is now controlled by the feeding of a small amount of a good biological source of available selenium, wheat or wheat bran, during the last 60 days of pregnancy.

Calf losses of the magnitude described above are a loss of income to a rancher. An 8 to 27%, above normal, loss in newborn calves on a 400-cow ranch is translated into a $6,400 to $21,600 loss in gross income when using a figure of $200 per calf. Few ranchers can sustain financial setbacks such as this and remain in business, particularly in view of live animal market prices. In instances where a dramatic loss in newborn calves occurs, a veterinarian is usually called in to solve the problem. When, however, the loss is less dramatic, a veterinarian may not be consulted and hence the loss is not documented or resolved. In any event, the loss to the ranching industry and subsequently to the consumer, is measurable, not only in statistical numbers, but economically as well.

Selenium deficiency is unexpected in North Dakota, since this state is generally regarded as having adequate amounts of selenium in the soil and livestock diet. Both ranching operations employ ranching practices common to west central United States. Each ranching operation is located near existing lignite coal-fired steam electric generating stations. Prior studies indicate that ingested sulfate can influence selenium levels in ruminants (Trace Elements in Human and Animal Nutrition, 1977, 4th Edition, Underwood, page 324). This relationship, coupled with a source of sulfur (as sulfur dioxide and sulfates) from the electrical generating facilities, suggests that the calf problems experienced on these two ranches, separated by some 65 kilometers, may be due to increased sulfur in the environment or food chain as a result of emissions from energy conversion facilities (Sulfur Metabolism of Plants, Industrial and Engineering Chemistry, 1950, Vol. 45, pages 2231-2235, Thomas, Hendricks, and Hill).

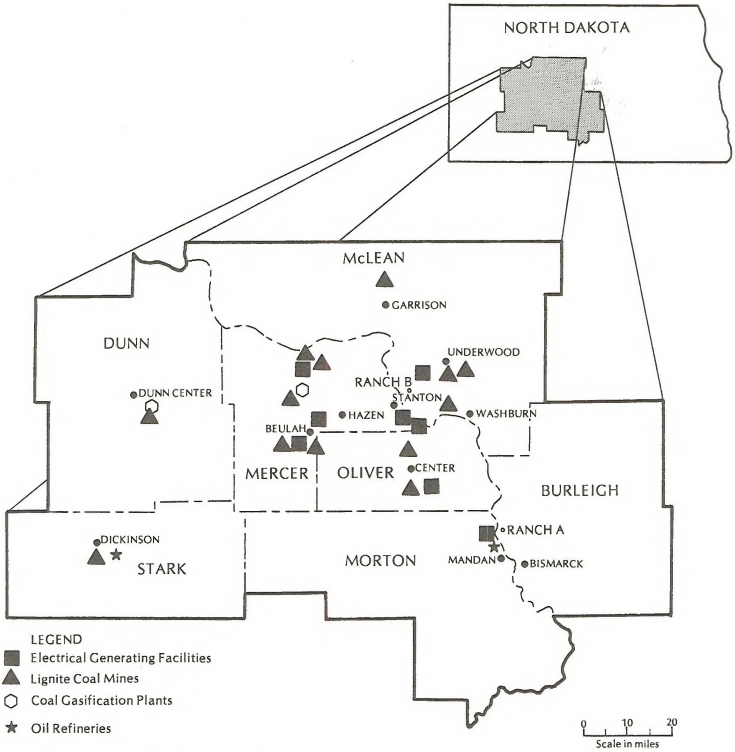
The electrical generating facilities in question are not large by comparison with the design capacity of sources being permitted for construction and beginning operation in the United States today. Ranch A is located within 2 kilometers (1.2 miles) of an existing generating station of approximately 100 megawatts. A generating complex approximately 10 kilometers (6 miles) from Ranch B (Stanton area), prior to diagnosis of the problem, had a design capacity of approximately 400 megawatts. At the present time, the operating capacity near Ranch B is approximately 800 megawatts. The Level 1 and Level 2 power plants near Beulah will have more than twice (1760 megawatts) the electrical generating capacity of the Stanton plants. However, including sulfur (as sulfur dioxide), emissions from all Level 1 and Level 2 projects in the Beulah vicinity will be approximately 1500 tons per year less than in the Stanton area.

The only fact known at either Ranch A or Ranch B is that they have experienced a selenium-responsive disease; i.e., a disease corrected with selenium treatment. It is not known whether this disease is caused by excess sulfur in the diet, by animal stress in the last 60 days of pregnancy, by lack of biological available of natural selenium in the diet material, or some other cause. One common error in logic is to assume that two phenomena that occur concurrently and side-by-side must be connected with one another in a cause-and-effect relationship. The environment is too complicated for a direct-simple analysis such as this. There is sufficient justification, however, to consider sulfur as the possible cause of the disease noted at Ranch A and Ranch B. Only through a study of the sulfur/selenium environmental balance and the effects of energy conversion facilities upon this balance, can a cause-and-effect relationship be established or discounted.

In view of the growth and development of coal-fired electrical generation in North Dakota and in a broader sense, the United States, studies need to be undertaken to determine, for possible mitigation action, the potential for increased environmental sulfur resulting in the incidence of selenium responsive diseases in cattle. This involves analysis of two possible hypotheses for this unknown: (1) If the increased levels of environmental sulfur are shown to cause a selenium deficiency in cattle, the present national sulfur (sulfur dioxide) emission control and ambient air quality regulations would be examined for appropriate numerical reduction; and (2) if the increased levels of environmental sulfur are not shown to cause a selenium deficiency in cattle, this study should examine other possible cause-and-

MAP 4

LOCATION OF EXISTING AND PROPOSED
AIR CONTAMINANT SOURCES



SOURCE: North Dakota State Department of Health 1977.

effect relationships in explanation of why a selenium responsive disease has occurred in two ranching operations and not at other ranches.

A study to resolve the two hypotheses noted above is expensive, and would take at least two or possibly three years of intensive scientific work to answer, due to the complexities involved. Some of the complexities are indicated in the analysis pathways shown in Figure 5. The study must employ a team of specialists working in close coordination. The North Dakota State Department of Health has been unsuccessful in attempts to obtain the funds necessary to perform this study. Even if sulfur is not related to the selenium responsive disease observed at Ranch A and Ranch B, this study would add much to the knowledge of the environment and aid in the protection of animal health.

In view of the relatively small projected increases in ambient air concentrations of the three major pollutants, particulate matter, sulfur dioxide, and nitrogen dioxide, no observable direct animal health effects are expected to occur in the Beulah vicinity, the maximum air quality impact area due to emissions from Level 1 and Level 2 projects.

Molybdenosis in animals, due to emissions from Level 1 and Level 2 projects, is also not expected since the concentration of molybdenum in lignite "boiler" coals is considerably lower than that expected to occur in uraniferous lignites. Further, the pollution control devices designed for Level 1 and Level 2 projects have demonstrated removal efficiencies significantly greater than those used at the Bowman uraniferous lignite ashing plant in the mid-1960s.

A confirmed relationship of selenium responsive disease to emissions from energy conversion facilities has not been demonstrated. Factors, other than those related to energy development, such as animal stress, the natural biological inavallability of selenium in the animal diet, or others, may be the cause of the animal problems noted at Ranch A and Ranch B. A study of the sulfur/selenium balance in the environment is indicated to clearly establish the significance of this relationship. Pending study results, should an above normal calf loss or weak calf syndrome occur in the maximum Level 1 and Level 2 impact area near Beulah, a veterinarian should be consulted for possible diet supplement with a good source of biologically available selenium such as wheat or wheat bran during the last 60 days of animal pregnancy. The State Department of Health should also be contacted since it needs to become aware of the extent of potential problems as a basis for fulfilling its regulatory responsibilities.

Acid Rainfall

In recognition of increasing lignite coal development in western North Dakota, the State Department of Health has reviewed the experience of other states and nations in terms of deleterious environmental impacts resulting from industrial development. This examination involved case histories of after-the-fact problems; problems which were either not expected, or which resulted from inadequate control of emissions.

Problems experienced with acid rain have been reported from northwestern Europe (Oden, S. 1976; Overrein, L. 1976; Nordo, J. 1976: Ottar, B. 1976; Semb, A. 1976; and Klackow, D. and H. Denzinger 1976), northeastern United States (Jacobson, J. et al. 1976; Boyce, S. and S. Butcher 1976; Cogbill, C. 1976; Likens, G.E. and F.H. Bormann 1976; and Likens, G.E. et al. 1972), and Canada (Hutchingon, T.C. 1976; Nyborg, M. and J. Crepin 1976; and Baker, J. et al. 1976).

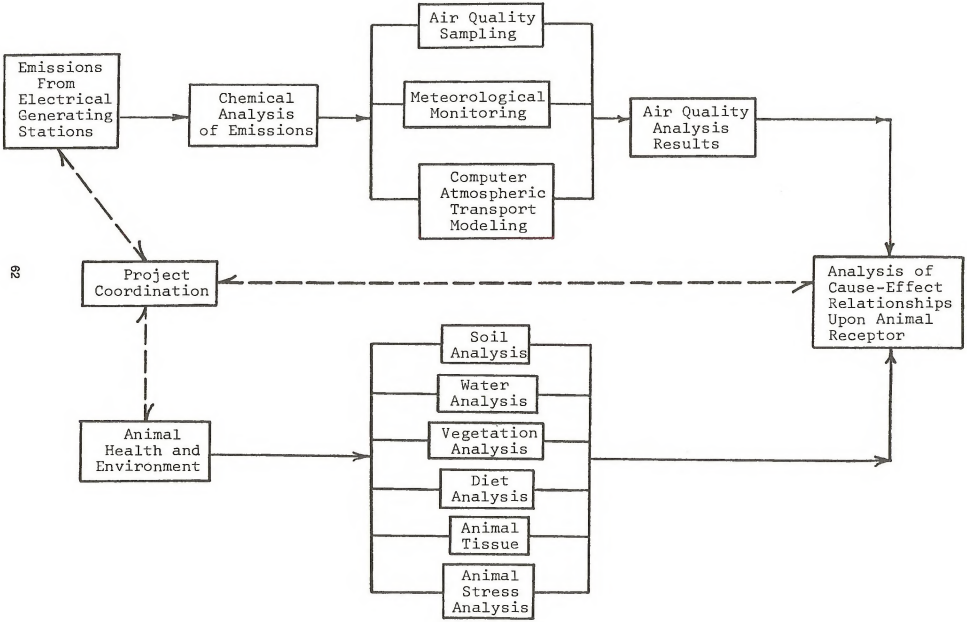
In North Dakota, the only recorded corrosive atmosphere problems occurred during the 1960s in the oil and sour gas production areas of the northwestern corner of the state. Farm machinery and metal farm buildings were apparently damaged by sulfurous gases in combination with water vapor. These problems occurred prior to an air pollution control law in North Dakota, and industry voluntarily corrected them. The primary chemical compounds attributed to causing acid rainfall are oxides of sulfur and nitrogen.

The potential for the problems in northeastern United States are evident in Map 5. This map presents a geographic picture of the emissions of oxides of sulfur and nitrogen, by state, for 1972 (the last year that the Department could obtain national data). In addition, it was reported by Hutchinson 1976 that the annual emissions of sulfur dioxide from smelters in the Sudbury, Ontario, area of Canada were in excess of three million tons in 1972.

The relationships of these sulfur oxide and nitrogen oxide emissions, by state, to the pH of rainfall is seen in Map 6 which is reproduced from a document entitled, "Environmental Effects of Increased Coal Utilization: Ecological Effects of Gaseous Emissions from Coal Combustion," edited by Norman R. Glass, Corvallis Environmental Research Laboratory (EPA-600/7-78-108) June 1978. As can be seen from Map 6, the average pH of annual precipitation in the eastern half of the United States has changed with time and increased emissions from 1955-56 to 1972-73. The emisions of sulfur and nitrogen oxides shown on Map 5 are reflected in the average precipitation pH values shown for the years 1972-73 shown on Map 6. The pH unit indicates a more acid solution with decreas-

FIGURE 5

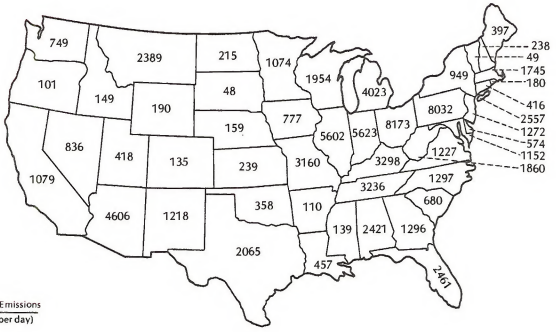
Analysis Pathways



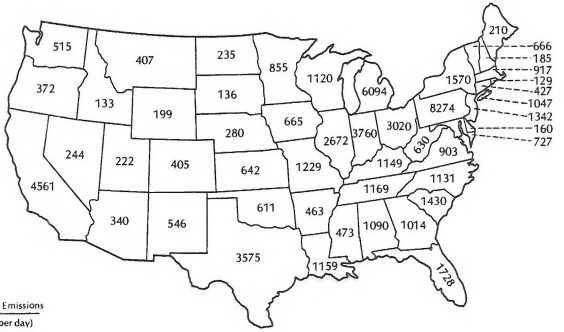
MAP 5

NATIONWIDE EMISSIONS OF SULFUR AND NITROGEN–1972

(metric tons per day)



1972 Sulfur Oxide Emissions
(1000 kilograms per day)

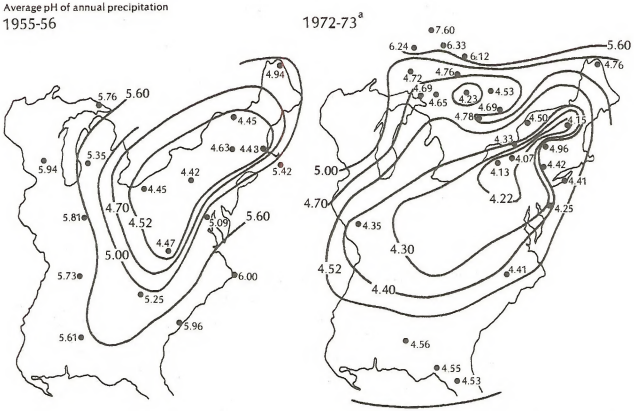


1972 Nitrogen Oxide Emissions
(1000 Kilograms per day)

SOURCE: 1972 National Emissions Report
U.S. Environmental Protection Agency
EPA—450/2—74—012 (June 1974)

MAP 6

TIME COURSE OF CHANGE IN pH ISOPLETHS FROM 1955-56 TO 1972-73 IN THE NORTHEASTERN UNITED STATES



SOURCE: G.E. Likens and C.V. Cogbill
From: C & E News, November, 1976

a Data from Oak Ridge, Tenn., for 1973-74; data from Tallahassee, Fla., for 1974-75; and from Gainsville, Fla., for 1976.

SOURCE: Various, including C.V. Cogbill, Thomas Burton, Patrick Brezonik, and Gary Henderson.

SOURCE: U.S. Environmental Protection Agency
Environmental Effects of Increased Coal Utilization: Ecological Effects of Gaseous Emissions From Coal Combustion (EPA—600/7—78—108) June 1978

ing values. It was reported in the Legislative History (U.S. Code, Congressional Administrative News, Legislative History, 95th Congress, 1st Session, page 1209) of the Clean Air Act Amendments of 1977 that in Ithaca, New York, in June-July of 1971, the average pH of rain was as low as 3.53. Values of rainfall pH between 2.1 and 3.6 have been reported for individual storms hundreds of miles from major sources of air pollution (Environmental Effects of Increased Coal Utilization: Ecological Effects of Gaseous Emissions from Coal Combustion, EPA-600/7-78-108, June 1978).

Even with the known energy development projects proposed for operation within North Dakota in the early 1980s, the total statewide emissions of oxides of sulfur and nitrogen are not expected to exceed one half of the 1972 emissions reported for our neighboring state to the west, Montana. It would appear that the potential for an adverse, or episodic acid rain problem is low in North Dakota. However, one cannot entirely rule out localized problems developing in areas of more intensive energy development or under stable atmospheric conditions.

It is important, in view of North Dakota's agricultural economy, to protect the rural environment from adverse atmospheric acidity. It is only through a properly functioning network of precipitation sampling stations for pH determinations that this protection will be insured. At the present time, only limited atmospheric pH data has been obtained by the North Dakota State Department of Health. Table 21 presents the available raw data obtained during 1977 at seven locations in western North Dakota. Table 22 presents a statistical analysis of site-specific rain data collected by the North Dakota State Department of Health. The time range in which the data was collected, the summation of samples, and the maximum and minimum pH values are presented in the table. In addition, the means and the standard deviations are given.

The results of the pH data given in Table 22 indicate a pH average of 6.0 for all sites, with individual site averages being within plus or minus 0.2 pH units of this average value. This compares with the average eastern United States precipitation pH range of 4.07 to 5.0 noted in the 1972-73 isopleths (see Map 6). The maximum pH reading measured was 8.2, the minimum pH reading was 4.4; both collected at the Bismarck site. This probably occurred because the site had the highest number of precipitation events measured. The data presented here can only be used as an indication of rain acidity. Much more data collected over a longer period of time is needed.

In Table 21, the pH or precipitation at three sites, Bismarck, west of Mandan, and Halliday, measured individual pH values in the range of pH 4.4 to 4.9, although the overall averages for these sites were comparable to the other four sampling sites. These relatively low pH, individual events, are not as acid as the Ithaca, New York, and other examples mentioned earlier. Attempts by the Department to find a plausible explanation of these events through examination of meteorological data and pollutant emissions from nearby sources was inconclusive. It is plausible that sulfur dioxide emissions were entrained into precipitation producing weather events during the three cases. It is, however, highly unlikely that the ambient air concentrations of sulfur dioxide were of magnitudes sufficient to have caused the lower pH levels of the three rain cases.

Normally, atmospheric moisture in equilibrium with atmospheric carbon dioxide will have a pH of 5.7 (Barret, E. and G. Brodin 1975). The average value of pH 6.0 found at the seven sampling sites indicates less acidity than would normally be expected. The data agrees with studies of pH of atmospheric rainfall in Iowa (Tabatabai, M.A. and J.M. Laflen 1976) and a low population, low industrial development area of Michigan's upper peninsula (Richardson, C.J. and G.E. Merva 1976; Semonian, R.G. 1976).

In view of the preceding discussion, it would appear that the potential for acid rainfall in North Dakota is low. Even with the addition of Level 1 and Level 2 Beulah projects, the expected combined emissions of oxides of sulfur and nitrogen should not result in average annual precipitation pH values much less than that currently seen. Monitoring of precipitation pH should, however, be increased to confirm this prediction, provide a baseline for possible future coal development in the state, and to monitor the regional influence of sulfur oxides and nitrogen oxides. The monitoring of precipitation pH is indicated because of the importance of precipitation to the state's agricultural economy and general environment.

Trace Element Effects

There is currently no known pollutant present in the ambient air of North Dakota that is causing an observable effect upon human health, vegetation, or animal health. This statement is based upon analysis of effects of major pollutants; i.e., those which are found in the greatest concentration in the ambient air, which are emitted in the greatest concentration from sources such as the Level 1 and Level 2 projects, or which historically have been shown to cause problems.

In addition to these major pollutants, there are groups of other chemical elements and compounds in the environment which become involved with,

TABLE 21

ACID PRECIPITATION EVENTS AT SEVEN COLLECTION SITES IN WESTERN NORTH DAKOTA, 1977

Collection Location	Date Collected	pH
Bismarck	3-30-77	6.6
	5-3-77	7.2
	5-4-77	6.3
	5-16-77	6.6
	5-17-77	6.2
	5-21-77	6.2
	5-25-77	8.2
	5-27-77	7.0
	5-29-77	6.7
	5-31-77	6.2
	6-3-77	5.9
	6-9-77	7.0
	6-13-77	5.5
	6-14-77	5.4
	6-17-77	5.4
	6-21-77	6.0
	6-21-77	4.7, 4.5, 4.4
	6-22-77	5.8
	--	6.7
	7-5-77	5.8
	7-7-77	5.9
	7-11-77	5.2
	7-27-77	6.4
	8-5-77	5.4
	8-15-77	6.1
	8-25-77	6.2
	8-27-77	5.8
	8-30-77	5.7
	9-1-77	5.9
	9-7-77	6.3
	9-8-77	5.4
	9-8-77	6.2
	9-22-77	5.7
	9-22-77	6.4
	9-23-77	5.6
	9-24-77	6.2
	9-30-77	6.1
West of Mandan	5-4-77	6.3
	5-17-77	5.6
	5-25-77	5.8
	5-29-77	6.5
	5-29-77	6.4
	6-3-77	5.7
	6-11-77	5.1
	6-14-77	4.6
	7-11-77	6.1
	8-27-77	5.3
	8-31-77	6.2
	9-2-77	5.5
	9-17-77	6.1
	9-24-77	5.8
New England	8-22-77	5.7
	8-23-77	5.6
	8-26-77	5.6
	8-30-77	5.4
	8-31-77	5.9
	9-1-77	6.4
	9-18-77	6.2
	9-20-77	6.4
	9-23-77	6.1
	9-29-77	5.3
	9-30-77	5.6
	10-1-77	5.6
Halliday	7-16-77	5.2
	8-15-77	6.4
	8-23-77	5.3
	8-26-77	6.2
	8-29-77	7.8
	8-31-77	5.7
	9-2-77	5.3
	9-9-77	6.6
	9-19-77	6.8
	9-22-77	5.6
	9-24-77	4.9
	9-30-77	5.7
Lake Tschida	9-18-77	5.6
	9-22-77	6.0
	9-24-77	6.3
	9-30-77	5.9
	10-1-77	6.4
Grassy Butte	5-18-77	6.3
	8-28-77	6.6
	9-21-77	5.8
	9-30-77	6.1
Mandaree	7-17-77	6.5
	7-28-77	5.9
	8-5-77	6.1
	8-29-77	6.0

SOURCE: North Dakota State Department of Health 1977

TABLE 22

RAINFALL pH ANALYSIS BY SITE LOCATION (1977)

Site Location	Date Range	pH
Bismarck	3-30/9-30	
Total (Σ)		234.8
Max (X_{max})		8.2
Min (X_{min})		4.4
Mean ($\bar{X}$)		6.0
No. of Samples (n)		39
Standard Deviation (σ)		0.73
Grassy Butte	5-18/9-30	
Total (Σ)		24.8
Max (X_{max})		6.6
Min (X_{min})		5.8
Mean ($\bar{X}$)		6.2
No. of Samples (n)		4
Standard Deviation (σ)		0.34
Mandaree	7-17/9-30	
Total (Σ)		24.5
Max (X_{max})		6.5
Min (X_{min})		5.9
Mean ($\bar{X}$)		6.1
No. of Samples (n)		4
Standard Deviation (σ)		0.26
Halliday	7-17/9-30	
Total (Σ)		71.5
Max (X_{max})		7.8
Min (X_{min})		5.2
Mean ($\bar{X}$)		6.0
No. of Samples (n)		12
Standard Deviation (σ)		0.83
New England	8-23/10-1	
Total (Σ)		69.9
Max (X_{max})		6.4
Min (X_{min})		5.3
Mean ($\bar{X}$)		5.8
No. of Samples (n)		12
Standard Deviation (σ)		0.39
Mandan	6-21/9-24	
Total (Σ)		86.4
Max (X_{max})		6.5
Min (X_{min})		4.6
Mean ($\bar{X}$)		5.8
No. of Samples (n)		15
Standard Deviation (σ)		0.53
Lake Tschida	9-18/10-1	
Total (Σ)		30.4
Max (X_{max})		6.5
Min (X_{min})		5.6
Mean ($\bar{X}$)		6.1
No. of Samples (n)		5
Standard Deviation (σ)		0.37

SOURCE: North Dakota State Department of Health 1977

and are directly or indirectly related to healthy growth and maintenance of humans, vegetation, and animals. Included are chemical groups such as fertilizers, insecticides, herbicides, fungicides, and trace elements, to name a few. These chemical groups can, and do, serve a useful purpose in agriculture, which is North Dakota's major industry. Without these chemical assists, the agricultural economy of North Dakota would not be as productive. If these chemicals are not added in excess concentrations to the environment, or are not enriched in concentration through the biological food chain, benefits can be seen. Conversely, if the concentrations are excessive in the environment, adverse effects can result in one or more of the human, vegetation, or animal receptors (animals as used in this discussion includes aquatic life and wildlife as well as domestic livestock). Although these groups of chemicals are involved in the environment, the focus of this discussion will be the trace element group.

Trace elements are found generally throughout the natural environment and, although there have been instances of high natural concentrations of these chemicals causing problems, the greatest concern over trace elements has been with respect to man-made enrichment of chemical elements in the soil environment, with subsequent possible effects upon either vegetation or animals, or both. These effects could be either direct or via the food chain. The use of fertilizer, whether chemical or organic, will not be considered in this discussion, although both forms contain trace elements. This discussion will be directed to the trace elements added to the air environment from energy conversion facilities and subsequently deposited on the soil.

The need for gathering and evaluating information concerning trace elements from industrial processes became a concern of the North Dakota State Department of Health in the late 1960s. The concern was fostered through the discovery of a molybdenosis toxicity condition in cattle grazing in an area influenced by the emissions of a uraniferous lignite ashing plant in the southwest corner of the state. This situation occurred before North Dakota had an air pollution law to prevent problems like this.

In 1975, initial funding to study the possible hazards of trace element emissions from coal conversion facilities was obtained from the Old West Regional Commission. This study, which is presented in the Climate and Air Quality Technical Supplement to the Draft Study, was an effort to gather background trace element data and literature concerning environmental research on specific trace elements.

The first phase of the trace element study by the Department is complete. The second phase, examining the long-term, i.e., 30 to 40 year period, is currently in process. A third phase to study the influence of trace elements in the aquatic environment is proposed for initiation in late 1979. All of this research work is a continuing process involving the same study area, and as each phase is completed it broadens the knowledge based on each succeeding phase.

The initial research effort allowed for the collection of a considerable body of information, but did not allow for the evaluation of the total trace element issue because of the complexities involved and the expense of performing trace element research. This study was performed in a 2,400 square mile area of western North Dakota to evaluate the potential significnce of 14 trace elements (arsenic, beryllium, cadmium, chromium, copper, fluorine, lead, mercury, molybdenum, nickel, selenium, uranium, canadium, and zinc) released to the environment through the energy conversion of coal. Sulfur was also considered, although not a trace element.

The methodology for evaluating these trace elements included the analysis of coal from four coal mines; the study of operating histories and design parameters of six lignite-fired electrical generating facilities; and the analysis of soil taken from 205 locations within the study area.

The concentrations of trace elements in the coal and the facility design parameters served as input data for a computer dispersion model with a deposition function for estimating the dry deposition of trace elements to the study area. Trace element deposition was compared to existing soil concentrations. The application of a computer dispersion and deposition model demonstrated that contemporary energy conversion facilities contribute three orders of magnitude less surface deposition than do energy conversion facilities designed and operated since the 1920s.

This report presented a methodology for determining the significance of individual trace elements released to the environment through the energy conversion of coal. For short-term (annual) projections, the projected depositions on environmental receptors are not expected to cause adverse effects on ecosystems. However, equating the potential long-term environmental significance of the quantities of these trace elements deposited in the environment, remains for further evaluation as part of this continuing research effort under Phase 2 being conducted in cooperation with the Old West Regional Commission.

The first phase study emphasized the short-term (annual) effects on the ecosystem. However, in the course of examination of trace elements from various coal-fired power plants in the study area, an interesting comparison of two facility designs developed concerning long-term effects. This comparison is shown in Table 23. Both of these plants are North Dakota electrical generating facilities with the "historic" design ceasing operation in 1968 after about 48 years of operation.

This comparison is interesting in that the "historic" plant had a projected factor of one thousand times more soil deposition per year per megawatt generation than that from the contemporary plant designed in the 1960s. This striking comparison was due to an increased thermal efficiency (burns less coal for same generating capacity), pollution control devices, and better pollutant dispersion characteristics of the contemporary facility. The facility designs of the Level 1 and Level 2 projects incorporate additional refinements beyond that of the contemporary design shown in Table 23. The "historic" facility was located at Washburn and it operated for about 48 years without apparent adverse effects due to trace element emissions in that area.

The comparison shown in Table 23 could indicate that there will be no adverse trace element effects in the environment within ten kilometers of the Level 1 and Level 2 Beulah projects as long as the total generating capacity was under one thousand times the Washburn facility capacity of 15 megawatts or 15,000 megawatts. This analogy would indicate that the Level 1 and Level 2 power plants (1760 megawatts combined total) could operate in the Beulah vicinity without adverse effect throughout the expected lifetime of those facilities. The question of trace element deposition can be approached from another avenue; that is, determining the years it would take to attain the same deposition from the 15 megawatt facility. Using a simple mathematical relationship of one thousand times the 15 megawatt capacity of the Washburn facility, times the 48 years operating period at Washburn, divided by the 1760 megawatts; yields a value of about 400 years which is well beyond the life expectancy of the Level 1 and Level 2 power plants near Beulah.

The first trace element study phase emphasized the short-term effects (annual); however, it would appear that the long-term (through the lifetime of the projects) trace element deposition from Level 1 and Level 2 projects would not result in adverse effects. The Department of Health feels that, although the probability of trace element effects from Level 1 and Level 2 projects is low, this question should not be left to chance.

The second phase of trace element study, "The Long-Term Effects of Trace Elements from Energy Conversion Facilities," is scheduled for completion in July of 1979. The results of this work will shed greater light on the rather simplistic analogies discussed above. The additional pollution control design characteristics of the Level 1 and Level 2 projects were not considered above due to the simplistic nature of the analogies.

Although further scientific study is indicated, it would appear that the emissions of trace elements from the Level 1 and Level 2 projects (including the gasification plant) would result in little or no adverse effect upon the ecosystem in the vicinity of Beulah, which is the maximum impact area.

Radiation Impacts

It is clear that exposure to radiation can cause harm to health, including cancer, genetic damage, and birth deformities. Further, effects of radiation are cumulative with each additional exposure increasing the risk of illness. Much of the attention to radioactive emissions and subsequent health effects has been related to the evaluation of nuclear power reactors and the nuclear fuel cycle (mining, milling, fuel fabrication, fuel utilization, fuel reprocessing, and waste disposal). There have been a number of studies which have documented the health hazards of radiation, including increased risk of cancer, genetic and mutagenic damage. Testimony before Congress in consideration of the Clean Air Act Amendments of 1977 also has presented concerns over the role of radiation in increased susceptibility to the diseases of aging, including diabetes, stroke, hypertension, cardiovascular disease, and cataracts.

There are no nuclear power plants in North Dakota. Other than Minnesota, there are no nuclear power plants in the states adjacent to North Dakota. The attention of environmental radiation in North Dakota, in this discussion, will be directed to the radioactive material in coal as it relates to Level 1 and Level 2 projects. Although uranium reserves exist in North Dakota, and mining and ore upgrading activities were conducted in the 1960s, uranium activities in this state, currently, are confined to exploration with possible future development. Uranium and other naturally occurring radionuclides are found throughout the environment and in the coal used in coal-fired energy facilities. Concern has been expressed that the utilization of western coals, including North Dakota coals, will result in increased radiation in the environment causing or contributing to increased incidence of disease. There have been reports that western coal contains 10 to 100 times more radionuclides than eastern

TABLE 23

A RELATIVE COMPARISON OF TWO FACILITY DESIGNS

DESIGN	HISTORIC[1] DESIGN	CONTEMPORARY[2] DESIGN	APPROXIMATE DIFFERENCE
Stack height	low	high	factor of two
Coal feed rate	low	high	factor of fifteen
Emissions control	no	yes	
Power generation	low	high	factor of twenty
Point of maximum deposition	less than 5 kilometers from the stack	more than 10 kilometers from the stack	
Maximum annual deposition of trace elements	very high	low	factor of fifty
Maximum annual deposition of trace elements per unit of power generation	very high	low	factor of one thousand

SOURCE: North Dakota State Department of Health - Trace Element Effects of Energy Conversion Facilities - A Phase One Final Report to the Old West Regional Commission, 1977.

1/ Approximate design period 1920

2/ Approximate design period 1960

coals. This generalization, by evaluation of Table 24, is not necessarily the case. It is proper to raise this question; however, it appears that given the amount of coal development contemplated in Level 1 and Level 2 projects, the risk of increased radiation induced disease is low. Although this risk is low, it is prudent to monitor and analyze the impacts of radiation on human and animal health, not only from coal development, but oil and gas development, terrestrial and other sources, as well.

Naturally occurring uranium, which is predominately (99.28%) composed of the isotope uranium 238, is found in various concentrations throughout the environment. Uranium 238 is the parent radioactive material which, when it goes through radioactive decay, leads to other radioactive daughter products. The uranium (radium) decay series includes the radionuclides: uranium 238, thorium 234, protactinium 234, uranium 234, thorium 230, radium 226, radon 222, polonium 218, lead 214, bismuth 214, polonium 214, lead 210, bismuth 210, polonium 210 until radioactive stability (non-radioactive) is achieved with lead 206. Further discussion of the daughter radioactive products would serve only to complicate the consideration of radiation impacts under consideration in this supplement; although future energy development, including uranium development, will require a more complex detailed analysis.

Not a great deal of chemical analysis work for uranium has been performed on the coal which will be used by Level 1 and Level 2 projects. Analysis of samples from four coal mines in central North Dakota by the State Department of Health yielded a concentration range of less than 0.10 to 1.4 parts per million of uranium in coal used to fire the existing power plants in the Stanton and Center areas (Miller, Christianson, Schock, and Morrison, Trace Element Effects of Energy Conversion Facilities, A Phase One Final Report to the Old West Regional Commission, November 1977). These coal uranium concentrations are contrasted to the commercial concentrations of 848 to 1,187 parts per million of uranium found in the uraniferous lignite coals. The quality of known uraniferous lignite coal in North Dakota is such that this coal would not be used as a fuel in a Level 1 or Level 2 project. The uraniferous lignites which were processed for uranium upgrading in North Dakota until 1967 had a heat value of 1,000 to 5,000 Btu's per pound and 30 to 52% moisture. The commercial deposits were found in veins ranging from 1 inch to 4 feet thick.

All of the radioactive material (e.g., uranium, thorium, and their daughter products) entering a coal burning facility will ultimately be discharged to the environment either as air emissions or as solid waste. With the exception of radon which is a gas (in the uranium-thorium series decay schemes), the radioactive material will be associated with the particulate matter resulting from coal burning. All of the Level 1 and Level 2 power plants will use either an electrostatic precipitator or fabric filter system which has a particulate removal efficiency of greater than 99%. The amount, if any, of radon removal by pollution control devices at the coal burning facility is not currently known. It is not known, for example, if some radon is trapped in the bottom ash, if some radon becomes attached to particulate matter and subsequently captured by the particulate collectors, or if scrubbers used to remove sulfur dioxide will have any appreciable effect upon radon removal. For purposes of this discussion, the worst case, or 100% release of radon to the atmosphere, will be considered.

Another radioactive material of interest in the coal burning process is potassium 40. This radioactive material is found to occur naturally throughout the environment. It is generally assumed that potassium 40 is collected as particulate matter in the control devices of the coal burning facility. Potassium is one of the major chemical elements in coal as contrasted to uranium which is considered as a trace element. The radioactive isotope, potassium 40, is, however, only 0.0118% abundant in nature. Two non-radioactive (stable) isotopes of potassium, 39 and 41, account for over 99% of the potassium in nature and presumably in the coal.

There is presently little information on the radioactive material content of North Dakota lignite coal, other than uranium concentrations. The EPA has examined the question of radioactive emissions from coal combustion in a document entitled, "Potential Radioactive Pollutants From Expanded Energy Programs" (EPA-600/7-77-082, August 1977). Table 24 contains a projection of emissions of radioactive material from 5 coal types in microcuries per day (microcuries, a unit of radioactivity describing the rate of decay of radioactive material. One microcurie equals 3.7×10^4 nuclear transformations per second.). This projection involved a number of assumptions concerning the amount and distribution of radioactive material in the emission of particulate matter from a 1,000 megawatt power plant employing a 99.5% particulate collection efficiency.

The example shown for the Powder River coal type corresponds most closely with the lignite coals of North Dakota. The Powder River Wyoming subbituminous coal used in this projection was 8,200 Btu/lb, 6% ash, with uranium and thorium concentrations of 0.7 and 1.9 parts per million, respectively. This compares to North Dakota lignite with 6,800 to 7,000 Btu/lb, 6.2% to 8% ash, with uranium and thorium concentrations of 0.83 and 0.77 parts per million, respectively (D.N. Baria, A Survey of Trace

TABLE 24

EMISSIONS OF RADIONUCLIDES IN PARTICULATE MATTER FROM A 1000 MW POWER PLANT: CONCENTRATION OF URANIUM, LEAD, AND POLONIUM IN FLY ASH ASSUMED (microcuries per day)

	Coal Type				
Radionuclide	Appalachia	Illinois-W. Kentucky	Powder River Basin Wyoming	Navajo Reservation New Mexico	Kaiparowits Plateau Utah
Uranium 238	66.5	150.0	63.5	87.5	48.0
Thorium 234	13.3	30.0	12.7	17.5	9.6
Protactinium 234	13.3	30.0	12.7	17.5	9.6
Uranium 234	66.5	150.0	63.5	87.5	48.0
Thorium 230	13.3	30.0	12.7	17.5	9.6
Radium 226	13.3	30.0	12.7	17.5	9.6
Radon 222	*	*	*	*	*
Polonium 218	66.5	150.0	63.5	87.5	48.0
Lead 214	66.5	150.0	63.5	87.5	48.0
Bismuth 214	13.3	30.0	12.7	17.5	9.6
Polonium 214	13.3	30.0	12.7	17.5	9.6
Lead 210	66.5	150.0	63.5	87.5	48.0
Bismuth 210	13.3	30.0	12.7	17.5	9.6
Polonium 210	66.5	150.0	63.5	87.5	48.0
Thorium 232	7.9	9.4	11.6	27.6	7.1
Radium 228	7.9	9.4	11.6	27.6	7.1
Actinium 228	7.9	9.4	11.6	27.6	7.1
Thorium 228	7.9	9.4	11.6	27.6	7.1
Radium 224	7.9	9.4	11.6	27.6	7.1
Radon 220	*	*	*	*	*
Polonium 216	7.9	9.4	11.6	27.6	7.1
Lead 212	39.5	47.0	58.0	138.0	35.5
Bismuth 212	7.9	9.4	11.6	27.6	7.1
Polonium 212	5.1	6.0	7.4	17.7	4.5
Thallium 208	2.8	3.4	4.2	9.9	2.6
Potassium 40	30.0	47.2	10.5	33.4	11.2
Total	625	1,280	631	1,110	459

SOURCE: U.S. Environmental Protection Agency - Potential Radioactive Pollutants Resulting From Expanded Energy Programs (EPA-600/7-77-082) August 1977.

* See Table 25

Elements in North Dakota Lignite and Effluent Streams from Combustion and Gasification Facilities). In contrast, the subbituminous coal from the Navajo Reservation of New Mexico, in this projection, had characteristics of 8,500 Btu/lb, 25% ash, with uranium and thorium concentrations of 1.2 and 4.8 parts per million, respectively.

Releases of radon gas (radon 222 and radon 220) from these five plants were also compared in Table 25 with the assumption that all of the radon in the coal exists in the stack without any removal or capture in the pollution control devices of the combustion facility. This is a maximum, worst case condition, since some radon may be caught in the sulfur dioxide scrubbers and because radon 220 has a comparatively short radiological half life of 54.5 seconds. (Radioactive half life is the time it takes a given radioactive material to decay to half its original radioactivity.) Some radon 220 could be expected to decay to a particulate with subsequent attachment to ash particulate and be captured in the particulate pollution control device. However, to simplify this discussion, 100% of the radon is assumed to be released from the Level 1 and Level 2 sources. Comparing Table 24 and 25 shows that radon radioactivity emissions are projected to be greater than all the other radioactive constituents in the coal.

Given the similar characteristic (previously described) of the Powder River subbituminous coal and North Dakota lignite coal, the projected radioactivity emissions from burning of the Powder River coal in a 1,000 megawatt power plant would approximate the burning of lignite coal in a North Dakota 880 megawatt power plant. A coal gasification plant, such as the ANG facility, would have similar particulate radioactivity; however, the radon component would probably be transferred to the product synthetic natural gas. The gas loops in a gasification plant are, for the most part, closed. The projected radioactive emissions from the burning of Powder River coal formed the basis for the assumed radioactivity in the air emissions from the Level 1 and Level 2 projects. These assumed emissions are shown in Table 26.

Translating these assumed radioactivity emissions to ambient air quality can be approached by considering radioactive particulate and radon gas separately. A relationship to the ambient air quality can be developed by using the 3,325 microcuries per day total assumed particulate emission radioactivity from Table 26. From Maps 3-1 and 3-4 in the Draft Study, the maximum annual average predicted concentration of suspended particulate increase in the ambient air in the seven-county study area is approximately one microgram per cubic meter from Level 1 and Level 2 sources, exclusive of the mines associated with these projects. Mine emissions will be considered later. The use of one microgram per cubic meter, due to particulate emissions, is conservative for analysis purposes since the North Dakota State Department of Health has predicted the maximum annual average estimated total suspended particulate ground level concentration to be 0.4 micrograms per cubic meter from Coal Creek, Coyote 1, ANG Coal Gasification Plant, and Antelope Valley Units 1 and 2, combined (Air Quality Effects Analysis of Basin Electric Power Cooperative Antelope Valley Station for Air Pollution Control Permit to Construct, North Dakota State Department of Health, January 1978).

To simplify calculations, the total particulate emissions from these sources, 7,075 tons per year (from Tables 3-1 and 3-20 of the Draft Study) is based upon a 365 day year, or an average emission of 19.4 tons per day. An average emission rate of 19.4 tons per day (1.76×10^{13} micrograms per day) results in an annual ambient average increase of 1-2 micrograms per cubic meter. The one microgram per cubic meter value will be used as the average concentration expected to occur over a 24-hour averaging period. During this average 24-hour period, 1.76×10^{13} microgram of particulate is released to the ambient air. To further simplify the analysis, the impact of one microgram per cubic meter annual average is, for the most part, from Map 3-4 of the Draft Study confined to Mercer and Oliver Counties with a narrow band of one microgram per cubic meter extended westward into central Dunn County. A dispersion factor, translating the emission quantity per day to average ambient air quality increase, is one microgram per cubic meter divided by 1.76×10^{13} micrograms per day or $5.68 \times 10^{0^{14}} m^{0^{3}}$ day.

This dispersion factor times the total assumed particulate radioactivity of 3,325 microcuries per day, yields an expected average particulate radioactivity in the ambient air of $1.89 \times 10^{0^{10}}$ microcuries per cubic meter or 189 attocuries ($10^{0^{18}}$ curies) per cubic meter average daily concentration.

Very little ambient air quality data exists in the United States today concerning radioactivity from the radioactive materials listed in Table 24. This is due to the expense and complexities involved in analyzing samples with low levels of radioactivity. In North Dakota and other areas of the United States, there is a considerable amount of beta radiation data, but the data is gross and not quantitative. In a recent document entitled "Radiological Quality of the Environment" (EPA-520/1-76-010 May 1976), EPA reported the analysis results of air samples collected at Bismarck by the North Dakota State Department of Health from July 1974 through June 1975. These results are summarized in Table 27.

Although the radioactivity across the state can be expected to vary, the Bismarck data will be used

TABLE 25

RELEASE OF RADON ISOTOPES FROM
A 1,000-MW POWER PLANT

Coal	Radon Release (μCi/day) 1/ Rn-222	Rn-220
Appalachia (bituminous)	3,140	1,870
Illinois-W. Kentucky	7,050	2,220
Powder River Wyoming (subbituminous)	2,980	2,720
Navajo Reservation, New Mexico (subbituminous)	5,000	6,500
Kaiparowits Plateau, Utah (bituminous)	2,260	1,670

Source: U.S. Environmental Protection Agency Potential Radioactive Pollutants Resulting from Expanded Energy Development (EPA-600/7-77-082) August 1977

1/ μCi/day is the abbreviation for microcuries per day.

TABLE 26

ASSUMED RADIOACTIVITY IN
AIR EMISSIONS OF LEVEL 1 AND 2 LEVEL PROJECTS

Project	Assumed Radioactivity (μCi/day)[1/]		
	Particulate	Radon 222	Radon 220
Antelope Valley 1 and 2	631	2,980	2,720
Coyote 1 and 2	631	2,980	2,720
ANG Coal Gasification	631	-	-
NGPL Coal Gasification	1,432[2/]	-	-

Source: North Dakota State Department of Health 1978.

1/ μCi/day is the radioactivity release per day with the units microcuries per day.

2/ The assumption for Natural Gas Pipeline Company. (NGPL) is based upon preliminary project design information supplied by the NGPL whereas, particulate emission information for the American Natural Gas (ANG) facility was based upon actual project design.

as an indicator of airborne uranium 234, 235, and 238 radioactivity for the study area for lack of more geographical specific data. Bismarck results from Table 27 compare favorably with the network summaries, particularly in the maximum values noted.

Uranium 234 and 238 are shown in the list of radionuclides of Table 24; however, uranium 235 is not. The radioactivity, due to uranium 34 and 238, is shown in Table 24 to account for approximately 20% of the total radioactivity in the Powder River Basin coal type. The total average radioactivity of uranium 234 and 238 at the Bismack sampling site is shown in Table 27 to be 106.8 microcuries per cubic meter. If one assumes the same radionuclide equilibrium conditions as found in Table 24, the total particulate radioactivity at the Bismarck sampling site could be 534 microcuries per cubic meter. This value, when compared to the projected 189 microcuries per cubic meter ambient air quality increase in radioactivity, would indicate an increase of approximately 35%. Relating this increase to perceptible increase in the incidence of human and animal disease in the study area, assuming the Bismarck data represents the study area, is impossible at this time. The radiation risk of particulate radioactivity cannot be assessed without further study and actual data.

Analysis of the increase in ambient radon gas radioactivity from the Level 1 and Level 2 projects can follow the same approach as used in the analysis of particulate radioactivity; however, it is assumed that 100% of the radon in the coal is released from the Level 1 and Level 2 coal fired power plants. This is a conservative assumption, because it does not take into account the possibility of radon capture in the source prior to release or the relatively short radioactive half life of radon 220. Referring again to Table 26, the total projected radon 222 release from the Level 1 and Level 2 projects is assumed to be 5.960 microcuries per day into the seven-county study area.

The average natural release of radon 220 above soil has been estimated at 150 microcuries per acre per day (U.S. Environmental Protection Agency, Potential Radioactive Pollutants Resulting From Expanded Energy Programs, EPA-600/7-77-082, August 1977). Given the area of 6,835,840 acres from Table 28 in the seven-county study area, the radon 220 release from the soil in the entire region would be 1.03×10^9 microcuries per day or a factor of about 180,000 times that from the Level 1 and Level 2 power plants. The use of the entire seven-county study area has a tendency to over magnify the difference between the radon emission from the power plants and that from the natural radon 222 release from the soil.

It is more realistic to use the counties in which the Level 1 and Level 2 impacts would be the greatest; i.e., Mercer and Oliver Counties. From Table 28, the total surface area for Mercer and Oliver Counties is 1,108,320 acres or a projected radon 222 release in those counties of 166×10^8 microcuries per day from the soil. This radon 222 soil release is about 28,000 times that from the Level 1 and Level 2 stack emissions.

Examining the radon 222 emissions from the power plant stacks and assuming that all of the radon gas is uniformly delivered at ground level within these two counties results in an insignificant 0.0054 microcuries per acre per day increase when compared to the natural radon 222 release of 150 microcuries per acre per day from the soil.

Natural radon release from soil in North Dakota is not currently known. The influences of factors such as soil moisture content, frozen soil, and the intensity of agricultural activities, specific to North Dakota, have not been determined. These factors could alter the 150 microcuries per acre per day natural radon release rate used in the preceding analysis. Although the probability of increased health risk to humans and animals from radon gas releases from Level 1 and Level 2 projects appears to be low, further study of the natural release of radon gas from the soil appears warranted.

Increases in particulate radioactivity would result from mining activities associated with the Level 1 and Level 2 projects; however, from Figure 3-1 of the Draft Study, the increase in suspended particulate matter and, subsequently, the particulate radioactivity would be small compared to the suspended particulate and naturally occurring radioactive particulate uranium, thorium and daughters from unpaved roads and agricultural activities. Additional terrestrial radiation analyses are needed concerning the radiation risks to health of humans and animals, especially concerning the radioactivity released to the environment from unpaved roads and agricultural activities which are projected to account for 91.4% or approximately 100,000 tons per year of particulate matter in four of the seven study counties. Further study may indicate that the radioactivity in the particulate matter resulting from existing unpaved roads and agricultural activities may result in a greater radiation risk to human and animal health than from the projected particulate emissions from the Level 1 and Level 2 projects, including associated mining activities.

As was discussed earlier, an assumption was used that more than 99% of the particulate radioactivity would be removed in the pollution control devices with the resulting emissions comparable to the measurements of airborne radioactivity at Bismarck, both quantities of radioactivity small; i.e., in

TABLE 27

AIRBORNE RADIOACTIVITY DUE TO URANIUM 234, URANIUM 235, AND URANIUM 238 AT BISMARCK DURING THE PERIOD JULY 1974 TO JULY 1975

Uranium Isotope	Samples Analyzed[1/]	Attocuries[2/] Per Cubic Meter	
		Maximum	Average
Uranium 234			
Bismarck	4	65.4	54.8
Network Summary[3/]	65	1290	82.1
Uranium 235			
Bismarck	4	4.1	3.6
Network Summary[3/]	65	54.3	4.49
Uranium 238			
Bismarck	4	62.2	52.0
Network Summary[3/]	65	232	52.7

SOURCE: Compiled from the U.S. Environmental Protection Agency - Radiological Quality of the Environment (EPA-520/1-76-010) 1976.

1/ Uranium analyses were performed on quarterly composite samples of air filters collected at 19 airborne particulate sampling sites across the United States. Above, uranium isotopes were determined by alpha spectorscopy following chemical treatment of the samples. The volume of air sampled ranged between 25,000 and 40,000 cubic meters for each quarterly composite sample analyzed.

2/ Attocuries is a unit of radioactivity 10^{-18} curies.

3/ The locations used in determination of the network summary were Montgomery, AL; Berkeley and Los Angeles, CA; Denver, CO; Miami, FL; Idaho Falls, ID; Bismarck, ND; Sante Fe, NM; Las Vegas, NV; Buffalo and New York City, NY; Columbus, OH; Oklahoma City, OK; Portland, OR; Harrisburg and Fittsburg, PA; Anderson and Columbia, SC; and Lynchburg, VA.

TABLE 28

SURFACE AREA OF SEVEN-COUNTY
STUDY AREA, BY COUNTY

County	Area[1/] (Square Miles)	Area (Acres)
Burleigh	1,625	1,040,000
Morton	1,920	1,228,800
Stark	1,316	842,240
Dunn	1,992	1,274,880
McLean	2,065	1,321,600
Mercer	1,042	666,880
Oliver	721	441,440
Totals	10,681	6,835,840

Source: North Dakota State Department of Health

1/ Obtained from "County and City Data Book - 1967" U.S. Department of Commerce.

the attocurie range of radioactivity in the ambient air. One area of possible future concern is the fate of the collected particulate radioactivity; i.e., the more than 99% that did not get away.

The EPA in "Potential Radioactive Pollutants Resulting From Expanded Energy Programs" (EPA-600/7-77-082) discussed this question. Table 29 is reproduced from this document. Factoring in the life expectancy of plant operations is appropriate because the localized storage of collected wastes accumulates with time. This accumulation includes radium 226 which is a parent to radon 222 in the uranium decay series. This radium 226 30-year accumulation results in the radon 222 releases shown in Table 29. It is important to note that the units of radioactivity in Table 29 are curies per day. The values shown in Table 29 for Powder River coal are, therefore, approximately 1,500 times greater than the radon 222 microcurie releases shown in Table 25.

It is impossible for all of the radon in these piles to be released into the air. EPA quoted references which state that about 5% of the radon is released, assuming that the radon release from coal ash piles is similar to that from uranium mill tailings piles. These ash piles could, however, locally increase the radon 222 radioactivity by factors of 3.4 to 15 above natural background. The release of radon gas from the coal ash could be reduced by burying the ash with earth cover at the reclaimed mine site. Other factors which need to be examined in the future, as previously mentioned, are the influences of soil moisture content and frozen soil on the release of radon through and from the soil. In addition, burying the coal ash should be preceded by an analysis of the possibility of ground water contamination by leaching of radioactive elements. The use of a layer of impermeable material between the coal ash wastes and the aquifer, as well as ground water monitoring, may be necessary to limit this possible contamination.

From the preceding analysis, the radiation impacts upon human and animal health as a result of Level 1 and Level 2 projects are expected to be very low with the natural radioactivity in the region significantly higher than the projected and assumed increases from facility emissions. As stated in this analysis, a number of assumptions were made due to a lack of site specific information such as the radionuclide content of North Dakota lignite coals, existing airborne radioactivity, soil concentrations of uranium, thorium, and their daughter radionuclides, and the natural radon release from North Dakota soils. These assumptions, although believed to be conservative; i.e., magnifying the expected impacts, should be validated by actual radiological field determinations.

Effects on Materials

Air pollution has a variety of effects on materials, including corrosion of metals, deterioration of materials and paints, and fading of dyes. The effects of air pollution on the material things around us is often the first effect to be noticed by the average citizen. This damage to property is annoying, causes inconveniences, and can cause expensive economic losses.

Materials may be damaged by any of several mechanisms, depending upon the type of material and the nature of the air pollutant, including:

1. Abraison

   Abraison is caused by a solid particle destroying the surface of the material. This is a physical erosion of the surface of the material by particulate pollutants. The particles strike the material (usually a metal or a building material) and a resultant wearing-away of the surface occurs. If abrasive particles become imbedded in fabrics, the fibers are subjected to increased wear.

2. Deposition and Removal

   Deposition is a depositing of a particle (liquid or solid) on the surface of the material. Basically, this is soiling.

   Soiling may or may not be harmful to the property, depending upon the nature of the deposited pollutant. It is usually desirable, however, to remove the

   collected soil, and in the cleaning process slight damage is done to the material.

   An example is the soiling of a stone building. For aesthetic reasons, the building must be cleaned, and sandblasting is the usual way of accomplishing this. The blasting removes the soil, but with it a small amount of the stone surface is removed.

   Deposition, then, is soiling by a particulate pollutant, either solid or liquid. This deposited matter usually must be removed, and the removal is often more deleterious than the soiling itself.

3. Chemical Attack

   Chemical attack by gaseous or particulate pollutants affects virtually all materials. A true chemical reaction occurs between the pollutant and the material itself.

   An example of chemical attack is the damage to building stone by carbon dioxide. The stone normally is composed of insoluble calcium carbonate. In the presence of water

TABLE 29

MAXIMUM RADON-222 RELEASE FROM 30-YEAR
ASH STORAGE PILE FROM 1,000-MW POWER PLANT

Coal Type	Area of Pile (acres)	Ra-226 Content[1/] (grams)	Rn-222 Release (Ci/day)[2/]
Appalachia	176	26.2	4.6
Illinois-W. Kentucky	245	59.5	10.5
Powder River	179	25.4	4.5
Navajo	721	42.0	7.4
Utah	159	19.3	3.4

Source: U.S. Environmental Protection Agency - Potential Radioactive Pollutants Resulting From Expanded Energy Programs (EPA-600/7-77-082) August 1977.

1/ Ra-226 is the abbreviation for radium 226. Radium 226 is the parent radionuclide of radon 222.

2/ Ci/day is the abbreviation for the radioactivity unit curies per day. A curie is 10^6 microcuries.

and carbon dioxide, carbonic acid is formed, and this acid will react with the calcium carbonate to form a soluble bicarbonate. The surface of the stone can then be dissolved in water present in the air or in rain.

Many other instances of chemical attack can be cited; the tarnishing of silver by hydrogen sulfide, the reaction of sulfur dioxide with metals, and the darkening of lead-base paints by hydrogen sulfide.

Certain chemical attacks occur in a less direct manner. Sulfur dioxide, for example, is adsorbed on leather in a dry atmosphere with little or no damage to the leather. But when water is present, the adsorbed sulfur dioxide is converted to sulfuric acid, and the leather is attacked.

4. Electrochemical Corrosion

Much of the attack on materials exposed to the atmosphere is by electrochemical corrosion. Many small electrochemical cells form on the exposed surface.

Electrochemical corrosion of metals is caused by gaseous or particulate pollutants in the presence of atmospheric moisture. If the metal is clean and dry, no current will flow and no corrosion will occur. If water is present, some corrosion will occur, but the rate of corrosion is greatly increased if the water is contaminated with pollutants.

Table 30 briefly summarizes the various mechanisms of attack, the type pollutant responsible, and the type material affected. Few materials escape attack by atmospheric pollutants. Some of the materials affected, and the type of damage incurred, are as follows:

1. Metals

Metals are subject to electrochemical corrosion, to other chemical attack by gaseous or particulate pollutants (e.g., tarnish, rust), and to abrasion by windblown particles.

Several studies have been undertaken to show that metals deteriorate much more rapidly in polluted atmospheres than in clean air. Field research has proven that steel, zinc, copper, nickel, lead, and tin all show a greater degree of corrosion in urban-industrial areas than in rural locations. One study showed that steel samples exposed in urban atmospheres corroded at 30 times the rate of similar samples exposed in rural areas.

This effect on metals is especially troublesome to those involved in electrical industries. Contacts must be initially larger and must be wiped often to counteract the corrosion film which acts as an insulator. This is of critical concern to communications and power companies.

2. Protective Coatings

Paints and protective coatings serve two purposes: to protect a surface and to beautify that surface. When the protective film is damaged by gaseous or particulate pollutants, the beauty of the surface is destroyed, and the underlying surface is exposed to attack. Often the tarry matter in soot tends to incorporate in paint layers, and this material cannot be removed without ruining the surface.

Hydrogen sulfide becomes a problem where lead-base paints are in use. The chemical reacts with the paint to form the blackish lead sulfide. The exposed painted surfaces acquire a slotchy, heavily stained appearance which varies in color from a grayish-brown to black. It is true that the darkened paint will eventually be oxidized in clean air to a white form, but this can be a lengthy procedure. Usually it will be necessary to repaint the building.

3. Fabrics

Fabrics are affected by air pollution, usually by soiling. City dwellers notice that clothing and draperies must be cleaned much more frequently than those of their rural counterparts. In addition to the necessity for increased cleaning which causes excessive wear, the fabrics are actually damaged if abrasive particles are allowed to remain imbedded in the fibers.

Fabrics may also be attacked chemically. This has been illustrated in the larger metropolitan areas of the country. Girls on the way to work in the downtown areas found that their nylon stockings were popping and running for no apparent reason. The cause was traced to pollution of the atmosphere with minute windborne particles of sulfuric acid. When a particle landed on a nylon thread, a run began. Instances of less delicate fabrics being attacked in a similar manner have been reported.

4. Dyes on Fabrics

Dyes on fabrics are subject to fading and discoloration in polluted air. For example, a blue dye might fade to a lighter blue color, or it might discolor to a reddish tone. Certain dyes are most susceptible than others, and extensive testing has been done by fabric

TABLE 30

SUMMARY OF MECHANISMS OF ATTACK

Mechanism	Type of Pollutant	Materials Affected
Abrasion	solid	metals, fabrics, building materials
Deposition and Removal	solid or liquid	metals, paints, fabrics, building materials
Chemical Attack	gas, liquid or solid	metals, paints, building materials, fabrics, dyes, paper leather
Electrochemical Corrosion	gas, liquid or solid	metals

manufacturers to determine the color-fastness of various dyes which are developed.

Oxides of nitrogen and ozone are contaminants which have been shown to affect dyes. Sulfur dioxide is the source of adsorbed acid which can accelerate the reactions.

It should be stressed, however, that certain dyes will fade in sunlight, even in the absence of any contaminating substances.

5. Rubber

One of the first-noted effects of the Los Angeles smog episodes was the cracking of rubber tires. The damage was traced to oxidation by ozone and other oxidants present in the smog. Since that time, much research has been done to establish the effect of ozone on natural rubber and on various types of synthetic rubber.

It is thought that ozone attacks the double bond of the unsaturated rubber formulations, such as butadiene-styrene and butadiene-acrylonitrile. These are susceptible to attack while the unsaturated ones, such as butyl and silicone rubber, are not harmed.

The effect of ozone on rubber is so predictable that it has been used as the basis for a method of ozone detection.

6. Building Materials

Probably one of the most readily noticed effects on building materials is the soiling so familiar to city dwellers. Soiling is a gradual process and often attracts little attention until a cleaning is undertaken, and the contrast between the clean and soiled portions is startling. In many cases, the color of the stone and architectural details are obscured under the layers of grime.

While soiling is displeasing, more serious damage to building materials may be done by certain acidic gases in the air, such as carbon dioxide. The carbon dioxide, in the presence of water, forms an acid, and this acid tends to dissolve the stone.

Abrasive particles, blown about by the wind, might also erode the exposed surfaces of building materials.

7. Paper

If paper is exposed to atmospheric sulfur dioxide, the paper becomes brittle and cannot be folded without cracking. Many important documents could potentially be lost in this way. Valuable historical documents must be stored and displayed in specially-maintained atmospheres.

This effect, however, only applies to relatively "modern" papers, those manufactured since about 1750, when chemical methods of paper manufacture were introduced. Traces of heavy metals remain in the papers and these impurities cause acceleration of the damage.

8. Leather

Leather is another material which becomes embrittled in the presence of sulfur dioxide. This effect was noted by Faraday in the 1840s. The leather armchairs in his club were cracking in the polluted London air.

This problem affects such diversified articles as the leather-upholstered furniture mentioned above, valuable bookbindings and even such things as the leather bellows in large church organs.

It is safe to say that most of the materials upon which we depend for everyday use can in some way be adversely affected by pollution in the air.

A certain amount of deterioration will occur even in unpolluted air. There are several factors to consider in determining the amount of deterioration that is caused by a particular pollutant, including:

1. Concentration of the Pollutant

The concentration of the pollutant in the air is important to consider. In general, the degree of deterioration will be roughly proportional to the amount of pollutant present.

2. Moisture

Moisture is probably the most critical influencing factor. Below a certain relative humidity, very little deterioration occurs. Some water must be present for metals to rust or corrode. Acidic gases cause their damage only in the presence of water (see Table 31). On the other hand, a great amount of moisture (a rain storm, for example) may tend to wash away the pollutants and lessen the damage.

3. Temperature

A change in temperature has an important effect on the amount of deterioration. Generally, the rate of a chemical reaction increases with an increase in temperature.

If a drop in temperature occurs, certain vaporous pollutants may condense on the surface of materials, and thus have an opportunity to react.

4. Sunlight

TABLE 31

CORROSION OF METALS IN AIR

Relative Humidity	Degree of Corrosion
<60%	none
>60%	slow but definite
80%	decided increase
>80%	very high

SOURCE: W. H. J. Vernon, Chemistry and Industry, Jubilee Memorial Lecture (1943)

It is well known that sunlight itself may have undesirable effects on certain materials; e.g., sunlight causes the fading of some dyes. It may have a more indirect effect by accelerating certain reactions which lead to deterioration. Also, new pollutants may be formed under the influence of sunlight (for example, smog) and the new pollutant may have a harmful effect on certain materials.

5. Air Movement

   Wind speed and wind direction are critical factors, especially in the case of erosion by particulate matter. The particles must strike the surface at such an angle and with sufficient velocity for deterioration to occur.

   Also, if the wind speed is high enough to cause dispersion of the pollutants, the effect will be greatly reduced.

Probably the chief way in which atmospheric deterioration of materials affects us is as an economic loss. The various costs caused by air pollution include the following:

1. Cleaning Costs

   Excess cleaning due to dirty air includes the increased need for cleaning of home and furnishings, more frequent dry cleaning and laundering of clothing, increased hair and facial care, increased car washings, increased cleaning of buildings and monuments, and increased washing of street lighting luminaries.

2. Painting Costs

   When paint has been marred or damaged by air pollutants, the surface usually needs to be repainted, both for appearance and protection.

3. Repair and Replacement Costs

   Materials damaged by air pollution must be repaired. If they are very badly damaged, they may have to be completely replaced.

4. Over-Design

   One of the more subtle costs of air pollution is that of over-design. Larger electrical contact points must be used so that insulating pollutant films do not form so rapidly. Entire systems must be completely enclosed in a protective capsule. Extra air-purifying devices must be installed in various operations. More inert (and thus more expensive) metals must replace such things as silver in electrical contacts. All these "hidden costs" are reflected in the cost to the consumer.

5. Reduced Property Values

   No one prefers to live and work in unpleasant, polluted surroundings. Dirty air can have a real effect on and lower the value of property.

   The Federal Housing Administration considers homes in polluted areas as a poor risk, and often refuses mortgages on these grounds.

The effects of specific pollutants and which materials each affects are as follows:

1. Particulates

   Particulate air pollution causes a wide range of damage to materials. Particulate matter may attack materials by abrasion or may chemically attack materials through its own intrinsic corrosiveness, or through the corrosiveness of substances absorbed or adsorbed on it. Merely by soiling materials, and thereby causing their more frequent cleaning, particulates can accelerate deterioration.

   Laboratory and field studies underscore the importance of the combination of particulate matter and corrosive gases in the deterioration of materials. On the basis of present knowledge, it is difficult to evaluate precisely the relative contribution of each of the two classes of pollution; however, some general conclusions may be drawn.

   Particulates play a role in the corrosion of metals. In laboratory studies, steel test panels, that were dusted with a number of active hygroscopic particles commonly found in the atmosphere, corroded even in clean air. Corrosion rates were low below a relative humidity of 70%; they increased at relative humidities above 70%; and they greatly increased when traces of sulfur dioxide were added to the laboratory air.

   It is apparent that the acceleratd corrosion rates of various metals in urban and industrial atmospheres are largely the result of relatively higher levels of particulate pollution and sulfur oxides pollution. High humidity and temperature also play an important synergistic part in this corrosion reaction. Studies show increased corrosion rates in industrial areas where air pollution levels, including sulfur oxides and particulates, are higher. Further, corrosion rates are higher during the fall and winter seasons when particulate and sulfur oxides pollution is more severe.

   Particulate air pollution damages electrical equipment of all kinds. Oily or tarry particles, commonly found in urban and industrial areas, contribute to the corrosion and failure

of electrical contacts and connectors. Dust can interfere with contact closure and can abrade contact surface. Hygroscopic dusts will absorb water and form thin electrolytic films which are corrosive.

Particulates can soil and damage buildings, statues, and other surfaces. The effects are especially severe in urban areas where large quantities of coal and sulfur-bearing fuel oils are burned. Particles may act as reservoirs of acids, and thereby sustain a chemical attack that will deteriorate even the more resistant kinds of masonry. Particles stick to surfaces, forming a film of tarry soot and grit which often times is not washed away by rain. Considerable money and effort have been spent in many cities to sandblast the sooty layers that accumulate on buildings. Water-soluble salts, commonly found in urban atmospheres, can blister paint. Other particles may settle on newly painted surfaces, causing imperfections, thereby increasing the frequency with which a surface must be painted.

The soiling of textiles by the deposition of dust and soot on fabric fibers not only makes them unattractive, and thereby diminishes their use, but results in abrasive wear of the fabric when it is cleaned. Vegetable fibers, such as cotton and linen, and synthetic nylons are particulary susceptible to chemical attack by acid components of airborne particles.

The Environmental Protection Agency, after a careful evaluation of American and foreign studies, concluded that corrosion of steel and zinc panels occurs at an accelerated rate when particulate concentrations ranging from 60 micrograms per cubic meter (annual geometric mean) to 180 micrograms per cubic meter (annual geometric mean) occur in the presence of sulfur dioxide and moisture. They set the National Secondary Ambient Air Qulity Standards for particulate matter at 60 micrograms per cubic meter annual geometric mean, and 150 micrograms per cubic meter maximum 24-hour concentration not to be exceeded more than once per year. National Secondary Ambient Air Quality Standards define levels of air quality which the Environmental Protection Agency judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

2. Sulfur Oxides

The oxides of sulfur (especially sulfur dioxide) cause increased corrosion of metals, deterioration of building materials, weakening and embrittlement of paper and leather, and weakening or actual disintegration of certain textiles such as nylon.

Laboratory and field studies underscore the importance of the combination of particulate and sulfur oxides pollution in a wide range of damage to materials. On the basis of present knowledge, it is difficult to precisely evaluate the relative contribution of each of the two classes of pollution; however, some general conclusions may be drawn.

Steel test panels, dusted with a number of active hygroscopic particles commonly found in polluted atmospheres, corroded at a low rate in clean air at relative humidities below 70%. The corrosion rate was higher at relative humidities above 70%. It greatly increased when traces of sulfur dioxide were added to the laboratory air.

It is apparent that corrosion rates of various metals are higher in urban and industrial atmospheres with relatively high levels of both particulate and sulfur oxides than they are in rural and other areas of low pollution. High humidity and temperature also play an important synergistic part in this corrosion reaction. Studies show increased corrosion rates in industrial areas where air pollution levels, including sulfur oxides and particulates, are higher. Further, corrosion rates are higher during the fall and winter seasons when particulate and sulfur oxides pollution is more severe. Depending on the kind of metal exposed as well as location and duration of exposure, corrosion rates were 1-1/2 to 5 times greater in polluted atmospheres than in rural environments.

In Chicago and St. Louis, where steel panels were exposed at a number of sites, high correlations were found in each city between corrosion rates, as measured by weight loss, and sulfur dioxide concentrations. In St. Louis, except for one exceptionally polluted site, corrosion losses were 30% to 80% higher than losses measured in nonurban locations. Sulfation rates in St. Louis, measured by lead peroxide candle, also correlated well with weight loss due to corrosion. Measurements of dustfall in St. Louis, however, did not correlate significantly with corrosion rates. Over a 12-month period in Chicago, the corrosion rate at the most corrosive site (mean sulfur dioxide level of 320 micrograms per cubic meter (0.12 parts per million)) was

about 50% higher than at the least corrosive site (mean sulfur dioxide level of 80 micrograms per cubic meter (0.03 parts per million)). Although suspended particulate levels measured in Chicago and high-volume samplers also correlated with corrosion rates, a co-variance analysis indicated that sulfur dioxide concentrations were the dominant influence on corrosion. Based on these data, it appears that considerable corrosion may take place (i.e., from 11% to 17% weight loss in steel panels) at annual average sulfur dioxide concentrations in the range of 80 micrograms per cubic meter (0.03 parts per million) to 320 micrograms per cubic meter (0.12 parts per million), and although high particulate levels tend to accompany high sulfur dioxide levels, the sulfur dioxide concentration appears to have the more important influence.

Sulfur oxides pollution contributes to the damage of electrical equipment of all kinds. Studies have reported a one-third reduction in the life of overhead powerline headware and guy-wires in heavily polluted areas. In some areas, it has been found necessary to use more expensive, less corrodible metals, such as gold, for electrical contacts.

Sulfur oxides pollution attacks a wide variety of building materials - limestone, marble, roofing slate, and mortar - as well as statues and other works of art, causing discoloration and deterioration. Certain textile fibers (such as cotton, rayon, and nylon) are harmed by atmospheric sulfur oxides. Dyed fabrics may fade in atmospheres containing sulfur oxides and other pollutants. Severe fading was noted for some dyes in fabrics exposed in Chicago, where annual average sulfur dioxide levels were 240 micrograms per cubic meter (0.09 parts per million). Leather exposed to sulfur oxides may lose much of its strength, and paper may become discolored and brittle.

Concentrations of 2,600 micrograms per cubic meter (1 part per million) sulfur dioxide can increase the drying time of some oil-based paints by 50 to 100%. Some films become softer and others more brittle, both developments adversely affecting durability. Sulfur dioxide also appears to render some paint films water sensitive, consequently reducing the film gloss. Under certain conditions, sulfur dioxide levels of 260 micrograms per cubic meter (0.1 part per million) to 520 micrograms per cubic meter (0.2 part per million) cause the blueing of Brunswick green, and in the presence of ammonia produce a troublesome defect called crystalline bloom brought about by the formation of very small ammonium sulfate crystals.

The Environmental Protection Agency, after careful evaluation of American and foreign studies, concluded that adverse effects on materials were observed at an annual mean of 320 micrograms per cubic meter (0.12 part per million) for sulfur dioxide. They set the National Primary Ambient Air Quality Standard at 80 micrograms per cubic meter (0.03 part per million) annual arithmetic mean and 365 micrograms per cubic meter (0.14 part per million) maximum 24-hour concentration not to be exceeded more than once per year. The National Secondary Ambient Air Quality Standardas set at 1,300 micrograms per cubic meter (0.5 part per million) maximum 3-hour concentration not to be exceeded more than once per year. These standards were set for reasons other than effects on materials.

3. Nitrogen Oxides

Significant effects of nitrogen oxides have been observed and studied on three classes of materials: textile dyes and additives, natural and synthetic textile fibers, and metals.

The most pronounced problem is associated with textile dyes and additives. Fading of sensitive disperse dyes used on cellulose acetate fibers has been attributed to nitrogen dioxide levels below 188 milligrams per cubic meter (less than 100 parts per million). Loss of color, particularly in blue and green dyed cotton and viscose rayon, has occurred in gas dryers where nitrogen oxide concentrations range from 1.1 to 3.7 milligrams per cubic meter (0.6 to 2 parts per million). Yellow discoloration in undyed white and pastel-colored fabrics has been attributed to nitrogen oxides by controlled laboratory experiments.

Laboratory and field observations have shown that cotton and nylon textile fibers can be deteriorated by the presence of nitrogen oxides, but specific reactants and threshold levels are undetermined.

Failure of nickel-brass wire springs on relays has been related to high particulate nitrate levels. This type of stress corrosion has been observed when surface concentrations of particulate nitrates have exceeded 2.4 micrograms per cubic meter and relative humidity was greater than 50%. Another type of this corrosion has been associated with

annual average particulate nitrate concentrations of 3.0 and 3.4 micrograms per cubic meter with corresponding nitrogen oxide levels of 2124 and 158 micrograms per cubic meter (0.066 and 0.084 parts per million).

The Environmental Protection Agengy, after careful evaluation of studies, concluded that although damage to materials has been attributed to nitrogen oxides in ambient atmospheres, the precise air concentrations producing these effects have not been determined. With respect to stress corrosion, they found that nitrogen oxide reaction products have been associated with corrosion and failure of electrical components at annual average particulate nitrate levels of 3.0 to 3.4 micrograms per cubic meter with associated average nitrogen oxide levels of 124 to 158 micrograms per cubic meter (0.066 to 0.084 parts per million).

The Environmental Protection Agency has set the National Primary and Secondary Ambient Air Quality Standard for nitrogen dioxide at 100 micrograms per cubic meter (0.05 part per million) annual arithmetic mean.

4. Photochemical Oxidants

Photochemical oxidants, especially ozone, primarily affect rubber, causing embrittlement and cracking. Ozone is also known to cause fading and discoloration in certain dyed fabrics.

The detailed, quantitative extent of damage to materials caused by atmosphere levels of ozone is unknown, but generally any organic material is adversely affected by concentrated ozone. Many polymers are extremely sensitive to even very small concentrations of ozone; this sensitivity increases with the number of double bonds in the structure of the polymer.

Economically, rubber is probably the most important material sensitive to ozone attack, particularly styrene-butadiene, natural, polybutadiene, and synthetic polysioprene. Antiozonant additives have been developed and are capable of protecting elastomers from ozone degradation. Synthetic rubbers with inherent resistance to ozone are also available. These additives are expensive, however, and add to the cost of the end product. In addition, increasing amounts of antiozonants are required as the amount of ozone which is to be encountered increases, and sometimes only temporary protection is provided.

Ozone attacks the cellulose in fabrics through both a free radical chain mechanism and an electrophilic attack on double bonds; light and humidity appear necessary for appreciable alterations to occur. The relative susceptibility of different fibers to ozone attack appears to be, in increasing order, cotton, acetate, nylon, and polyester.

Certain dyes are susceptible to fading during exposure to ozone. The rate and extent of fading is also dependent upon other environmental factors such as relative humidity and the presence of air pollutants other than ozone, as well as the length and concentration of ozone exposure and the type of material exposed.

The Environmental Protection Agency, after careful evaluation of many studies, has concluded that adverse effects on materials from exposure to photochemical oxidants have not been precisely quantified, but have been observed at the levels presently occurring in many urban atmospheres. They have set the National Primary and Secondary Ambient Air Quality Standards for photochemical oxidants at 160 micrograms per cubic meter (0.08 part per million) maximum 1-hour concentration not to be exceeded more than once per year. EPA has recently proposed the National Primary Ambient Air Quality Standard for ozone to be set at 200 micrograms per cubic meter (0.10 part per million).

5. Hydrogen Sulfide

Hydrogen sulfide has two widely observed effects: the darkening of lead-base paints and the tarnishing of certain metals such as silver. In addition, hydrogen sulfide may be oxidized to sulfur dioxide or sulfur trioxide, and these will produce characteristic effects as previously discussed.

Damage to lead-based or pigmented paints and paints containing mercury based fungicides can be caused by hydrogen sulfide. Discoloration occurs when the metallic oxides react with the hydrogen sulfide to form metallic sulfides. The occurrence of this type of damage depends considerably upon the presence of water, which hastens the reaction and allows it to occur with smaller amounts of hydrogen sulfide. When the paint surface is moistened, damage may occur with exposures of less than 1-hour and concentrations as low as 140 micrograms per cubic meter (0.1 part per million). Paint blackness, under dry conditions, occurs at concentrations of 1,400 micrograms per

cubic meter (1.0 part per million) for 30 minutes exposure time. Tarnishing of silver and copper occurs slowly at concentrations as low as 4 micrograms per cubic meter (0.003 part per million).

The North Dakota State Department of Health has adopted ambient air quality standards for hydrogen sulfide of 45 milligrams per cubic meter of air (0.032 part per million), maximum 1/2 hour concentration not to be exceeded more than twice in any five consecutive days, and 75 milligrams per cubic meter of air (0.054 part per million), maximum 1/2 hour concentration not to be exceeded over twice a year. These concentrations would be detected as odors by some people, and some tarnishing of metals would occur, but the frequency of such occurrences would be low.

6. Carbon Dioxide

Carbon dioxide is an acidic gas which causes the deterioration of building stone by formation of soluble carbonates. It is also responsible for the corrosion of certain metals such as magnesium. Carbon dioxide is normally not considered as an air pollutant, as it has no known effects on health at the levels normally encountered in the ambient air.

The projected ambient air quality changes due to pollutant emissions from the Level 1 and Level 2 projects are summarized in Table 13 for particulate matter, sulfur dioxide, and nitrogen dioxide. These projected changes are well under the concentrations known to cause observable effects on materials. Therefore, any adverse effects on materials should be small and their frequency of occurrence would be low. The effects on materials for other pollutants such as hydrogen sulfide and carbon dioxide would be very small as these pollutants would not be emitted in large quantities.

Effects on Visibility

Visibility reduction is one of the most common and dramatic effects of air pollution. Visibility reduction effects include the aesthetic degradation of the environment, an economic burden on society, and a threat to public safety.

Congress has recognized the harmful aesthetic effects of visibility reduction with the passage of the Clean Air Act Amendments of 1977. A new section of this law, Section 116, establishes, as a national goal, the protection of visibility in federally mandated Class I areas.

In addition to aesthetic degradation of the environment, reduction in visibility creates an economic burden upon most communities and can be a threat to public safety. Among the operations which are adversely affected are those related to airports, highways, and homes.

1. Effects on Airports

Airport operations may be affected by reduced atmospheric visibility. When the air traffic pattern is slowed due to delays in take-offs and landings, operational costs are increased. Additional hazards to safety are imposed which may result in deaths, personal injury, or property damage. The passengers may be inconvenienced, especially if operations are closed. Business is indirectly affected when the businessman fails to meet his appointments in some distant city. If reduced visibility becomes frequent, enlarged or additional facilities may have to be built to compensate for the reduced speed with which air traffic can be handled. Perhaps the airport will need to be relocated to an entirely different community if reduction in visibility becomes exceedingly severe. Such would be a great economic loss to the community near which the airport is presently located.

2. Effect on Highways

Impairment of atmospheric visibility affects traffic on highways and city streets. Automobile traffic may be slowed; traffic arteries leading to and from great metropolitan areas may become clogged to the point of standstill. When the motorist's vision is limited, accidents, bodily injury, deaths, and property damage increase. These lead to increased insurance rates. Additional highways may be needed to compensate for the reduced flow of traffic; this means more money, and the money will come from the public, probably through increased taxes.

3. Effect on Electricity Demand

Another economic burden is the increased cost of electricity due to additional usage of lighting on streets and in the home when the pall of the community becomes dense so that adequate sunlight is unable to penetrate.

Visibility reduction is caused by the scattering and absorption of light by particles or gases in the atmosphere, and depends in a complicated way on the concentration and properties of the gases and particles present. The individual and synergistic effects of particulates, sulfur oxides, and nitrogen

oxides result in the major effects on visibility by air pollutants.

Particles suspended in the air reduce visibility, or visual range, by scattering and absorbing light coming from both an object and its background, thereby reducing the contrast between them. Moreover, suspended particles scatter light into the line of sight, illuminating the air between, to further degrade the contrast between an object and its background.

The scattering of light into and out of the line of viewing by particles in the narrow range of 0.1 to 1 micron in radius has the greatest effect on visibility. Certain characteristics of behavior of these particles make it impossible to formulate a useful approximate relationship between visual range and concentrations of particulate matter:

$$L_v = \frac{A \times 10^3}{G'}$$

Where:

G' = particulate concentration (micrograms per cubic meter)

L_v = equivalent visual range, and

A = 0.75 for L_v expressed in miles.

The value of 0.75 for A is the mid-range value empirically obtained from observations in a variety of air pollution situations. The data indicate that the range 0.38 to 1.5 covers virtually all cases studied. The relationship does not hold at relative humidities above 70%, nor does it apply to fresh plumes from stacks, and it may not hold for the products of photochemical reactions.

Within the limitations prescribed, the relationship provides a useful means of estimating approximate visual range from particulate concentrations. In addition to aesthetic degradation of the environment, reduced visibility has serious implications for safe operation of aircraft and motor vehicles. At a visual range of less than 5 miles, operations are slowed at airports because of the need to maintain larger distances between aircraft. Federal Aviation Administration restrictions on aircraft operations become increasingly severe as the visual range decreases below 5 miles. Using the upper and lower bounds of the relationship described above, visibility could be 5 miles at a particulate loading as high as 300 micrograms per cubic meter or as low as 75 micrograms per cubic meter. However, on the average, visibility can be expected to be reduced to approximately 5 miles at a particulate concentration of 150 micrograms per cubic meter. At a level of 100 micrograms per cubic meter, visibility is reduced to about 7 1/2 miles. This limited distance, however, may be related to particulate concentrations as low as 50 micrograms per cubic meter and as high as 200 micrograms per cubic meter.

The normal existing background levels for particulate matter in rural North Dakota are approximately 25 micrograms per cubic meter, annual geometric mean. The predicted average visibility at this level would be 30 miles. The extremes of visibility would be from 15 to 60 miles. From Table 13, the maximum change in annual particulate levels due to the Level 1 and Level 2 projects is 3 micrograms per cubic meter or an increase of rural annual geometric mean particulate concentrations from 25 micrograms per cubic meter to 28 micrograms per cubic meter. This would reduce the average visibility from 30 miles to 26.8 miles or an 11% reduction. The extremes of visibility would be reduced from 15 to 13.6 miles and from 60 to 53.6 miles.

The scattering of light is the most important effect of sulfur oxides pollution. The exact contribution that the oxides of sulfur make to the total scattering of light by various atmospheres has not been well studied. The sulfur oxides products that cause light scattering are sulfuric acid mist and other sulfate salt particulates. Because these compounds are hygroscopic and also because their rate of formation is affected by moisture in the air, their effects on visibility increase with increasing relative humidity. Visibility is reduced by sulfuric acid mist and sulfate salt particulates, and is further reduced by other particulate matter suspended in the air.

The scattering of light into and out of viewing by particles in the narrow range of 0.1 to 1 micron in

radius has the greatest effect on visibility. Of the total suspended particulate matter in urban air, commonly from 5% to 20% consists of sulfuric acid and other sulfates, and of these, 80% or more by weight are smaller than 1 micron in radius. Consequently, suspended sulfates in the air can contribute significantly to reduction in visibility.

Characteristic behavior of suspended particles in the size range mentioned makes it possible to relate visual range to concentrations of overall particulate matter. Since sulfur dioxide levels, in general, correlate with levels of overall suspended particulate matter, and since the ratio of sulfur dioxide to suspended sulfate can be estimated, given the relative humidity, it is possible to estimate visibility for various relative humidities from sulfur dioxide concentration.

Although direct measurements are not available, the likely effect of sulfuric acid and sulfate salts on visual range can be estimated from existing data on particle size distribution, refractive indices, and concentrations. Because of changes in particle size, at a given concentration of sulfuric acid mist or sulfate salts, visual range is affected more and more as relative humidity increases. If only sulfuric acid mist were involved, at 50% relative humidity, the estimated visual range would be about 100 miles at a concentration of 10 micrograms per cubic meter, but only about 1 mile at a concentration of 1,000 micrograms per cubic meter. At 98% relative humidity, the estimated visual ranges at the same concentrations would be, respectively, 10 and 0.10 miles. With a normally associated amount of sulfuric acid mist and other particulate matter present, the estimated visual ranges at 50% relative humidity would be about 50 and 0.5 miles at measured sulfur dioxide concentations of 26 micrograms per cubic meter and 2,600 micrograms per cubic meter (0.01 and 1 part per million), respectively. At 98% relative humidity, the estimated visual ranges at the same concentrations would be about 15 and 0.2 miles, respectively. Visibility would be reduced to about 5 miles at a sulfur dioxide concentration of 260 micrograms per cubic meter (0.10 part per million) at 50% relative humidity and 78 micrograms per cubic meter (0.03 part per million) at 98% relative humidity.

The normal existing background level for sulfur dioxide in rural North Dakota is approximately 5 micrograms per cubic meter, annual arithmetic mean. The predicted average visibility at this level would be 280 miles and 150 miles at 50% and 98% relative humidity, respectively. From Table 13, the maximum change in the annual sulfur dioxide levels due to Level 1 and Level 2 projects is 2.5 micrograms per cubic meter, or an increase of rural annual arithmetic mean sulfur dioxide concentration from 5 micrograms per cubic meter to 7.5 micrograms per cubic meter. This would reduce the average visibility from 280 to 187 miles at 50% and 150 to 100 miles at 98% relative humidity, or a 33% reduction.

These predicted visibility ranges for sulfur dioxide are much greater than those calculated for particulates; therefore, it can be expected that particulates are the governing pollutants and are the most critical.

Observed limits of visibility at given sulfur dioxide concentrations may, however, depart from the calculated values, depending on the concentration of particulate matter and the oxidizing quality of the atmosphere.

An effect of reduced light transmission is a reduction in solar energy reaching the ground, which in turn contributes to atmospheric stability and, consequently, to the further buildup of pollutants. The oxides of sulfur do not in themselves contribute significantly to the loss of solar energy reaching the ground, but other light-attentuating particulates and gases present in fogs do so. Consequently, fogs last longer, and additional sulfuric acid mist forms, and because of its hygroscopic nature, contributes to longer lasting fogs.

Nitrogen dioxide is intensely colored and absorbs light over the entire visible spectrum, but primarily in the shorter wavelengths, violet, blue, and green. In the atmosphere it reduces the brightness and contrast of distant objects, and causes the horizon sky and white objects to appear pale yellow to reddish-brown. A token amount of light is attentuated by the molecular scattering effect of nitrogen dioxide.

The additional presence of particulate matter tends to mask the coloration effect of nitrogen dioxide, but the two combined markedly reduce the visibility, contrast, and brightness of distant objects. Particulate matter and aerosols are present in the atmosphere as primary pollutants from urban sources such as industrial combustion and vehicular transportation, and from natural sources such as the sea, soil, and fog. They are also formed through photochemical reactions and are considered to be the major cause of the reduced visibility associated with photochemical smog.

The photochemical system involves nitrogen oxides and hydrocarbons in the formation of visibility-reducing aerosols. Light scattering associated with the presence of aerosols is the primary cause of visibility reduction in photochemical smog; absorption of light by nitrogen dioxide makes a minor contribution.

In summary, it can be concluded that the projected increase in emissions from the Level 1 and Level 2 projects will cause a reduction in visibility. The emissions of particulates from the facilities appears to be more critical than sulfur oxides emissions.

The worst case visibility reduction, based on annual particulate concentrations, appears to be approximately 11% in Mercer and Oliver Counties. The average reduction throughout the seven-county study area would be much less than this.

Effects on Water Quality

The effects of air pollution on the quality of surface and ground water have yet to be clearly delineated.

The ultimate fate of air pollutants, once they are emitted into the atmosphere, is the continual deposition on the earth's surface, both water and land. Some of the pollution undoubtedly moves into the upper atmosphere where it can remain for long periods of time, until it is washed out.

Pollutants can enter surface waters directly or be transferred from land deposition by rain runoff. Pollutants can enter ground water by percolation of rainfall through the soil or from surface water reservoirs.

The major effect on water quality is that of acidity. Oxides of sulfur and nitrogen are converted to acids in the atmosphere, thus increasing rainfall acidity. This acidic rainfall can enter surface water directly or indirectly by runoff from land and may increase the acidity of the water. In addition, acidic rain water can dissolve and leach soil minerals and trace elements and transfer them to both surface and ground waters.

In addition, toxic chemicals and trace elements can enter surface water directly from pollutants in the atmosphere causing potential adverse effects on water quality.

The information necessary to quantify the effects of air pollution on the water quality in the seven-county study area is not presently available. Therefore, it is not possible to conclude whether or not the problem is significant.

The State Department of Health is aware of the potential problems and will continue conducting necessary research and monitoring to protect water quality from possible adverse effects of air pollution.

Effects on Weather

Public concern about "unintended effects upon the weather" has been sparked in recent years by scientists who have become concerned about the temperature stability of the earth. Scientists have debated whether the average temperature of the earth is heating or cooling: minute changes on the order of a few degrees of temperature could have a profound impact on man and the ecosystem. Such a change in temperature is caused by a change in the global radiation balance.

Local and regional scales of unintended weather changes are occurring because of man's activities. Large metropolitan cities such as Chicago and St. Louis clearly modify the weather by increasing the number and severity of storms. The temperature, humidity, clouds, precipitation (rain, hail, and snow), wind, visibility, and air composition are changed by large cities.

Agricultural practices over the southern Great Plains states which exploited the land likely contributed to the "dust bowl" of the dirty thirties. In contrast, studies of historical weather for the large (about 18,000 square miles) irrigated areas from Texas to Nebraska suggest summer season rainfall increases of 15 to 50%, depending on the year's weather conditions; the area affected appears to be about 100,000 square miles. Apparently, irrigation over such wide areas leads to higher specific humidity with resulting lower temperatures and lower albedo (fraction of reflected solar radiation).

Agricultural practices such as crop types and grazing may cause local weather (microclimate) changes, but these changes are likely to be minor. Surface heat differentials may result from spatial differences of crop types and in arrays of crop and bare soil.

Extensive burning of crop and weed residues in Hawaii, the Phillipine Islands, and Australia have been attributed to increases and decreases in cloudiness, rainfall, and visibility. Such burning introduces large quantities of particulates which affect solar radiation influx and also affects the growth of raindrops.

In each of the instances of unintended weather changes cited above, the physical mechanisms producing the changes are not well understood, although changes were clearly evident. Identifying the weather changes in these instances was difficult. Proving a physical relationship between the apparent cause (the city, the burning, and the large acreage of irrigation) and the weather change has been much more difficult, and has eluded scientific research.

The construction of power plants, such as those proposed for Level 1 and Level 2 projects, has potential for causing local and regional scales of unintended changes in the weather. The effects on weather by power plants will likely not be as pronounced as other observed unintended weather changes, since the inputs of heat, water vapor, and particulates are not as large. The release of heat, water vapor, and particulates can conceivably affect the albedo, specific humidity, temperature, and cloudiness with resulting affects on precipitation and visibility.

Cloud and precipitation processes are sensitive to the number, size, and type of particulates in the air from which a cloud grows and precipitation results. In fact, the process of formation of clouds depends upon the presence of minute particles, called condensation nuclei, onto which water vapor can condense and form water droplets. In clean air, air without any solid or liquid particles, clouds would not form.

The microphysical and dynamical mechanisms leading to clouds and precipitation are extremely complex. Simply stated, an excess of very small particles may inhibit precipitation processes, additional extra large particles may enhance precipitation processes, additional ice nuclei (particles which act as centers for collecting water vapor to grow ice crystals or which, when in contact with droplets colder than freezing, cause these droplets to freeze) may enhance the precipitation process, or any combination may occur.

Natural condensation nuclei include vegetative pollens, windblown soils, sea salts, volcanic ash, and meteoritic dust. Natural ice nuclei are primarily soil particles, about 1 in 10,000 atmospheric particles is an ice nuclei. Other sources of condensation and ice nuclei are exhausts of motors, furnaces, industrial processes, and power plants. Particulate emissions and conversion of gases to particles in plumes of power plants can create active condensation and ice nuclei.

A study ("Weather Modification Potential of Coal-Fired Power Plants," Department of Atmospheric Sciences, University of Wyoming) of two power plants was conducted during 1976: the Jim Bridger plant at Rock Springs, Wyoming, and the Colstrip Unit One plant located at Colstrip, Montana. The Jim Bridger plant operates typically at 650 megawatts, but is capable of producing 1,000 megawatts. The Colstrip Unit One plant was operating at about 250 megawatts during the study, but is capable of operating at 360 megawats. Both plants had electrostatic precipitators which were operating during the collection of data for the study. An aircraft equipped with instruments for measuring particles made several data gathering flights through the plumes of the two plants.

The study emphasized an assessment of effects upon precipitation by particulates contained in plumes of the two plants. Some results of the study include:

1. A production rate of about 10^{15} per second condensation nuclei was observed for the Jim Bridger plant and 10^{14} per second for the Colstrip Unit One plant. In the worst case of a thunderstorm located downwind of the plant, moving toward the plant, and having an influx of air of 10^{9} cubic meters per second, the increase in the condensation nuclei above existing background concentrations in the influx of air is only about 20%. This would change the mean drop size by about 3 to 7%. If the precipitation was formed in the absence of ice crystals, the effect might cause a minor change (increase or decrease) in precipitation. However, other studies have demonstrated that precipitation over the Northern Plains depends upon the presence of active ice nuclei: this process is probably less sensitive to changes in the droplet spectrum.
2. The maximum ice nucleus concentration measured in the plume was 0.3 per liter of air at -16 degrees C.; a number marginally greater than background concentrations. However, current sample collection methods do not provide the required accuracy. Further, other studies have demonstrated very little relationship between ice nucleus concentrations in clouds and observed ice cyrstal concentrations; either instruments are in error, or ice crystal multiplication occurs, or both.

   The addition of ice nuclei could increase or decrease precipitation, depending upon how many ice nuclei are already present and how many are added. Indications are that there are insufficient ice nuclei concentrations to create precipitation effectively, and that addition of ice nuclei would increase precipitation in most cases.

In summary, the study concluded that additional condensation nuclei may cause small effects (increases or decreases) in the limited region of the plume, but the effects are probably negligible compared to natural year-to-year variations. Although the ice nuclei measurements indicate the plants are not an important source of ice nuclei, the measurements are of questionable validity. The results should not be extrapolated to larger plants or interacting plumes of two or more plants due to the non-linear nature of emission and dispersion processes as well as precipitation processes.

Although studies suggest unintended effects of power plants on weather are negligible, larger changes of 5 to 10% decreases or increases in summer precipitation can significantly affect crop and grassland yields. Similarly, increases in winter snowfall would increase the costs of wintering cattle, snow removal, and transportation. Additional research is needed: such research requires complex and sensitive technical equipment and highly trained personnel. This type of research is time-consuming and costly. The Department of Health will continue to examine new research findings and will encourage research when appropriate to do so.

Other Changes

Draft Study

In Table 2-1, page 27, change column heading "Percent of Missing Data" to "Days of Missing Data in Percent." Also change column heading "Climatic Elements Included (percent of total)" to "Climatic Elements Included (percent of total data obtained on days which data was collected)."

In Table 2-7, page 30, change all "26.1" with footnote "2" under column heading "Hourly Recorded Maximum, 1975" to "ND[2]." Change footnote "2" to "ND, not detectable (less than lower detectable limit of 26.1 micrograms per cubic meter)."

In Table 2-9, page 30 change all "19" with footnote "2" under column heading "Hourly Recorded Maximum, 1975" to "ND[2]." Change footnote "2" to "ND, not detectable (less than lower detectable limit of 26.1 micrograms per cubic meter)."

In Table 2-11, page 31, change SOURCE from "38 Code of Federal Regulations 25678, September 14, 1973" to "40 CFR Part 50, 1976."

In Table 3-4, page 29, the reference for Oxides of Nitrogen Emissions in footnote "4" should be changed to Federal New Source Performance Standard for lignite as stated in Federal Register Vol. 43, No. 45, Tuesday, March 7, 1978, pp. 9276-9278. (NOTE: 0.6 lb/10^6 Btu input for all types of lignite-fired boilers except cycline-fired boilers where the emission regulation is 0.8 lb/10^6 Btu input for lignite coal found in North Dakota, South Dakota, and Montana.) Also, 0.6 lb/10^6 Btu input should be added under the North Dakota Standard column where deleted.

In Table 3-20, page 86, a footnote "3" should be added above Coyote 2 Power Plant. Footnote "3" should be changed as follows: Assumes average annual operations of 8,232 hours (343 days) as expressed in Permit to Construct application.

In Table 4-1, page 149, the source should be changed to: 40 CFR Part 50, 1976.

In Table 4-3, page 150, the reference for Oxides of Nitrogen Emissions in footnote "4" should be changed to: Federal New Source Performance Standard for lignite as stated in Federal Register Vol. 43, No. 45, Tuesday, March 7, 1978, pp. 9276-9278. (NOTE: 0.6 lb/10^6 Btu input for all types of lignite-fired boilers except cyclone-fired boilers where the emission regulation is 0.8 lb/10^6 Btu input for lignite coal found in North Dakota, South Dakota, and Montana.) Also, 0.6 lb/10^6 Btu input should be added under the North Dakota Standard column where deleted.

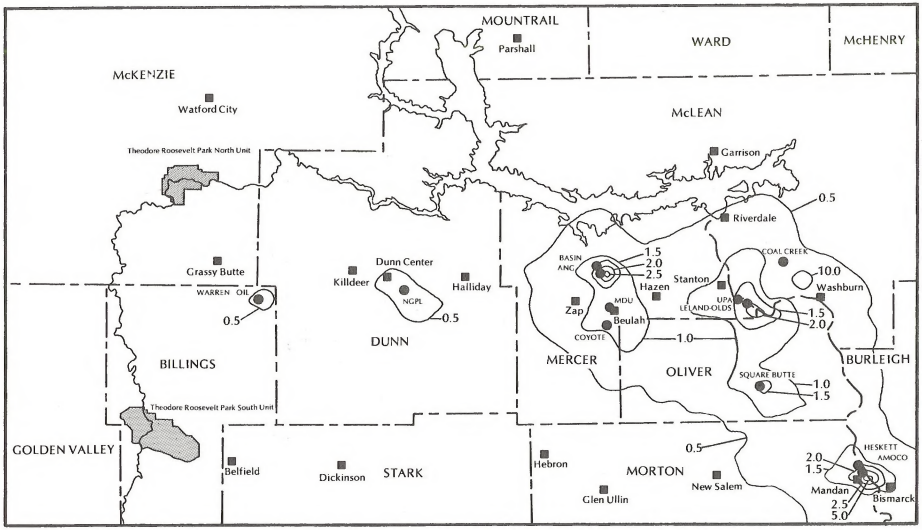
In Table 45, page 150, a footnote "3" should be added above Coyote 2 Power Plant. Footnote "3" should be changed as follows: Assumes average annual operation of 8,232 hours (343 days) as expressed in Permit to Construct application.

Map 3-2, "Projected Annual Concentrations of Sulfur Dioxide from all Existing and Proposed Sources," found on page 81 in the Draft Study, is replaced by Map 3-2/5, which follows. Map 3-5, "Projected Annual Concentrations of Sulfur Dioxide from all Existing and Proposed Sources--Level 2," found on page 86 in the Draft Study, is also replaced by Map 3-2/5. NOTE: Clean Air Act Amendments of 1977 will not allow any additional emissions from Coyote 2 (the only Level 2 facility); thus, no change in total emissions and subsequent ground level concentrations from Level 1 and Level 2 projects.

Revised tables 3-1; 3-6; 3-8; 3-10 and 3-21; 3-11; and 3-19 and 3-23 also follow.

REVISED MAP 3-2 AND 3-5

PROJECTED ANNUAL CONCENTRATIONS OF SULFUR DIOXIDE (SO_2) FROM ALL EXISTING AND PROPOSED SOURCES



LEGEND

- Cities and Towns
- Existing and Proposed Sources

0 10 20

Scale in Miles

REVISED TABLE 3-1

EXPECTED PARTICULATE EMISSIONS FROM
LEVEL 1 PROJECTS

Proposed Project	Date	Expected Emissions pounds/hour	tons/year[2]
Antelope Valley 1[1]	1981	210	829
Antelope Valley 2[1]	1982	210	829
Coyote Unit 1[1]	1981	445	1,832
ANG Coal Gasification Plant[3]	1981	170	677
NGPL Coal Gasification Plant[3]	1984	397	1,582
TOTAL		1,432	5,749

SOURCE: North Dakota State Department of Health 1978

[1] Lignite coal-fired electrical generating facility.

[2] Assumes average annual operation of 7,968 hours (332 days) for American Natural Gas and Natural Gas Pipeline; 7,896 hours (329 days) for Antelope Valley; 8,232 hours (343 days) for Coyote. Based on information supplied for the Study.

[3] American Natural Gas coal gasification plant expected emissions are based on actual project design from Permit to Construct application under normal operating conditions. Natural Gas Pipeline coal gasification plant based on preliminary project design proposals only.

NOTE: For purposes of air dispersion modeling, emissions were assumed to be steady state at pounds/hour levels for the entire year averaging period.

REVISED TABLE 3-6

EXPECTED SULFUR DIOXIDE EMISSIONS FROM
LEVEL 1 PROJECTS

Proposed Project	Date	Expected Emissions pounds/hour	tons/year[2]
Antelope Valley 1[1]	1981	1,922	7,588
Antelope Valley 2[1]	1982	1,922	7,588
Coyote Unit 1[1]	1981	5,335	21,959
ANG Coal Gasification Plant[3]	1981	3,081	12,275
NGPL Coal Gasification Plant[3]	1984	2,914	11,609
TOTAL		15,174	61,019

SOURCE: North Dakota State Department of Health 1978

[1] Lignite coal-fired electrical generating facility.

[2] Assumes average annual operation of 7,968 hours (332 days) for American Natural Gas and Natural Gas Pipeline; 7,896 hours (329 days) for Antelope Valley; 8,232 hours (343 days) for Coyote. Based on information supplied for the Study.

[3] American Natural Gas coal gasification plant expected emissions are based on actual project design from Permit to Construct application under normal operating conditions. Natural Gas Pipeline coal gasification plant based on preliminary project design proposals only.

NOTE: For purposes of air dispersion modeling, emissions were assumed to be steady state at pounds/hour levels for the entire year averaging period.

REVISED TABLE 3-8

PREVENTION OF SIGNIFICANT DETERIORATION OF AIR QUALITY, MAXIMUM ALLOWABLE SULFUR DIOXIDE CONCENTRATION

Pollutant Averaging Time Period	Class II[1] ($\mu g/m^3$)[3]	Class I[2] ($\mu g/m^3$)
Sulfur Dioxide		
Annual arithmetic mean[4]	15	2
24-hour[4]	91	5
3-hour[4]	512	25

SOURCE: North Dakota State Department of Health
Air Pollution Control Regulations 1978.

1 Existing sulfur dioxide classification in the seven-county study area.

2 Mandatory classification over the Theodore Roosevelt National Park and the Lostwood National Wilderness Area.

3 Micrograms per cubic meter of air.

4 Annual arithmetic mean cannot be exceeded, 24-hour and 3-hour is allowed no more than one exceedance per year.

REVISED TABLES 3-10 AND 3-21

SHORT-TERM SULFUR DIOXIDE ANALYSIS LEVEL 1 AND LEVEL 2 PROJECTS

Atmospheric Stability Class	Distance North of ANG/Antelope Valley Site Boundary Wind from South (miles)	Projected Increased Ground Level Concentrations (ug/m^3)[1/]			Background Concentrations (ug/m^3)			Total Projected Concentrations (ug/m^3)		
		1-hr	3-hr	24-hr	1-hr	3-hr	24-hr	1-hr	3-hr	24-hr
A	Site Boundary	126.1 (331.3)[2/]	78.5 (206.2)	30.8 (80.9)	105	35	25	231.1 (436.3)	113.5 (241.2)	55.8 (105.9)
B	0.8	63.8 (135.2)	39.7 (84.2)	15.6 (36.7)	105	35	25	168.8 (240.2)	74.7 (119.2)	40.6 (61.7)
C	Site Boundary	117.1 (230.9)	71.4 (140.8)	28.1 (55.4)	105	35	25	222.1 (335.9)	106.4 (175.8)	53.1 (80.4)
C	1.2[3/]	122.6 (241.7)	74.8 (147.5)	29.5 (58.1)	105	35	25	227.6 (346.7)	109.8 (182.5)	54.5 (83.1)
D	8.1	88.9 (153.3)	55.0 (94.7)	21.9 (37.9)	105	35	25	193.9 (258.3)	90.0 (129.7)	46.9 (62.9)
E	36.0	84.2 (120.0)	51.9 (74.0)	20.7 (29.6)	105	35	25	189.2 (225.0)	86.9 (109.0)	45.7 (54.6)
F[4/]	--	--	--	--	--	--	--	--	--	--
State Ambient Air Quality Standards								715		260
Federal Ambient Air Quality Standards								1300		365
State Class II Prevention of Significant Deterioration Allowable Increment			512	91						

SOURCE: North Dakota State Department of Health 1978

1/ Abbreviation for micrograms per cubic meter.

2/ Numbers in parenthesis are projected ground level concentrations based upon outdated emissions of sulfur dioxide presented in the Draft Study. These numbers are included for comparison purposes.

3/ These concentrations were estimated to occur with the wind from the north. Therefore, ground level concentrations south of the ANG/Antelope site boundary--thus no contribution from Coyote.

4/ The projected concentrations under F stability class were found to be lower than those concentrations under E stability class for all cases. Also the distances to the point of maximum concentrations are too great such that meteorological conditions are not likely to persist long enough for the plume(s) to travel that far. The stability class is a measure of the ability of the atmosphere to disperse emissions. Generally, Classes A, B, C, and D favor rapid dispersion whereas the more stable Classes, E and F, are associated with poor dispersion.

REVISED TABLE 3-11

EXPECTED NITROGEN DIOXIDE EMISSIONS FROM
LEVEL 1 PROJECTS

Proposed Project	Date	Expected Emissions pounds/hour	tons/year[2]
Antelope Valley 1[1]	1981	2,465	9,732
Antelope Valley 2[1]	1982	2,465	9,732
Coyote Unit 1[1]	1981	3,190	16,094
ANG Coal Gasification Plant[3]	1981	536	2,135
NGPL Coal Gasification Plant[3]	1984	2,855	11,374
TOTAL		12,231	49,067

SOURCE: North Dakota State Department of Health 1978

[1] Lignite coal-fired electrical generating facility.

[2] Assumes average annual operation of 7,968 hours (332 days) for American Natural Gas and Natural Gas Pipeline; 7,896 hours (329 days) for Antelope Valley; 8,232 hours (343 days) for Coyote. Based on information supplied for the Draft Study.

[3] American Natural Gas coal gasification plant expected emissions are based on actual project design from Permit to Construct application under normal operating conditions. Natural Gas Pipeline coal gasification plant based on preliminary project design proposals only.

NOTE: For purposes of air dispersion modeling, emissions were assumed to be steady state at pounds/hour levels for the entire year averaging period.

REVISED TABLES 3-19 AND 3-23

PROJECTED MAXIMUM SHORT-TERM AIR CONTAMINANT IMPACTS UPON FORT BERTHOLD INDIAN RESERVATION
LEVEL 1 PROJECTS

Total Suspended Particulate (micrograms per cubic meter of air)			Sulfur Dioxide (micrograms per cubic meter of air)					
Projected Concentration	Background Concentration 24-Hr	Total Concentration 24-Hr	Projected Concentration 3-Hr	24-Hr	Background Concentration 3-Hr	24-Hr	Total Concentration 3-Hr	24-Hr
2	80	2 (82)[1]	60.9	24.4	35	35	60.9 (95.9)	24.4 (49.4)
STANDARDS		30[2] 150[3]					512[2] 1,300[3]	91[2] 365[4]

SOURCE: North Dakota State Department of Health 1978.

NOTE: The maximum ground level concentration was projected to occur at the southern boundary of the Fort Berthold Indian Reservation. The distance from this boundary to the north boundary of the Antelope Valley Complex is eight miles. Addition of Coyote 2 to the particulate ground level concentration would be the same as Level 1 concentration.

[1] Numbers in parenthesis have background added in and are to be compared to Ambient Air Quality Standards. Numbers without parenthesis are counted against Prevention of Significant Deterioration of Air Quality increments.

[2] Prevention of Significant Deterioration of Air Quality increments (Class II).

[3] Maximum allowable concentrations for Federal Secondary (most stringent) Ambient Air Quality Standard.

[4] Maximum allowable concentration for Primary Ambient Air Quality Standard.

GEOLOGY

INTRODUCTION

The North Dakota Regional Environmental Assessment Program (REAP) referenced an unpublished report dealing with inverted overburden. A copy of the report was obtained and revisions in the text were made to indicate that surface mining operations do not generally invert the overburden, but instead bring deeper overburden near the surface at many places.

The State Geological Survey pointed out that a search for uranium is being carried out on a statewide scale. The text of the Draft Study was revised accordingly. The State Geological Survey also felt that not enough attention had been given to the interrelationships of potential occurrence of coal and oil and gas on the same land. Chapter 38-15 of the North Dakota Century Code provides for resolution of conflicts and subsurface mining production, and includes oil and gas subsurface minerals and coal. Revisions as appropriate were made in the text and a copy of Chapter 38-14 of the NDCC is included with their letter in Part 2.

A review of the most current oil and gas activities was made as a result of a comment from the North Dakota State Water Commission. The review revealed that 74 producing wells had been drilled as of December 1978, with the expectation of doubling the number of producing wells during the next year.

MODIFICATIONS AND CORRECTIONS

Oil and Gas

The last paragraph of the Geology section in Chapter 2, page 35, should be revised as follows: "However, the rate of increase in production of oil and natural gas should have little effect, except locally, on surface disturbance and population increases within the seven-county study area. For example, development is occurring in the Little Knife River Field and Dunn and Billings Counties. Seventy-four producing wells had been drilled by December 1978 with the expectation of doubling the number of producing wells in the next year. As of December 1978, the field was 15 miles long north-south and 3 miles wide east-west."

Other Minerals (Resolution of Conflicts)

Chapter 38-15 of the North Dakota Century Code provides for the resolution of conflicts on subsurface mineral protection and specifically includes oil, gas, surface minerals, and coal, including lignite. The North Dakota Industrial Commission has jurisdiction and authority to enforce provisions of the chapter, and the State Geologist is charged with the responsibility and authority to enforce the rules and regulations of the Industrial Commission applicable to the provisions of the chapter.

(Note: A copy of Chapter 38-15 of the North Dakota Century Code is included in comment #158 received from the State Intergovernmental Clearinghouse State Planning Division, North Dakota Geological Survey.)

Other Changes

Draft Study

On page 32, Topography subheading, first column, first sentence, "northeast" should be changed to "northwest." In the second paragraph, last sentence, "Cheyenne" should be "Sheyenne."

In the legend of Map 2-10, "Akaree" should be spelled "Arikaree," and "Sentinal" should be spelled "Sentinel."

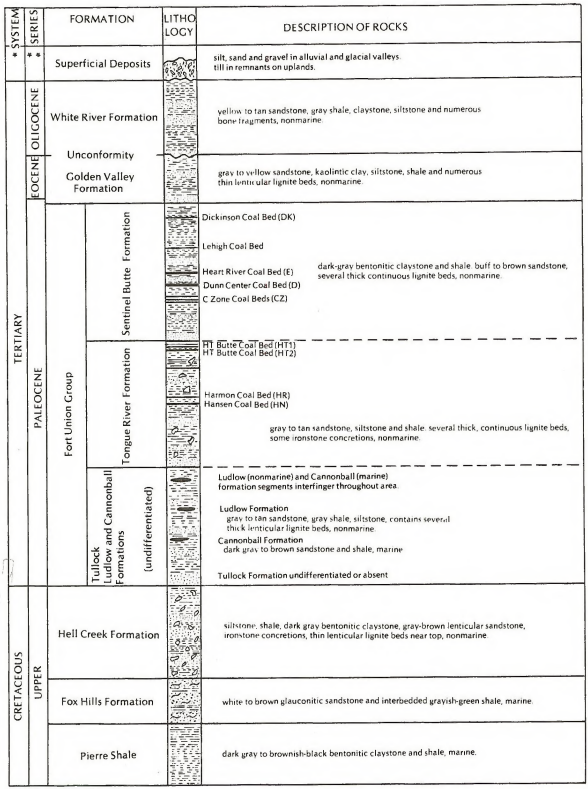
On page 33, left column, last paragraph, the reference to Map 2-11 should be deleted. In Table 2-13 in the column under "Drill Hole 121," the bottom number should be changed to ".2L." In the right hand column, third paragraph, Map 2-11A should be "Map 2-11."

On page 34, Federal Coal Study Area subheading, first paragraph, the sentence reading "The deposition could be changed to "The depositional surface has resulted in a flat to rolling hilly relief, generally less than 25 feet; hummocky surface and abundant potholes."

Figure 2-5 has been revised as follows:

REVISED FIGURE 2-5

COLUMNAR SECTION OF SEDIMENTARY FORMATIONS DUNN CENTER AREA



* QUATERNARY

** PLEISTOCENE, HOLOCENE

SOURCE: Modified after Menge, 1977

In the fourth column, first paragraph, the second sentence should be changed to "Tracts S-1, S-2A, S-3, N-1B, N-2A, N-2B, N-3A, and N-3B have a flat to rolling topography with bedrock mostly covered by ground moraine."

On page 89, level 1, topography, the first paragraph should have "32,800" acres changed to "34,000" acres.

On page 89, Stratigraphy, the second sentence should be changed to: "A surface mining operation generally brings deeper overburden near the surface at many places (Winczewski 1978)."

On page 169, Geology heading, first paragraph, "80%" should be changed to "75%." In the third column, first paragraph, "32,250" should be changed to "34,000;" and "94,500" should be changed to "76,000."

On page 170, Coal subheading, first paragraph, "56.8" should be changed to "68."

On page 181, Geology heading, first paragraph, "1,035" should be changed to "1,371."

On Map 2-9, the glacial line showing the limit of ground moraine and abundant erratics should be extended in an arc towards Hebron, then follow the southern boundary of the modern flood plain to the bottom of the map.

Summary

On page 13, under the Residual Impacts heading, "possibly altering the chemical properties of soil" should be deleted.

References

The following reference should be added:

Winczewski, L.M. 1978. An overview of western North Dakota lignite strip mining processes and resulting subsurface characteristics in proceedings of the International Congress for Energy and the ECO-System, University of Arizona and University of North Dakota, June 12-16, 1978, Grand Forks, North Dakota, in press.

SOILS

INTRODUCTION

Public concerns regarding soils were expressed by several individual citizens and especially by representatives of the Dakota Resource Council. The primary concerns included: detail of mapping and suitability criteria, identification and analysis regarding prime farmland, separate removal and segregation of suitable plant growth material, sodium-related hazards, erosion hazards between mining and reclamation, reclamation costs, and soil productivity effects of acid rainfall.

The emphasis of soils resource analysis can be clarified by the following statement recently made by Bruce Seelig of the North Dakota Public Service Commission: "From the soils point of view, this document can be very useful if it is used as a general planning document. The information can be used for overview studies of the area and to provide information on a regional basis. When specific management decisions will be made, this document can be used to provide preliminary information to be followed by more detailed studies." On a more site specific basis, mining proposals submitted to the PSC must include a detailed soil survey which, along with test hole overburden information, would reveal the amount of suitable plant growth material available for reclamation.

The issue of prime farmland acreages also will be clarified with completion of detailed soil surveys being conducted by the Soil Conservation Service as part of the National Cooperative Soil Survey. The extent and distribution of both prime farmlands and farmlands of statewide importance is being identified. When mining prime farmland areas, the A horizon with high organic matter and the B to C horizon soil and subsoil must each be segregated and separately stockpiled. These two materials then are to be replaced in their original order, with compaction and uniform depth, over the regraded spoil. Prime farmland considerations in facility siting are discussed in the Land Use section.

The concerns expressed over sodium affected materials reflect a continuing interest in this aspect of surface mining reclamation. Considering both state and federal regulations, sodium affected material and other toxic-forming materials would be buried to a minimum depth of four feet, provided four feet of nontoxic material is available. Upward migration of sodium in the soil appears to be limited to the top four inches of soil material. Continued research, however, is being conducted.

Updated federal and state regulations address the concerns over delays between mining and revegetation. Revegetation would be conducted during the first normal period for favorable planting after final grading. Otherwise, stockpiled topsoil and disturbed areas would be seeded or planted with an effective cover of non-noxious quick-growing annual and/or perennial plants or protected by other approved measures, such as mulching.

Reclamation costs are of universal concern. Per acre costs in west central North Dakota averaged $2,500, and ranged from $2,200 to $3,000 in 1976. Reclamation cost estimates are currently being further updated by the North Dakota Public Service Commission.

The issue of acid rainfall from power plant emissions, raised by one concerned citizen, is not as critical to soils in North Dakota as in the eastern portion of the United States. Soils in the study area tend to be alkaline with soil pH ranging from 7.5 to 9. The presence of high amounts of calcium carbonate tend to buffer soil reaction near 8 (ten times more alkaline than the neutral point). Expected increases in rainfall acidity are low within the study area and would have a minimal effect on soils. The slight adjustment in soil reaction toward neutrality would be negligible and could have a slightly positive effect on plant growth by increasing availability of soil elements essential to plant growth.

MODIFICATIONS AND CORRECTIONS

Draft Study

On page 35, column 4, "Soils," replace paragraph 2 with the following two paragraphs:

> From the soils point of view, this document can be very useful if it is used as a general planning document. The information can be used for overview studies of the area and to provide information on a regional basis. When specific management decisions will be made, this document can be used to provide preliminary information to be followed by more detailed studies.

The information provided in this REIS will be useful to people making decisions on a regional or statewide basis. It will also point out areas where more information is needed. However, it will not replace the need for more detailed technical information which is needed to make management decisions on a site-specific basis. (Bruce Seelig, Environmental Scientist, North Dakota Public Service Commission)

On page 35, column 4, National Prime Farmland and Statewide Important Farmland, the following paragraph should be added:

As part of the National Cooperative Soil Survey, the U.S. Soil Conservation Service in North Dakota presently is identifying prime farmland and additional farmlands of statewide importance (AFSI). Updated acreage figures are based on the published soil surveys for Burleigh, Morton, Oliver, and Stark Counties; and the completed but not published soil surveys of McLean and Mercer Counties. The soil surveys, available at the office of the State Soil Conservationist in Bismarck, are detailed and published at a scale of 1:20,000, except Morton which is 1:62,500. The survey is not completed for Dunn County.

On page 35, column 4, Soil Texture, paragraph 2, lines 3 and 4 should read: ". . . clay (less than .002 millimeter)."

On page 36, column 4, second paragraph under "Soils: Federal Coal Study Areas," fourth line, 10% should be changed to 1%, and three "N" tracts should be changed to one "N" tract. Paragraph 3 should be changed to: "Statewide important farmland distribution falls within the 5% seven-county study area average, although Tracts N-1B, S-1, S-4A, and S-4B have 10%, 8%, 12%, and 10%, respectively, consistent with surrounding lands."

On page 42, Table 2-27, the percentage under cropland for Burleigh County should be changed from "32.02" to "52.02."

On page 91, column 2, Soils: Level 1, paragraph 3, the second sentence should be replaced with: "By following required procedures in PSC Rule 69-05-07, the high organic matter (1.5% or higher) topsoil materials would not be mixed and diluted with subsurface unweathered material."

On page 91, column 2, Soils: Level 1, paragraph 3, sentence 3 should be omitted.

On page 92, column 3, after paragraph 2, the following new paragraph should be added:

In high sodium hazard areas, with less than 30 inches suitable plant growth material, premining land use is limited and productivity is low. Based on observations of ongoing reclamation efforts, it is the professional opinion of North Dakota Public Service Commission staff involved in implementation of reclamation that 30 inches of suitable plant growth material may not be necessary to restore these lands to pre-mining productivity levels. These areas could very well have an increase in productivity because mining activities would break up the impervious hard plan which often develops in sodium affected soils.

On page 96, column 1, "Soils: Federal Coal Study Areas," paragraph 4, change lines 2 through 5 to: "'S' tracts occur in Tract S-3, between Stanton and Center, and encompassing the Level 1 Glenharold Mine area. Some 2%, or 312 acres, would be disrupted by mining activity as determined from placing the Federal Coal Study Areas overlay on Map 3-7." Change paragraph 5 to: "Of the 'N' tracts, N-1A and N-1B, in the area of the Dakota Star Mine, with 310 and 660 acres respectively; N-3A, near the Coyote 2 Power Plant with 585 acres; and the adjacent N-3B with 469 acres of national prime farmland, would be disrupted if mining occurred." Change paragraph 6, lines 5 through 7, to: "a 12% composition of these lands, Tract S-4B has 10%, and Tract S-1 has 8%. Tract N-1B has 10% statewide important farmlands."

On page 153, column 1, Applicants' Commitments, paragraph 3, line 11, "texture by feel" should be replaced with "texture by hydrometer or pipette method."

On page 153, column 3, Applicants' Commitments, paragraph 3, the second sentence should be changed to: "PL 95-87, Section 515(b)(3), and North Dakota PSC Rule 69-05-97-01, call for elimination of highwalls, spoil piles, and depressions."

On page 153, column 3, Applicants' Commitments, paragraph 7, the first sentence should be changed to: "A double trenching method in laying of pipelines is an unwritten policy requirement of the North Dakota Public Service Commission."

On page 153, column 4, Applicants' Commitments, continuing paragraph from column 3, the following should be added: "18 CFR 2.69 applies only to natural gas pipelines. Comparable federal regulations applicable to other pipeline excavation and reclamation are: 30 CFR 211; 43 CFR 2800; U.S. Geological Survey Notice to Lessees #6; and Secretary of the Interior Order 2948."

Revised Table 2-21 (page 37) follows:

REVISED TABLE 2-21

Distribution of National Prime Farmland and Statewide Important Farmland
In Federal Coal Study Areas

	N-1A Tract %	N-1A Tract Acres	N-1B Tract %	N-1B Tract Acres	N-2A Tract %	N-2A Tract Acres	N-2B Tract %	N-2B Tract Acres	N-3A Tract %	N-3A Tract Acres	N-3B Tract %	N-3B Tract Acres	Total N Area %	Total N Area Acres	S-1 Tract %	S-1 Tract Acres	S-2A Tract %	S-2A Tract Acres	S-3 Tract %	S-3 Tract Acres	S-4A Tract %	S-4A Tract Acres	S-4B Tract %	S-4B Tract Acres	S-5 Tract %	S-5 Tract Acres	Total S Area %	Total S Area Acres	Total Area %	Total Area Acres
National Prime Farmland	1	310	3	660			1	286	3	585	4	469	2	2310					2	312			1	150			1	462	1	2772
Statewide Important Farmland	2	345	10	2009	2	246	5	1340					3	3940	8	1418			1	159	12	1339	10	2170	5	640	6	5726	5	9666
Total Area Acreage		22,176		20,767		12,646		25,953		19,506		12,763		113,811		18,525		4,932		18,296		10,769		22,581		13,993		89,036		202,847

SOURCE: Pointer, based on U.S. Soil Conservation Service data 1977.

On page 153, column 4, Applicants' Commitments, paragraph 1, the third sentence should be changed to: "Separate removal, stockpiling, and replacement of topsoil following excavation in establishment of transmission or energy conversion facilities is an unwritten North Dakota Public Service Commission policy."

On Map 2-12, the following note should be added: "For a discussion of land capability classes, see page 35, column 1, Land Capability."

Patterson Lake should also be added.

On Map 2-13, the legend should be rearranged as follows:

Very High Erodibility

High Erodibility

Medium Erodibility

Low Erodibility

Mined Land (Erodibility too variable to evaluate)

Marshes and Water Surface

Patterson Lake should also be added.

On Map 2-14, the legend should be rearranged and altered to read:

Severe Hazard Areas

Low to Moderate Hazard Areas

Water

Patterson Lake should also be added.

On Map 2-15, Patterson Lake should be added.

On Map 3-7, the following note should be added: "For discussion of land suitability classes, refer to page 92, column 1, paragraphs 3, 4, and 5."

Summary

On page 14, column 3, paragraph 1, line 5 should be changed to "Level 3 areas and about 2,000 acres are located within . . ."

WATER

INTRODUCTION

Public comments on water resources were rather evenly divided between federal agencies, state and local agencies, and Indian Reservation representatives. Most comments related to water use, including secondary uses associated with increased population in Dickinson and water and sewage requirements for new housing on the Fort Berthold Indian Reservation.

Many of the responses to the comments were handled simply by referring to sections of the Draft Study or the appendix where the subjects had already been covered, but apparently missed. Several responses included further clarifications or elaborations. Corrections were made to the Corps of Engineers' responsibilities under Section 404 of the Federal Water Pollution Control Act, as amended in 1972. A series of comments by the City Engineer at Dickinson questioned whether industrial water supply systems for the proposed mines and gasification plants could be modified to include municipal water supplies, especially regarding Dickinson's need for an expanded water supply. There is nothing in the proposed actions to justify such a hope. Several comments from Indian spokespersons based on assumptions that water impacts would occur were answered by reiterating that such impacts would not occur.

The response to questions about the long-term effect of air emissions and of mining on water quality indicate the need for additional research and monitoring. Monitoring of hydrologic features, both quantity and quality, is required under the Surface Mining and Reclamation Act of 1977. In addition, a program to monitor ground water levels and quality is already underway at several mines in the study area.

MODIFICATIONS AND CORRECTIONS

Draft Study

On page 21, column 2, at the end of the sixth paragraph, the following paragraph should be added:

> For site specific proposals that would require Corps of Engineers Section 404 permits, impact statements must contain data complying with that section. However, any fills involving streams having an average annual flow of less than 5 cubic feet per second would be permitted under the "Nationwide Permit."

On page 40, column 2, last line, change "Durn" to "Dunn."

On page 97, column 2, paragraph 1, the second sentence should be changed to: "The Antelope Valley Power Plant would use water from the lake for generation of electric power."

On page 154, column 4, last paragraph, line 2, "Beulah" should be changed to "Dunn Center."

Fort Berthold Technical Supplement

On page 54, paragraph 3 should be changed to show that the "normal maximum" capacity of Lake Sakakawea is 22,640,000 acre-feet.

On page 55, the following should be added at the end of the first sentence: "allocations from Lake Sakakawea, evaporation from the lake surface, and downstream water commitments."

On page 60, the first paragraph under "Residual Adverse Impacts" should be deleted.

On page 60, last paragraph, the second sentence should be changed to: "Long term effects on Fort Berthold water resources might include dewatering of aquifers within one mile of mined areas and chemical degradation of ground water if water from mine spoils moved into reservation aquifers. These effects could only occur if lignite is mined in close proximity to reservation boundaries."

On page 61, the second paragraph should be deleted.

VEGETATION

Most comments on vegetation included concerns regarding reclamation and the effects of air quality upon vegetation.

Major reclamation concerns were (1) the three to five year reclamation cycle used in the study, and (2) the reclaimability of mined lands to pre-mined productivity. These concerns were expressed by the North Dakota Resource Council, North Dakota Game and Fish Department, North Dakota State Water Commission, the North Dakota Chapter of The Wildlife Society, and several individuals. These concerns were answered with clarification and by additional research. This research included conclusions from a meeting of reclamation experts from the Northern Great Plains Experiment Station, Mandan; Agricultural Research Service; Public Service Commission; North Dakota State Planning Commission; and the Bureau of Land Management. A summary of findings were that: (1) from a technological viewpoint, the three to five year reclamation cycle is an adequate timeframe for reclamation, assuming that no special adverse problems such as excessive subsidence, extremely dry climatic cycles, excessive upward sodium migration, etc., occur; and (2) with present day reclamation technology, 100% of the pre-mined productivity can be attained for most croplands and grasslands; however, only time will provide absolute proof. Other vegetative types such as shrublands, woodlands, and wetlands require longer than three to five years to attain 100% of this pre-mined productivity. There are also still some concerns as to whether this productivity can be maintained over periods of 20 or more years.

Major concerns regarding air quality oriented toward the effects of trace elements and acid rains were expressed by the North Dakota Resource Council, North Dakota State Water Commission, the North Dakota Chapter of The Wildlife Society, League of Women Voters of North Dakota, and several individuals. These concerns were addressed by additional research, explanations, and clarification. Information regarding the effects of trace elements and acid rain are found in Part 1, Climate and Air Quality.

On page 155 of the Draft Study, the word "unlikely," in line 15, fourth paragraph, fourth column, should be changed to "likely."

ANIMALS

INTRODUCTION

The majority of comments on domestic animals and wildlife were concerns about possible air quality impacts. Comments on this subject were received from the North Dakota Chapter of the Wildlife Society, the Dakota Resource Council, the North Dakota State Water Commission, the League of Women Voters of North Dakota, and various individuals. These comments generally expressed the feeling that the analysis of air quality impacts avoided the problem by asserting that all applicable state and federal air quality standards would be met and that, therefore, there was no basis for predicting any adverse impacts. It was mentioned in several locations in the Draft Study that adverse impacts are indeed possible even though standards are met, that the studies upon which the existing standards are based do not adequately address long-term synergistic effects, nor do they address many important air pollution components such as trace elements. However, Part 1 now includes an analysis by the North Dakota Department of Health that discusses what is known about animal responses to various concentrations of pollutants.

The Bureau of Reclamation pointed out that greater attention should have been given to the fact that post-mining land uses generally would be different from pre-mining land uses and that in most cases these changes would be harmful to wildlife. Although this impact was mentioned in several places in the Draft Study, several additional paragraphs of discussion on this subject included herein again conclude that locally and cumulatively such land use changes could have a significant impact on game and non-game wildlife.

The Bureau of Reclamation pointed out that high voltage transmission lines do not present an electrocution hazard to raptors because the distance between conductors on these lines is greater than the wing span of even the largest eagles. This fact was verified and our analysis was changed to conclude that except for smaller distribution lines, most of which would be outside the seven-county study area, no bird losses from electrocution would be anticipated.

The North Dakota Regional Environmental Assessment Program pointed out that a very recent publication by Robert Seabloom concludes that the acreage of prairie dog towns in North Dakota has been increasing in recent years, apparently as a result of the cessation of poisoning programs in North Dakota. The studies used in our analysis concluded that prairie dogs were decreasing. The issue is important because prairie dog towns can be important habitat for the endangered black-footed ferret. Several paragraphs were revised to show that the increase in prairie dog towns pointed out by Seabloom's study indicates a growing opportunity for the return and increase of the ferret. This change does not, however, affect the original conclusion that ferret impacts because of either Level 1 or Level 2 development are still considered to be unlikely.

The North Dakota Game and Fish Department questioned the meaning of several passages and pointed out several technical errors involving the current status of the bald eagle and the citation of references. Some of these concerns had already been identified through a review of the Draft Study by the Animals Work Group, and are clarified or amended under the headings that follow.

The review by the Animals Work Group discovered the failure to include the location of black-footed ferret sightings on the endangered species map and the incorrect listing of the northern kit (or swift) fox as an officially listed federal endangered species. The update below includes the location of the ferret sightings. There is also an explanation that although the northern kit or swift fox (*Vulpes velox hebes*) is officially endangered in Canada and is observed occasionally in several northern states, including North Dakota, it is not officially an endangered species in the United States, but is, however, recognized by the State of North Dakota as being "a protected furbearer."

An update explains that proposed designations of critical habitat for the endangered whooping crane within the seven-county study area must be re-proposed in the Federal Register under new criteria established in recent amendments to the Endangered Species Act.

MODIFICATIONS AND CORRECTIONS

Post-Mining Land Use Decisions on Wildlife

Data on post-mining land uses for previously strip mined areas is available, but has not been compiled (Klein 1978, personal communication). Such compilation might lead to better understanding of this impact. Landowner requests to convert grasslands to cropland after mining are likely, particularly when the market price of cereal grains is high compared to beef. Depending on the size of areas, these decisions reduce species such as sharp-tailed grouse which depend heavily on native prairie. Small areas of woodland and shrubland could also be affected by those decisions, but the topography of most major woody draws is too steep to make conversion to cropland economical.

Unless the landowner requests conversion of these steep areas to grassland, the Public Service Commission would require woodland and shrubland habitats restored to the extent practical (Klein 1978, personal communication). However, as explained in the Vegetation section, the effective restoration of woodland habitats has not yet been proven.

Locally and cumulatively, all the above land use changes could have a significant impact on both game and non-game wildlife.

Increases in Prairie Dogs Improve Chances For Black-Footed Ferrets

At the time the Draft Study was written, available information indicated that prairie dogs were decreasing within the seven-county study area. However, a recent report by Seabloom et al. (1978) reveals that the opposite is true, apparently because of the halt of government prairie dog control efforts. The return of the prairie dog indicates a growing opportunity for the increase of the black-footed ferret.

To reflect this, the last full paragraph of column 3, and the quotation that spans columns 3 and 4 on page 51, should be replaced with the following:

> During the last eight to ten years, the number of prairie dog towns in western North Dakota has increased noticeably (Seabloom et al. 1978). This increase in prairie dog towns indicates greater opportunity for the increase of the black-footed ferret.

The increased possibility of ferrets occurring in the seven-county study area increases only slightly the already mentioned remote chance that the proposed actions would impact this endangered species. However, in order to reflect this slight change in the analysis, paragraph 2, column 1 on page 111 should be replaced with the following:

> Ferret observations and sign within the seven-county study area in the last 60 years has been confined to Mercer, Dunn, Burleigh, and, particularly, Morton County (Linder and Hillman 1973). Most observations since 1970 were made at sites with prairie dog towns at least within a 2-mile radius. Based on available data, including an absence of prairie dog towns, it is probable that ferrets no longer occur in Oliver and Mercer Counties, the two counties which would host the most development under Level 1. Although Level 1 mining and construction may not directly affect any known prairie dog towns, increased disturbance (particularly shooting) related to the increase in human populations could reduce the size of the prairie dog towns and, thus, indirectly affect any remaining ferrets.

Transmission Line Electrocution Hazard to Raptors

Discussions in several places in the Draft Study (page 110, column 1, paragraphs 7 and 8; page 111, column 1, paragraph 5; and page 174, column 3, 8th full paragraph) incorrectly assumed that all high voltage transmission lines present an electrocution hazard to raptors. Because of the distance between conductors, 69 kilovolt lines and above are not an electrocution hazard to eagles and other raptors (Olendorffe 1978, personal communication). The only line that is part of the proposed action that could cause bird electrocutions is the 41.6 kilovolt line from the NGPL plant to Lake Sakakawea. However, the applicant has committed to make this line "electrocution proof" for raptors. Techniques for doing this are explained in the 1975 publication prepared by the Raptor Research Forum, Inc., for the Edison Electric Institute entitled "Suggested Practices for Raptor Protection on Power Lines."

Thus, bird electrocution losses would be expected only from smaller distribution lines. No estimate is available for the number of miles of smaller distri-

bution lines which would be developed as a result of the proposed action.

Northern Kit (or Swift) Fox Is Not on Federal Endangered Species List

Although the northern kit (or swift) fox--*Vulpes velox hebes*--is officially endangered in Canada and is observed occasionally in several northern states, including North Dakota, it is not officially an endangered species in the United States. References to this species in paragraph 7, column 3 and the first full paragraph in column 4, page 51, and paragraph 7, column 1, page 111 should be transferred to paragraph 7, column 1, page 52, which is revised to read as follows: "The State of North Dakota considers the black-footed ferret a 'rare and endangered animal.' The following species, although in some cases well established elsewhere, are listed by North Dakota as 'protected furbearers:' northern kit (or swift) fox, wolverine, otter, marten, and fisher. These species are not known to occur within the seven-county study area, but the latter four especially may occur along the Missouri River or in the Missouri and Little Missouri Breaks."

Proposed Whooping Crane Critical Habitat

In the August 17, 1978, Federal Register, the U.S. Fish and Wildlife Service published a proposed rule-making that would establish critical habitat for the whooping crane in major portions of the seven-county study area. Lake Ilo National Wildlife Refuge; all of Lake Sakakawea within maximum full pool, including the Audubon National Wildlife Refuge; and all of Oahe Reservoir within maximum full pool are proposed for critical habitat designation. If these areas are designated as critical habitat, there would be significant implications for the developments proposed under Levels 1 and 2. The proximity of the NGPL project to Lake Ilo would be of particular concern. Although it is premature at this date to predict what activities would be or would not be allowed within and near critical habitat, it seems clear that the NGPL project would reduce the attractiveness of the Lake Ilo Refuge to whooping cranes because of the increase in human population and possible noise and air pollution problems. Whether sufficient mitigating measures could be developed that would allow the project to proceed despite critical habitat designation would require further study.

It will probably be at least mid-1980 before any whooping crane critical habitat designations are finalized within the seven-county study area. The Endangered Species Act Appropriation Bill and attached amendments recently passed through Congress and are awaiting the President of the Senate's signature and the President's signature. When this appropriation act and attached amendments become law, it will establish new criteria for the designation of critical habitat. All critical habitat designations that have been proposed but not finalized must be proposed again under new criteria. It is not known if the proposed whooping crane critical habitat designations of the August 17, 1978, Federal Register will qualify for designation under the new criteria. If they do, it will take at least six months for the process, including the development of new regulations, to be completed.

Other Changes

Draft Study

On Maps 2-23 through 2-34, a note explaining the following should be added: "Relative" means "comparative" in the sense that population densities in one area are compared with population densities in other areas.

On Map 2-36, "Endangered Species," the solid and open circles representing verified and unverified prairie dog towns should all be the same size. The following confirmed black-footed ferret sightings (from Linder and Hillman 1973) should also be added (revised Map 2-36 is included in the map packet):

County	Year	Location
Dunn	1913	Quinion (between Killdeer & Medora)
Mercer	1915	Stanton
Burleigh	1961	5 miles east of Bismarck
Morton	1968	Section 21, T. 137 N., R. 80 W.
Morton	1971	Section 28, T. 135 N., R. 80 W.

On Map 3-25, the parenthetical definitions of intermediate and low sensitivity should be interchanged.

On Map 3-27, the Lake Ilo and Audubon National Wildlife Refuges should be included. The note under the legend starting "(Wetland Areas) . . ." should be replaced with the following: "The only National Waterfowl Management Easements and National Waterfowl Production Areas in the seven-county study area are in McLean and Burleigh Counties. The Audubon National Wildlife Refuge is on land owned by the Corps of Engineers, but is managed by the Fish and Wildlife Service through a cooperative agreement."

On page 48, column 1, the next to the last word in paragraph 1 should be eliminated so that the last part of the sentence reads ". . . the pheasant and Hungarian partridge have become established."

On page 48, column 3, paragraph 4; and page 51, column 3, paragraphs 7 and 8, scientific names should be italicized, and *Yucca glanca* should be spelled *Yucca glauca*.

On page 49, column 1, paragraph 3 should be replaced with the following:

> Although they lack the expanses of grassland characteristic of the very best sharp-tailed grouse habitat, most of Morton, Oliver, Mercer, and Dunn Counties have high sharp-tail populations compared to McLean and Burleigh Counties, only parts of which are rated high. Stark County is rated the lowest of the seven counties for sharptails (Map 2-26).

On page 50, column 1, paragraph 3, the first sentence should begin, "Important *sandhill* crane migration stopover sites. . ."

On page 51, column 3, paragraph 8, the northern bald eagle (*Haliaetus leucocephalus*), which was declared officially endangered in the February 14, 1978, Federal Register, should be added to the list of endangered birds.

On page 52, column 1, paragraph 1 should be eliminated.

On page 52, column 4, the following paragraph should be added to the discussion of threatened and endangered species:

> The Endangered Species Act of 1973 was signed into law by the President on December 28, 1973. The Act is the strongest legislation ever enacted to preserve and protect endangered and threatened animals and plants. There are provisions for state cooperation and participation through cooperative agreements, grants-in-aid funding, and other incentives. The new Act calls for participation where appropriate by all federal agencies and directs that no federal funds can be utilized for an activity that would be detrimental to an endangered or threatened species. The effect of this Act on threatened and endangered species should be favorable, allowing maintenance and in some cases increases in their populations. Where habitat is protected or developed for endangered species, other species dependent upon that habitat will also benefit.

On page 108, column 1, paragraph 7, the last sentence should be changed from ". . . 700 miles of electric transmission lines . . ." to ". . . 424 miles of electric transmission lines . . ."

On page 108, column 3, 5th full paragraph, the first sentence should be replaced with the following: "The projected construction of 424 miles of new transmission lines would result in an increase in wire strike mortality for many species of birds."

On page 108, column 4, 5th full paragraph, the last sentence should be changed from "(metals) . . . can also affect selenium intake by animals . . ." to ". . . may be able to cause selenium deficiency in some animals . . ." The following sentence should also be added: "The potential significance of this problem in the seven-county study area is unknown but is not believed to be great, because the disease is uncommon and can be effectively treated with vitamin E."

On page 109, column 3, the first full paragraph should be replaced with the following:

> The preferred habitats of antelope (grassland and shrubland) would be impacted most severely in the NGPL, ANG, and Antelope Valley project areas (Table 3-57 in the Vegetation section). It is likely that the losses would be measurable and might total 10-20 animals annually until successful reestablishment of rangeland is achieved. Antelope population densities (Map 2-25) are relatively high compared to other parts of the seven-county study area in portions of the NGPL, ANG, Antelope Valley, and Glenharold Mine project areas. The probability of measurable impacts appears to be especially high in the vicinity of the ANG and Antelope Valley plants (Hostetter 1977, personal communication).

On page 109, the paragraph spanning columns 3 and 4 should be replaced with the following:

> Construction of transmission lines and product pipe lines associated with the proposed actions would disturb 110 acres of wetlands

(Table 3-47 in the Vegetation section). Significant long-term impacts could result to these wetlands. Trenching or drilling in a clay-sealed wetland could break through the seal resulting in drainage. However, many of these wetlands are believed to be underlain by deep layers of impervious clay till which should provide protection from such damage. In addition to damage or loss from drainage, wetlands could be detrimentally affected by improper spoil disposal and backfilling.

On page 109, column 4, the first full paragraph should be replaced with the following:

> The projected increase of 424 miles of new transmission lines (Table 1-8 and Map 1-6 in Chapter 1) plus an additional but unknown number of miles of new distribution lines would result in an increase in waterfowl mortality from wire strikes. Figure 3-8 shows this can be of local significance. Birds are certain to collide with wires where they cross natural flyways such as the Missouri River (Oahe Reservoir) near the mouth of the Cannonball River. The North Dakota Game and Fish Department indicates that peak mallard populations in that area are 8,000-10,000. In addition, bald eagles are often recorded in that area during the Winter Waterfowl Count. A minimum of several hundred waterfowl could be killed annually by the 424 miles of new transmission wires (Anderson 1978, Fish and Wildlife Service 1978, Krapu 1974, McEnroe 1972, McKenna and Allard 1976, and Weir 1972). Probably these several hundred birds by themselves would not significantly reduce waterfowl populations within the seven-county study area, but when added to losses from other causes they may be important.

On page 110, column 1, last paragraph, "2,400" acres should be changed to "1,700" acres.

On page 110, column 2, paragraph 1, the last two sentences should be combined as follows: ". . . regional non-game bird populations would not be significantly affected, and local populations would be restored to the extent reclamation of their habitats is successful. See Chapter 6 for a discussion of some of the difficulties of reestablishing wildlife habitats."

On page 110, column 4, paragraph 2, the second sentence should be replaced with: "There is not enough data available to quantify this impact."

On page 111, column 1, paragraph 8; and page 113, column 4, paragraph 1, should both have the following sentence added: "The discussion of air pollution impacts on page 108 applies to Fort Berthold as well as the rest of the seven-county study area."

On page 112, column 4, paragraph 2; and page 113, column 4, paragraph 3 should have references to the colors representing the three habitat ratings shown on Map 3-25 changed to: Habitats rated "1" being dark brown on the map, those rated "2" being an intermediate brown, and those rated "3" or "4" being light brown.

On page 113, column 1, paragraphs 1, 2, and 3 should have references to Map 3-23 in the Vegetation section changed to Map 2-20 in the Vegetation section.

On page 159, third column, the last full paragraphs should refer to Table 1-3 rather than Table 1-10.

On page 183, column 4, 4th full paragraph, the second sentence should include a parenthetical reference to Appendix 2.

Summary

On page 23, column 1, paragraph 2, the last sentence should be replaced with: Some non-game species especially tolerant of man, such as English sparrows, horned larks, and house mice, would increase in response to habitat modifications caused by a gradually increasing human population and its increasing influence on the environment.

On page 23, column 2, first full paragraph, the third sentence should have the parenthetical phrase ". . . (nominated for endangered status) . . ." eliminated.

Fort Berthold Technical Supplement

On page 64, paragraph 1 should be replaced with the following: Residual impacts would be similar to impacts without mitigation. Air pollution and increased numbers of non-Indian visitors to the reservation could reduce animal populations, but it is not likely that the impacts would be measurable.

On page 64, paragraph 2 should be replaced with the following: The proposed actions would not affect the productivity of wildlife and domestic animals beyond the life of the projects. Future management options of the Three Affiliated Tribes with respect to domestic animals and wildlife would not be affected.

On page 64, paragraph 4, the first line should have the word "populations" replaced with the word "impacts."

References

The following references are cited in this Final Supplement but not in the Draft Study:

Anderson, W.L. 1978. Waterfowl collisions with power lines at a coal-fired power plant. Wildlife Society Bulletin, Vol. 6, No. 2, pp. 77-83.

Kaiser, Robert 1978. Personal communication (Assistant Project Manager).

Krapu, G. 1974. Avian mortality from collisions with overhead wires in North Dakota. The Prairie Naturalist, Vol. 6, No. 1, pp. 1-6.

McEnroe, M. 1972. Summer Employment Report, Audubon National Wildlife Refuge, Coleharbor. June 5-August 25, 1972.

McKenna, M.G. and G.E. Allard 1976. Avian mortality from wire collisions. North Dakota Outdoors, Vol. XXXIX, No. 5, pp. 16-18.

Olendorffe, Richard R. 1978. Personal communication. Telephone conversation August 17, 1978. (Biologist, U.S. Bureau of Land Management, California State Office, Sacramento).

Seabloom, R.W., R.D. Crawford and M.G. McKenna 1978. Vertebrates of southwest North Dakota - amphibians, reptiles, birds, mammals. Research Report #24, Institute for Ecological Studies, University of North Dakota, Grand Forks, 549 pp.

U.S. Fish and Wildlife Service 1978. Office files, Bismarck Area Office.

Weier, R. Wayne 1972. A probable instance of songbird mortality. The Prairie Naturalist, Vol. 4, No. 2, pp. 55-56.

MODIFICATIONS AND CORRECTIONS

Draft Study

Description of the Environment (Chapter 2)

Comments from the State Historical Society of North Dakota indicated concern about the need for updated data. New and important cultural resources information has been developed since the Draft Study was completed. A summer and fall, 1977, inventory was conducted on the mine areas proposed for the ANG Coal Gasification Plant and Antelope Valley Power Plant in Mercer County. A total of 27,721 acres of the proposed mine area and railroad spur in six townships were intensively inventoried. A March 1978 report (Dill 1978) detailed the location of 149 prehistoric and historic sites (14 of which had been reported earlier by other investigators). For the total 149 sites known as of September 1, 1978, categorization of the sites is shown in Table 1.

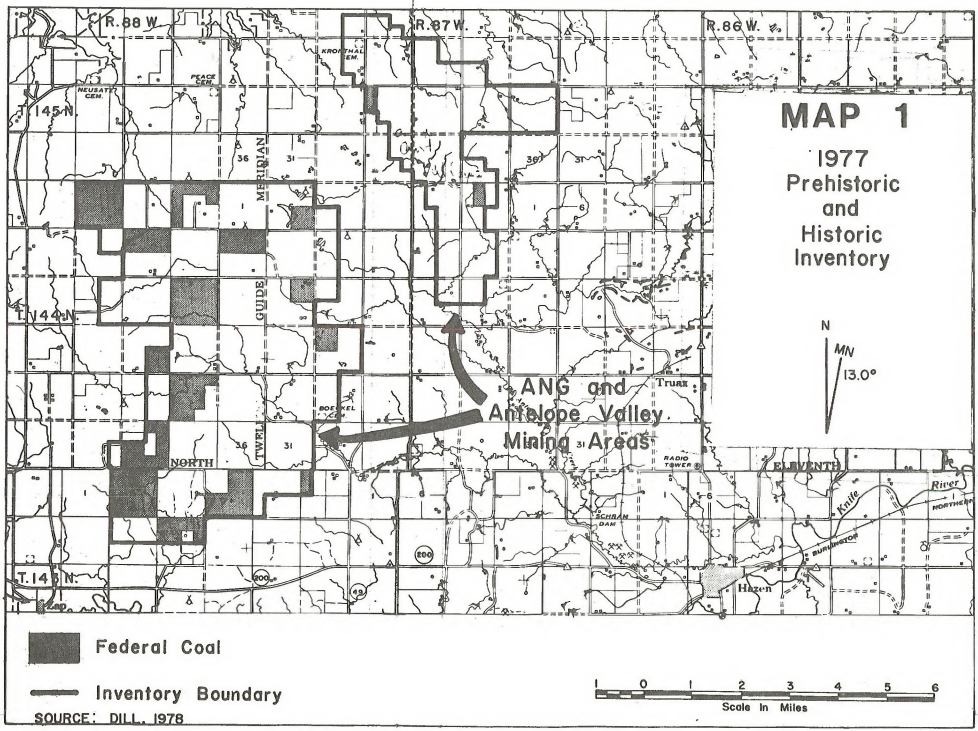
TABLE 1

Prehistoric and Historic Features Associated With
ANG Coal Gasification Plant and
Antelope Valley Power Plant Mine Areas

Prehistoric	
Stone Circle Sites	94
Lithic Scatters	10
Rock Cairns	1
Subtotal	105
Historic	
Farmsteads	37
Schools	2
Trails	1
Coal Mines	1
Cemeteries	3
Subtotal	44
TOTAL	149

Map 1 shows the exact area inventoried. The inventory area encompasses portions of the proposed Federal Coal Study Areas S-1, N-1A, N-2A, and N-2B. The increased amount of inventory requires several changes in Draft Study Chapter 2 tables and maps. In Table 2-40, site category totals would change for Mercer County and in the totals column as follows:

	MERCER COUNTY		TOTAL	
	From	To	From	To
Stone Circles	25	119	54	148
Lithic Scatters	3	13	144	154
Cairns	5	6	27	28


R.88 W.
R.87 W.
R.86 W.
T.145 N.
T.144 N.
T.143 N.
MERIDIAN
GUIDE
TWP.1
NORTH
ANG and
Antelope Valley
Mining Areas
MAP 1
1977
Prehistoric
and
Historic
Inventory
N
MN
13.0°
Truax
ELEVENTH
Knife
River
Hazen
Federal Coal
Inventory Boundary
SOURCE: DILL, 1978
0 1 2 3 4 5 6
Scale In Miles

On Map 2-37, parts of the enclosed dashed lines north of Beulah indicating spot-checking for prehistoric and historic features have now been intensively inventoried. Those portions can be determined by using the township and range mylar overlay in the Draft Study with Map 2-37, while referring to Map 1 in this document. (Also on Map 2-37, Cairns is misspelled, the legend blocks should be red, and the "D" in the NGPL project area should be changed to a "C.")

On page 53, column 1, paragraph 4, line 10, "ever" should read "even."

On page 54, column 3, paragraph 1, line 6, "Tracts N-1A and N-1B have not been inventoried" should be deleted.

Environmental Impacts (Chapter 3)

The 149 sites listed above could be impacted and potentially destroyed by mining and ancillary construction. The importance of the potential loss of these sites cannot be determined at this time because they have only been surface-recorded. The report on the inventory (Dill 1978) recommends further study to determine their importance. Table changes in Chapter 3 required by the new information are as follows:

Table 3-79, page 114. Potential Impacts on Known Prehistoric Sites

	Total Sites Known		Sites Potentially Impacted			
			Number		Percent	
Site Type	From	To	From	To	From	To
Stone Circle	54	148	27	121	50	82
Lithic Scatter	144	154	104	114	72	74
Cairn	27	28	6	7	22	25

Table 3-80, page 114. Prehistoric Site Types in Level 1 Areas

ANG and Antelope Valley

Site Type	From	To
Stone Circle	5	94
Lithic Scatter	0	10
Cairn	0	1

On Table 3-81 (page 115), Historic Features Associated With Level 1 Development, two farmsteads and two cemeteries associated with ANG Coal Gasification Plant and Antelope Valley Power Plant are listed by name. Due to the much greater number of historic features now known for this mine area, they are now listed by number of sites on each historical category, and should be changed to read 37 farmsteads, 3 cemeteries, 1 historic trail, 2 schools, and 1 historic coal mine.

Some further changes in analysis of impacts are a result of comments received from various agencies and individuals. The National Park Service was concerned that there would be some visual impacts

on the Knife River Indian Villages National Historic Site from mining at the Glenharold Mine. Mining within the visual area of the Knife River Indian Villages and Fort Clark downstream would change the natural setting for these sites.

Further discussion of the evaluation of prehistoric and historic sites, a concern of the State Historical Society of North Dakota, is needed to clarify the treatment in the impacts chapter, but also in other chapters and the appendix. Two areas need to be stressed. First, simply recording that a site exists does not evaluate it. For historic sites, documentation is necessary. Test excavation is often, but not always, necessary to evaluate the importance of prehistoric sites. Second, the inferrence should not be made from the Draft Study that the many sites recorded (with little supporting evaluatory information) are unimportant. Most of the approximately 550 prehistoric sites and numerous historic sites presently known have not been fully evaluated.

On page 114, column 2, paragraph 1, line 3, the "plant" area should read "study" area.

On page 114, column 2, paragraph 3, line 10, the sentence beginning "The Quarries . . ." should begin "Five of the quarries and six of the lithic scatters . . ."

On page 115, Table 3-81, Wodworth should read Woolworth.

Mitigating or Enhancing Measures (Chapter 4)

Under Additional Enforceable Measures on page 160, column 2, of the Draft Study, the new information from ANG Coal Gasification Plant and Antelope Valley Power Plant causes the following changes:

Paragraph 2, item 2 calls for a supplementary report on ANG. Such a report is now complete (Dill 1978). Item 3.c. should be amended to require further evaluation and possible avoidance and/or excavation of 105 prehistoric features; and further evaluation and/or preservation of 44 historic sites.

Since completion of the Draft Study, more information relating to the recommendation of a potential National Register of Historic Places District on or near the proposed NGPL development is available and should answer the concerns of NGPL mentioned in their comments. The extensive survey in Mercer County on the ANG Coal Gasification Plant and Antelope Valley Power Plant shows that of 105 prehistoric sites inventoried, only 10 are lithic scatters and no quarry areas were found. The distribution of sites on the NGPL project area shows 114 of 119 sites inventoried to be either lithic scatters or Knife River Flint quarries. This would suggest the lithic scatters to be important in the interpretation of the quarries. However, thus far the potential boundaries of such a district encompassing Knife River Flint quarries and lithic scatters depends upon inventory within coal study areas. It is suggested as an Other Possible Measure that this inventory be expanded to the northeast and south of the present NGPL study area to more meaningfully define the district. This inventory would be the responsibility of federal and state agencies instead of energy companies because it would cover areas where no coal development is presently planned.

Residual Adverse Impacts (Chapter 5)

Further study of the 149 new sites inventoried on the proposed mine area serving ANG Coal Gasification Plant and Antelope Valley Power Plant would have similar effects in terms of residual adverse impacts to those already described in the study. New information would be added to the prehistoric and historic record, but information would be lost from portions of sites not excavated or preserved. Also, the sites could not be restudied with improved future research methods.

Summary

On page 26, column 2, paragraph 2, lines 1 and 3, "136" should be changed to "242." Also, Figure 14 would change to correspond to the revisions made for Table 2-40 under the heading "Description of the Environment (Chapter 2)" here in Part 1.

On page 27, column 2, paragraph 1, add the following end sentence: "The 106 sites recently inventoried in Level 1 should be evaluated for significance, followed by possible nomination to the National Register of Historic Places, excavation, or further mapping and collecting of artifacts."

References

The State Historical Society of North Dakota commented on omission of sources for Table 2-39. The source for Table 2-39 should read as follows: Dill 1975a, 1975b, 1976a, 1976b, 1977; Fox, Stolt, and Loendorf 1976; Loendorf, Carmichael, and Miller 1976; and Woolworth Research Associates 1974. Of these sources, only Dill 1977; Loendorf, Carmichael, and Miller 1976; and Woolworth Research Associates 1974 are presently listed in the References section.

The following references should be added:

Dill, C.L. 1975a. 1975 archaeological and historic sites survey of the Falkirk Mining Company extended mining plan areas, McLean County, North Dakota. Manuscript on file, State Historical Society of North Dakota.

1975b. Archaeological and historic sites survey, South Beulah Mine and Gascoyne Mine expansion areas, Knife River Coal Company. Manuscript on file, State Historical Society of North Dakota.

1976a. 1976 Archaeological and historical sites survey of the North American Coal Corporation's Indianhead Mine, limited and extended mining plan areas, Mercer County, North Dakota. Manuscript on file, State Historical Society of North Dakota.

1976b. 1976 archaeological and historic sites survey of the Baukol-Noonan, Incorporated, Center Mine, limited and extended mining plan areas, Oliver County, North Dakota. Manuscript on file, State Historical Society of North Dakota.

Fox, Richard; Wilbur Stolt; and Lawrence Loendorf 1976. Archaeological and historical studies in the vicinity of the proposed Coyote Station electrical generation plant site near Beulah, North Dakota. Research Report No. 16, Institute for Ecological Studies, University of North Dakota, Grand Forks.

One further reference should be added to the References section based on the information obtained in connection with the ANG Coal Gasification Plant and Antelope Valley Power Plant proposals:

Dill, C.L. 1978. 1977 cultural resources inventory; Antelope Valley Station/ANG Coal Gasification Plant site, associated mining areas, and ancillary facilities. Two volumes, manuscript on file at State Historic Society of North Dakota.

AESTHETICS

INTRODUCTION

Only three comments were received on the Aesthetics analysis. Minor revisions were made in text items; however, no changes resulted in significant modifications to conclusions or analysis results.

MODIFICATIONS AND CORRECTIONS

Draft Study

On page 55, column 2, line 10, "(good)" should be changed to "(average)".

On page 56, column 2, "intersity" should be changed to "intensity."

On page 205, Lee Huber should be added to the list of participants from the North Dakota State Health Department.

The title of Map 2-39 (Draft Study) should be changed to Scenery Units and Visual Sensitivity Zones. The legend should include a heading *Scenery Units* above the word "Plains" and a heading *Visual Sensitivity Zones* after the legend line "Major Lakes in the Prairie Potholes Plains." Items 1 and 2 of the legend should read "Missouri River *Valley*" and "Major Lakes West of *Missouri* River."

RECREATION

INTRODUCTION

Most of the comments on the recreation analysis dealt with impacts to the Fort Berthold Indian Reservation and came from representatives of the Three Affiliated Tribes. The primary emphasis of the comments was on jurisdictional issues and the need to provide additional information on tribal planning efforts. Discussions of the jurisdictional issue relative to recreation were for the most part already included in the Draft Study, but additional information is provided on tribal proposals for the Lake Sakakawea shoreline. Other comments dealt with minor technical changes or additions.

MODIFICATIONS AND CORRECTIONS

Draft Study

On revised Map 2-42 in the map packet, the following historic sites have been added:

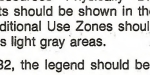
County	Site Name	Legal Description
Mercer	Fort Clark Historic Site	Section 36, T. 144 N., R. 84 W.
Burleigh	Double Ditch Historic Site	Section 21, T. 140 N., R. 81 W.
Burleigh	Menoken Indian Village Historic Site	Section 22, T. 139 N., R. 78 W.
Mercer	Crowley Flint Quarry Historic Site	Section 1, T. 142 N., R. 90 W.
Dunn	Killdeer Mountains Battlefield Historic Site	Section 33, T. 146 N., R. 96 W.
Morton	Huff Indian Village Historic Site	Section 8, T. 136 N., R. 79 W.
Burleigh	Chaska Historic Site	Section 34, T. 140 N., R. 75 W.
Burleigh	Steamboat Warehouse Historic Site	Section 31, T. 139 N., R. 80 W. (in Bismarck)
Burleigh	Camp Hancock Historic Site	Section 4, T. 138 N., R. 80 W. (in Bismarck)
McLean	Fort Mandan Historic Site	Section 15, T. 144 N., R. 84 W.

(Location in Draft Study correct for McLean County Historic Site of same name)

Also, the Knife River Indian Villages National Historic Site should be changed from a Potential State Nature Preserve to a Federal Recreation Area.

On Map 3-30, two legend items are reversed. Recreation Resources Physically Disturbed by Level 1 Projects should be shown in the legend as dark areas. Additional Use Zones should be shown in the legend as light gray areas.

On Map 3-32, the legend should be clarified as follows:



Also, delete the legend reference to "negligible."

The last two sentences of paragraph four, column one, on page 176 should be revised to read as follows:

> Adequate tax revenues needed to build new facilities would not be available even with the increase in population. However, North Dakota Coal Impact Office funds would be available from existing coal production through severance tax collections and could be used to supplement other tax revenues.

Summary

The fourth sentence in column 2, page 33, should be reworded as follows:

> State law and subsequent regulations forbid energy conversion facility siting on federal, state, or local recreation areas, wildlife refuges, game management areas, hardwood draws, or unique natural areas. In addition, transmission facility siting is restricted in federal or state parks, historic sites, monuments, landmarks, national wilderness areas, state archaeological sites, state nature preserves, and all local park and recreation areas.

Fort Berthold Technical Supplement

On page 77, the heading "Natural Values" should be changed to "General Recreation Values."

On page 77, the first sentence in the last paragraph should be deleted.

On page 77, the last sentence should read as follows: "The Three Affiliated Tribes have proposed tribal administration for seven major areas along the shores of Lake Sakakawea to be managed as conservation and wildlife habitat areas."

On page 85, the last paragraph should be deleted.

ECONOMIC CONDITIONS

INTRODUCTION

Comments on the economic conditions section of the Draft Study were received from state, industry, and individuals within North Dakota.

Many of the comments, from individuals in particular, expressed a desire for more complete information concerning boom-bust cycles, probability of future development, and impacts from coincident oil and gas development. In most cases, it could only be explained that inherent uncertainties preclude any further analysis on boom-bust cycles or future development beyond that already analyzed in Levels 1, 2, and 3. In other cases (concerning oil and gas development in Stark and Dunn Counties, for example), additional information not previously available is now included.

The North Dakota Regional Environmental Assessment Program (REAP) questioned some inconsistencies in income, population, and employment projections. These subjects were updated with more current information.

Changes were also made because of industrial concerns regarding current and future levels of coal severance revenues available to the state for impact assistance.

MODIFICATIONS AND CORRECTIONS

Draft Study

Even though the economic modeling indicated that the additional Level 2 development would not significantly impact Stark County, future coal development coincident with future large scale oil and gas development could conceivably generate significant social and economic impacts in Dickinson and Killdeer, as well as in the general area. However, indications so far are that oil and gas development in Dickinson has not created significant impacts on that community's infrastructure. According to Mayor Schank, there were some seismograph people in the area earlier in the year, most of whom have left. The mayor estimates that there are only approximately 30 to 40 new families (maximum) in Dickinson directly related to oil and gas activity.

Mayor Binnick of Killdeer feels that impacts from oil and gas activity are noticeable in that community. Housing seems to be the most highly impacted sector. Recent building includes two new motels, a six-plex, two four-plexes, two or three duplexes, and 10 to 15 new single family residences. In addition, he feels that a new trailer court is needed. There is only one cafe open in town; the other two are closed due to health restrictions. The water and sewage treatment capacity of the town could handle double the present population as a result of a new well and remodeling of the sewage treatment lagoon.

It is uncertain at this time how much additional oil and gas related impacts will occur in this area. Mayor Schank noted that seismic activity in the Dickinson area resulted in the most noticeable increase in people. The actual manpower requirements for development and operations were not large due to the high degree of mechanization and automation present in modern day oil fields.

The "total" column in Table 2-46 should read "Total State."

Table 2-52 should include an entry of "198" for Butte in 1975.

The footnote in Table 2-69 should read ". . . June 30, 1979" instead of . . . "June 30, 1978."

On page 125, the following clarifier should be added at the bottom of column one:

> The economic modeling used to predict future economic and social conditions in communities in the seven-county study area looked only at incorporated communities. It is likely that some unincorporated communities in the study area could also experience economic growth as a result of future energy development. The modeling procedure used is discussed in greater detail in the Economic and Social Conditions Technical Supplement.

Sector rows in Table 3-91 should be numbered 1 through 13. The next to the last parenthetical statement on page 126 should read: "(sectors 3 through 11 of Table 3-91)."

Tables 2-60, 2-61, 2-63, 2-64, and 2-65 have been revised as follows:

Figure 3-27 is revised as shown:

REVISED TABLE 2-60

	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark	7 County Total
1978	19,818	1,628	4,264	2,666	7,408	1,036	8,151	44,971
1979	20,172	1,613	4,163	2,612	7,385	1,028	8,252	45,225
1980	20,440	1,600	3,945	2,530	7,333	1,013	8,349	45,210
1981	20,982	1,589	3,964	2,536	7,364	1,015	8,467	45,917
1982	21,485	1,579	3,097	2,526	7,380	1,014	8,578	45,659
1983	21,987	1,567	3,857	2,513	7,391	1,014	8,686	47,015
1984	22,491	1,554	3,802	2,503	7,398	1,011	8,790	47,549
1985	22,997	1,541	3,750	2,491	7,402	1,099	8,891	48,141
1986	23,501	1,529	3,698	2,478	7,402	1,008	8,991	48,607
1987	24,008	1,517	3,644	2,466	7,398	1,006	9,088	49,127
1988	24,512	1,504	3,592	2,452	7,390	1,004	9,182	49,636
1989	25,018	1,490	3,537	2,438	7,381	1,002	9,271	50,137
1990	25,525	1,478	3,486	2,428	7,368	1,000	9,358	50,643
1991	26,029	1,463	3,433	2,413	7,351	998	9,440	51,127
1992	26,535	1,450	3,381	2,399	7,333	995	9,521	51,614
1993	27,041	1,436	3,332	2,387	7,310	991	9,598	52,095
1994	27,554	1,422	3,278	2,372	7,285	989	9,673	52,573
1995	28,047	1,408	3,230	2,356	7,258	986	9,742	53,027
1996	28,548	1,395	3,179	2,341	7,229	983	9,807	53,482
1997	29,048	1,380	3,130	2,326	7,196	980	9,872	53,932
1998	29,548	1,366	3,082	2,312	7,162	977	9,935	54,382
1999	30,047	1,352	3,032	2,295	7,125	973	9,996	54,820

REVISED
TABLE 2-61

Projected County Employment As Percent of
Total Projected Seven-County Employment

Year	Burleigh	Dunn	McLean	Mercer	Morton	Oliver	Stark
1980	45.2	3.5	8.7	5.6	16.2	2.2	18.5
1990	50.4	2.9	6.9	4.8	14.5	2.0	18.5
1999	54.8	2.5	5.5	4.2	13.0	1.8	18.2

SOURCE: North Dakota Regional Environmental Assessment Program 1977

REVISED
TABLE 2-63

Baseline Forecast Per Capita Income SPR 7 & 8

Year	Per Capita Income
1975	$4,520
1976	4,876
1977	4,916
1978	4,913
1979	4,975
1980	4,980
1981	5,106
1982	5,206
1983	5,300
1984	5,392
1989	5,799
1994	6,158
1999	6,558

SOURCE: North Dakota Regional Environmental Assessment Program 1977

REVISED
TABLE 2-64

Baseline Forecast Personal Income SPR 7 & 8
(Thousands of 1972 Dollars)

Year	Personal Income
1975	$626,090
1976	677,268
1977	690,097
1978	697,512
1979	712,476
1980	719,326
1981	745,704
1982	768,121
1983	790,537
1984	812,954
1989	925,036
1994	1,307,118
1999	1,149,200

SOURCE: North Dakota Regional Environmental Assessment Program 1977

REVISED
TABLE 2-65

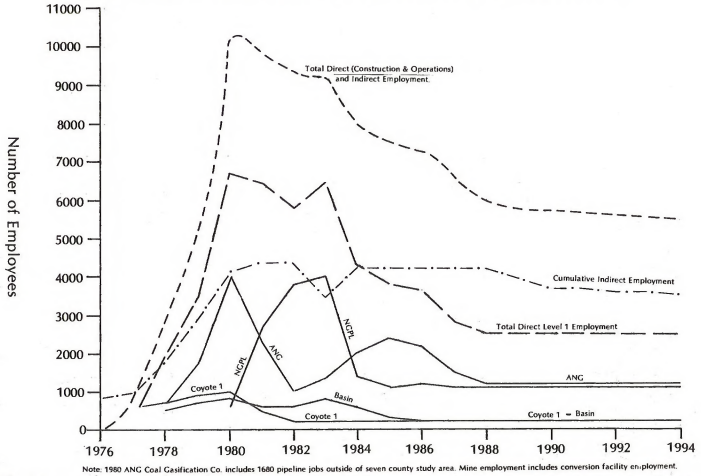
Baseline Forecast Total Business Activity SPR 7 & 8
(Thousands of 1972 Dollars)

Year	Business Activity
1975	923,755
1976	998,550
1977	1,019,273
1978	1,030,454
1979	1,048,214
1980	1,055,322
1981	1,091,436
1982	1,123,579
1983	1,155,721
1984	1,187,861
1989	1,348,566
1994	1,509,269
1999	1,669,974

SOURCE: North Dakota Regional Environmental Assessment Program 1977

REVISED FIGURE 3-27

EMPLOYMENT RELATED TO LEVEL 1 DEVELOPMENT



Note: 1980 ANG Coal Gasification Co. includes 1680 pipeline jobs outside of seven county study area. Mine employment includes conversion facility employment.

SOURCE: Direct employment estimates by industry. Indirect employment estimates by North Dakota Regional Environmental Assessment Program, 1977.

Chapter 4 (Mitigating Measures) should mention that economic impact assessment methodology and the relevancy and accuracy of data should be monitored. If this monitoring is done, it is likely that future modeling effects would benefit from any refinements in data collection and projection techniques. As the modeling becomes more accurate through these improvements, the response to forecasted impacts by legislators and decisionmakers would also become more effective and useful.

As an example, the 1978 update and expansion of the North Dakota Regional Environmental Assessment Program (REAP) model will provide North Dakota legislators with more accurate information upon which to base decisions concerning the economic future of the state. It is suggested that any economic assessment model which is used by decisionmakers be one which has been updated and expanded as new information and/or techniques become available. This will require the users of any such model to make certain that the most recent employment, population, income, and taxation information is used in a model which is current and reliable.

Table 3-93 and 3-101 have been revised as follows:

REVISED
TABLE 3-93

Projected Per Capita Income for Southwestern North Dakota With Level 1 Development
(1972 Constant Dollars)

Year	Per Capita Income Without Projects	Per Capita Income With Level 1 Projects	Difference	% Change
1975	4,520	4,520	0	0
1976	4,876	4,876	0	0
1977	4,916	4,982	66	1
1978	4,913	4,980	67	1
1979	4,975	5,069	94	2
1980	4,980	5,362	382	8
1981	5,106	5,556	450	9
1982	5,206	5,630	424	8
1983	5,300	5,265	-35	-1
1984	5,392	5,461	69	1
1989	5,799	5,793	-6	0
1994	6,158	6,122	-36	-1
1999	6,558	5,484	74	1

SOURCE: North Dakota Regional Environmental Assessment Program 1977.

NOTE: Data is for all counties in state planning regions 7 and 8 except Emmons, Kidder, and Sheridan.

REVISED
TABLE 3-101

Projected Per Capita Income in Southwestern North Dakota
With Total Level 2 Development
(1972 Constant Dollars)

Year	Per Capita Income Without Projects	Per Capita Income With Level 2 Projects	Difference	% Change
1975	4,520	4,520	0	0
1976	4,876	4,876	0	0
1977	4,916	4,982	66	1
1978	4,913	4,980	67	1
1979	4,975	5,069	94	2
1980	4,980	5,362	382	8
1981	5,106	5,596	490	10
1982	5,206	5,648	442	8
1983	5,300	6,245	945	18
1984	5,392	5,526	134	2
1989	5,799	5,774	-25	0
1994	6,158	6,097	-61	-1
1999	6,558	6,448	-110	-2

SOURCE: North Dakota Regional Environmental Assessment Program 1977.

NOTE: Data are for all counties in state planning regions 7 and 8 except Emmons, Kidder, and Sheridan.

Summary

The first money bag in Figure 23 (page 37) for Level 1 and Level 2 should be 285 instead of 385. The last money bag in Level 1 should be 1,892 instead of 2,445. The last money bag in Level 2 should be 3,501 instead of 5,319.

Fort Berthold Technical Supplement

The Fort Berthold portion of the Draft Study and the Fort Berthold Technical Supplement were prepared by a representative of the Three Affiliated Tribes and reviewed by the Natural Resources Planner and Coordinator for the Three Affiliated Tribes and by the Environmental Coordinator for the Bureau of Indian Affairs in Aberdeen, South Dakota. Although the Tribal Representative attempted to obtain information, there are a number of problems due in part to a general lack of economic data covering the Reservation. Without the existence or availability of this information, it is virtually impossible to assess existing economic conditions and make forecasts concerning impacts from energy development. Even so, the author has attempted to qualify the magnitude of impacts in those cases where hard data and quantification were impossible to obtain.

SOCIAL CONDITIONS

INTRODUCTION

Comments on the Social Conditions section of the Draft Study were received from academic, state government, and conservation group sources. The geographical locations of the academically-based commentators are outside the State of North Dakota, while state agency and conservation organization reviewers are located in North Dakota.

The university personnel who prepared statements differed in their orientations. The focus of one set of comments was on the attitudinal study. The methods used in completing the research (the fundings of which are displayed in Chapter 2, Social Conditions) were questioned and severely criticized. These comments, incorporated indirectly in the testimony and directly in the written remarks of a conservation group representative, are based on the belief that relatively unstructured, ethnographic research is more valuable than structured social research. The response herein reiterated the assertion that reliability is enhanced through structure, that the scholarly reputation of the researcher is quite sound, and that attitudinal, not behavioral, analyses were judged most appropriate for the "existing environment" section of the Draft Study.

The second series of comments from another person in an academic setting are generally directed toward the impact-mitigation sections (Chapters 3-5) of the Draft Study. While generally complimentary, these perceptive and well-documented remarks indicate that some aspects of the analysis required simple elaboration or clarification, but no substantive changes were required.

One individual attached a series of articles and speeches for use by the study team. One dealt with the relationship between human pathology and social environment, another with a mental health specialists' experiences in Gillette, Wyoming, and another with rural industrialization and its social-demographic effects. A fourth attachment was an overview of social and economic issues associated with coal development. These documents reinforced the analysts' ideas on the severity of the social impacts anticipated. The conclusion of these reports, though much more elaborately stated, are consistent with the conclusions of the original assessment.

A major concern expressed through a state government representative, a conservation group member, and others, was on the effects of air quality deterioration on human health. Several sources stated that the Social Conditions section of the Draft Study failed to adequately address this issue. Such information, to the extent available, is now located in Part 1, Climate and Air Quality.

A final series of comments, both written and oral, were received from a conservation group member who severely criticized the attitudinal study. These concerns were focused on the planning, execution, analysis, reporting, and application of the research. Part 2 reiterates the rationale behind the research, the strengths of the chosen approach relative to other methods, and asserts that the research was conducted by a respected, locally experienced, and skilled social analyst.

MODIFICATIONS AND CORRECTIONS

Draft Study

The second sentence under Social Conditions on page 136 should read: Population growth, particularly in Beulah, Hazen, and Killdeer, would be so rapid that dramatic changes in social conditions would be inevitable and, at least temporarily, chaotic and uncertain.

The third sentence under the Family on page 136 should read: However, expanded coal development would likely cause some of this socialization to be transferred from traditional structures, such as the family, to non-traditional groups, such as the schools, social service agencies, and emergent reference groups.

Revised Map 2-45 follows:

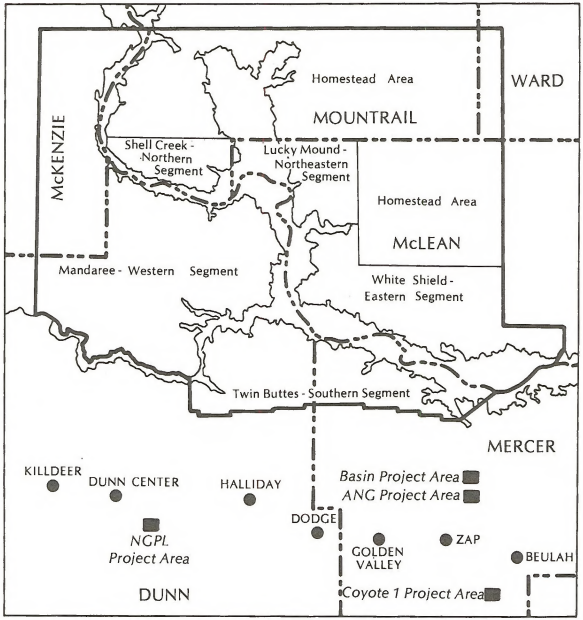
References

References should be amended to include the following:

Schneider, Don 1977. Personal interview, Gillette, Wyoming.
Weisz, Robert 1977. Personal interview, Gillette, Wyoming.

Revised Map 2-45

FORT BERTHOLD INDIAN RESERVATION



SOURCE: Inventory of Water Resources; Fort Berthold Indian Reservation North Dakota 1977

LAND USE

INTRODUCTION

The Roosevelt-Custer Regional Council for Development has pointed out that Dunn County adopted county zoning ordinances and a comprehensive land use plan on December 6, 1977. As a result of extensive planning and public input, the comprehensive plan includes alternatives for the projected impacts of potential energy developments. Zoning has also been laid out to guide an orderly county development; however, this additional information does not amend the land use analysis.

The Dakota Resource Council expressed concern regarding Level 1 and 2 permanent acreage disturbance. Of the total 336,134 acres proposed for leasing, land disturbance was projected at 92,461 acres, thus leaving 243,673 acres supposedly in excess of development's needs. Surface disturbance was based only on the acreages where some type of surface disturbance activity would actually occur; however, other non-surface disturbance effects, such as noise, visual intrusions, etc., were identified throughout the draft analysis.

Also expressed was concern over rights of surface landowners who do not control mineral rights under their surface lands. The North Dakota Public Service Commission (PSC) can not issue a permit to surface-mine land unless the application is accompanied by statements of consent, executed by each surface owner within the permit area, to have surface mining conducted on his land. However, if surface owner consent cannot be obtained, district courts can authorize the PSC to issue the mining permit without the surface owner's consent. To issue this order, the court must be satisfied that the surface owner will be adequately compensated for lost production, lost land value, and loss of the value of improvements due to the mining activity. Also, the Secretary of the Interior cannot enter into any lease of federal coal until the surface owner has given written consent to enter and commence surface mining operations. Surface landowners whose land may be suitable for surface mining will be consulted in early 1979 and asked to state their preference for or against offering such federal coal for lease, if needed. In those areas where a significant number of surface owners have stated a preference against the offering of the coal for lease, the Secretary shall, in his discretion, but to the maximum extent possible, refrain from leasing coal for development by methods other than underground techniques. Persons who are or who may be adversely affected by surface mining can petition the regulatory authority to have the land in question designated as unsuitable for all or certain types of surface mining or to have such a designation terminated. A survey of the surface which has been leased over coal within five of the seven counties of the study area indicates that an average of 60% of the surface has been leased. Valid written consent (a surface lease) given by any surface owner prior to enactment of the Surface Mining Act will be considered as surface owner consent for leasing of federal coal, if needed.

Another concern was the failure of the Draft Study to assess the impacts after the proposed projects end. It was reiterated that the environmental conditions after projects are terminated was discussed throughout the Draft Study under each environmental component. Chapters 5, 6, and 7 particularly address these issues. Detailed treatment of this subject, however, would be highly speculative. Because of the uncertainty surrounding the timing and magnitude of future energy and economic development beyond Level 2, it is impossible at this time to forecast the magnitude or timing of any possible turndown in economic activity.

A representative of the Dakota Resource Council noted that "a permit had already been granted for the (American Natural Gas Coal Gasification Plant and Antelope Valley Power Plant) site on land containing 535 acres of prime farmland." Concern was expressed as to the status of prime farmland in the facility siting permit decision process. At the time of the writing of the Draft Study, North Dakota regulations did place prime farmland into the exclusion criteria for siting of energy conversion plants. Those regulations were revised in February 1978 to add the provision that exclusion would not apply to involved blocks of prime farmland of such small acreage as to be of negligible impact on agricultural production. The American Natural Gas application involved soils with small, isolated prime farmland acreages.

It was noted that mileage distances and impact analyses were based on a straight line between origin and termination of lines involved in energy development. A check with the companies shows that the Coyote project transmission line mileage would not change and the Antelope Valley project transmission line mileage should increase over the straight line mileage by only about 4%.

Concern regarding consideration of Fort Berthold Reservation jurisdictions and land use impacts

was expressed by the Three Affiliated Tribes. Work groups included a representative from the Fort Berthold Reservation, the North Dakota Indian Affairs Commission, and the Bureau of Indian Affairs. All reservation information was based on data provided by those representatives. They also prepared a technical supplement which provides a detailed treatment of impacts to the Fort Berthold Reservation.

A question regarding reclamation to 100% of pre-mining productivity within 3 to 5 years is discussed in the vegetation section.

MODIFICATIONS AND CORRECTIONS

Draft Study

On page 76, column 1, "Railroad," the following information should be added after the last paragraph:

"Table 1 represents the existing and forecasted eastbound Burlington Northern coal train traffic originating from mines in the Fort Union and Powder River formations in eastern Montana and northern Wyoming."

TABLE 1

Existing and Forecasted Daily Coal Train Traffic[1/] Through Montana

Rail Segment[2/]	Existing	1990 Forecast
Huntley to Sarpy	3	6.4
Sarpy to Nichols	6	16.8
Nichols to Forsyth	10	23.9

1/ Includes empty backhauls.

2/ Figures are not cumulative among segments. For example, the Nichols to Forsyth segment currently handles four more coal trains than the Sarpy to Nichols segment.

SOURCE: Data on existing traffic - Burlington Northern 1977. Data forecasts from Interstate Commerce Commission 1976.

Table 1 shows that the Nichols to Forsyth segment of the Burlington Northern in Montana, easternmost of the three segments, is currently averaging 10 trains per day. This amount of traffic continues on through western North Dakota to markets in the eastern U.S. By 1990, this traffic is expected to increase by 139% to a new daily traffic figure of 23.9 trains.

Consequently, the 344 daily rail car traffic associated with the proposed action (approximately 3-4 trains) estimated in Chapter 3, Land Use, would be further increased by the 23.9 trains traveling through the seven-county study area in 1990 to and from Montana and Wyoming mines.

Noise, dust, odors, and traffic congestion are the major impacts upon local inhabitants resulting from increases in rail traffic, especially through small towns where residential and commercial activities may be in close proximity to rail lines. There are several small communities adjacent to Burlington Northern rail lines in the study area which would be impacted by this increase in traffic. Health and safety problems may occur, depending upon many factors such as weather, existing safety facilities, proximity to tracks, length of trains, and traffic volume.

On page 77, column 4, Counties, paragraph 5, the next to the last sentence should be replaced with:

> As a result of extensive planning with much public input, Dunn County adopted county zoning ordinances and a comprehensive land use plan on December 6, 1977. The comprehensive plan includes alternatives which take into account the projected impacts of potential energy developments. Zoning also has been laid out to guide an orderly county development.

On page 78, column 2, "Land Use: Federal Coal Study Areas," paragraph 1, lines 15 and 16 should be changed to: "the greatest amounts are N-1B (3%), N-3A (3%), N-3B (4%), and S-3 (2%)."

On page 148, column 2, "Land Use: Federal Coal Study Areas," paragraph 1, line 13 should be changed to: "also result in the disturbance of up to 2,772 acres of potential. . ."

On page 166, column 3, Applicants' Commitments, item 4, lines 4 and 5 should read:

> Under the siting criteria, irrigated land and prime farm land (except in such small acreage as to be of negligible impact on agricultural production) are exclusion areas.

The proposed gas pipeline on Map 2-49 is mistakenly represented in blue as a 30-inch proposed water pipeline. The pipeline should be gold and would connect with the proposed Northern Border Pipeline, which should also be shown. Revised Map 2-49 is included in the map packet.

Map 2-51, Subsurface Ownership, will be reprinted and available at a later date. Meetings between state agencies, BLM, and printers are currently still planning how the map can be revised to be of maximum benefit for long-range use.

MODIFICATIONS AND CORRECTIONS

Draft Study

'Million" should be "billion" on line 2, paragraph 4, column 3, page 202.

Summary

Under the Coal Export alternative on page 47, the first sentence should be revised to read:

> A large amount of the coal currently mined in the seven-county study area is connected to electrical energy within the area and is then exported by transmission lines for use outside the state.

REFERENCES

An introductory line stating "Authors and work groups are found in Chapter 9 and are not repeated under these references," should be added.

PART 2

RESPONSE TO PUBLIC COMMENTS

The Human Side of Coal Energy Development

William R. Freudenburg,
Principal Investigator

P. O. Box 183
Paonia, Colorado 81428
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OR

Department of Sociology
Yale University
New Haven, Connecticut 06520
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April 2, 1978

Mr. Edwin Zaidlicz
State Director, Bureau of Land Management
c/o West-Central North Dakota
Regional Environmental Impact Study
Suite 2, Capitol Place
1533 No. 12th St.
Bismarck, ND 58501

Dear Mr. Zaidlicz:

Thank you for the opportunity to comment on the recently completed draft of the West-Central North Dakota Regional Environmental Impact Study.

First of all, please accept my compliments along with my comments. You and your staff deserve congratulations for a job well done, at least in the area of assessing likely social impacts. Although there is naturally still room for improvement, this document is clearly superior to most existing environmental impact statements (EISs) in its social sections, and in particular, it is a substantial improvement over previous "regional" EISs in this regard.

However, while compliments are both nice to hear and well-deserved for your social impacts assessment team, they will not be as useful to you in improving the final document as constructive criticisms will be; accordingly, most of this letter will consist of the latter.

First, as I suspect you are already aware, there are a number of minor errors in the document that can be taken care of by simple editing. Just in case your editors have not already found them, here are a few examples:

--page 136 now contains the statement that "growth...would be so rapid that social conditions would be inevitable" (by definition, if people are involved, social conditions are "inevitable" under any circumstances, aren't they?); [1]

--there do not currently appear to be full citations for "Weisz, 1977" and "Schneider, 1977," which are cited on pages 136 and 137, respectively;

--although this might seem to be quite a minor point, you might wish to use the word "technological" (rather than "technologic") as the preferred adjective; most dictionaries and most readers

(including this one) would rather read of "technological improvements," for example, than of "technologic" ones.

However, since it seems likely that most such minor errors will be corrected in the final version of this study, the remainder of the present letter will be devoted to the actual content of the study. Because I am not closely familiar with the actual study region, I will offer no comments on portions of the study which relate exclusively to the region (for example, on the description of the current social environment), and will instead confine my remarks to those which are generally applicable in energy growth regions of the Rocky Mountain and Great Plains states.

(1) First and foremost, I applaud your study team's explicit recognition that economic effects of a proposed action can be quite different from its social effects. This study is both unusual and laudable in that it is not seduced by the word "socio-economic" into pretending that economic effects somehow "take care of" social effects as well. Social effects are social effects, and by dealing with them as such this study has set an example which deserves to be followed in all future BLM EISs. The present study also deserves praise (and more company than it has among current EISs) for the fact that it appears to have taken advantage of current research knowledge, and for its straightforward acknowledgement of the unfortunate fact that "it is unlikely that social impacts (from such a substantial degree of development) would be mitigated" (page 177). That is the kind of statement that few of us like to read, but it points out a relevant and important fact that will not go away if we simply pretend it's not there, and that is after all one of the primary beneficial purposes of an EIS.

(2) This study does a much better job than most in avoiding what I have come to call "the edifice complex"--talking about impacts on facilities and service agencies (sewer systems and police departments, for example), to the exclusion of any discussion of impacts on actual human beings. Nevertheless, as noted above, there is of course still room for improvement. In particular, the study states (page 136) that socialization will "be transferred from the family to schools and social service agencies." My own research findings (from western Colorado) indicate that a good deal of socialization is already handled by the schools and by the community at large in a pre-growth community; the sudden influx of energy-related growth does make any particular family's socialization of youth less effective, on average (as your draft currently indicates); however, my research clearly shows that for the most part the socialization is neither transferred to nor provided by schools, formal social service agencies, or any other public entities, perhaps at least partially because all of the above are suddenly faced with a whole range of new problems. The socialization experience simply becomes less coherent; if any group takes up the slack, it is likely to be a group of an adolescent's more deviant peers--an outcome which has stressful

consequences for the young person involved as well as negative consequences for the community's deviance rates. (In fact, an analogous argument applies to a community's crime rate overall: To a large extent, deviant activities which are kept in check by informal mechanisms and interpersonal acquaintances in a stable community will simply not be monitored as effectively (if those informal mechanisms are broken down by the sudden arrival of more people than can be contained within them) by any of the more formal mechanisms, such as police forces and jails; if there is a sudden increase in population, I predict quite confidently that there will be an equally sudden but more than equal increase in the local crime rate no matter how many additional officers are brought in to beef up the existing police force.)

(3) The study states (page 136) that the elderly will have the greatest difficulty in coping with the likely rapid rate of change in their communities, and this is a prediction often found in the relevant literature. However, my own research clearly indicates that the "least elderly"--the young, and particularly the adolescent males--have an even greater difficulty in adapting to the changes. This is partly because of the fragmentation of the socialization process noted above, and partly because they are less likely to see growth as a positive change for their communities (despite the fact that they are much more likely, on average, to get jobs from such an expansion of the local economy); but it is partially also because they are at a stage of their lives when they are just discovering the people they are likely to become (unlike their grandparents, who have sixty years of momentum to keep themselves on course), and partly also because the reality of the changes are brought home to them much more forcefully, in that they encounter newcomers firsthand every day they attend classes.

(4) The study cannot be praised too strongly for its repeated recognition that the severity of social chaos created will for the most part be a function of one vital variable--the rate of the population influx into each community--and for pointing out the simple and powerful (but often overlooked) fact that the best way to avoid the agony would be to lower the rate of growth to hit any one community at any one time, by means of judiciously controlling the timing, type, and placement of the developments that are allowed. In fact, if anything, the document as it currently stands <u>under</u>states the significance (and the beneficial consequences) of simply slowing down the influx, e.g. by rational scheduling of leases, by re-locating the facilities to regions which have the population to support them, and by exporting the coal (after mining) to the regions where the end-product energy will be utilized.

(5) Finally, in light of the extreme importance of the RATE of change (not the simple fact that a community is changing, or growing at a more normal rate), the final version of this study ought to either retract or else to provide additional evidence to support

the assertion that the quickening pace of life, increasing interpersonal conflict, and increasing personal anxiety mentioned in the study "would probably occur in North Dakota regardless of whether or not coal development is expanded." (These words are found on page 138, and echoed later on pages 194-195.) It is unquestionably true that some form of change is inevitable in any community at any time in history, but it is not true that all sections of our nation are becoming "urbanized" at the present, nor is it true that changes even REMOTELY approximating those likely to result from massive coal development in the region would occur even if no such development takes place. Since no other disturbance factors are mentioned in the current document as the likely source of the envisioned changes (should the coal development not take place), it appears that there are only two possible sources for those changes: Urbanization of the region, or the general "trend of the times." Yet this document's own data clearly indicates that most of the study region shows absolutely no historical evidence of a trend toward urbanization over the last several decades, and it seems highly unlikely that these historical trends will alter themselves drastically unless they are impacted by an outside force comparable in magnitude to the proposed coal development. And changes attributable to the trends of the times are so vastly different from those likely to be caused by coal development that the two are not even comparable; the former are so gradual as to be unnoticeable on a day-to-day basis (partly because "everybody else" is going through the same changes at the same time), and rural North Dakotans are in fact even less likely to have trouble adjusting than the rest of America, since rural areas in the midsection of this country do not generally respond as skittishly to the fads and fashions of the day. By contrast, the proposed level of coal development would cause communities of the region to change much MORE rapidly than other sections of the country, and in a manner over which local residents will appear to have annoyingly little control.

Finally, I have only one further change which I would recommend for the final version of this report: Although the current format is striking, it is a bit difficult to manage, and it may prove impossible to store unless I banish it to the basement or give up about half of my current book storage space. Would it be possible to produce a more "standard-sized" product, even if that requires dividing the study into several volumes? [2]

On the whole, however, as the beginning of this letter indicated, the persons who worked on the social sections of this study deserve recognition for a job well done and for a clear improvement upon previous regional EISs. I hope that future BLM documents follow your good example.

Sincerely yours,

Wm R. Freudenburg

William R. Freudenburg

RESPONSE TO HUMAN SIDE OF COAL ENERGY DEVELOPMENT LETTER

#1

The second sentence under Social Conditions on page 136 should read: "Population growth, particularly in Beulah, Hazen, and Hildeer, would be so rapid that dramatic changes in social conditions would be inevitable and, at least temporarily, chaotic and uncertain."

Paragraph 4, Item 2

The References section should contain the following:

Schneider, Don 1977. Personal interview. Gillette, Wyoming.

Weiss, Robert 1977. Personal interview. Gillette, Wyoming.

We would use the preferred "technological" adjective in the future.

The third sentence under The Family on page 136 should read: "However, expanded coal development would likely cause some of this socialization to be transferred from traditional structures such as the family to non-traditional groups such as the schools, social service agencies, and emergent reference groups."

The first paragraph on page 136 states that "changes in the way of life of the residents of these communities would be permanent and significant to the entire population, regardless of age, sex, and occupation."

The statement, located on page 138, that "these changes will probably occur in North Dakota regardless of whether coal development is expanded" refers to transformations in American society that have occurred and will occur in the future. Increased impersonalization, segmentation, public sector involvement in fulfilling responsibilities once met by family and neighbors, and similar changes, are included.

The sentence, "However, with expanded development, the pace of social change would be greatly accelerated, particularly in the rural areas of Dunn and Mercer Counties," on page 138 addresses the issue of pace of social change.

#2

A number of planning agencies have indicated a preference for the larger format and overlay system; however, most people indicated a preference for reducing the 15" x 29" to something like 15" x 15". The main issue in determining size and format of the printed study related to mapping a seven-county area. Since many maps were primary-source information, reducing them to less than 1/8 inch to the mile would destroy most of their value even for regional analysis. In addition, the mylar overlay system, which does not allow for folding, was adopted to avoid expensive, repetitious printing. The choice was whether to print a more conventional sized volume with an oversized map book, or to integrate text and visuals. The decision was to use the larger size which allowed for simultaneous use of text and visuals. Also see response #3.

At first appearance the Draft West-Central North Dakota regional Environmental Impact Study on Energy Development is an impressive document. The cartographics, the table and graphs and the listing of contributors adds to the impressiveness of the writing.

The sheer volume of the data tends to make the reader believe that it is true. In its favor the document presents an incredible amount of data, which will be extremely helpful for future decisions and reference. The information is organized in a logical and flowing manner concentrating on the energy development first. Following the comprehensive examination of energy development, the document examines the secondary impacts on such diverse elements as sociology, wildlife and recreation.

One question, however, is --- who is the study directed to? Would a layman understand the portent of Oxides of Nitrogen (p. 29) or the effect, if any of suspended particles? does the layman know the effects of nitrogen dioxide? I believe that it would be reasonable to publish one document for the layman, and two volumes for the technicians, academicians and agencies.

In its present form the document is too bulky and unwieldy. The size should be reduced. It would be better to divide it into two volumes, one for energy development, and one for the secondary topics and effects. This would allow individuals to use the information (and a great deal of it) on the socio-

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302 Babcock
Geography Department
Grand Forks, N.D. 58201
28 April, 1978

Regional Environmental Impact Study
Capitol Place Office Building
1533 North 12th Street
Bismarck, North Dakota
58501

Sirs,

Enclosed with this cover letter is an analysis of the Draft West Central North Dakota Regional Environmental Impact Study on Energy Development, produced in conjunction with the U.S. Department of Interior, Bureau of Land Management.

The examination and analysis is being done for a graduate level seminar, Environmental Monitoring, held at the University of North Dakota, Grand Forks.

The background on which the analysis is based comes from my educational background (A Bachelor of Science degree in Geography with interests in Cartography, Remote Sensing and Environmental Issues), and my employment experience of six years of surveying, with two of those for a government agency.

I understand the necessity for energy development in North Dakota, but I am also a staunch proponent of the ability of man to limit his possible destructive search for such energy by reasonable restraints.

It is excellent opportunity to view this document, its construction and layout and to critically analyze it. The information in this draft will soon be used as a basis for decisions that will greatly effect North Dakota, and may set further precedents.

It is essential that it be critically analyzed.

Sincerely yours,

Mark Hoffman

Mark Hoffman

2.

logical, recreational and wildlife data without the sifting of material concerned with energy development.

The bibliography is an impressive collection of experts. Yet, the reader does not know who wrote the chapters, their qualifications or experience. Credibility would be greatly enhanced if the authors of each chapter and the final editors, cartography chiefs and statisticians were listed in the chapters or in a preamble.

It is however, the tendency of the document to totally overwhelm the reader with graphics, cartography, statistics one issue, that is its greatest disadvantage. Simplification is the finest guideline for such documents, not only for simplication's sake, but to limit the cost.

It appears that this document was an expensive venture. One further element that should be printed is the cost of production or at least the grant amount that covered the documents publication.

My interests in my geographic studies are cartography and remote sensing. Cartography is a practice by which a great deal of data that would be difficult to get across to the reader can be symbolized on an areal surface.

I found the cartographics generally inadequate in comparison to the rest of the production. One major cause of the failing is the ratio of wordings and the construction of the legend. Rather than eight a large number of errors on different maps, I will choose two examples that have the

most typical errors.

Map 2-51 (Chapter 2, p. 81) Subsurface Ownership, displays an inadequate choice of shading to indicate ownership. Some of the shades merge to form indiscernible differences, difference that are improtant to this map. On Map 2-13 the order of erodibility is out of natural sequence.

To rectify this problem two steps could be taken: first to try to put less information on the map and secondly to choose much more opposing tone and shades.

More attention should be paid in the cartographics to simplicity and distinction in tones. The cartographics will be the first viewed by the layman, and if misunderstood will effect the interpretation of the entire document.

5

In a document of such scientific and statistical quality on particular topic is quite alien to the entire tone or portent of the document. Aesthetic values are extremely difficult to determine, and they are highly subjective in this document. This is an approach not to be followed in a document of this statistical and scientific content. An example of this subjectivity can be found in the Appendix (p. 213) Under color and its rating criteria and score we have the following statement: " Some variety in colors and contrast of the soils, rocks and vegetation, but not dominant." This is a highly subjective statemnt and the reader may have a difficult time determining the intent. Including a summary

RESPONSE TO HOFFMAN LETTER

#3

The study is hopefully for the most part written for the average public. However, some portions are admittedly difficult for many readers. Attempts were made to simplify information as much as possible, but an impact study is required to display effects, significance, analysis, and methodology. Even more technical versions were written in the Technical Supplements (see page i, column 2, paragraph 6; and for example, page 29, column 1, sentence 4; of the Draft Study.

All information in the Draft Study relates to energy development; therefore, it would be difficult to split information into energy development or secondary topics.

The cost of publishing 2,000 Draft Studies, 3,000 Summaries, and 1,000 extra copies of each large map and overlay was $70,000. The Washington Government Printing Office estimate for printing 1,500 typed pages, several hundred tables, and considerably more maps if overlays were not used, was $138,000.

Chapter 9 lists all authors and participants.

Also see response #2.

#4

See response #6.

#5

The treatment of aesthetic values or visual resources is subjective, because aesthetics deal with man's perception of his surroundings (a highly subjective and individualistic reaction); therefore, objectivity is impossible to obtain. The adage that "beauty is in the eye of the beholder" clearly applies to the evaluation of visual resources.

However, an analysis of impacts to aesthetics is critical in a study such as this. Changes in the scenic quality of rural areas are often overlooked as a major item of dissatisfaction to local residents (Ludtke 1977), especially when strip mining of coal and construction of energy conversion facilities are involved. Every attempt was made to develop and present the analysis of visual resources using a meaningful visual resource evaluation methodology; i.e., to make an intrinsically subjective evaluation as objective as possible. The Bureau of Land Management's Visual Resource Management System (explained in detail in Appendix 2) was used by a professional trained in the design arts field. This methodology is used by the Bureau throughout the nation and has proven a valid tool for analysis of a difficult but important facet of the environment.

or text of the Bureau of Land Management Manual from which the standards are developed.

The immense amount of work that was performed to complete this work should be applauded. The information will serve as a tremendous resource for future multiple purpose studies. The items pointed out do not detract from the general overall quality of the document, and with a certain attention to the aforementioned deficiencies, the document will be a tremendous resource for energy development in North Dakota and the western United States.

207 Filmore
Grand Forks, North Dakota 58201
May 3, 1978

David Darby, Environmental Impact Study Manager
West Central North Dakota Regional Environmental
Impact Study on Energy Development
Suite 2, Capitol Place
1533 North Twelfth Street
Bismarck, North Dakota 58501

Dear Sir:

The Geography Department of the University of North Dakota received a Draft West Central North Dakota Regional Environmental Impact Study. Within it was a request for review and comment by concerned citizens and groups. Dr. Roland D. Mower introduced the draft document to members of his postgraduate course in Environmental Monitoring. As a student of that course, I have reviewed the draft document. I hereby submit my comments to you in response to the request for review and comment.

An explanation of my education and experience may be helpful in evaluating my comments on the draft document. I received a Bachelor of Arts Degree from Whittier College with a major in chemistry and a minor in mathematics. I received a Master of Arts Degree in education from Long Beach State College. My post graduate studies have continued for the equivalent of three academic years beyond the Master of Arts Degree in broad studies of the natural sciences: geology, physics, biology, meteorology, astronomy, and geography. These continuing postgraduate studies have extended over a period of twenty years of experience as a science teacher in public high schools and junior high schools. Because of that background, I would describe myself as a professional educator with an above average interest and education in the natural sciences. My viewpoint of the draft document is essentially that of an interested consumer of its information about coal development as it affects the environment of North Dakota.

During my first examination of the draft document, my reaction was surprise at both the breadth and the depth of the Study. I was equally impressed by the magnitude and the quality of the reporting document, particularly for a draft version. Continuing examination did not reduce my admiration for the study and its reporting document. I cannot imagine a more suitable assessment being performed within reasonable time limitations, available funds, and existing base-line data for the regional environment.

I have not reviewed all parts of the draft document with equal depth. I examined each page in an exploratory manner. I read the first eight chapters, with special attention to Chapters Two, Three, and Seven. I examined all the maps critically. I have chosen not to submit a lengthy critical review of the text. Instead, I have concentrated upon an evaluation of the maps in the draft document. I would like to describe my general reaction to the text as one of admiration for the information conveyed and the style of reporting, tempered by annoyance at the repetition encountered by articles reporting Level One effects, Level Two effects, Level Three effects, and Coal Study Area effects. If an editorial decision had been made to report the effects of each variable in separate articles for each level of development, repetition was programmed into the report.

As I report upon my critical evaluation of the maps in the draft document, remember that my viewpoint is essentially that of a consumer of the information that the maps attempt to report. From that viewpoint the maps are useful if they report information clearly, and defective if they conceal information. I found a total of thirty two maps to be defective in eight different ways. The eight different types of defects will be explained first. Next the thirty two defective maps will be listed. The defects found on each map will be identified by code numbers which refer to the eight numbered statements of defects.

1. The colors used on certain maps were not identified in the legends of those maps. The most common color omitted from the legend was blue for surface water features. Since that use of blue was explained in some legends, one wonders why it was omitted from other legends. Another color commonly omitted from a legend was the background color of a base map. Absence of the background color from the legend tends to confuse the reader of the map. Some maps had colors missing from the legend for no apparent reason. Eighteen maps had colors not identified in their legends.
2. Similar colors used on certain maps obscured data that could have been clarified by contrasting colors. Colors similar in hue and intensity were difficult to distinguish on the maps. Colors with the same hue and different intensities were even more difficult to distinguish. Selection of contrasting colors, such as those on Map 2-11, would have clarified map data for the reader. Seventeen maps had this defect.
3. Map colors were difficult to match with unnecessarily small blocks of color in most map legends. This defect was aggravated by the use of similar colors on the same maps. It could be alleviated by using contrasting colors. Twenty three maps had this defect.
4. Data on certain maps were obscured by excessive detail on the base map. Shaded relief on a base map tended to obscure linear data on these maps. Three maps had this defect.
5. Certain maps printed in black and white needed colors to clarify data. Five maps had this defect.
6. Imperfect registration occurred during the printing of certain multicolor maps. Sixteen maps had this defect.
7. Colors were listed in misleading order in the legends of certain maps. Maps reporting areas that have the same property in different amounts should have listed the colors in a logical order in the legend. This error was aggravated by the selection of pale colors for extremes of the property and intense color for a moderate amount of the property. Three maps had this defect.
8. Certain shaded single color maps were printed with pale colors. More intense colors produced by darker shading would have clarified the data on these maps. Two maps had this defect.

MAP NUMBER	DEFECTS OBSERVED
1-9	4 5
2-9	1 2 3 6
2-10	3 6
2-11	1 3 6
2-11A	1 2 3 6
2-12	1 2 3 6
2-13	3 7
2-14	2 3 7
2-15	2 3 7
2-17	5
2-18	1 3 6
2-19	5 6
2-20	1 2 3
2-21	2 3
2-37	1
2-39	1 2 3 6
2-41	1 2 3
2-42	1 2 3 6
2-43	2 3 6
2-46	1 2 3 6
2-47	1 5
2-49	1 4
2-50	1 2 3 6
2-51	2 3 6
2-52	1 4 5
3-7	2 3
3-24	3 6
3-25	1 2 3
3-27	1 3 6
3-36	8
3-37	8
5-1	1 2 3 6

An example may clarify the interpretation of the table of map defects. Map 1-9 is followed by the code numbers 4 and 5. The code numbers refer to the eight numbered statements of map defects. Map 1-9 had data obscured by excessive detail on the base map. Map 1-9 was printed in black and white and needed colors to clarify the data which it reported.

In closing, I reaffirm my basic admiration for the draft document. I respectfully submit my critical evaluation of its maps with the hope that it may be of assistance in evaluation of the draft document.

Sincerely,

Gary L. Anderson

Gary L. Anderson

RESPONSE TO ANDERSON LETTER

#6

We were definitely dissatisfied with some of our color maps which were printed separately from the main document. However, the difficulties of keeping colors constant, registration perfect, densities correct, and printing square with the paper, are such that even in the best printing jobs there are some imperfections. Registration is extremely important, because for every color, an additional plate is required. If there are 17 colors on a map, there must be 17 preparation plates, and each must register. Placing lettering on one plate so that it will not interfere with another plate is also very difficult. The biggest mapping problem in the printing of the Draft Study involved color separation. Separations were not kept to a 1:1 ratio, were distorted, were out of focus, and the colors did not match. There are also a few areas where the black shade relief covers up other information. The shaded relief is air brushed, which is similar to a screen. It is very difficult to again screen into other colors because of our color printing method limitations.

Other problems which we recognized, or which were commented upon, include the following:

1. Many of the colors could have been in greater contrast for easier identification. The original maps had more contrasting colors, but much of this was lost during color separation.

2. In many cases, the legend color blocks could have been larger.

3. Water is not normally identified in the legend unless confusing.

4. We now recognize that zipatones should not be photographed prior to printing.

5. Color would have been more appropriate even on some of the small black and white maps.

We are very aware of aspects of some of the maps which made them less readable than they should have been. (Also see Part 1.) This is in part reflective of the fact that the North Dakota Study was a pilot effort for a single peel coat mapping process using computer scanner color separation to create color negatives for printing. This pilot process was coupled with the normal difficulties caused by establishing new base maps, mapping information previously unmapped, the gathering of information by over 50 specialists located in a five-state area, and consequent problems with obtaining consistent, timely review and clearance of all maps. Some changes have been overprinted on several maps, and the Subsurface Ownership map is being redone as a separate federal/state project. We trust that other problems with the maps can be overcome, since the information itself is essentially correct. We are now using different mapping processes to make it easier to obtain quality control before printing.

John R. Fredericks
715 N. 42 St. 208B
Grand Forks, N.D.

West-Central North Dakota
Regional Environmental Impact Study
Suite 2, Capitol Place
1533 North Twelfth St.
Bismark, N.D. 58501

Dear Sirs,

As a graduate student in Geography at the University of North Dakota I have had the opportunity to review the Draft West-Central North Dakota Regional Environmental Impact Study. It is an impressive collection and analysis of data of the study area and it will undoubtedly serve as an invaluable reference for future study groups as well as students and educators. However, the need for criticism of a study of this magnitude is critical in order to insure that the final published study is as accurate and presentable as possible. I, therefore, respectfully submit the following comments and criticisms.

John R Fredericks

John R. Fredericks

RESPONSE TO FREDERICKS LETTER

#7

See response #6.

#8

In the Introduction to the Draft Study, the availability of Technical Supplements is explained. The purpose of the Technical Supplements was to keep the basic document to a more manageable size, to provide additional detailed information which was used in the analyses, and to provide technical explanations of study methodologies. The reason for not including the Air Quality Technical Supplement in the list of references of the Draft Study is that the Technical Supplements are a part of the total study, as mentioned on page i. We would have preferred to refrain from the use of Technical Supplements; however, the document would have become totally unwieldy had the Technical Supplements for Climate and Air Quality, Economic and Social Conditions, Land Use, and Fort Berthold all been included in the primary study document.

#9

Early public involvement indicated that because of some unique interests, the State of North Dakota and Fort Berthold representatives wanted separate sections on the Fort Berthold Reservation. Each of the seven counties had enough projects and analysis to easily be found even though integrated. Fort Berthold, however, had no federal coal nor any proposed projects, and it would have been difficult to find Fort Berthold information if integrated with the seven counties. Federal coal areas were required as a seperate section so that the Department of the Interior could determine if there were any problems which applied only to federal actions.

This analysis is primarily concerned with Chapter 2: Description of the Environment, although some comments pertain to the entire draft. 7
The use of tables, maps, and figures is well coordinated and generally well presented. However, there are inadequacies in many of the maps, several tables are confusing and not well explained in the associated descriptions, and there is quite a bit of duplication of information between many of the sections.
Many of the full page color maps are of poor quality. The colors used in the maps and legends are too bland - the color shadings often do not provide the contrast necessary to compare the legend to the map. Examples are: Map 2-50 with its two yellow colors, Map 2-46with the greys and blues, and Map 2-39 is a nightmare of unmatchable tones due to overlapping. This problem on Map 2-39 can best be solved by using individual overlays rather than trying to present the information on a single map. Also many maps contain too much information to be reasonably presented on a single map such as Map2-39 and Map 2-51. Larger scale maps of individual counties may help this deficiency in certain cases. When small sections are used on the maps as in Map 2-50 and Map 2-51 the coloring is often off center and this same comment applies to many of the map legends. The legend of Map 2-21 is so blurred as to be almost useless while the reproduction of Map 2-38 is extremely poor and Map 2-8 is too small for its purpose of showing shaded relief and physical features.
Since each section of the descriptions mentions the Federal Coal Study Areas small inset maps showing the effects on these areas would be appropriate. These maps should be similar to those insets showing Level 1 and Level 2 projects. i.e. Maps 2-23, 2-24, 2-25 etc.
There are three different base maps used for the full page color maps in Chapter 2. They are a county line map, a county line and drainage system map, and a relief map. These three base maps seem to be used indiscriminately. Why is a relief base used for Maps 2-36 and 2-37? Why are rivers shown on Map 2-11, but not on Map 2-9? Base map information should be more uniformly applied throughout the entire draft.
Table 2-1 is extremely confusing and not well explained in the description. The major difficulty is determining the use of the data under the heading " Climatic Elements Included (percent of total)." 8
The section descriptions are generally well written and informative. However, on pages 28, 29, and 31 the reader is told to "refer to the keyword index of the Climate and Air Quality Technical Supplement." This supplement is not included with the draft nor is it mentioned in Chapter 9 or the list of references. 9
The outline format used for the Contents is an aid in finding desired information, however, strict adherence to this format, especially in Chapter 2, seems to promote a duplication of information between sections. In many cases the entire sections for both Federal Coal Study Areas and Fort Berthold state that the information found in those two sections was previously covered in another section. Also, why is Fort Berthold Singled out when individual counties are not?

John R Fredericks

United States Department of the Interior

NATIONAL PARK SERVICE
ROCKY MOUNTAIN REGIONAL OFFICE
655 Parfet Street
P.O. Box 25287
Denver, Colorado 80225

IN REPLY REFER TO:
L7621 (RMR)PC

MAY 5 1978

Memorandum

To: State Director, Bureau of Land Management, Billings, Montana

From: Acting Regional Director, Rocky Mountain Region

Subject: Review of Draft Regional Environmental Impact Study on Energy Development, West-Central North Dakota

We have reviewed the subject study and offer the following comments on a technical assistance basis.

The National Park Service is intent on preserving a segment of our cultural past at the Knife River Indian Villages National Historic Site and would like to have the historic scene remain as unaltered as possible. The study lists earthlodge villages and campsites as known prehistoric sites that may be adversely impacted; no mention is made of Knife River Indian Villages National Historic Site which is listed on the National Register of Historic Places. Since Knife River Indian Villages National Historic Site is a National Register property, appropriate procedures (page 114) will need to be implemented to mitigate any adverse impacts. We hope that any adverse impacts on Knife River Indian Villages with regard to strip mining (page 45), visual aesthetics (pages 55-56), air quality (pages 68-79), Knife River stream flow (page 89), and archeological sites (pages 114-115) can be avoided. 10

We feel it is unfortunate that the Knife River Historic Site was overlooked in almost all segments of this study. Maps numbered 2-37 (prehistoric sites), 2-41 (visual management classes), and 2-50 (surface ownership) should designate the historic site location.

We were reassured of North Dakota's commitment to a healthy environment by mentioning of the Clean Air Act Amendments (addendum to draft dated March 9, 1978) and the Reclamation guidelines (page 160). These are sound policies but we feel strict enforcement is the real key to their effectiveness.

Thank you for the opportunity to respond on this study.

Glen T Bean

Glen T. Bean

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

RESPONSE TO NATIONAL PARK SERVICE LETTER

#10

The abbreviated analysis of the effect on the Knife River Indian Villages National Historic Site was not intentional. Originally, a site-specific environmental statement on the Glenharold Mine was scheduled to be released with the Draft Study. This Level 1 project would be the only definitely planned activity to affect the Knife River Indian Villages National Historic Site. Although no actual site-disturbing activities would impact the National Historic Site, visual alterations in its setting would occur. The following passages paraphrase the analysis in the unpublished Draft Glenharold Environmental Statement.

The Glenharold Mine is visible to a significant stretch of the Missouri River bottomlands. The remaining free-flowing Missouri River in North Dakota from Garrison Dam to the upper end of Oahe Reservoir, a few miles south of Bismarck, contains much of the remaining evidence of late prehistoric and early historic activity along the Missouri River in central North Dakota.

The portion of the Glenharold project area in the Missouri Breaks, which is adjacent to the bottomlands, can be seen from a number of features which are significant from both the prehistoric and historic point of view. These include the four earthlodge villages comprising the Knife River Indian Village National Historic Site: Sakakawea (32ME11), Lower Hidatsa (32ME10), Big Hidatsa (32ME12), and Buchfink (32ME4). The visible area also includes a state historic site, Fort Clark (32ME2).

Visual impacts would be imposed on the prehistory of these five earthlodge villages. If further mining occurs in the Missouri Breaks, it would continue destruction of the original context of the prehistoric farming villages found along the terraces above the Missouri River flood plain including the Knife River Indian Villages National Historic Site and Fort Clark. The way of life in these villages included farming in the valley and use of the wild plants and animals in the surrounding breaks. Because this portion of the valley contains the only remaining stretch of the Missouri River not inundated in North Dakota, mining activity would visually destroy one of the major places where such a context could be preserved.

Secondary impacts resulting in degradation of the visual context of the Knife River Indian Villages National Historic Site and Fort Clark could be partially mitigated through complete restoration of original contours and vegetative communities following mining.

The Knife River Indian Villages National Historic Site was not specifically addressed in terms of air quality or visual aesthetics. Air quality review of this area was included in the assessment of air quality impacts in the Stanton vicinity. As stated on pages 149, 150, and 151 of the Draft Study, the impacts upon air quality in the seven-county study area, as a result of the proposed industrial developments, would not be significant. The maximum air quality impact area is in Mercer and Oliver Counties, within about 8 miles of Beulah, and no perceptible adverse changes in the environment of the Beulah area are expected to occur.

The air quality effects on the Knife River Indian Villages National Historic Site are expected to be minimal as a result of the proposed action which the Draft Study addresses. Further, as is indicated in Part 1, Climate and Air Quality, a number of events have occurred which would further reduce the air quality impacts upon this historic site. Specifically, the 1977 Amendments to the Clean Air Act resulted in additional emissions limitations for sulfur dioxide from proposed projects in the study area. This emission reduction will also be reflected in a reduced predicted ground level concentration of sulfur dioxide.

Visual aesthetics questions have been closely tied to the particulate loading in the ambient (outdoor) air. The U.S. Environmental Protection Agency (EPA) has provided some guidance in the assessment of impacts on visibility from emission sources which come under the provisions of the Prevention of Significant Deterioration Regulations. This guidance is in order to fulfill the requirements established by the 1977 Clean Air Act Amendments. The methodology utilized is that described in the EPA document "Air Quality Criteria for Particulate Matter." The percent reduction in visibility, as a result of proposed new sources, is ascertained by comparing the visible range existing prior to the proposed plants (background) with the visible range after the operation of these facilities. Visual range is related to the annual ground level concentration of particulate matter.

Air sampling by the North Dakota State Department of Health has indicated that the background ground level concentration, for particulate matter in the vicinity of Stanton has a maximum annual ground level concentration of 25.1 micrograms per cubic meter. This, according to the above EPA document, would establish a visible range of 60 miles. EPA suggests that a reduction in visible range of less than 10% of the background visible range is considered to be within acceptable limits. This 10% factor is being used until EPA has finalized the visibility guidelines. On Map 3-1, page 80 of the Draft Study, a projected annual suspended particulate concentration increase due to the major existing and proposed sources indicates a value on the order of 0.6 micrograms per cubic meter in the vicinity of the Knife River Indian Villages National Historic Site. Although Map 3-1 presents both existing point sources (which contribute to the current background), the addition of 0.6 micrograms per cubic meter to a background of 25.1 micrograms per cubic meter would result in a reduction of approximately 1.4 miles in an equivalent visual range. This visual range reduction of 1.4 miles is approximately 2% of the background visual range and, hence, would be acceptable.

The subject of Knife River streamflow is discussed on page 98 of the Draft Study. Lowered flow would amount to about 0.3% of the average annual runoff. As the mines and plants would be operating on a relatively continuous basis, the decrease in streamflow would presumably be uniform and, except for times of extreme low flow in the normal cyclic pattern, would be unnoticed at Knife River Indian Villages.

The Knife River Historic Site should be added to Map 2-42 (see Part 1, Recreation).

United States Department of the Interior

BUREAU OF RECLAMATION
Upper Missouri Region
P.O. Box 2553
Billings, Montana 59103

IN REPLY REFER TO: 160

MAY 1 - 1978

Memorandum

To: State Director, Bureau of Land Management, Billings, Montana

From: Regional Director, Bureau of Reclamation, Billings, Montana

Subject: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development

The draft is the product of a tremendous effort which we are sure you are happy to have completed. The study contains a wealth of reference data. Unfortunately the dimensions of the document make it difficult to file for future use. If a final study is issued we believe you will wish to take the following points into consideration.

Map 1-1 appears to show a gasification plant at the Coyote 1 site. We believe a powerplant is proposed for that location. Also, the words "Synthetic Natural" appear along the ANG pipeline north of Garrison; "SNG" or "Synthetic Natural Gas" would be more explanatory. 11

Page 1 - The ANG Final Environmental Impact Statement was filed with EPA on January 20, 1978.

Page 6 - The different values on this page regarding average daily and average annual production of SNG could be confusing to the reader. The first paragraph talks about 275 MMcf/d average daily production but below Figure 1-10 a cumulative average annual daily production of 500 MMcf/d is discussed, or 250 MMcf/d for two plants. Only the footnote to Figure 1-9 clarifies that the 275 MMcf/d value applies only for 332 operating days per year.

Page 6 - It is not clear which powerplant the coal fines would be sent to. ANG proposes selling their coal fines to the Basin Electric powerplant but the fate of NGPL's coal fines is unknown.

Page 7 - The gaseous emissions for the ANG plant in Table 1-3 appear low, apparently because only one source of emissions is shown. Total projected emissions of all sources (as of late 1977) for the ANG EIS were:

Particulates	265 lbs/hr
SO_2	2,825 lbs/hr
NO_x	1,100 lbs/hr

All sources of emission should be given so that total gaseous emissions can be considered in Chapter 3. Regarding Footnote 2 of Table 1-3, we believe ANG proposes to use a gaseous boiler fuel also.

Page 7 - An explanation of why the power needs of two very similar plants vary so much (160 MW for ANG versus 110 MW for NGPL) would be useful.

Page 8 - It should be pointed out that of the 350 MW of electrical power to be used in North Dakota nearly half (160 MW) would be used by ANG to produce SNG for export.

Page 9 - The emissions in Table 1-5 for the Basin Electric powerplant are lower than those used for the same facility in the ANG EIS which were:

Particulates	424 lbs/hr
SO_2	11,832 lbs/hr
NO_x	4,934 lbs/hr

The differences should be explained.

Page 33 - Figure 2-5 would be more useful if general depths of the various sedimentary formations were given. 12

Map 2-20 - The mined and reclaimed lands are difficult to pick out on this map. More distinctive or contrasting colors for these ground cover types would help. 13

Page 44 - Type 2 wetlands also occur in the seven-county study area. 14

Page 74 - Much of the information in the Land Use section duplicates data previously presented in the Vegetation section. These sections could be shortened by removing the discussion on land use from the Vegetation section and the discussion of vegetation from the Land Use section. 15

2

Page 109 - The publication cited (Stout and Cornwell 1976) does not support the conclusion that several hundred waterfowl would be killed annually by 665 miles of new and upgraded transmission lines. That study reported a Nation-wide mortality of 1,487 waterfowl due to collisions with telephone and powerlines from 1963-1965. Since there are approximately 750,000 miles of powerlines in the United States, this mortality would average .002 birds per mile of powerline, over 3 years, and not even taking into account telephone lines. .This calculates out to a 3-year total loss of 1.3 waterfowl for 665 new miles of powerline. There is no reason to believe an "upgraded" powerline would necessarily be more lethal than the line it replaced.

Page 110 - The ANG intake site has been surveyed for fish nursery areas and none were located.

Page 111 - The discussion of impacts on endangered species paints an unnecessarily alarming picture. The circumstances surrounding the average annual loss of Japanese cranes, cited in support of the conclusion that whooping cranes might collide with powerlines, are far different from those to be encountered in North Dakota by migrating whoopers. We understand virtually the entire Japanese crane population concentrates in an area of a few hundred acres surrounded by powerlines for several months. Also, powerlines of the size which will serve the new facilities are unlikely to present an electrical hazard to bald eagles. The space between conductors on high voltage lines far exceeds an eagle's wing span making electrocution most unlikely.

L. W.

cc: Director, Office of Environmental Project Review, Office of the Secretary, Department of the Interior, Washington, D.C. 20240
Commissioner, Attention: 150

Map 2-49 - The map does not show any proposed gas pipeline associated with the NGPL gasification plant. 16

Page 79 - Some information on the effects of large scale gaseous emissions on climate is available and should be discussed under Climate. We understand that the particulate emission rate from the ANG plant would be 265 lbs/hr, not 170 lbs/hr as shown in Table 3-1. The assumption of 325 operating days for gasification plants should be justified, as Chapter 1 says a plant would operate 332 days a year. In this case, yearly emissions for ANG would total 677 tons using the 170 lbs/hr value or 1,056 tons for the 265 lbs/hr value used in the ANG FES (Data used in the ANG FES came from ANG). 17

Page 80 - The Air Quality Dispersion Analysis performed by ANG for their FES calculated maximum TSP ground level concentrations of 2.4 mg/m^3 (annual) and 23.6 mg/m^3 (24-hour) for their proposed plant and the Basin Electric powerplant alone. This study claims maximum levels of 2.0 mg/m^3 (annual) and 5.3 mg/m^3 (24-hour) for all Level 1 projects. The reasons for the disparities between the two analyses should be explained.

Page 82 - The same comments above regarding particulates also apply to SO_2 and NO_x. For example, data provided us by ANG showed maximum SO_2 concentrations of 6.7 mg/m^3 (annual) and 481.3 mg/m^3 (24-hour) for the ANG and Basin Electric plants. Comparable values for this study are 3.1 mg/m^3 (annual) and 280.4 mg/m^3 (24-hour), thus significantly underestimating effects as even the companies see them. This study did not appear to use a reasonable number of operating days for gasification plants, nor did it take into account all sources of emissions in calculating air quality concentrations. These matters should be considered in the final study. The study does not appear to include air quality effects from associated growth in the analysis.

Page 97 - The ANG Coal Gasification Plant would not use water from Lake Sakakawea for generation of electric power. Basin Electric Antelope plant would. 18

Page 108 - The Animals section should contain a discussion on the impact of land use changes on wildlife. Current North Dakota law allows landowners to require their land to be reclaimed for a post-mining use different than the current use. It seems likely that many current grassland areas would be reclaimed to cropland uses, thus lowering the overall habitat base for wildlife. This concept should also be discussed in the various wildlife sections (e.g., big game) noting that even with successful reclamation post-mining wildlife populations would be reduced from current levels. 19

3

RESPONSE TO BUREAU OF RECLAMATION LETTER

#11

Map 1-1 of the Draft Study incorrectly displays the Coyote 1 facility as a gasification plant. The symbol for Coyote 1 should be an electric power plant. Also, the explanation of the pipeline north of Garrison, North Dakota, should read Synthetic Natural Gas.

On page one of the Draft Study, the reference in the third column to the ANG Environmental Statement should show that the Bureau of Reclamation's ANG Final Environmental Impact Statement was completed in January 1978 rather than in 1977.

In the first column of page 6 of the Draft Study, reference is made to an average daily production of synthetic natural gas for one plant of 275 million cubic feet and 500 million cubic feet per day average annual production of synthetic natural gas for two plants. For clarification purposes, the 275 million cubic feet is considered to be the average production of synthetic natural gas each day for a period of 332 days. The 332 days are considered the number of days each year that the gasification plant would actually be producing synthetic natural gas. The 500 million cubic feet is the average production of synthetic natural gas each day for two plants covering a period of one year (365 days). In actuality, if the 275 million cubic feet is multiplied by two for two plants, we would have 550 million cubic feet of synthetic natural gas each day for 332 days. However, if the 550 million cubic feet were to be averaged over 365 days or one year, we would then show 500 million cubic feet of synthetic natural gas being produced each day for one year.

The Natural Gas Pipeline Company project proposes to use most of the coal fines in their own boilers for steam generation. The fines that are left would be sold; however, the market for these fines has not been established.

The information presented in Table 1-3, page 7, is the latest data available from the company and which had been supplied to the North Dakota State Department of Health as their company's application for the Permit to Construct. This permit is required prior to construction. Before the Department of Health grants any permit, a rigorous review is undertaken, including facility emissions, engineering processes and control technology. The information presented in the Draft Study was taken from the Permit to Construct and subsequently used in the analysis of the ANG plant. The footnote regarding the use of liquid boiler fuel is also part of the information supplied to the Department of Health for the Permit to Construct reflecting the latest available data.

The variation in the power requirements is primarily that the NGPL plant is designed to power the oxygen plant totally by steam turbine prime movers while the oxygen plant for the ANG facility is powered electrically. Also, the ANG facility uses large electric motors in some of their other process areas where NGPL's design used steam driven turbines.

Of the 350 megawatts of power scheduled to be used within North Dakota as stated in column 2 of page 8, 160 megawatts will be used by ANG to produce synthetic natural gas for export.

The emission data in Table 1-5 for Basin Electric Power Plant was taken from data supplied by Basin Electric Power Cooperative in their application for Permit to Construct. Since the publication of the Draft Study, revisions were made to take into account the Clean Air Act Amendments of 1977. The following is a tabulation of the emissions currently being used to reflect the 1977 Amendments:

Antelope Valley Emissions (lbs./hr.):[1,2]

TSP	420
SO_2	3845
NO^*_x	4930

1/ Two 440 megawatt units
2/ TSP and NO_x are maximum allowable as per New Source Performance Standards

#12

Generalized columnar sections usually do not show depth since the conclusions derived from such information might be more misleading than useful. Figure 3 page 40, is a generalized cross-section of geological formations showing elevations above sea level that would be more useful than showing depths on a generalized columnar section.

#13

See response #6.

#14

Type II wetlands do occur within the study area; however, this type is classified as "inland fresh meadows." They are intermittent and could not be identified from infrared photography. Refer to Shaw and Fredine 1956 for a description of this wetland type.

#15

The duplication between the land use section and the vegetation section is unavoidable. It is unrealistic to completely separate them and still attempt to present a comprehensive assessment of the proposed actions.

#16

The proposed gas pipeline is mistakenly represented on Map 2-19 in blue as a 30-inch proposed water pipeline. The pipeline should be gold and would connect with the proposed Northern Border Pipeline, which should also be shown.

#17

Some information on the effects of large scale gaseous emissions on climate is available; however, the sources that were consulted indicated speculative conclusions and gave only possible hypothesis. To our knowledge, no climatic modifications studies related to energy development have been completed in this area of the country nor are any study results expected in the near future. The Climate and Air Quality Technical Supplement to the Draft Study did discuss climate modifications concerning acid rain questions; however, further information on acid rainfall is presented under "Air Pollution Effects," Climate and Air Quality, Part 1.

There is a disparity between the operating days for gasification plants as indicated in Chapter 1 (332 days/year as indicated on page 19), and the correct number of operating days should be 352 days/year. This would have a bearing on the emissions in terms of tons/year; however, the air quality effects modeling work was based on worst-case emissions. A worst-case analysis of emissions means that the modeling used continuous emissions at the maximum emission rate. This worst-case analysis was performed for all of the averaging times mentioned in the Draft Study, including the annual, 24-hour, 3-hour, and 1-hour averaging times.

We assume in the reference to pages 80 and 82 that the concentration units are micrograms per cubic meter instead of milligrams per cubic meter units. A milligram is 1,000 micrograms. Apparently this was a typographical error. The correct units should be micrograms per cubic meter as was indicated throughout the Draft Study.

Concerning the disparities between the analysis performed by American Natural Gas for preparation of their Final Environmental Statement and the modeling analysis as performed in this Draft Study; simply stated, this disparity is due to the fact that the Draft Study information was more current in terms of expected emissions and subsequent ground level concentrations than that which the Bureau of Reclamation had received earlier.

It has been our experience that by the time an environmental impact statement is published, a number of things can occur, including additional design considerations or events such as passage of the Clean Air Act Amendments of 1977. The Clean Air Act Amendments of 1977, with the designation of Class I areas in the state, have had a dramatic impact upon the emissions of sulfur dioxide. This is discussed more in depth in Climate and Air Quality, Part 1.

#18

The sentence on page 97 of the Draft Study should be changed to read: "The Antelope Valley Power Plant would use water from the lake for generation of electric power."

#19

The potential impact of land use decisions on wildlife is mentioned on:

Page 108, column 1, paragraph 5
Page 174, column 1, paragraph 2
column 3, 6th full paragraph
column 4, 4th full paragraph
Page 183, paragraph spanning columns 3 and 4
column 4, 5th full paragraph
Page 189, column 1, last paragraph
column 2, first paragraph
column 2, paragraph 4

However, an expanded discussion of this subject is also included in Animals, Part 1.

The use of a nationwide study such a Stout and Cornwell (1976) to support a localized statement that several hundred waterfowl would be killed annually in a specific area by new or upgraded transmission lines is questionable. There are several references geographically closer to the mercer-county study area and more specific to birds and wire collisions, which more effectively support the statement (Anderson 1978, Fish and Wildlife Service 1978, Krapu 1974, McKenzie 1972, McKenna and Allard 1976, and Weir 1972). These references suggest that the estimate of several hundred waterfowl killed by wires annually is actually low. (Also, the reported mortality of 1,487 waterfowl due to collisions is the number reported in the literature over a period of 34 years, not actual mortality from 1963-65. Only a small percentage of such fatalities are observed and even fewer are reported.)

The comment that an "upgraded" power line would not necessarily be more lethal than the line it replaced is valid, assuming, as is the case for the Level 1 projects (Kaiser 1978, personal communication), that "upgrading" means increasing slightly the diameter of the cables but not increasing the number of cables. Therefore, the increased hazard to waterfowl is from 424 miles of new transmission lines (page 10, column 2, paragraph 1)--not 665 miles of lines--plus an unknown number of miles of electric distribution lines, most of which would be located outside the study area in the vicinity of the ultimate consumers of the energy produced (Kaiser 1978, personal communication).

Fish surveys in Benner Bay, the area of the ANG intake site, produced 25 species of fish, size and species distribution being comparable to test netting results in Lake Sakakawea by the North Dakota Department of Game and Fish for preceding years (Woodward-Clyde Consultants 1975). The above reference seems to indicate that Benner Bay is not an important fish nursery area. Although "carp were observed spawning in Benner Bay from early June to mid August" and "eggs of another species, probably Notropis sp., were observed attached to aquatic vegetation in shallow water . . . larvae fish were not collected with the 0.5-meter net or the otter trawl" (Woodward-Clyde Consultants 1975).

We cannot agree that the discussion on endangered species (page 111, column 1) "paints an unnecessarily alarming picture." The first sentence states, "There could be adverse impacts on individual threatened and endangered species, and the loss of even one threatened and endangered animal would be significant." For each of the six species addressed, we concluded the following:

Black-footed ferret - "May no longer occur"
"Level 1 siting and construction would not directly affect any known prairie dog town."

Whooping crane - "Most likely to be impacted"
"No wetlands known to be used by migrating cranes would be disturbed under Level 1."
"An increase in human population increases the possibility that cranes would be shot or disturbed."
"An increase in power transmission lines under Level 1 increases the chance of wire collision by these birds."

Bald eagle - "New power transmission poles increase chances of electrocution."

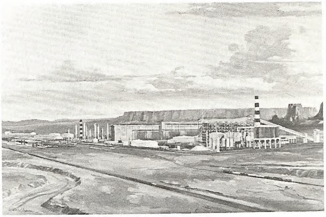
Peregrine falcon - "It is likely that they would not be impacted by the proposed (Level 1) actions."

Kit fox (swift) fox - "Potential impacts are not likely."

Eskimo curlew - "Potential impacts are not likely."

We agree that it could be arguable to refer to Japanese cranes in order to show cause for our concern regarding wire collisions. However, the many wire strikes by various bird species documented by Anderson (1978), Fish and Wildlife Service (1978), Krapu (1974), McEnroe (1972), McKenna and Allard (1976), and Weir (1972) adequately support our view.

The comment on the lack of electrocution hazard to eagles from most of the power transmission lines that will serve the Level 1 facilities is correct. Lines of 69 kilovolt and above are not an electrocution hazard to eagles (Olendorffe 1978, personal communication). Except for an unknown number of smaller distribution lines, most of which would be outside the seven-county study area near the ultimate consumers of the energy produced (Kaiser 1978, personal communication), the only transmission line that would present an electrocution hazard to eagles or any other birds is the 41.6 kilovolt line from the NGPL plant site to Lake Sakakawea (Map 1-6). However, the applicant has committed to make this line "electrocution proof" for raptors.



RESPONSE TO WESCO LETTER

#20
The correct source for Figure 1-6, page 4, should be Western Gasification Company 1978. This change is now noted in Part 1.

WESCO

Edward L. Irwin, Manager of Administration

May 17, 1978

West-Central North Dakota
Regional Environmental Impact Study
Suite 2 Capitol Place
1533 North Twelfth Street
Bismarck, North Dakota 58501

Gentlemen:

You should be aware that the "Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development" contains an artist's conception of a coal gasification plant on page four, where proper credit has not been given. This same illustration appears on page five of the summary and is incorrectly labeled. 20

The reproduction which you have used is actually from the oil commissioned by Western Gasification Company (WESCO) in 1973 to depict our plant which will be constructed in northwest New Mexico on the Navajo Indian Reservation. It appeared in our Draft EIS filed with CEQ November 1974 and again in our final EIS filed January 1976.

The picture next appeared on the cover of the ANG Coal Gasification Company Draft EIS filed March 1977 and on the cover of their final EIS filed January 1978. It has now appeared in a somewhat altered form in your draft regional study labeled in the summary as the "NGPL Coal Gasification Plant" and in the full statement as "Source: Natural Gas Pipeline Company of America 1977".

I am enclosing a reproduction of our original oil if you wish to use the illustration in your final document. Proper credit, however, should be given to the WESCO project.

E. L. Irwin

ELI:gha
Enclosure

Western Gasification Company
810 South Flower Street, Los Angeles, California 90017
P. O. Box 30155 Terminal Annex, Los Angeles, California 90030

SWC NORTH DAKOTA STATE WATER COMMISSION
900 east boulevard
701-224-2750
bismarck 58505
north dakota

May 18, 1978

Dr. Gary Johnson
Governor's Executive Offices
State Capitol Building
Bismarck, North Dakota 58501

Dear Dr. Johnson:

As I indicated to you in our recent telephone conversation, I will not be in the state for this coming month and will therefore miss the hearings on the draft of the West Central Regional Environmental Impact Statement. In spite of feelings of futility about the effectiveness of expressing my views, you urged me to write this letter, which will have to serve as my testimony.

As a decision-making tool, the study is deficient in several significant ways; therefore, should not be used in that way, but only as a repository for certain information.

First of all, I and others I know in western North Dakota spent a good deal of valuable time interviewing with members of the task force, with the promise that our concerns will be seriously addressed in the study. I feel I was led down the proverbial primrose path, because my concerns have been passed over lightly. Others have reported to me the same disappointment.

My concerns briefly were:

1. Impact of air and water pollution on health with special attention to trace elements.
2. The QUANTIFICATION of detrimental effects on water, air and land.
3. The economic recognition that reclamation of sodic, claypan soils of the study area cannot be achieved in three to five years if ever.

1. HEALTH IMPACTS 21

What is more important than human health? Yet, the study breezes over The subject giving it only surface treatment. There is no effort at all to quantify the physical illnesses that will be directly related to stress. Yet, the effect of energy development on the health of North Dakotans is a serious enough subject so that it was discussed for three days at the

GOVERNOR ARTHUR A. LINK, Chairman — ALVIN A. KRAMER, Minot — ARTHUR J. LANZ, Devils Lake — MYRON JUST, EX-OFFICIO MEMBER, Comm. of Agriculture
RICHARD P. GALLAGHER, Vice Chairman-Mandan — GORDON K. GRAY, Valley City — ARLENE WILHELM, Dickinson — VERNON FAHY, Secretary & State Engineer

Annual Public Health Conference in Bismarck during April. I am enclosing papers distributed at that conference, which contain material that should be added to this study. There are more, but I do not have copies in my possession.

Regarding the effects of air pollution on health, there is only one sentence in the entire study which deals with it. It states; "This study has not analyzed impacts on human health from emissions at levels below established state and federal standards." I would like to point out that this study does not analyze impact from emissions at all! Why not? There could have been at least some reference to the myriads of studies and articles that exist pointing out the health hazards from radioactive atoms and heavy metals contained in western coal. (See enclosed articles).

On July 10, 1977 in a "Meet The Press" interview, James Schlesinger of the Department of Energy indicated he was confident of the New York Times that he feels it is safer for his own family to live near a nuclear plant that a coal fired plant. This statement after Mr. Gowen pointed out that there are 21,000 people who die prematurely every year east of the Mississippi from the release of pollutants exhausted by coal burning plants, and that this would increase to 32,000 even if scrubbers are used.

Certainly, health effects are insidious and difficult to quantify, but that doesn't mean we should close our eyes to them. North Dakota now has the lowest death rate of all the states because of its very low cancer rate. How is that going to change when the countryside is dotted with coal plants?

The 23d West Regional Study on "Trace Element effects of Energy Conversion Facilities" is tasked onto the study on an addendum (Placed in the back of an additional book not readily available to the public).

This section alludes to the potential long-term effects of trace element emissions and lists excerpt after excerpt of studies showing damage to humans, plants and animals from trace element emissions. Yet, neither in the summary or the draft even mentions the subject! There is also no mention of the fact that there are no federal standards set for trace element emissions, nor are there North Dakota standards.

2. QUANTIFICATION OF DETRIMENTAL EFFECTS

It is time legitimate studies on environmental impact stop ignoring factors difficult to quantify simply because they have been heretofore unquantified. We must come to grips with them. I am enclosing a paper on this subject of a systems approach, which supports examination of all problem areas, including those which are difficult.

This leads me to my next concern, the necessity of developing systems to quantify in some way (not necessarily in dollar terms) the effects of damage to air, water and land as well as health.

"One of the most significant results of the numerous pollution controversies in recent years has been the bookkeeping that forces internalization of previously unrecognized cost items which had been left for the general public to pay." Excerpt from January, 1977 Contents, a University of North Dakota publication.

I would sincerely appreciate your addressing these concerns. However, since there are no additional funds available for the study, I am greatly concerned that these areas cannot be addressed and that my raising them is indeed futile unless it documents the fact that the study should not be used exclusively for making future decisions regarding coal development in western North Dakota.

Cordially,

Arlen Wilhelm

AWvte

Enclosures

P.S. I still do not understand why the NDPC and AMAX site is included in Level 1. Since the North Dakota Water Commission has refused to grant the water permit, it appears that the AMAX mine and its cooperative effort to coerce North Dakota into a reversal of that decision. The NDPC plant should have been included in Level 2.

Footnote, re trace elements;
In the paragraph on page two about trace elements, by the word "subject" I don't mean trace elements generally. I mean the specific discussion of potential deleterious effects as displayed in the addendum. Any reference to trace elements in the summary or study draft document simply indicate a lack of existing information or white wash potential danger. The draft states that its Old West Regional study says there will be no short term effects noticeable. But it does not say that by "short term" is meant only ONE YEAR! How could adverse effects show up noticeably in one year? The selenium and molybdenosis problems with animals certainly didn't show up in a single year.

Some of the "externalized" costs related to coal mining and conversion are:

1. Lowering of water tables from strip mining.
2. Pollution of ground and surface water through mining and leaching of toxic substances from solid and liquid waste disposal.
3. Deleterious effects of airborne pollutants on human, animal and plant life.

Thus far there has been little effort to quantify the economic and social value of these costs or simply to place numbers on them. Yet, arbitrary dollar amounts are being used many times to quantify social and economic "benefits" for the justification of coal development.

3. ECONOMIC RECOGNITION OF RETARDED RECLAMATION

The third concern listed on page one needs little clarification. It is obvious to most people living in western North Dakota that sodic and claypan soils are going to be difficult if not totally impossible to reclaim. Federal "experts" have admitted to me that it may be 30 to 40 years before these lands can be turned over for regular agricultural use. Thus when we do the economic projections in the study count them as reclaimed and productive as before they were disturbed within five years! This is certainly fallacious juggling of figures and reality.

Finally, I would like to make a few observations about the EIS Summary Book. There are several places that rain its credibility by generalizing and distorting information so that the material argues in favor of additional coal development. Some of these places are:

1. The statement on page 38, second paragraph; "However, only air quality deterioration appears to be directly attributable to energy development, while land and water impacts are expected to worsen only without energy development." This makes it appear that the energy development really will have no additional impact on crime and tax rates. There is also nothing mentioned about the possible effects of development on PHYSICAL health.
2. The "No Further Development Alternative" on page 46 ignores the accumulation of impact of plants now permitted and under construction. It also states that potential state and local coal severance and conversion tax revenues would be lost. But it ignores the fact that revenues would be continually obtained from existing and newly constructed facilities now permitted. Further, it does not mention the adverse social, and economic impacts that would be averted with the "No Further Development" alternative.
3. The "No Leasing of Federal Coal" alternative is a glaring example of rationalization in favor of federal leasing. There is no effort to balance the material with the many arguments against leasing.

March 23, 1978

Example Methodology and Associated
Problems for the Study of Environmental
Impacts on Health Status

Environmental data collection and analysis required for the systems approach to planning will involve the identification of a host of factors, for which data retrieval is hampered by a lack of well defined collection and dissemination procedures. To appraise the impact of the environment on health status a wide universe of data collection is necessary, but at the present time much of the needed data is not being collected, is not collected and published in the necessary format, or does not lend itself to interpretation due to a lack of defensable methodologies.

Available literature on the environment and health suggest that to effectively examine the impact of the environment on health status, one must seek to describe and analyze the entire system. It has also been suggested that where only specific problem areas be examined. Clearly, this suggestion is perhaps the most manageable solution, but its nature is strictly reactionary and does not lend itself to overcoming future environmental health problems. Only the systems approach allows for complete analysis and future intervention, and the identification of what should constitute a healthy environment.

Understanding the need to view environment in its entirety, therefore, leads one to realize that data collection will be quite extensive and extremely difficult to effectively analyze, especially if computer capabilities are unavailable. The system approach to data collection will entail collecting statistics on the following environmental factors:

Water Resources and Water Supply
Sewerage and Liquid Waste Disposal
Solid Waste Disposal
Air Quality
Housing
Occupational Health and Safety
Radiological Health
Milk and Food Sanitation and Protection
Noise Pollution
General Sanitation
Vector Control
Rodent Control
Industrial Hygiene - Safety
Nuisances
Manpower
Planning

The process for data collection and analysis cannot begin, however, until it has been determined just what one intends to achieve with the data and an inventory of the data has been taken. The inventory itself is a complex process involving the following:

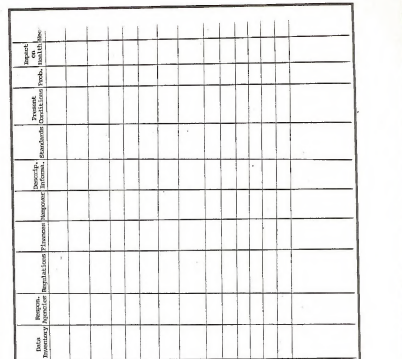
- Agencies responsible for data collection
- History of the data collection program (how long it has been functioning, methods used, capabilities, geographical coverage, etc.)
- Specific description of data compiled
- Manner in which the collection is made
- Periodicity of reporting
- Associated disease entities, if any
- Population actually or potentially at risk
- Potential interrelationship of data
- Cost of data system
- Publications

Once the inventory of available data has been conducted and a decision has been made as to the purpose and scope of the study, the collection of data can begin.

For each environmental factor the first step is to collect information necessary to provide a description of the activities of the responsible agency with regard to its specific area of concern. Essentially this will include an inventory of manpower, pertinent regulations, (local, state, and federal) available local, state and federal money, and a current status description (i.e.: number of radiation emitting devices licensed, and (i.e.: number of radiation emitting devices licensed, and conformance and non-conformance). The description of the resources must also include what currently exists, what does not exist, what things are necessary to establish. The information should point out problem areas and possible solutions.

Information concerning requirements - federal and state - can then be analyzed against data describing current levels or status. For those counties not in conformance, vital statistics, cancer registry, etc. can be analyzed to provide possible impacts on health status. In order to determine possible impacts on health status. In order to determine this will involve assumptions, as no almost every instance this will involve assumptions, as no concrete methodologies are available to prove the linkage impact of the environment on health status.

The final outcome of the information collected will be a plan describing the current status of each of the environmental factors, who has responsibility for each, what standards must be met, what steps must be taken to achieve the standards, and what counties, cities, or towns must take steps to achieve mandated standards.



The trend throughout the country today, in health planning, seems to strictly be the gathering and displaying of statistics regarding only a few specific environmental factors such as water, air pollution, and noise. From these statistics standards are chosen which essentially become goals. Again, however, it must be understood that this is simply a reaction approach to environmental problems. Only parts of the system have been examined. No attempt has been made to actually analyze the data in order to determine real effects on health status, only assumptions have been made. The standards or goals are factors time framed, but the planning process is very narrow and does not permit one to examine the universe of intervening variables that may develop in the future.

The systems approach for studying the effects of the environment on health status will be essential to the environmental planning efforts in western North Dakota, especially since it will be consistent with the current planning processes. Energy development will undoubtedly impact the area in a manner never before been experienced. One must keep in mind that the environmental concerns previously listed will not only affect the environment but will also affect life styles, mental health, economics, and many social and health related factors. The collection and analysis of data, and the planning process must be able to examine all the environmental interrelationships, providing the descriptive linkage the environment-environment on health status; an inherent, time consuming, costly, and near impossible task because of the amount of data needed and the lack of acceptable methodological approaches.

Environmental Health Letter, November 15, 1977

WESTERN COAL SAID TO CONTAIN 10-100 TIMES MORE RADIONUCLIDES

Western coal contains 10 to 100 times more radioactive atoms than eastern coal and the use or deposition of the precipitated fly ash, which contains 70 percent of the radioactive atoms, merits further attention.

That assessment was presented by Drs. C.E. Styron and B. Robinson of Monsanto Research Corp.'s Mound Laboratory in Miamisburg, Ohio, operated under contract to the Department of Energy. Their paper was presented to the First Joint Conference on Sensing of Environmental Pollutants in New Orleans.

In a modern power plant, equipped with emission controls, the stack gas emissions do not present a health hazard but the use or deposition of the precipitated fly ash may present problems, they said. Likewise, the potential release of the fly ash in stack gas from many small operations that have no emission controls requires further study, they pointed.

"Western coal is expected to play an increasingly important role in meeting national energy needs, largely because of its abundance, accessibility and low sulfur concentration," they said. "However, western coal is comprised largely of sub-bituminous and lignite ores, which have a higher geochemical affinity for uranium than eastern coal.

"Western coal reserves are known to contain uranium and its decay products at 10 to 100 times greater concentrations than most eastern coal. Uranium is found chiefly in low-rank and impure coal, including lignite, sub-bituminous coal and carbonaceous shale of the northern Great Plains and Rocky Mountain regions."

Surveys of radionuclides in western coal reserves based solely on uranium may have appreciably underestimated the total radioactive content of these coals, the authors said, noting a disequilibrium in the uranium decay chain for western coals. The ratio of polonium-210 to uranium varies from 1.4 to 12.6 as the grade of the coal declines, they reported, adding:

"This does not create a problem for coals being mined today, but it is recommended that some studies be used in assaying coal reserves for radionuclides."

Finding that the maximum deposition on soil from stack gas during a 30-year operation is less than 1 percent of the radionuclide concentrations in the soil, the investigators concluded that modern power plant stack effluent is not the major source of these environmental radionuclides.

"Considerable attention in the continuing studies will be given to testing this conclusion and to investigating other possible sources of radionuclides, such as the ash pond.

"Preliminary results do not indicate a health hazard from burning western coal in a modern power plant, but additional studies are planned to test field data on possible biomagnification of radionuclides in the food chain and to assess implications of fly ash disposal and/or utilization.

"Subsequent studies will also consider movement of radionuclides from ash ponds and coal cleaning refuse piles. Lee et al. have suggested that evolution of radon-222 from ash ponds will constitute the most significant radionuclide problem in the fossil fuel cycle.

"The potential radon-222 dose to the public from use of fly ash in bricks and cement blocks for construction of homes will be evaluated. The potential release of radionuclides from many small manufacturers who have no emission controls will be studied."

THE MILWAUKEE JOURNAL Friday, January 13, 1978

Potential Cancer Risk Clouds Prospect of Greater Coal Use

(c) New York Times Service

New York, N.Y. — Another potential risk to human health — this time involving the threat of lung cancer from fine coal ash particles — has emerged to cloud the prospects of using coal to generate a much greater share of the nation's electricity.

The new cloud, in the form of a research report in the Jan. 6 issue of Science, a scientific weekly, is not very big at present, but it illustrates the environmental problems that beset efforts to produce additional supplies of energy.

Greater use of coal is a key part of the energy program that President Carter has been struggling to enact. If later tests bear out a newly reported cancer risk from the ashy, low sulfur coals of the Plains and mountain states, the thrust toward coal could be blunted.

In response, industrial spokesmen say that costly efforts are already underway to test new, more compact and more efficient dust collectors called electrostatic precipitators. According to the industry, these would reduce sharply the immediate risk of lung disease from dust as well as the longer term, more remote risk of cancer.

Scientists at the University of California — Davis subjected fly ash from a Western power plant burning low sulfur coal to a test devised by Bruce N. Ames of the University of California — Berkeley that detects whether a substance causes genetic mutations in bacteria.

The Ames test involves strains of salmonella bacteria that have lost the ability to make a particular protein subunit or amino acid called histidine. The bacteria need supplemental histidine to grow, except when they occasionally undergo a spontaneous mutation and revert to the normal type.

In the Ames test, chemicals and other substances suspected of being able to cause cancer are added to a laboratory dish containing about a bil-

Turn to Coal, page 12, col. 1

Coal

Industry Doubts Coal Ash Risk

From Page 1

lion histidine requiring bacteria and extracts of rodent or human liver. If the foreign substances raise the frequency of reversions to normal, it is scored as mutagenic.

About 90% of the substances known from other tests to induce cancer in animals or human beings have caused an excess of mutation in the Ames bacterial test. Thus, a positive result in the test is regarded as a strong indication that a substance should be tested for its cancer causing potential in laboratory rats or mice, a procedure requiring two years.

The Davis scientists found that the mutations caused by the power plant dust apparently were traceable both to organic (carbon containing) compounds, and to inorganic compounds, possibly those containing traces of heavy metals.

Industry Skeptical

The industry reacted with skepticism to the findings. Cyril L. Comar, director of the environmental assessment department of the utility sponsored Electric Power Research Institute, said, "We have a problem relating positive Ames tests to potential health effects on human populations."

Even before the report of a possible cancer risk from fly ash, the electric utility industry was under regulatory pressure to improve the performance of dust controlling equipment at coal fired power plants.

To meet tightening emission standards, the Electric Power Research Institute is experimenting with electrostatic devices that will trap particles more efficiently in a smaller space.

Coal Process for Gas Unveiled by Mobil

Paulsboro, N.J. —AP— The production of high quality, unleaded gasoline from coal rather than oil may be economically feasible by 1990, officials of one of the nation's largest oil firms said Thursday.

Mobil Oil Co. officials released details of a patented process that transforms coal to alcohol and then to high octane unleaded gasoline. Development of the process was announced about a year ago, but until Thursday details were scarce.

Officials said the new gasoline would cost 40 to 50 cents more per gallon than gasoline made from oil, but the process would be economically feasible within 15 to 20 years.

Mobil's process depends on a new catalyst, which would, in existing technology, turn coal into gas and then to a form of alcohol called methanol. Using the catalyst, the methanol is turned into gasoline and a lesser amount of water.

Read Personally GAP

AMERICAN JOURNAL OF EPIDEMIOLOGY
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THE CONTRIBUTION OF THE SOCIAL ENVIRONMENT TO HOST RESISTANCE[1]

THE FOURTH WADE HAMPTON FROST LECTURE

JOHN CASSEL[2]

I count myself honored indeed to be included among those who have been chosen to present this, the Wade Hampton Frost Lecture. Unlike my predecessors in this series, I never had the privilege of knowing or meeting Dr. Frost, although of course I know many of his illustrious students. I do claim one unique experience, however; I read his collected papers when practicing in South Africa before I had ever heard of the word epidemiology, much less knew what it meant. In a real sense, then, those papers were my introduction to the whole field, and for this I must thank my very wise chief, Dr. Sidney L. Kark, who introduced me to the papers, particularly the section on tuberculosis. The thinking displayed in those articles opened my eyes to a new world and provided an opportunity to begin to understand what up until then had been to me a totally mysterious phenomenon, the explosive epidemic of tuberculosis I was witnessing in the African population for whom I was providing care.

Perhaps, though, of all the words Frost wrote, the ones that have made the most impression on me have been his often quoted introduction to the reprinting of John Snow's papers (1) which starts, "Epidemiology at any given time is something more than the total of its established facts. It includes their orderly arrangement into chains of inference which extend beyond the bounds of direct observation." It is this "orderly arrangement into chains of inference" which intrigues me and which I think distinguishes creative epidemiologic studies from studies which may display considerable rigor in their methods but which are essentially pedestrian.

The question then is, what guides us in developing these chains of inference? Unquestionably, in large part the answer is the model of disease causation which we (implicitly or explicitly) espouse. In Frost's day this model, stated in its most general form, was that disease occurred as a result of new exposure to a pathogenic agent. It was recognized, of course, that the consequences of such exposure would be determined both by the pathogenicity of the agent and the degree of resistance or susceptibility of the host. This relationship has now been extended and formalized into the well-known triad of host, agent and environment in epidemiologic thinking. Since Frost, the elucidation of host resistance factors has largely been the responsibility of the vastly expanded fields of biomedical research, such as genetics, molecular biology, immunology, biochemistry and endocrinology; while epidemiology has continued to search for the effects of a vastly expanded array of pathogenic agents in the environment. The inferences drawn on the basis of such findings have been that, given a certain level of resistance (for whatever reasons), we should be able to explain the occurrence of disease as a result of exposure to these pathogenic agents.

René Dubos (2) has recently pointed out, however, that this formulation, which may have provided a satisfactory basis for inferences in the 19th and early part of the 20th century when most diseases of interest (such as typhoid, cholera, smallpox or plague) were the result of agents of over-

[1] Presented at the 104th Annual Meeting of the American Public Health Association in Chicago, Ill., on November 18, 1975.

[2] Department of Epidemiology, U. of North Carolina, Chapel Hill, NC 27514.

Wall St Journal
Jan 4, 1978
p6

Fly Ash Is Found To Be Possible Cause Of Cancer in Man

Building of Coal-Fired Plants Could Be Complicated if Direct Link Is Discovered

A WALL STREET JOURNAL News Roundup

The increased use of coal to generate electric power may soon be plagued by the same sort of cancer specter that is inhibiting the spread of nuclear power.

Researchers in California reported discovering that the fly ash emitted by coal-fired power plants contains substances capable of causing mutations in bacteria. The bacterial mutations were observed in the same laboratory test system that is being used to spot potential cancer-causing chemicals in foods, cosmetics and industrial environments.

Because the substances can cause the mutations, fly ash falls under suspicion as a possible cause of cancer in man, the researchers reported.

The research team, whose work was performed at the University of California at Davis under federal sponsorship, studied tiny particles of fly ash. Fly ash is composed mainly of silicon and aluminum, but also is coated with traces of more than a dozen other elements, the researchers reported in the latest issue of Science, a weekly publication of the American Association for the Advancement of Science, a professional group.

The researchers are Clarence E. Chrisp, a veterinary pathologist; Gerald L. Fisher, an environmental chemist, and Jeanne E. Lammert, a cell biologist, all of whom are associated with the university's Radiobiology Laboratory.

Millions of tons of fly ash are released into the atmosphere annually at coal-fired power plants, and emissions are expected to increase if the use of coal does. Although the pollution controls known as electrostatic precipitators reduce fly-ash pollution, they don't eliminate it.

Any direct link between fly ash and cancer would complicate decisions over whether to build more coal-fired plants. Health concerns over burning of coal to date have been mainly over the association between general air pollution and increases in heart and respiratory ailments.

The researchers said they studied particles of ash small enough to be inhaled by humans and lodged in the lungs. The particles were found to be coated with cadmium, cobalt, nickel and some other substances that caused genetic changes in bacteria, they said.

The experiments involved the Ames test, a procedure that is becoming a standard technique for determining mutagenicity. According to the researchers, many mutagenic substances also prove to cause cancer in animals and presumably humans.

They stressed, however, that further study is needed to determine more about the mutagenic substances in fly ash and whether they cause human cancer. Animal studies are planned, and the researchers also plan to study the effects of temperature changes on fly ash. There's a possibility sunlight might affect the ash between the time it leaves a stack and when it is inhaled.

Miss Lammert, in a telephone interview, said the researchers hadn't drawn any conclusions as yet about whether fly ash causes cancer.

Researchers haven't previously determined that fly ash contains mutagenic substances, she said. The finding may be surprising to some researchers because the ash has been thought to be inert, she added.

Soviet Union to Increase Nuclear Plant Capacity

Special to THE WALL STREET JOURNAL

MOSCOW—The Soviet Union plans to increase its nuclear generating capacity this year to 10 million kilowatts from seven million, Anatoly Maximov, deputy director of electric power development and electrifications, said in an interview with Tass, the Soviet news agency.

Mr. Maximov also said that new nuclear plants will be equipped with one-million-kilowatt reactors, more than twice as much as the current 440,000-kilowatt reactors in existing installations. He added that the unit capacity of power plants eventually will rise to 1.5 million to 2.4 million kilowatts.

Hyster Says Strike Ended At Its Danville, Ill., Facility

PORTLAND, Ore.—Hyster Co. said 1,000 striking workers at the company's Danville, Ill., plant returned to work, following agreement on a new three-year labor contract.

The strike began Nov. 13. Details of the new contract weren't immediately available.

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whelming pathogenicity and virulence, is no longer of particular use in technologically developed societies. In modern societies the majority of the citizens are protected from these overwhelming agents and most of the agents associated with current diseases are ubiquitous in our environment. Dubos states it quite succinctly: "The sciences concerned with microbial diseases have developed almost exclusively from the study of acute or semi-acute infections caused by virulent microorganisms acquired through exposure to an exogenous source of infection. In contrast, the microbial diseases most common in our communities today arise from the activities of microorganisms that are ubiquitous in the environment, persist in the body without causing obvious harm under ordinary circumstances, and exert pathological effects only when the infected person is under conditions of physiological stress. In such a type of microbial disease, the event of infection is of less importance than the hidden manifestations of the smoldering infectious process and than the physiological disturbances that convert latent infection into overt symptoms and pathology" (2).

Thus Dubos is stating that in societies where most disease agents are ubiquitous in the environment (and I believe his statement would cover most physicochemical agents, not only microbiologic ones), a full understanding of the distribution and determinants of disease requires that we know both the prevalence and toxicity of these agents *and* the determinants of those factors which change the relationship between the host and these agents, thus transforming an innocuous, possibly symbiotic, relationship to one in which clinical disease is the outcome.

The question facing epidemiologic inquiry then is, are there categories or classes of environmental factors that are capable of changing human resistance in important ways and of making subsets of people more or less susceptible to these ubiquitous agents in our environment? When we have thought of these questions at all, we have been accustomed to think in rather general terms of such things as nutritional status, fatigue, overwork or the like. I would suggest, however, that there is another category of environmental factors capable of producing profound effects on host susceptibility to environmental disease agents, and that is the presence of other members of the same species, or more generally, certain aspects of the social environment.

The problem is that as soon as one introduces the concept of the potential role of the social environment in disease etiology, the almost inevitable response is that this means stress and stress disease. I think the simple-minded invocation of the word stress in such thinking has done as much to retard research in this area as did the concepts of the miasmas at the time of the discovery of microorganisms. While there can be no question regarding the use of the concept of stress in the hands of the originators of this term (as applied in a scientific sense to medicine), and that Selye and Wolff (3), for instance, have made a significant contribution to our ideas about the nature of disease and its causes, the current uncritical subscription to what are thought to have been the ideas of these investigators and the often erroneous interpretation of their theories by modern investigators has frequently led to contradictory findings and inappropriate inferences.

First it is important to recognize the semantic difficulties surrounding the use of the word "stress." By Selye and Wolff stress was envisaged as a bodily state, not a component of the environment. Thus Wolff (3) states, "I have used the word stress in biology to indicate that state within a living creature which results from the interaction of the organism with noxious stimuli or circumstances, i.e., it is a dynamic state within the organism; it is not a stimulus assault, load symbol, burden, or any aspect of environment, internal, external, social or otherwise." While Wolff dem-

The central concept

onstrated that this stress state (evidenced by neuroendocrine changes) can be produced by a variety of noxious stimuli, physical as well as psychologic, he did not attempt to define the characteristics or the properties of these nonphysical (psychologic and/or social) noxious stimuli. Despite such formulations, subsequent investigators have tended to apply the term "stress" to these postulated noxious social or psychologic stimuli, often quoting Wolff for their justification. The use of the word "stressor" to indicate the environmental noxious stimulus and "stress state" or more frequently "stress disease" to indicate the postulated consequences of such exposure clarifies the semantic difficulty but highlights the more important conceptual issue. Stated in its most general terms, the formulation subscribed to (often implicitly) by most epidemiologists and social scientists working in this field is that the relationship between a stressor and disease outcome will be similar to the relationship between a microorganism and the disease outcome. In other words, the psychosocial process under investigation is envisaged as a stressor capable of having a direct pathogenic effect analogous to that of a physicochemical or microbiologic environmental disease agent. The corollaries of such a formulation are that there will be etiologic specificity (each stressor leading to a specific stress disease), and there will be a dose-response relationship (the greater the stressor, the more likelihood of disease). There is serious doubt as to the utility or appropriateness of both of these notions.

Wolff himself stated quite explicitly that the action of physicochemical disease agents is different from psychosocial factors in that the former have a direct pathogenic effect by damaging and distorting structure and function, while the latter act indirectly (or, as he termed it, conditionally) by virtue of their capacity to act as signals or symbols (3). Thus, disease can occur by virtue of a disturbance in the balance between the organism and various disease agents, as maintained by Dubos (2), and if this balance is mediated largely by the neuroendocrine system, as has been maintained by Cannon (4) and Schoenheimer (5) and widely accepted since, then the mechanism through which the signals and symbols produced by the conditional noxious stimuli work presumably will be by altering neuroendocrine secretions and levels in the body and thus changing the balance. As will be referred to later, there is evidence from both animal and human experiments indicating that variations in the social milieu are indeed associated with profound endocrine changes in the exposed subjects.

Viewed in this light, it is most unlikely that any given psychosocial process or stressor will be etiologically specific for any given disease, at least as currently classified. In other words, it no longer becomes useful to consider a subset of existing clinical entities as "stress" diseases as all diseases can in part be due to these processes. Hinkle (6), arguing from the biologic evidence, supports this point strongly when he states: "At the present time the 'stress' explanation is no longer necessary. It is evident that any disease process, and in fact any process within the living organism, might be influenced by the reaction of the individual to his social environment or to other people."

A more reasonable formulation would hold that psychosocial processes acting as "conditional" stressors will, by altering the endocrine balance in the body, increase the susceptibility of the organism to direct noxious stimuli, i.e., disease agents. The psychosocial processes thus can be envisaged as enhancing susceptibility to disease. The clinical manifestations of this enhanced susceptibility will not be a function of the particular psychosocial stressor, but of the physicochemical or microbiologic disease agents harbored by the organism or to which the organism is exposed. Presumably, the disease manifestations will also be determined by constitutional

factors, which in turn are a function of genetic endowment and previous experience.

Some reasonably convincing data exist to support this point of view. For example, one of the striking features of animal studies concerned with demonstrating the health consequences of a changed social environment has been the wide range of diseases that have followed such changes. Alteration of the social environment by varying the size of the group in which animals interact, while keeping all aspects of the physical environment and diet constant, has been reported to lead to a rise in maternal and infant mortality rates; an increase in the incidence of arteriosclerosis; a marked reduction in the resistance to a wide variety of direct noxious stimuli, including drugs, microorganisms and x-rays; an increased susceptibility to various types of neoplasia; alloxan-produced diabetes; and convulsions (7–15). Thus, in animals at least, no specific type of "stress disease" appears in response to changes in the social milieu—changes which have been interpreted as "stressors." Rather, the animals appear to respond with a variety of diseases, the particular manifestation being determined by factors other than the disturbed social process. The evidence from human studies is somewhat less direct but nevertheless still consistent with this idea. A remarkably similar set of social circumstances characterizes people who develop tuberculosis (16) and schizophrenia (17, 18), become alcoholics (19), are victims of multiple accidents (20), or commit suicide (21). Common to all these people is a marginal status in society. They are individuals who for a variety of reasons (e.g., ethnic minorities rejected by the dominant majority in their neighborhood; high sustained rates of residential and occupational mobility; broken homes or isolated living circumstances) have been deprived of meaningful social contact. It is perhaps surprising that this wide variety of disease outcomes associated with similar circumstances has generally escaped comment. To a large extent this has probably resulted from each investigator usually being concerned with only one clinical entity so the features common to multiple disease manifestations have tended to be overlooked.

One exception to this has been the study by Christenson and Hinkle (22). In an industrial study in the United States, they have shown that managers in a company who, by virtue of their family background and educational experience were least well prepared for the demands and expectations of industrial life, were at greater risk of disease than age-matched managers who were better prepared. They found that this increased risk included all diseases, major as well as minor, physical as well as mental, long-term as well as short-term. A further example illustrating this point is the health consequences that follow the disruption of important social relationships, particularly death of a spouse. It has been shown that widowers have a death rate three to five times higher than married men of the same age for every cause of death (23). It is difficult to conceive of a specific etiologic process responsible for the increased death rate from such diverse conditions as coronary heart disease, cancer, infectious diseases and peptic ulcer, and it would appear more reasonable to consider that the loss of the spouse increases the susceptibility of such men to other disease agents.

Of course this position that psychosocial factors act as conditional or predisposing factors rather than as direct pathogenic agents is no different from the position taken by the psychosomaticists, who have maintained quite specifically that psychologic factors should be regarded as predisposing rather than direct etiologic agents in disease. Where it does differ is suggesting that these order of factors will not be etiologically specific for any given disease (at least given the current clinical classification of diseases) and that research aimed

at searching for a specific subset of "stress diseases" or attempting to link any type of stressor to a single clinical manifestation is likely to be unproductive.

My position on this complete absence of etiologic specificity (or putting it in another way, that the function of these psychosocial processes is to enhance susceptibility to all disease in general) may have to be modified somewhat by relatively recent developments. Henry (24) has shown that, in animal colonies, animals in the process of establishing their dominance show a sympathetic adrenal medullary catecholamine response and persistent elevated blood pressures. The ones forced into subordination, however, show more of the pituitary adrenal cortical response pattern, a pattern he feels is more consistent with depression and all the disease manifestations that have been associated with depression and hopelessness. If this is true it might be necessary to modify my stance and admit there may be several clusters of diseases associated with different psychosocial situations.

Clarification of the outcomes to be expected from exposure to these psychosocial processes is, however, only one of the dilemmas facing research in this area. It provides no guide as to what these processes might be, much less how they are to be measured.

One of the unfortunate controversies that has clouded research in this area has been the one about whether such stressors are invariant, affecting all people in a similar manner, or whether they are idiosyncratic, affecting each person differently depending upon his personality, interpretation of the situation, and so forth. The position for the latter point of view (which might be summarized as "what is one man's meat is another's poison") has recently been stated quite succinctly by Hinkle (6): "In view of the fact that people react to their 'life situations' or social conditions in terms of the meaning of these situations to them, it is difficult to accept the hypothesis that certain kinds of situations or relationships are inherently stressful and certain others are not." Others, including perhaps the majority of investigators, have treated these factors not only as if they were invariant but as if they were unidimensional, the presence of the factor being stressful, its absence beneficial.

Quite clearly, if the idiosyncratic point of view is correct, much of the work to identify universal or general stressors will be futile and lead to contradictory and confusing results. But equally clearly, the contrary point of view ignores the proposition that these processes do not have a direct pathogenic action but operate in their capacity as signals or symbols triggering off responses in terms of the information they are perceived to contain. And as this perception will almost certainly be a function of the differing personalities and the salience of the experience to different individuals, it is hard to accept the notion that certain social circumstances will always, or even in the majority of cases, be "stressful." This dilemma can best be resolved, I believe, by two changes in our thinking, changes which appear consistent with most of the data and which conceivably explain some of the existing contradictions. The first of these is that the extent to which the postulated psychosocial processes are generally noxious versus idiosyncratic in their action is largely a function of our level of abstraction. If we can identify the characteristics or properties of those signals or symbols which generally evoke major neuroendocrinal changes in the recipients, we will have identified a general class of stressors even if the particular circumstances or relationships creating those types of signals or symbols differ for different people. Furthermore, if we can identify the attributes of this class of stressors, it may well be that the same relationships or social circumstances within a given culture (or, perhaps, subculture) regularly produce such a class of signals. Secondly, the existing data have led me to believe that we should no longer treat psychosocial processes as unidimen-

sional stressors or nonstressors, but rather as two-dimensional, one category being stressors, and another being protective or beneficial.

The evidence supporting these points of view comes from both animal and human research. As has been indicated earlier, altering the social milieu of animals by increasing the number housed together leads to marked changes in health status, even when all relevant aspects of the physical environment and diet are kept constant. The biologic mechanisms through which such changes are produced have also been identified. Changes in group membership and the quality of group relationships in animals have been shown to be accompanied by significant neuroendocrinal changes affecting the pituitary, the adrenocortical system, the thyroid and gonads (25, 26). These same endocrines are those responsible in large part for maintaining what Schoenheimer (5) has termed "the dynamic steady state" of the organism, and thus, presumably, its ability to withstand changes which would result from the action of disease agents.

The questions of concern are, what are the properties of the changes in this social milieu, and are there analogues in the human social system? The usual notion that the crowding itself (that is, the physical density of the population) is responsible for the deterioration in health status has not been sustained in human studies. Despite the popularity of the belief that crowding is harmful to health, a review of the literature shows that for every study indicating a relationship between crowding and some manifestation of poor health, there is another equally good (or bad) investigation showing either no relationship or even an inverse one (27, 28). Furthermore, Hong Kong, one of the most crowded cities in the world, and Holland, one of the most crowded countries, enjoy some of the highest levels of both physical and mental health in the world (29).

A careful review of the data reported from these animal studies may hold a clue to these puzzles. In animals, an almost inevitable consequence of crowding is the development of a set of disordered relationships among the animals. These, while manifested by a wide variety of bizarre and unusual behaviors, often have in common a failure to elicit anticipated responses to what were previously appropriate cues. Thus, habitual acts of aggression (including "ritualized aggression" in defending the nest), or evidence of acceptance of subordination on the part of one animal, fail to elicit appropriate reciprocal responses on the part of another. In social animals under wild conditions, for example, the occupier of a nest will define a zone around that nest as "home territory." Invasion of this territory by another animal of the same species will lead to a set of highly ritualized aggressive moves and countermoves, rarely leading to bloodshed, but culminating in one or the other animal "signalling" capitulation. Under crowded conditions the defending animal may initiate this ritual "dance," but the invading animal fails to respond in the anticipated fashion. Instead he may lie down, go to sleep, attempt to copulate, walk away, or do something which, for the situation, is equally bizarre.

This failure of various forms of behavior to elicit predictable responses leads to one of three types of responses on the part of the animals involved, the most common of which is repetition of the behavioral acts. Such acts are always accompanied by profound neuroendocrinal changes, and presumably their chronic repetition leads eventually to the permanent alterations in the level of the hormones and to the degree of autonomic nervous system arousal reported under conditions of animal crowding. The fact that these behavioral acts are in a sense inappropriate, in that they do not modify the situation, can be expected to enhance such hormonal changes. Under

these conditions it is not difficult to envisage the reasons for the increased susceptibility to environmental insults displayed by such animals.

An alternative response on the part of some animals is to withdraw from the field and to remain motionless and isolated for long hours on end. It is not uncommon to observe some mice under crowded conditions crouched in most unusual places, on top of the razor-thin edge of a partition or in the bright light in the center of the enclosure, completely immobile and not interacting with any other animals. Such animals do not exhibit the increased pathology demonstrated by the interacting members (7).

The third alternative is for animals to form their own deviant groups that apparently ignore the mores and codes of behavior of the larger group. Thus, "gangs" of young male rats have been observed invading nests, attacking females (the equivalent of gang rapes has been reported), and indulging in homosexual activities. I am not aware of any data on the health status of these gang members, but according to this hypothesis they also should not exhibit any increase in pathology.

These observations would suggest that at least one of the properties of stressful social situations might be that the actor is not receiving adequate evidence (feedback) that his actions are leading to anticipated consequences. While we do not as yet have the appropriate instruments to measure in any direct fashion the extent to which such a phenomenon is occurring in humans, it is not unreasonable to infer that this phenomenon is highly likely to occur under certain circumstances. First, it is probable that when individuals are unfamiliar with the cues and expectations of the society in which they live (as in the case of immigrants to a new situation, or of individuals involved in a rapid change of social environment, such as the elderly in an ethnic enclave caught up in urban renewal), many of their actions and the responses to these actions would fall into this category and thus, if this suggestion is correct, they should be more susceptible to disease than those for whom the situation is familiar. Another circumstance in which this lack of feedback might occur would be under conditions of social disorganization. This, while still being far from a precise term which can be measured accurately, has proved to be a useful concept in a number of studies.

As indicated earlier, however, a fuller explanation of the potential role of psychosocial factors in the genesis of disease requires the recognition of a second set of processes. These might be envisioned as the protective factors buffering or cushioning the individual from the physiologic or psychologic consequences of exposure to the stressor situation. It is suggested that the property common to these processes is the strength of the social supports provided by the primary groups of most importance to the individual. Again, both animal and human studies have provided evidence supporting this point of view. Conger et al. (30), for example, have shown that the efficacy with which an unanticipated series of electric shocks (given to animals previously conditioned to avoid them) can produce peptic ulcers is determined to a large extent by whether the animals are shocked in isolation (high ulcer rates) or in the presence of litter mates (low ulcer rates). Henry (31) has been able to produce persistent hypertension in mice by placing the animals in intercommunicating boxes all linked to a common feeding place, thus developing a state of territorial conflict. Hypertension only occurred, however, when the mice were "strangers." Populating the system with litter mates did not produce these effects. Liddell (32) found that a young goat isolated in an experimental chamber and subjected to a monotonous conditioning stimulus will develop traumatic signs of experimental neurosis while

its twin in an adjoining chamber and subjected to the same stimulus, but with the mother present, will not.

The evidence from human epidemiologic studies is somewhat more circumstantial, yet I believe not inconsistent with these notions, and it certainly suggests that it is worthwhile to pursue these areas of investigation.

I have selected a number of studies which illustrate the potential importance of these twin themes, lack of appropriate feedback to individuals and absence of social supports. On some occasions these have been indexed by situations of rapid social change or social disorganization, on others by attempts to measure the processes more directly. I have deliberately selected examples which employ a variety of research designs and which have examined the phenomena in relation to a wide variety of health outcomes.

The first is an older study of our own designed to illustrate the potential importance of rapid social change (33). It took place in the mountains of Appalachia, where the population had been isolated from developing civilization for about 150 years. In the early 1900's a factory located in one of these mountain coves, and over the next 50-60 years, by deliberate company policy, recruited its labor force from the surrounding mountain coves. By 1960 the factory was populated by about 3000 workers living in the company town, eating similar diets and doing the same work for the same pay. They were composed of two groups, however. First, there were those who were the first of their family to leave the coves for this new and strange life (where relationships, rights and obligations were no longer determined by kinship, and where personal identity and worth did not depend on the family one came from) and, second, there were those whose fathers had worked in the same factory before them. The company made no distinction between these two groups in terms of work, pay or promotion, and, in fact, the only way they could be identified was by examining the company records to find out whether a particular worker had had a relative of the same name there before him. The hypothesis of the study was that the second group, by virtue of their previous experience, would be better prepared for the expectations and demands of industrial living than the first group and should thus exhibit fewer signs of ill health. As indicated in figures 1 and 2, when health status was measured by responses to the Cornell Medical Index and sick absenteeism, the prediction held true.

The second study, by Neser et al. (34), is an ecologic study in which the health outcome measured is no longer self-perception of health or health behavior, but death from stroke, and the index of the postulated psychosocial processes, social and family disorganization. For this purpose, all 100 counties of North Carolina were

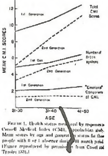

Figure 1. Health status measured by responses to Cornell Medical Index (CMI), Appalachian study. Mean scores by age and generation status for those people with 0 or 1 absence during ... month period. (Figure reproduced by permission from Cassel and Tyroler (33).)

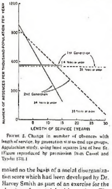

Figure 2. Change in number of absences with length of service, by generation status and age groups, Appalachian study, using least squares line of best fit. (Figure reproduced by permission from Cassel and Tyroler (33).)

ranked on the basis of a social disorganization score which had been developed by Dr. Harvey Smith as part of an exercise for the planning of mental health services. The components of the score are: family instability (per cent of primary families with only one parent present); per cent of illegitimate births; rate of males sentenced to prison camps; per cent of population separated or divorced; and per cent of children under 18 not living with both parents.

The ranked counties were then grouped by index severity of the score into five tiers, from the least to the most disorganized, and the stroke mortality rate for Black men for the nine-year period 1956–1964 was computed, basing the population figure on the 1960 census data (figure 3).

As can be seen, there is a marked gradient in stroke mortality with increasing county index of social disorganization, this being most evident in the younger age group. Other than social disorganization, there did not seem to be any particular features that systematically differed between these various tiers of counties. No tier clustered geographically (making it unlikely that some component of the water or soil was responsible), nor were there any major differences in economic level or access to medical care. To test for the possibility of confounding by an economic factor, however, a subsequent study of James and Kleinbaum (35) expanded the original list of indicators of social disorganization and included a number of economic indicators as well. The resulting county scores were derived by factor analysis which produced two factors, one labeled a social instability factor and the other socioeconomic. The death rates from stroke (limited at this time to 45 to 54-year-old non-white males for 1960) is shown in figure 4.

The difference previously observed persists even when controlling for socioeconomic level, making it unlikely that the findings can be explained on the basis of poverty.

No matter how carefully ecologic studies are done, however, nor how unambiguous their results, the findings are always sus-

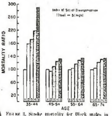

Figure 3. Stroke mortality for Black males in North Carolina by county index of social disorganization, 1956–1964. (Figure adapted by permission from Neser et al. (34).)

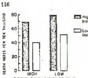

Figure 4. Hypertension-related deaths per 10,000 by socioecologic stress levels in non-white males aged 45-54 in North Carolina, 1960. (Figure adapted by permission from James and Kleinbaum (35).)

pect due to the possibility of the ecologic fallacy. It is comforting then to find these results replicated by another study that was conducted in another locality by an independent investigator. This study, conducted in Detroit by Harburg et al. (36), rank ordered all census tracts by various components of what they called stress scores which included residential and family instability, crime and density, and economic deprivation. The scores were also subjected to factor analysis, yielding the two factors of social instability and socioeconomic status. Tracts having both the upper range for the instability score and lower range for the socioeconomic score were labeled high-stress tracts, and the converse for the low-stress tracts. Within each of these tracts a random sample of families was selected (with about an 89 per cent acceptance rate). These family members were interviewed and had their blood pressures measured under standard conditions by trained and standardized interviewers. Figure 5 shows that after controlling for weight, blood pressure levels are higher for Black males at all ages, but particularly at young ages if they live in the high-stress areas.

It is interesting to note that in none of these three studies was the same relationship found for Whites. Two possible speculations can be advanced to explain this apparent anomaly. The first of these relates to the situation of Blacks. In animal experiments, changes in the social milieu have their most marked and dramatic effects on the health and endocrine status of subordinate animals, with dominant ones showing the least effects (37). Perhaps these findings reflect the subservient role that Blacks (until perhaps recently) have been forced to occupy in our society. The second speculation is the possibility that in the face of social disorganization Whites have more resources, including sources of social support, to help buffer their physiologic processes from these effects.

The next study uses a further design, case control, and examines a phenomenon first described by a contemporary and colleague of Frost, Jean Downes. In some of her Eastern Health District studies, Downes reported that a small proportion of school children were responsible for a disproportionately large number of school absences, that these tended to be the same children year after year, and that they came from families in which other members had a disproportionately high rate of chronic and emotional illness (38). This study also examined family cohesiveness and the supports available in such families.

Two pools of elementary school children were identified in a sample of 18 Florida schools in a study by Boardman (39). From these pools, 100 families of children who had consistently had the highest absence experience in two successive years were randomly selected and matched by race,

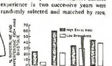

Figure 5. Diastolic blood pressure levels by stress areas, age and weight in Black men in Detroit. (Figure reproduced by permission from Harburg et al. (36).)

sex, grade and school attended of the index child with 100 randomly selected families of low-absence children. An instrument to measure the concept of family competence was developed by the investigator and applied blind to each of the 200 families. The components of the family competence score were: commitment of members to family group objectives; communication, or the ability of the group to arrive at a working consensus on issues and problems; pride in family; self-confidence; judgment, or the ability to identify and weigh alternatives; creativity or resourcefulness; and participation, or the commitment of family members to a collective process in the community, their contribution to a definition of goals (39).

In addition, data on a number of possible confounding variables which might account for the high absence rates were also gathered from both groups of families. These variables were: number of family members with time-losing illnesses; presence of father in the home; family size; number of preschool children; mother's age; number of siblings younger than the index child; grade, sex and school attended of the index child; school absence record of the index child; number of chronically ill family members; belief in education; social position; and race (39).

Figure 6 shows the mean competence scores of these two groups of families. In the scores, the non-matched confounding variables have been controlled by stratification in the case of social class and by stepwise partial correlation for the rest. As can be seen from the figure, families of high-absence children consistently had poorer family competence scores (indicating lower cohesiveness and support) than did those of low-absence children. The family members of the high-absence children were also found to have more illness of all sorts than was true in the families of the low-absence children. The study thus confirmed Downes' original findings.

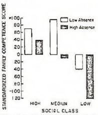

FIGURE 6. Family competence scores and school absences in children by social class. (Figure reproduced by permission from Boardman (39).)

Perhaps one of the more dramatic findings is that of Michael Marmot (40), who was impressed by the findings of the Japanese-Hawaiian-American heart study which showed that the incidence of coronary heart disease was higher in Japanese people living in Hawaii than in those living in Japan and still higher for those living in California than in Hawaii. Furthermore, these differences could not be explained by variations in any or all of the standard risk factors. Marmot wondered what additional factors might explain the high rate of coronary heart disease among the Japanese living in California, and he speculated that in the process of migration they may have lost important sources of social support in the face of bewildering and rapid cultural change.

He conducted a cross-sectional study on a sample of Japanese men living in California and developed an instrument to measure to what extent they had retained the values of traditional Japanese culture. The components of the instrument and the proportions of Japanese men giving "traditional" answers to culture of upbringing questions are shown in table 1. As a validation of this instrument Marmot compared scores obtained for these Californian Japa-

TABLE 1

Culture of upbringing: proportion of Japanese men living in California giving "traditional" answers on culture of upbringing questions[a]

Question	"Traditional" answer	% Giving "Traditional" answer
Years in Japan	>10 years	30
Age left parents' home	Older than 25	36
Ever lived on a farm	Yes	58
School in Japan	Yes	36
Years in Japanese language school	>5 years	27
Religion (growing up)	Buddhist	51
Friends while growing up	Mostly Japanese	60
Wife's place of birth	Japan	18
Wife schooled in Japan	Yes	19
Wife's school Japanese language	Yes	40

[a] Table reproduced by permission from Marmot (40).

TABLE 2

Distribution of scores on index, culture of upbringing, by generation, Issei (Japanese immigrants to US) and Nisei (offspring of immigrants)[a]

Index score		Issei (%)	Nisei (%)
Non-traditional	1	2.0	13.1
	2	5.2	20.5
	3	14.9	25.8
	4	11.6	12.7
Traditional Japanese	5	29.8	18.1
	6	38.4	9.8
Total		100	100

[a] Table reproduced by permission from Marmot (40).

nese born in Japan with those obtained for those born in the US (table 2).

As can be seen from figures 7 and 8, the prevalence of coronary heart disease (whether measured as angina or as myocardial infarction by history or by electrocardiogram criteria) was always higher in those men who had retained less of their traditional cultural matrix.

To assure that these differences were not simply a function of differences in diet or major risk factors in the two groups, Marmot then controlled for these by stratification, as shown in figures 9–12. In each case (except perhaps for nonsmokers) the same relationship holds true.

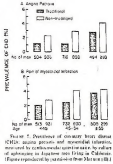

FIGURE 7. Prevalence of coronary heart disease (CHD): angina pectoris and myocardial infarction, measured by cardiovascular questionnaire, by culture of upbringing in Japanese men living in California. (Figure reproduced by permission from Marmot (40).)

One of the few cohort type studies in this field (Nuckolls et al.) was concerned with complications of pregnancy as the outcome (41). Complete data were obtained from 170 white married primiparae of similar age and social class, all delivered by the same service. Social stresses were measured by a cumulative life-change score, a method developed by Holmes and Rahe

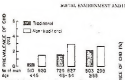

FIGURE 8. Prevalence of coronary heart disease (CHD): major electrocardiogram abnormalities (Minnesota codes 1:1, 1:2, 7:1) by culture of upbringing in Japanese men living in California. (Figure reproduced by permission from Marmot (40).)

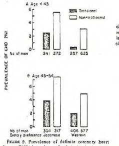

FIGURE 9. Prevalence of definite coronary heart disease (CHD) by culture of upbringing in Japanese men living in California, controlling for dietary preference, Japanese or Western. (Figure reproduced by permission from Marmot (40).)

(42) to assess the major life changes to which an individual had had to adapt. Social supports, or as they were termed, psychosocial assets, were assessed by an instrument developed by the investigator designed to measure the subject's feelings or perceptions of herself (with particular reference to this pregnancy), her relationships with her husband, her extended fam-

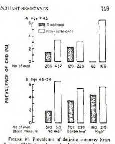

FIGURE 10. Prevalence of definite coronary heart disease (CHD) by culture of upbringing in Japanese men living in California, controlling for blood pressure level. * WHO criteria. (Figure reproduced by permission from Marmot (40).)

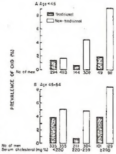

FIGURE 11. Prevalence of definite coronary heart disease (CHD) by culture of upbringing in Japanese men living in California, controlling for serum cholesterol. (Figure reproduced by permission from Marmot (40).)

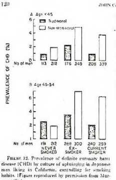

FIGURE 12. Prevalence of definite coronary heart disease (CHD) by culture of upbringing in Japanese men living in California, controlling for smoking habits. (Figure reproduced by permission from Marmot (40).)

ily and her immediate community in terms of the support she was receiving or could anticipate receiving. Both instruments were administered to the subjects before the 32nd week of pregnancy. After delivery, the records were reviewed blind for any evidence of complications of pregnancy or delivery. Among these patients, 47 per cent had one or more minor or major complications, a rate comparable to the 50 per cent found in a national study using the same criteria.

Figure 13 shows that in the presence of high life changes both before and during pregnancy, 90 per cent of women with low assets had one or more complications of pregnancy. With equally high life change scores but with a high support score, only 33 per cent of women had such complications. When life change scores were high prior to pregnancy but low during the pregnancy, the asset score was protective but less so. Figure 14 shows that when the life change scores prior to pregnancy were low, the asset score was irrelevant.

In an intervention trial, Pless and Satterwhite (43) were concerned with the numerous psychologic handicaps faced by chronically ill children and their family members, handicaps that were seriously interfering with function and appeared to be immune to the interventions of two eminent departments of the medical center, Pediatrics and Psychiatry. As an experiment, they recruited a number of lay persons to serve as sources of social sup-

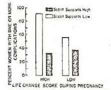

FIGURE 13. Complications of pregnancy by life change score and level of social support: high life change score before pregnancy. Study of 170 white married primiparae of similar age and social class, all delivered by the same service. (Figure adapted by permission from Nuckolls et al. (41).)

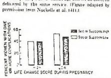

FIGURE 14. Complications of pregnancy by life change score and level of social support: low life change score before pregnancy. Study of 170 white married primiparae of similar age and social class, all delivered by the same service. (Figure adapted by permission from Nuckolls et al. (41).)

part. These family counselors were given little specific training but were carefully screened to insure they had the desirable qualities. Preference was given to a woman who had coped with a chronically ill child of her own and each one was subjected to a battery of psychologic tests to measure such attributes as emotional stability, empathy, dedication, etc.

The families with chronically ill members were then randomized and each counselor was assigned six families in the treatment group, with the other group remaining as controls. Visits to the families were determined by the counselors' availability and the families' needs. The results at the end of one year, based upon a variety of psychologic scores, are shown in figure 15.

Taken alone, then, no one of these studies is entirely convincing. Taken together, however, the results are more impressive. The study designs have varied to include ecologic, cross-sectional, case-control, cohort and randomized controlled trial approaches. The health outcomes have spanned a spectrum from self-reported symptoms and sickness behavior to levels of blood pressure, complications of pregnancy and death. The postulated psychologic stressors and social supports have been assessed by measures ranging from indirect proxy indicators to more direct and focused instruments. In each case a positive finding in the predicted direction

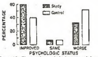

FIGURE 15. Changes in psychologic status of chronically ill children attending medical center pediatric and psychiatric departments after receiving counselling from lay persons recruited to serve as sources of social support. (Figure adapted by permission from Pless and Satterwhite (43).)

has been discovered. Clearly it would have been more desirable if these varied outcomes and/or approaches had been used on the same populations or if different study designs had been used to study the same outcomes. The results, however, appear sufficiently encouraging to warrant further research and to add a further dimension to Fosst's "orderly arrangement into chains of inference."

If such research were to support these ideas, it would suggest the need for a radical change in the strategies used for preventive action. Recognizing that throughout all history, disease, with rare exceptions, has not been prevented by finding and treating sick individuals, but by modifying those environmental factors facilitating its occurrence, this formulation would suggest that we should focus efforts more directly on attempts at further identification and subsequent modification of these categories of psychosocial factors rather than on screening and early detection.

Of the two sets of factors, it would seem more immediately feasible to attempt to improve and strengthen the social supports rather than reduce the exposure to the stressors. With advancing knowledge, it is perhaps not too far-reaching to imagine a preventive health service in which professionals are involved largely in the diagnostic aspects—identifying families and groups at high risk by virtue of their lack of fit with their social milieu and determining the particular nature and form of the social supports that can and should be strengthened if such people are to be protected from disease outcomes. The intervention actions then could well be undertaken by nonprofessionals, provided that adequate guidance and specific direction were given. Such an approach would not only be economically feasible, but if the notions expressed in this paper are correct, would do more to prevent a wide variety of diseases than all the efforts currently being made

through multiphasic screening and multi-risk-factor cardiovascular intervention attempts.

REFERENCES

1. Frost, WH: *Introduction to* Snow on Cholera. New York, Commonwealth Fund, 1936
2. Dubos R: Man Adapting. New Haven, Yale University Press, 1965, pp 164-165
3. Selye H, Wolff HG: *Quoted in* LE Hinkle: The concept of "stress" in the biological and social sciences. Sci Med & Man 1:31-48, 1973
4. Cannon WB: Stresses and strains of homeostasis. Am J Med Sci 189:1-14, 1935
5. Schoenheimer R: Dynamic State of Body Constituents. Cambridge, Harvard University Press, 1942
6. Hinkle LE: The concept of "stress" in the biological and social sciences. Sci Med & Man 1:31-48, 1973
7. Calhoun JB: Population density and social pathology. Sci Am 206:139-148, 1962
8. Ratcliffe HL, Cronin MIT: Changing frequency of arteriosclerosis in mammals and birds at the Philadelphia Zoological Garden. Circulation 18:41-52, 1958
9. Swinyard EA, Clark LD, Miyahata JT, et al: Studies on the mechanism of amphetamine toxicity in aggregated mice. J Pharmacol Exp Ther 132:97-102, 1961
10. Davis DE, Read CP: Effect of behavior on development of resistance in trichinosis. Proc Soc Exp Biol Med 99:269-272, 1958
11. Ader R, Hahn EW: Effects of social environment on mortality to whole-body x-irradiation in the rat. Psychol Rep 13:211-215, 1963
12. Ader R, Kreutner A, Jacobs HL: Social environment, emotionality and alloxan diabetes in the rat. Psychosom Med 25:60-68, 1963
13. King JT, Lee YCP, Visscher MB: Single versus multiple cage occupancy and convulsion frequency in C3H mice. Proc Soc Exp Biol Med 88:661-663, 1955
14. Andervont HB: Influence of environment on mammary cancer in mice. J Natl Cancer Inst 4:579-581, 1944
15. Christian JJ, Williamson HO: Effect of crowding on experimental granuloma formation in mice. Proc Soc Exp Biol Med 99:385-387, 1958
16. Holmes T: Multidiscipline studies of tuberculosis. *In* PJ Sparer, ed: Personality Stress and Tuberculosis, Chapter 6. New York, International Universities Press, 1956
17. Dunham HW: Social structure and mental disorders: Competing hypotheses of explanation. Milbank Mem Fund Q 39:259-311, 1961
18. Mishler EG, Scotch NA: Sociocultural factors in the epidemiology of schizophrenia: A review. Psychiatry 26:315-351, 1963
19. Holmes TH: Personal communication, 1963
20. Tillmann WA, Hobbs GE: The accident-prone automobile driver: A study of the psychiatric and social background. Am J Psychiatry 106:321, 1949
21. Durkheim E: Suicide: A Study in Sociology. Glencoe, IL, The Free Press, 1951
22. Christenson WN, Hinkle LE: Differences in illness and prognostic signs in two groups of young men. JAMA 177:247-253, 1961
23. Kraus A, Lilienfeld A: Some epidemiologic aspects of the high mortality rate in the young widowed group. J Chronic Dis 10:207-217, 1959
24. Henry JP, Ely DL, Stephens PM: The role of psychosocial stimulation in the pathogenesis of hypertension. Verhandlungen der Deutschen Gesellschaft für Innere Medizin, 80:107-111, 1974
25. Mason JW: Psychological influences on the pituitary-adrenal-cortical system. Recent Prog Horm Res 15:345-389, 1959
26. Mason JW, Brady JV: The sensitivity of the psychoendocrine systems to social and physical environment. *In*: PH Leiderman and D Shapiro, eds: Psychobiological Approaches to Social Behavior. Stanford, Stanford University Press, 1964, pp 4-23
27. Cassel J: Health consequences of population density and crowding. *In*: National Academy of Sciences: Rapid Population Growth. Consequences and Policy Applications. Baltimore, Johns Hopkins Press, 1971, pp 462-478
28. Cassel J: The relation of the urban environment to health: Implications for prevention. Mt Sinai J Med NY. George James Memorial Issue 40:539-450, 1973
29. Dubos R: The human environment in technological societies. Unpublished article
30. Conger JJ, Sawrey W, Turrell ES: The role of social experience in the production of gastric ulcers in hooded rats placed in a conflict situation. J Abnorm Psychol 57:214-220, 1958
31. Henry JP, Cassel J: Psychosocial factors in essential hypertension: Recent epidemiologic and animal experimental evidence. Am J Epidemiol 90:171-200, 1969
32. Liddell H: Some specific factors that modify tolerance for environmental stress. *In*: HG Wolff, SG Wolff Jr, CC Hare: Life Stress and Bodily Disease, chapter 7. Baltimore, Williams and Wilkins, 1950
33. Cassel J, Tyroler HA: Epidemiological studies of culture change: I. Health status and recency of industrialization. Arch Environ Health 3:25-33, 1961
34. Neser WB, Tyroler HA, Cassel JC: Social disorganization and stroke mortality in the Black population of North Carolina. Am J Epidemiol 93:166-175, 1971
35. James S, Kleinbaum DG: Socioecologic stress and hypertension. Related mortality rates in North Carolina. Am J Public Health 66:354-358, 1976
36. Harburg E, Erfurt JC, Chape C, et al: Socioecologic stressor areas and Black-White blood pressure: Detroit. J Chronic Dis 26:595-611, 1973
37. Christian JJ: The potential role of the adrenal

cortex as affected by social rank and population density on experimental epidemics. Am J Epidemiol 87:255-264, 1968
38. Downes J: Sickness as an index of the need for health supervision of the school child. Am J Public Health 35:593-601, 1945
39. Boardman V: School absences, illness and family competence. *In*: B Caplan and J Cassel, eds: Family and Health: An Epidemiologic Approach. Chapel Hill, NC, University of North Carolina, Institute for Research in Social Science, 1975, pp 61-69
40. Marmot M: Acculturation and coronary heart disease in Japanese Americans. PhD dissertation, Berkeley, CA, University of California, 1975
41. Nuckolls KB, Cassel J, Kaplan BH: Psychosocial assets, life crisis and the prognosis of pregnancy. Am J Epidemiol 95:431-441, 1972
42. Holmes TH, Rahe RH: The social readjustment rating scale. J Psychosom Res 11:213-218, 1967
43. Pless IB, Satterwhite B: Chronic illness in childhood: Selection, activities and evaluation of nonprofessional family counselors. Clin Pediatr (Phila) 11:403-410, 1972

RESPONSE TO WILHELM (STATE WATER COMMISSION) LETTER

#21

("The Contribution of the Social Environment to Host Resistance," by John Cassel, 1976, Volume 104, Number 2, from the "American Journal of Epidemiology," John Hopkins University, Baltimore, Maryland, is copyrighted but is reproduced herein with the permission of the publishers.")

For information on health aspects related to stress, see response #190.

The analysis of air quality impacts from the proposed action did consider the health and welfare of the citizens of North Dakota. Before issuing a Permit to Construct, the State Health Department analyzes the emissions from each proposed project and compares the emissions and ground level concentrations with the state and federal ambient air quality standards, new source performance standards, and the Prevention of Significant Deterioration of Air Quality Standards. The permit can only be issued if the proposed facility does not exceed these standards.

The original ambient air quality standards for air contaminants, such as sulfur dioxide, were established after research, surveys, and review of existing articles and published reports. The air quality criteria for sulfur dioxide alone examined over 300 sources. The guidelines for the standards were that the quality of the air should be good enough that:

1. The health of even sensitive or susceptible segments of the population would not be adversely affected;

2. Concentrations of pollutants would not cause annoyance such as the sensation of unpleasant tastes or odors;

3. Damage to animals, ornamental plants, forests, and agricultural crops would not occur;

4. Visibility would not be significantly reduced;

5. Metals would not be corroded and other materials would not be damaged;

6. Fabrics would not be soiled, deteriorated, or their colors affected;

7. Natural scenery would not be obscured.

Using the guidelines and analyses of the various data sources, the variations in the effect of a particular contaminant on a person for various concentrations of the

contaminant over a given time were shown. This information indicated a range of concentrations and exposure times for which mortality had been reported in excess of normal, a range where significant health effects were reported, and a third range where health effects were suspected. All other concentrations and exposure times below these ranges were considered not to be significant.

The standards established under the original Clean Air Act used the latest available information. Federal standards for the ambient air quality were established in two segments, primary and secondary. The purpose of setting these standards was to provide for the general health and welfare of the people. The primary standard was established for contaminants at the level of concentration above which health effects would be considered to occur. The secondary standard was set for contaminants at the level of concentration above which the welfare of a person would be considered to be affected. This means that above the secondary standard, but below the primary standard, people might notice some discomfort, such as burning of the eyes; however, no known health effects would be expected.

Therefore, even though care has been taken in setting these standards, the possibility exists that some persons, depending on personal factors, may be especially sensitive to various contaminants, and those persons could experience discomfort when concentration of a contaminant is just below the standard.

State ambient air quality standards are not broken into segments, but they have one standard for each contaminant to achieve and maintain the best air quality possible to protect human health, welfare, and property; to prevent injury to plant and animal life; to promote the economic and social development of the State of North Dakota; to foster the comfort and convenience of the people, and to facilitate the enjoyment of the natural attractions of the state. The ambient air quality standards of North Dakota are equal to, or more stringent than, the federal standards.

For the past 10 years, the scientific basis for setting ambient air quality standards has been reviewed, evaluated, subjected to outside criticism, and re-evaluated. The national ambient air quality standards for the contaminants were promulgated in 1971. A review of the ambient air quality standards has been an ongoing process by a number of groups. In 1973, the American Medical Association endorsed the present levels and time schedules. In 1973, the National Institutes of Environmental Health Sciences concluded "There is . . . no basis for relaxation of the present standards for sulfur oxides at this time," however, they did note that the "scientific basis for this judgment is incomplete" and called for further research. In 1974, the National Environmental Research Center stated "No new information was presented which would suggest that the U.S. primary air quality standards are in error." Later in 1974, the National Academy of Sciences published its report on the review of the national ambient air quality standards. The report stated that the panel members were not satisfied with the data base available for setting the standards. Nevertheless, these panels found that the evidence accumulated since promulgation of the standards supports the standards.

Many new studies have been completed since promulgation of the initial standards (which indicate a continuing controversy on the margin of safety in the standards), the U.S. Congress passed the 1977 amendments to the Clean Air Act. The amendments state that regulation is authorized if emissions contribute to air pollution which "may reasonably be anticipated to endanger public health or welfare." In the evaluation of what "may reasonably be anticipated," the limitations and difficulties inherent in environmental medical research must be considered.

A comparison of the ground level concentrations for Level 2 development with the appropriate ambient air quality standard shows that for particulates, the annual maximum ground level concentration is 47% of the annual geometric mean total suspended particulate standard. For sulfur dioxide, the annual maximum ground level concentration is 12.5% of the annual maximum allowable concentration set by state ambient air quality standards. The annual maximum ground level concentration for nitrogen dioxide is about 11% of the annual ambient air quality standard.

Because of the admitted need for greater research, the importance of the national ambient air quality standards, the continued controversy over the standards, and the desire for an independent scientific review, Congress included in the 1977 Clean Air Act Amendments that EPA review the standards each two years. To assist in this review, an independent scientific review committee was established and is composed of physicians, scientists, and air pollution administrators.

Some have suggested that since the standards are to protect against all known or anticipated effects and since no safe thresholds can be established, the ambient standards should be set at zero or background levels. Others have suggested that unless conclusive proof of actual harm can be found based on past occurrence of adverse effects, then standards should remain unchanged and no pollution limits should be applicable to areas which are cleaner than the ambient standards.

The 1977 amendments for the prevention of significant deterioration were established to balance the unchecked pollution increase and the no pollution increase philosophies. This approach provides the necessary information to the public and the process is set up by which each state can prescribe the degree of increased pollution desirable for their area.

The Prevention of Significant Deterioration of air quality standards originally classified all areas of the state Class II. Under the 1977 amendments, all areas remained Class II except for Class I areas specially designated by the amendments.

Many people believe that the class of air determines whether one's air is cleaner or better than another area. The classification does not determine the quality of the air, but how much of an increment the existing air quality can be deteriorated. This means that under a Class II designation, the existing quality of the air in North Dakota cannot be degraded annually beyond 15 micrograms per cubic meter of air for sulfur dioxide. If the area was Class I, the amount of annual average degradation would be only 2 micrograms per cubic meter of air for sulfur dioxide. Regardless of what the classification and the increment, the air quality cannot exceed the ambient air quality standards. These increments were established in the Clean Air Act, as amended, as follows:

- Class I - The increment is determined to be 2 of the lowest national standard except for particulates which is 10% of the lowest national standard.
- Class II - The increment is determined to be 25% of the lowest national standard.

To determine the quality of the air in an area, the increment from Prevention of Significant Deterioration is added to the baseline air quality of January 1975 which was established by the Act. A comparison of the ground level concentration of Level 2 development with the prevention of significant deterioration standards for Class II shows that particulates are 30% of the Class II increment and sulfur dioxide is 17%.

An unconfirmed Czechoslovakian study has indicated hematologic changes, as well as respiratory disease effects, at very low concentrations of nitrogen dioxide (0.02-0.07 parts per million). A comparison of these concentrations with the increase in nitrogen dioxide concentration for Level 2 development shows that Level 2 nitrogen dioxide is one seventh of the lowest concentration shown in the Czechoslovakian study.

Standards have not been established for all air contaminants because sufficient data has not been collected to make accurate determinations of what effects it would have on health. However, research is continuing on what effects various contaminants could have on the health and welfare of the people, and as conclusions are reached, the need for corrective action to protect the public is continually assessed.

Western coal does contain radioactive atoms and there is ongoing research as to its effects on the environment, including health. As pointed out in the Environmental Health Letter attached to the comment, in modern power plants equipped with emission controls, the stack gas emissions do not present a health hazard. The article refers to the potential use or deposition as a possible problem. For the North Dakota facilities being proposed, the fly ash is proposed to be buried in the mine during the reclamation process.

The reason for the low cancer rate in North Dakota is not known, because from numerous literature sources, almost all types of activity have indicated the potential for causing cancer. As stated in the Wall Street Journal article "researchers hadn't drawn any conclusions as yet about whether fly ash causes cancer." Because of the variety of possibilities for causes of cancer, it cannot be determined if the increase in coal fired plants within North Dakota will or will not have any affects on the cancer rate.

Trace elements, and further information on all of these subjects, are included in Part 1, Air Quality.

#22

Certainly the issue of quantifying hidden or ignored social cost aspects of environmental impact is a very real issue. A typical modern example relates to the cost of individual use of automobiles for commuting in metropolitan areas, where the hidden or indirect costs include increased street repair, increased need for highly expensive air pollution control equipment, and indirect health costs associated with air quality problems, including increased psychic and bodily health problems caused by congestion.

Basic research is just now beginning to quantify these types of problems. Without more complete basic research, no environmental study using an analysis of existing information, such as was the case with the North Dakota Draft Study, can begin to address quantification of these issues. The Draft Study. however, has made every effort to highlight indirect impacts considered important and to discuss the range of importance or concern they represent in the minds of the best trained professionals available, even though absolute quantification may be lacking.

In addition, specific research efforts have begun as a result of the specific concern been expressed by the public during the review period. The North Dakota Department of Health is on a long term study to evaluate the effects of trace elements. Several federal and state agencies and universities have projects to monitor the affects of coal mining, reclamation, and waste disposal on ground-water sources. These projects will document and evaluate any changes in water quality, water levels, and the availability and usability of the water. Similar studies are underway in a number of other areas by various sectors, including government, industry, the university system, and private groups.

Finally, one use to which the governor and the Bureau of Land Management are committed as a followup to the study, is to present an evaluation of key information gaps important in understanding the effects of energy development that have surfaced during the study and public review periods. Federal and state programs will be developed based on this analysis to begin research in these areas.

#23

See response #21.

#24

Page 38 of the Summary states that the basis of these statements is a social psychological research report. The statements reflect what residents believe will happen. Pages 33 and 39 of the Summary present the analytically projected impacts on taxes and crime, respectively.

See response #21 for physical health information.

#25

The "No Further Development Alternative" discussion on page 46 of the Summary is further detailed in Chapter 8, Alternatives, page 193, of the Draft Study. The impacts of facilities permitted and under construction at the time of the preparation of the study were considered as part of the existing environment or baseline data (Chapter 1, page 22). The impacts of these facilities were taken into account before considering impacts of new proposals.

#26

"Baseline" economic and social information for the seven-county study area included all existing and newly constructed energy facilities as of December 31, 1976. As such, all the effects from these facilities (including revenues) were included in the baseline economic modeling. The Economic and Social Conditions Technical Supplement contains more detailed information on this process and its input. Also see #23.

#27

More detail on this Summary alternative can be found in Chapter 8, page 193, of the Draft Study. This alternative covers only those impacts that would occur if federal coal is not leased. If federal coal is to be leased, this has already been covered throughout Chapters 1, 3, 4, 5, 6, and 7 of the Draft Study as a separate subheading.

#28

The plan to establish levels of development and the criteria necessary to determine what proposals would fit into the various levels was completed in early May of 1976. The criteria for proposals to be considered in Level 1 development included the following:

1. Proposal would be expected to initiate construction within about five years.

2. Proposal had submitted applications for federal/state coal leases.

3. Mine proposals had developed a preliminary mining plan.

4. Proposal had made application for or received some required permits.

5. Proposals for energy conversion facilities should include:

a. location, type of facility, acreage requirements, plant output
b. coal consumption rate
c. emission levels expected
d. plant water requirements
e. work force levels and time when they are needed
f. waste disposal systems
g. transmission line, pipeline, and road locations
h. dollar value of capital equipment goods purchased within the state
i. any other available information regarding the facility

The NGPL proposal met these criteria and, at the time of analysis, the company expected that the facility would be under construction within about five years, if approvals were received.

The water permit application by NGPL requesting 70,000 acre-feet of water annually for four coal gasification complexes was filed with the State Engineer's Office on April 17, 1976. The proposal in the Draft Study is only for one coal gasification complex using 11,750 acre-feet of water per year. The denial of the application for the 70,000 acre-feet was issued to NGPL on June 6, 1976. In this denial, the State Engineer stated that the disapproval by the State Water Commission is compelling evidence that approval of the application, at least at the present, would be contrary to the public interest. The denial further stated that the company had not shown the project was in the public interest, and that a number of research programs were underway, but were incomplete at the time and were not a source of immediate information. Based on the above criteria and information, the NGPL and ANAX proposals still met the requirements for being considered as a proposal within Level 1 development.

Also, the purpose of an environmental assessment is to determine the pros and cons of proposals. Even if the cons of any one proposal should outweigh the pros, this is not justification to drop the proposal from study. The study should show all results on those proposals which meet the criteria when the study begins--not just those that measure favorably.

STATE PLANNING BUREAU
State Capitol
Pierre, South Dakota 57501
605/224-3661

SOUTH DAKOTA
Office of
Executive Management

May 26, 1978

Bureau of Land Management
222 North 32nd Street
P.O. Box 30157
Billings, Montana 59107

RE: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development (EIS 080678)

Dear Sir:

The State Clearinghouse has distributed the above stated draft environmental impact study for review. Attached are comments which we received from the South Dakota Department of Environmental Protection.

The State Planning Bureau feels that water uses are discussed quite adequately in this study. However, we feel that the amount of consumption must be addressed as well.

Thank you for the opportunity to comment.

Sincerely,

Joyce Hamlin
Commissioner
STATE PLANNING BUREAU

SH:jrr
Enclosure
cc: District Directors
Dept. of Environmental Protection

SOUTH DAKOTA Department of
Environmental Protection

Pierre, South Dakota 57501
Phone (605) 224-3351

MAY 1978 RECEIVED State Planning Bureau

May 23, 1978

Mary Jane Nelson
State Planning Bureau
Pierre, South Dakota 57501

Dear Mary Jane:

The environmental impact from the West-Central North Dakota Energy Development Plan on South Dakota's air quality appears to be minimal but the cumalative effect of Wyoming, Montana, and North Dakota's energy development may be of some concern. A need for an adequate air quality data base is essential for this region prior to extensive energy development. Also, South Dakota's Class II ambient air quality designation should be considered in any energy development. 30

Another concern lies with the potential loss of millions of kwh/year from South Dakota's hydroelectric power. Water would be taken from Lake Sakakawea and the Missouri River below Garrison Dam, for the NGPL and ANG Coal Gasification Plants and the Antelope Valley and Coyote 1 Power Plants, apparently for cooling purposes. The reduction in hydroelectric power would effect dams from Garrison to Gavins Point. This aspect should be looked into more closely by the Plan. 31

Sincerely,

Vonni Kallemeyn
Vonni Kallemeyn
Environmental Specialist
Department of Environmental Protection

81/12

Equal Opportunity Employer

#31
The annual hydropower loss from the entire system (Garrison to Gavins Point) from all Level 1 projects would be about 19 million kilowatt hours and from Level 2 (which includes Level 1) the power not generated would be about 26 million kilowatt hours. These figures are taken from page 97 and page 99 of the Draft Study. The breakdown as to which dams would not be generating how many kilowatt hours was not made, as the power plants are a complex integrated operation. Variations in power generation at individual dams depend on many factors besides the diversions discussed. Among those factors are the management of flood control storage in upstream reservoirs, rates and timing of diversions for irrigation, increased withdrawals for municipal and industrial uses, and management decisions relative to the integrated hydropower-thermal power generation system. Such an analysis would not be meaningful.

RESPONSE TO SOUTH DAKOTA STATE PLANNING BUREAU AND DEPARTMENT OF ENVIRONMENTAL PROTECTION LETTERS

#29
Water consumption was addressed in the appendix, page 210 of the Draft Study, in some detail. Present consumption by municipalities is also addressed in Table 3-51, on page 97, and water use is shown in Figure 2-8, on page 39.

#30
The environmental impact from the West-Central North Dakota Energy Development Plan on South Dakota's air quality seems to be minimal, as evident in the discussion of air quality impacts on pages 85-88 of the Draft Study. Although South Dakota's Prevention of Significant Deterioration Class II area designation was not specifically commented upon in the discussion of impacts from proposed Level 1 and Level 2 sources discussed in this study, the predicted ground level concentrations shown in Tables 3-21 and 3-22, as well as the isopleths for the annual concentrations as displayed in Maps 3-4, 3-5, and 3-6, indicate that the maximum ground level concentrations occur within the seven-county study area and decrease as the distance increases between the sources and the ground level receptors.

It is doubtful that the effects of energy development in Wyoming, Montana, and North Dakota would impact upon South Dakota's air quality simultaneously, due to the geographical relationships of the energy development areas of these three states. In that sense, the probability for a cumulative effect would be very low.

The point concerning the need for an air quality data base is well taken. The U.S. Environmental Protection Agency has provided air sampling stations in Montana, North Dakota, South Dakota, and Wyoming to provide an air quality data base prior to development. This air sampling network was referred to as the Northern Great Plains Air Sampling Network and these stations, two of which were located in South Dakota, were initiated in 1974. Although it appears at this time that this network will terminate operations in September of 1979, air sampling capabilities should be maintained by the respective states to monitor any increases above baseline as a result of energy development. The North Dakota State Department of Health has a number of air sampling stations located between the energy development areas of this state and the state of South Dakota. The state of North Dakota would be happy to provide further information concerning the air quality as measured at these sites.

United States Department of the Interior
BUREAU OF MINES
BUILDING 20, DENVER FEDERAL CENTER
DENVER, COLORADO 80225
Intermountain Field Operations Center

Office of Chief

May 31, 1978

Memorandum

To: Robert D. Kaiser, Federal Assistant Manager, West-Central North Dakota Regional Environmental Impact Study, Suite 2, Capitol Place, 1533 North Twelfth Street, Bismark, North Dakota 58505

From: Chief, Intermountain Field Operations Center

Subject: Draft West-Central North Dakota Regional Impact Study on Energy Development

Personnel of the Intermountain Field Operations Center have reviewed the subject impact study as part of the Bureau's participation on the West-Central North Dakota study team.

We have only two comments to make on the documents. In the summary, hardwood draws are described as being both exclusion (p. 33) and avoidance areas (pp. 22 and 42) for transmission line facility siting. The former is probably incorrect. 32 Table 2-11 on page 31 of the study indicates that the source of the information is 38 CFR 25678, Sept. 14, 1973. The correct citation should read 40 CFR 50.4-50.11, July 1, 1976. 33

Raymond L. Lowrie
Raymond L. Lowrie

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

RESPONSE TO BUREAU OF MINES LETTER

#32

The comment questioning whether hardwood draws are exclusion areas for transmission facility route selection is valid. Under North Dakota's criteria for transmission facility corridor and route selection, hardwood draws are considered "avoidance areas." The sentence in question (page 33, Summary) should be reworded as follows:

"State law and subsequent regulations forbid energy conversion facility siting on federal, state, or local recreation areas, wildlife refuges, game management areas, hardwood draws, or unique natural areas. In addition, transmission facility siting is restricted in federal or state parks, historic sites, monuments, landmarks, national wilderness areas, state archaeological sites, state nature preserves, and all local park and recreation areas."

#33

Correction noted in Part 1.

Gary Johnson
June 2, 1978
Page-2

primarily to the effects of increasing oil and gas activity in the area. Regional Environmental Assessment Program population projections indicate an increase of approximately 4,000 persons in Dickinson's population by the year 2000 should the Natural Gas Pipeline project become a reality. Level 3 developments would mean an even greater increase. Population growth of this type would undoubtably alter Dickinson's existing social, economic, environmental, and political conditions to a significant degree. The study is deficient in this regard. The analysis of coal development impacts, which presently concentrate heavily on Beulah, Hazen, and Killdeer should be expanded to include Dickinson, as well as other Stark County cities.

2. The scope of the discussion concerning coal export should be enlarged. The social and economic impacts of coal trains are presently being felt in central and southwestern North Dakota. It is probable that the number of such trains will increase in the future as higher coal production levels occur at Montana and Wyoming mines. As an obvious and significant consequence of coal development, it is suggested that a more complete analysis of the effects of coal trains be included.

3. The Regional EIS does not address to any great extent the social and economic implications associated with the conclusion of energy development in the area, i.e. the burden upon local residents of financing services and facilities with a greatly reduced population base and tax base.

4. The study asserts on page 35 that "the rate of increase in production of oil and natural gas should have very little effect on surface disturbance and population increases within the seven county area." This is generally true in most instances. Oil activity in southwestern North Dakota, however, is concentrated and is very intense within a geographically small area. The cities of Killdeer and Dickinson are presently experiencing rapidly expanding populations and economies due to recent oil discoveries in the immediate area.

5. The City of Manning, the Dunn County seat, is scarcely mentioned in the study. Manning would be in a position to gain population and experience the impacts of coal development if Dunn County if an adequate water and sewer system were established. Though an unincorporated community, its location halfway between Killdeer and Dickinson would likely attract a number of new residents.

6. It is recognized that a delineation of the study area was necessary. We believe that it would be useful, however, to briefly address the effects that coal development in the seven county area would have upon surrounding locations, such as potential addition/loss of labor force to high-wage coal-related

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ROOSEVELT-CUSTER

REGIONAL COUNCIL FOR DEVELOPMENT

Telephone (701) 227 1241
Fisher Hall
Dickinson, North Dakota 58601

June 2, 1978

Gary Johnson
Regional EIS Office
1633 No. 12th St.
Suite #2
Bismarck, North Dakota 58505

Dear Mr. Johnson:

The Roosevelt-Custer Regional Council has reviewed with interest the draft West Central North Dakota Regional Environmental Impact Study on Energy Development. We appreciate the opportunity to offer our comments concerning this document.

Stark and Dunn Counties are included in our southwestern North Dakota planning region. In several areas, the study is inadequate in its discussion of the effects of potential coal development upon these two counties. These areas are outlined as follows:

1. Further attention should be devoted to the effects of social/economic changes and impacts upon communities in Stark County, particularly Dickinson. Exception must be taken with three comments contained in the study. One, on page 114 states: "Level 2 development impacts in Stark County are expected to be negligible. Economic impacts resulting from catchment Level 3 development in Stark County could possibly be absorbed by Dickinson without undue stress on that community's already well developed infrastructure."

The second statement, found on page 140, concludes: "Level 3 activity is not expected to affect Dickinson and Stark County to any great extent because considerable services are already available in Dickinson."

Also, it is assumed on page 105 that social conditions in Stark County "would be only slightly affected" by Level 3 development because of the existing population based in Dickinson.

Dickinson is a major trade and population center. The city would certainly be affected by any coal development which might occur in the Dunn County area. It is within easy commuting distance, and would attract construction workers and secondary employees who desire a larger community. The corresponding impacts, however, are not likely to be "negligible". Dickinson is, in fact, currently experiencing difficulty in its ability to provide necessary services to a growing population, due

34

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Gary Johnson
June 2, 1978
Page-3

jobs, filling of allowable air quality increments, unit coal train impacts (as mentioned previously), etc.

7. Dunn County adopted a comprehensive plan on December 6, 1977. Also adopted was a county zoning ordinance which modified several of the provisions of the interim ordinance dealing with energy development.

We trust you will find the foregoing comments helpful. It is our hope that similar conservative ventures between the State of North Dakota and the Bureau of Land Management will exist in the future.

Sincerely,

Bob Reinertson

Bob Reinertson
Associate Planner

BR/cs

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RESPONSE TO ROOSEVELT-CUSTER REGIONAL COUNCIL FOR DEVELOPMENT LETTER

#34

Even though the economic modeling indicated that the additional Level 2 development would not significantly impact Stark County, future coal development coincident with future large scale oil and gas development could conceivably generate significant social and economic impacts in Dickinson and Killdeer, as well as in the general areas. However, indications so far are that oil and gas development in Dickinson has not created significant impacts on that community's infrastructure. According to Mayor Schank, there were some seismograph people in the area earlier in the year, most of whom have left. The mayor estimates that there are only approximately 30 to 40 new families (maximum) in Dickinson directly related to oil and gas activity.

Mayor Binnick of Killdeer feels that impacts from oil and gas activity are noticeable in that community. Housing seems to be the most highly impacted sector; recent building includes two new motels, a six-plex, two four-plexes, two or three duplexes, and 10 to 15 new single family residences. In addition, he feels that a new trailer court is needed. There is only one cafe open in town; the other two are closed due to health restrictions. The water and sewage treatment capacity of the town could handle double the present population as a result of a new well and remodeling of the sewage treatment lagoon.

It is uncertain at this time how much additional oil and gas related impacts will occur in this area. Mayor Schank noted that seismic activity in the Dickinson area resulted in the most noticeable increase in people. The actual manpower requirements for development and operations were not large due to the high degree of mechanization and automation present in modern day oil fields.

Also see responses #36 and #72.

#35

Relative to the dramatic changes projected in Mercer and Dunn Counties, the social changes projected in Dickinson and Stark County are moderate. The primary reason is that Stark County's population is expected to increase quite steadily regardless of whether or not coal development proceeds in the vicinity. Growth attributed to the proposed action is only a minor part of the total anticipated change.

The following table represents the existing and forecasted eastbound Burlington Northern coal train traffic originating from mines in the Fort Union and Powder River formations in eastern Montana and Northern Wyoming.

#36

The last paragraph of the geology section, page 35, should be amended to read, "However, the rate of increase in production of oil and natural gas should have very little effect except locally on surface disturbances and population increases within the seven-county study area. For example, development is occurring in the Little Knife Field in Dunn and McKenzie Counties. Seventy-four producing wells had been drilled as of December 1978 with the expectation that the final number of producing wells would be between 120 and 150 wells. The field currently covers an area of 45 square miles. Also see responses #34 and #72.

#37

Manning was not mentioned in any great detail because only incorporated communities were analyzed in the economic model. It is likely that many such small, unincorporated communities could experience some economic growth if their infrastructures were upgraded to support additional population and economic activity.

#38

Significant economic and social change would be confined to the seven-county study area. The Proposed Action (Chapter 1) discusses the rationale for choosing a seven-county impact area surrounding the three-county project area. Wherever significant impacts extended beyond the seven-county study area, they were explained.

The filling of allowable air quality increments will place additional limitations upon future development in both the seven-county study area as well as surrounding areas. A more detailed discussion of this matter is found in Climate and Air Quality, Part 1, "Air Quality Influence of Oil and Gas Production."

#39

Through public participation in the planning process, Dunn County adopted county zoning ordinances and a comprehensive land use plan on December 6, 1977. The comprehensive plan includes alternatives which take into account the projected impacts of potential energy developments. Zoning also has been laid out to guide an orderly county development.

Table 1

Existing and Forecasted Daily Coal Train Traffic 1/ Through Montana

Rail Segment 2/	Existing	1990 Forecast
Huntley to Sarpy	3	6.4
Sarpy to Nichols	6	16.8
Nichols to Forsyth	10	23.9

1/ Includes empty backhauls.

2/ Figures are not cumulative among segments. For example, the Nichols to Forsyth segment currently handles four more coal trains than the Sarpy to Nichols segment.

SOURCE: Data on existing traffic - Burlington Northern 1977. Data forecasts from Interstate Commerce Commission 1976.

Table 1 shows that the Nichols to Forsyth segment of the Burlington Northern in Montana, easternmost of the three segments, is currently averaging 10 trains per day. This amount of traffic continues on through western North Dakota to markets in the eastern U.S. By 1990, this traffic is expected to increase by 139% to a new daily traffic figure of 23.9 trains.

Consequently, the 344 daily rail car traffic associated with the proposed action (approximately 3-4 trains) estimated in Chapter 3, Land Use, would be further increased by the 23.9 trains traveling through the seven-county study area in 1990 to and from Montana and Wyoming mines.

Noise, dust, odors, and traffic congestion are the major impacts upon local inhabitants resulting from increases in rail traffic, especially through small towns where residential and commercial activities may be in close proximity to rail lines. There are several small communities adjacent to Burlington Northern rail lines in the study area which would be impacted by this increase in traffic. Health and safety problems may occur depending upon many factors such as weather, existing safety facilities, proximity to tracks, length of trains, and traffic volume.

The conclusion of energy development is not discussed in more detail because of the uncertainties surrounding future Level 3 energy development. Because no one can predict, at this time, the timing of eventual phaseout of all energy development in the area, it is virtually impossible to be more specific concerning the magnitude or duration of an areawide downturn in economic activity.

Also see responses #34, #36, and #72.

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

ORIGINAL

Public Hearing

in re

WEST-CENTRAL NORTH DAKOTA REGIONAL

ENVIORNMENTAL IMPACT STUDY

First National Bank Building

Dickinson, North Dakota

June 5th, 1978

CARNEY, GRAUSAM AND ASSOCIATES
REGISTERED PROFESSIONAL REPORTERS
P.O. BOX 1031
ROCHESTER, MINNESOTA 55901

Presiding: Mr. Gary Johnson, Chairman
North Dakota Natural Resources Council
Bismarck, North Dakota

Panel Members: Mr. Charles Steele
District Manager
Bureau of Land Management
Dickinson, North Dakota

Mr. Robert Kaiser
Federal Assistant Manager
Regional EIS
Bismarck, N rth Dakota

Mr. Bruce Seelig
Reclamation & Sighting Divelon
N. D. Public Service Commission
Bismarck, North Dakota

Mr. Gene Christianson
Director, Environmental Engineering
North Dakota State Health Department
Bismarck, North Dakota

Speakers:

GARY JOHNSON: It is a little past the time. I think we will begin. I have some prepared remarks to begin with. I will call the hearing to order.

I am Gary Johnson. I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

Our interest is in correcting errors in the draft study in order to assure the best possible resource information for decision-makers. This draft study makes no decisions concerning energy development but rather analyzes the environmental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and

the Bureau of Land Management with the opportunity to receive comments from the public and private sectors. This is in addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 9, 1976.

As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1976. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me today are Chuck Steele, who is the District Manager of the BLM here in Dickinson; Bob Kaiser, who serves as the Federal Assistant Manager on the Region EIS and Bruce Seelig, who is a member of the Reclamation and Citing Division of the North Dakota Public Service Commission. One more individual I would like to ask to join us as the panel who just came in, Gene Christianson, who is Director of the Environmental Engineering Staff of the State Health Department.

As official reporter will make a verbatim transcript of this hearing. In order to ensure a complete and accurate record of the hearing, it is necessary that only one person speak at a time. Therefore, while this hearing is in session,

only the designated speaker and members of the hearing panel will be recognized.

There are several procedural guidelines which we request you observe during the hearing. They are:

1. It is requested that all statements be confined to your comments on the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development.

2. This hearing is structured to receive information concerning the accuracy of the study, not to debate the study. Publicized informational meetings were previously held on the study on April 3, 4, and 5 in Bismarck, Dickinson, and Essex respectively.

The hearing panel is here primarily to clarify comments where necessary. The panel is not here to engage in debate on the study, but to ask clarifying questions, if necessary, at the conclusion of your remarks.

3. It is requested that speakers confine their remarks to ten minutes, if possible. This request is made in order to accomodate all those who wish to make comments in regard to the accuracy of the study. We do not wish to be unreasonable in enforcing the ten-minute time limit and will do so only should excessive demands of time be made.

4. For those of you who have both oral and written statements, it is requested that the oral statement

highlight the points you wish to make. You may choose to submit only a written statement. Copies of written statements should be identified with your name, address, and the organizations, if any, which you represent. When you are called to speak, copies of your statement should be given to the reporter.

5. Registration cards are available at the table near the entrance to this room. If you have not registered for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of these cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address, and the organization you represent, if any.

The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

So far I have three cards from individuals who have indicated a desire to present remarks today.

Is there any preferred order among you?

Evelyn Newton, okay, our first speaker will be Evelyn Newton.

EVELYN NENTON: I am Evelyn Newton, Chairman of the Dakota Resource Council Concerning the Draft West-Central North Dakota Regional Environmental Impact Study. Monday, June 4, 1978, here in Dickinson.

I would like to thank the Bureau of Land Management and our State for this opportunity to comment on the draft West-Central for the North Dakota Regional Environmental Impact Study. Since this study is supposed to be laying the groundwork for planning with regard to potential coal development in this area, it is essential that the people who live here take an active part in its production.

Unfortunately, the EIS in its present form is inadequate as a tool for planning. It glosses over some of the most serious impacts of coal development in ways that lead an unsuspecting reader to believe that the massive coal development will have many positive and few negative effects on the lifestyle and ecology of the area. The fact is, the development of coal on the scale projected by Levels 1 and 2 in the EIS could be disastrous for the long term well-being of the land and people of North Dakota.

The way the study presents the sections on Climate and Air Quality is one example. The EIS states that, "A general reduction in the overall ambient air quality of the seven-county area would be expected to occur. However, the application of existing mitigating measures would not permit

the reduction to attain levels which would significantly alter the existing quality of the air environment in the seven-county study area."

Statements such as this, and there are plenty of them in the study, lead the reader to believe that air pollution due to Levels 1 and 2 development would be insignificant. If the various figures that the EIS spreads throughout the section on Air Quality are added up, however, the facts are these: particulate emissions would total 13,014 tons per year; sulphur dioxide emissions would total 103,303 tons per year; nitrogen oxide emissions would total 59,600 tons per year. This adds up to a total of 175,917 tons every year. With an expected lifespan for these projects of 35 years, the amount of these pollutants to be emitted into the area's air would be 6,157,095 tons. This averages out to 482 tons per day.

Although the study doesn't give all of these totals, it defends the amount of pollution which would foul our air by repeatedly emphasizing that Levels 1 and 2 development would not violate federal or state air pollution standards. It doesn't indicate, however, the amount of damage which can occur at levels well within the federal Class II standards. What's more, the study fails to assess the impacts which Class I air standards would have on the area. It seems to take for granted that everyone in the area is

content with Class II designation, which is not the case at all.

The EIS reports that the State Department of Health's Phase I study on trace element emissions "indicates that there is a low probability of short term adverse effects resulting from the emissions of trace elements from energy conversion facilities." The Dakota Resource Council considers the thirty to forty-year life expectancy of these projects as short term, but as it applies to this study, the "short term" is only one year. The EIS doesn't point this out, however. To find that out, the reader must consult the Technical Supplement on Climate and Air Quality.

It should be noted here that at the informational meetings for the study which was held in Dickinson, we were told that the Technical Supplements were limited in quantity and were meant to be used only by people with expertise in those related areas.

We don't have expertise in the field of air pollution, but we also found that the Air Quality Supplement also admits that the long term effects of trace element emissions are not known. The EIS doesn't point this out, either. The supplement also lists a considerable amount of material which deals specifically with trace elements, but the EIS doesn't cite any of them.

The EIS does not adequately assess the synergistic

effects of pollutants which become highly toxic when combined. It mentions that such pollution is possible, but fails to detail the potential for such problems as they relate to the development proposals.

The EIS quantifies the particulate emissions which will occur in the area and notes that most of them will be coming from unpaved roads, agricultural activities, and mining operations. It doesn't qualify these emissions, however, and calls the particulate emissions from the Coyote 2 Power Plant "indistinguishable" in comparison to the other sources. It overlooks the fact that particulate emissions from power plants and gasification plants are far more dangerous than those from these other sources.

The study says next to nothing about the possibility of "acid rains", despite the fact that they have occurred in other parts of the United States as well as Europe as a result of high sulphur emissions.

Other areas of the study are equally deficient. The EIS also states that "as a result of the current state of the art of reclamation...estimates of the residual adverse impacts are speculative and in most cases beyond calculated predictions," and that "while pre-mined productivity may be accomplished on post-mined lands, no one really knows what productions levels will be on reclaimed lands in 20 to 30 years."

Despite these statements, and with no evidence of any land in North Dakota being reclaimed to 100% of its original productivity, the EIS bases figures in the sections dealing with Land Use, Soils, Vegetation and Geology on 100% reclamation in a three to five-year period.

The EIS gives no estimates of the cost of reclamation. This is especially important as it relates to bonding requirements in North Dakota, and should be included to provide an idea of what would be involved if the State has to take over the reclamation process.

The Study states that the timespan between mining and reclamation is critical because of erosion hazards. It fails, however, to relate these potential hazards to North Dakota's reclamation law.

In the section concerning Land Use, the EIS projects that the total amount of land to be leased by all projects in Levels 1 and 2 development is 336,134 acres. The amount of land it projects will be disturbed is 82,481 acres. The EIS says nothing about what will be happening on the 243,673 acres of land which is in excess of the development's needs.

The Study also implies, in the Land Use section, that surface owners have "veto power" over the mining of coal which is owned by another party. This is not always the case in North Dakota.

The Social Impacts sections are based on a survey

which has been called "in many places a distorted and misleading version of the human concerns it attempts to portray," by one of the leading impact sociologists in the nation. Here, as in many other sections, the EIS quantifies without qualifying, and as a result it fails to adequately portray the meaning of the statistics.

The EIS presents a slanted view of the alternative of no further development. For instance, the EIS says that "the primary residual adverse effects of this alternative would be the non-availability of the energy" for jobs and production. This implies that the energy would be used for jobs and production in North Dakota, when in fact most of the energy produced by these projects would be sent out of the State. The EIS doesn't mention this, however.

There are other areas where the study is in need of considerable revision: the EIS fails to assess the impacts which will affect the area when the proposed projects would come to an end; Natural Gas Pipeline Company's proposed gasification plant near Dunn Center should not have been included in Level 1 development; NGPL has not even filed the necessary applications with the Public Service Commission or the Department of Health, and has been denied a permit by the State Water Commission; in general, the EIS would have been better organized had it been broken down by subject rather than by study process.

All of these areas represent serious flaws in the EIS and should be revised to accurately reflect the real impacts of massive coal development.

We've been told that citizens' comments are intended to be an important part of the final document, but that there's no money available to do a revision of the study. It's been suggested to us that citizens' comments will simply be added as an attached volume to the draft. If citizens' input is given so low a priority as this implies, these hearings are of little value. Simply attaching citizens' comments to the draft would effectively nullify them because of the difficulty there would be in applying them to a document as massive and complex as this EIS. Many people are already inhibited by the sheer size of the study, and adding these critical corrections in a separate volume would only make matters much worse.

In conclusion, the Dakota Resource Council opposes the use of this study as the final assessment of the effects of massive new federal coal leasing. The cumulative effects of such leasing should be studied in much greater detail in and of themselves.

Thank you.

MR. JOHNSON: Before you are seated, may I ask is there members of the panel who would care to ask for clarification on any of these remarks presented?

MR. STEELE: Evelyn, would you just elaborate on the acres that are in excess of development? The three hundred and some thousand acres -- would you elaborate?

EVELYN NEWTON: Well, what are they going to do with that excess? What are the plans for the excess? They have used up -- where is it -- okay, they have projected as use of so many and they will be using so many -- here we are. I was just wondering what are the plans for the extra land.

MR. CHRISTIANSON: On synergistic effects, you mentioned that as a potential problem.

EVELYN NEWTON: Yes.

MR. CHRISTIANSON: Do you have any facts, any information that you can give us which would indicate the projected ambient air quality levels predicted for these plants would be detrimental to health?

EVELYN NEWTON: What I got was out of the Supplement. My interpretation of the Supplement is not such that I can even give you a good qualifying answer on that one. But I know it does effect -- you get those, you know --

MR. CHRISTIANSON: Were you aware of the Phase II of the project which deals with monitoring those plants?

EVELYN NEWTON: No, only what was mentioned I guess in the Supplement there. But when you get into that or somebody like me -- or anyone else --

MR. CHRISTIANSON: It is a very complicated subject.

certainly.

I might make a couple of comments. The reason that we are doing a technical summary is because the size of this one, you know --

EVELYN NEWTON: And I don't imagine a lot of people got the Supplement either along with it, so if anyone gets into that expertise of someone trying to get into that is -- just don't --

MR. CHRISTIANSON: I know it is difficult.

One more comment I would like to make and that is for your interest and for the rest of the group here, that the Clean Air Act of 1977 changed the picture of emissions and the effects on air quality dramatically, and certainly that will be addressed in any further publications related to the study.

EVELYN NEWTON: How will that be added in here, what will you do with that?

MR. CHRISTIANSON: That is up to the administration of the project, and when that answer is known we will supply that information. If anyone has any questions, certainly they can be directed to them, to the Department.

MR. JOHNSON: Bob or Bruce? I have one, Evelyn, in reference to a leading impact sociologist who questioned the sociological study -- could you tell me who that might be in order that we might contact that individual?

EVELYN NEWTON: I will tell you right now we are not at liberty to give you that. We will be in the future. It is at his discretion, he has other people he is working with and he would like them to know that he has done this, so it will be available at a later date.

MR. JOHNSON: Thank you.

The next speaker will be Jacqie Maixner.

MRS. MAIXNER: My name is Jacqie Maixner. I live southwest of New England, North Dakota. I have been studying the Land Use sections of the Draft EIS and also the Soils and Vegetation sections.

I have criticisms in four areas of the Land Use sections: the first is that the study assumes that there will be 100% successful reclamation in three to five years, the second concerns statements about plant siting, the third criticism has to do with new transmission line mileage, and the fourth concerns the rights of surface owners who do not own the minerals under their land.

The statements made in the Draft EIS concerning the amount of land which will be out of production at a given time and the statements as to loss of productivity and income are predicated on the assumption that there will be 100% successful reclamation within three to five years after mining. There are several reasons why this is not probable.

Our state reclamation law returns 40% of the bond

when backsloping and grading are completed, 30% when re-spreading of plant growth material is completed, and the final 30% when reclamation has been accomplished "as provided here-in." "As provided here-in" does not necessarily mean that the land must be restored to 100% of its former pro-ductivity. The reclamation law provides for a permit term of three years. Another three years after the termination of the permit term are allowed for the completion of reclama-tion. However, if reclamation is not complete by that time, two years of automatic extensions are added. This brings us to eight years from the beginning of mining. After this time, more extensions may be added at the discretion of the Public Service Commission. Under these conditions, it looks highly improbable that reclamation will be completed in three to five years.

One problem with reclaiming land in this seven-county area is the upward migration of sodium into the topsoil and subsoil of reclaimed land. According to page 187 of the Draft EIS, "Soils disturbed by mining activities would be scrambled and soil profile identity will be established only after extended time, perhaps over 100 years." This scrambling causes the sodium from deeper layers to be mixed with other layers and end up closer to the surface and the soil to deteriorate and yields to decrease as years go by. According to the soils section of the Draft EIS, (Page 38), twenty per

done. Table 3-31, page 92 shows that less than one-half of land permitted for Level 1 strip mining is in the suitable to most suitable categories, and more than one-half is in the less suitable to least suitable categories. If we mine land that is not considered suitable for reclamation, I doubt that we will achieve 100% successful reclamation.

The Draft EIS is very contradictory. While pointing out some of the problems with reclamation, they assume that every square foot of every mined acre will be returned to its former productivity when making the computations of loss of production and income. The only clue I could find in the Draft EIS as to why the authors believe that 100% reclamation is possible is on page 155. In discussing an experiment in which 77% of the pre-mined productivity was attained in the second year of reclamation at the Glenharold Mine, they draw the conclusion that full reclamation would be expected within the five-year reclamation period. However, according to the study printed in the appendix, yields began to decrease after the second year due to the upward migration of sodium causing deterioration of the topsoil. (Figure 5, page 13) In one experiment with created wheatgrass at four mine sites, the third-year yields dropped to about one-half the second-year yields. The 77% of pre-mined productivity is more likely the best reclamation possible, since it was attained in the second year and most experiments have shown a decrease in production

cent of the land in the study area has sodium affected soil material of high hazard classification and another eighteen per cent has sodium affected soil material of moderate hazard classification. Studies have not been going long enough to determine how long this soil deterioration will continue, but a definite trend of soil deterioration has been seen. Ac-cording to the Draft EIS, "Where less than thirty inches of suitable plant growth material exists to bury sodium af-fected materials, problems could result in reduced agricultural productivity."

Although the Draft EIS assumes that reclamation will progress only two or three spoil piles behind reclamation, this is, in actuality, not feasible and not the way it is presently being done. The norm has been for reclamation to begin two or three years behind mining. At this rate, with the automatic six to eight years timespan allowed by the State reclamation law, reclamation would just barely be beginning during the three to five years allowed by the Draft EIS. The Draft EIS points out that water and wind erosion can cause much damage during this time between stripping and the establishment of reclamation. This further decreases the chances of 100% successful reclamation.

As the Draft EIS points out, there are federal and state laws authorizing deletion from mining plans areas not suitable for reclamation. This may be true, but hasn't been

beginning with the third year. In another report, North Dakota Progress Report on Research on Reclamation of Strip-mined Lands -- Update 1977, experiments with ten cool-season grasses, six wild [illegible]-ten miscellaneous grasses, six warm-season grasses and five legumes planted on spoil piles six inches topsoil, the yields dropped drastically from the first year to the second and from the second year to the third. Rather than assuming that productivity of reclaimed land will automatically improve with time, the evidence points to the opposite conclusion.

In order for the EIS to be an effective tool in assessing loss of production and income from strip-mining, the conclusions and figures should be revised to reflect reclamation success that has been attained so far and a more realistic time frame for the completion of reclamation.

The Draft EIS states that our siting law for energy conversion and transmission facilities protects culturally important or environmentally sensitive areas from project siting, particularly prime farm land and irrigated land. The State siting law does so such thing; it merely directs the Public Service Commision to write regulations. These regu-lations have recently been changed and do not explicitly protect prime farm land. The Draft EIS states that "The Public Service Commission could require that an alternate American Natural Gas Coal Gasification Plant and Antelope

Valley Power Plant site he chooses which would avert locating on 535 acres of prime farm land." The permit has already been granted for the site on the land containing 535 acres of prime farm land.

The Draft EIS states that plant sites for Level 1 would permanently remove from production 3,223 acres of agricultural land. Checking with the Public Service Commission, I found that the plant site for the Antelope Valley Power Plant is 448 acres, the plant site for the American Natural Gas Coal Gasification Plant is 792 acres, and the plant site for the Montana-Dakota Utilities Coyote 1 Power Plant is 2,483 acres. So far this adds up to 3,723 acres, already 500 acres more than the Draft EIS figure with only three out of the four plants included in Level 1. No figure is available for Natural Gas Pipeline Company of America's plant site because they have not yet applied for a permit. This figure should be revised and where no figure is available the EIS should point out that the figure given does not include all projects.

Table 3-122 on page 144 of the Draft EIS titled, "Level 1: New Electrical Transmission System Mileage by County and Type" is inaccurate because all mileage distances are figured on a straight line distance between origins and destinations. Although this is pointed out in a footnote, I would not want to see these mileage figure used in planning

for development. I would think that there could be a multiplier devised to give us a more realistic picture of these mileages, allowing for the lines going around exclusion and avoidance areas.

The Draft EIS has barely mentioned the problems of surface owners who do not own the minerals under their land. On page 21 is a statement that surface owner consent must be secured before the Public Service Commission can issue a permit to surface mine land. This statement is very misleading because the surface owner has no choice in the matter. If the mineral owner has consented to strip-mining, the mining company makes an offer to the surface owner to cover damages. If the surface owner is not satisfied with the offer, his only alternative is to sue for more payment. If the Court rules that the offer was a fair one, the surface owner must pay the court costs and attorney fees. At no point does the surface owner have a say as to whether or not the mining will take place. One page 166 of the Draft EIS is a statement that State law requires that surface owners be compensated for loss of production. The fact is, that without a veto power the surface owner has a very poor bargaining position to receive adequate compensation. The EIS should point this out and address the problem of surface owner protection in greater depth as it is one aspect of energy development that will greatly affect many North Dakotans.

I recommend that the Draft EIS be reviewed and revised in these areas that I have mentioned.

MR. JOHNSON: Thank you. May I ask, are there any questions from the panel?

MR. SEELIG: What would you consider the explicit protection of prime farm land?

MRS. MAIXNER: Well, the law does not protect prime farm land, it is strictly up to the Public Service Commission to write that into the regulations. The EIS said State law protects farm land, which it really don't. It is very general, and the PSC has recently revised their regulation and they do not say more in the regulations explicitly mention prime farm land. It is simply up to their discretion on a project by project basis.

MR. SEELIG: What do you base -- you say that you don't agree that within four or five years reclaimed land can be reclaimed to 100% productivity, what it was formerly. Just exactly what are you basing that on? On the study that makes --

MRS. MAIXNER: Well, on the statements that are brought out in the draft itself about reclamation, the fact that it's never been done before, and the fact on most reclamation projects, experiments, the ones that I have studied show a decrease in productivity after about the second year. So I would say -- in the Draft EIS it states

that because they had 77% the second year that they will have 100% by the fifth year, and the evidence that I have seen says it deteriorates after the second year.

MR. JOHNSON: Thank you.

I will just remind you to just provide your name and address and your affiliation when you make your statement.

The next speaker will be Susan Westfall.

SUSAN WESTFALL: My name is Susan Westfall, and I am testifying here today as a concerned citizen of North Dakota. While I am concerned with the total impact of coal development in Western North Dakota, I have chosen to limit my comments to the area in which I am personally most qualified to comment.

As a trained sociologist I am extremely disturbed by the Social Conditions section of this Draft EIS. Social conditions cannot be measured, quantified, or regulated with the same kind of precision an air quality or water availability. There is no federal regulations requiring a set degree of satisfaction with living conditions, so the measurement of such conditions becomes much more difficult.

Human social data is derived directly through social survey and indirectly through statistical data which theoretically combine to present an accurate picture of the attitudes, satisfactions, and lifestyle of the residents of an area. As a social scientist, I appreciate the difficulty of achieving

an accurate picture of social conditions, but I do not believe that this difficulty is insurmountable or that it should serve as an excuse for poor research.

The social attitude survey directed by Dr. Richard Ludtke of the University of North Dakota is immediately suspect if one only reads the introductory statements. Doctor Ludtke disassociates himself with the study, at least in part, (and I am not sure why he did not quit the entire study) because he states that there was substantial interference by Department of Interior (BLM?) and the Office of Management and Budget in altering the interview schedule. My first reaction to such a statement is that any data generated by such a study is questionable at best and biased, slanted, and totally unreliable at worst.

Specifically, the study is subject to serious methodological criticisms of which the following are only samples:

1. No occupational breakdown is reported within the study, despite the fact that it is used in tables as significant data.

2. "Farmers and Dunn County residents" are reported as one category and generally in a negative context; ie. "unfamiliar with industry and so not likely to see its advantages."

3. The nonresponse category to some questions is as high as 45.8 per cent, yet the use of percentage tables

doesn't clearly indicate this.

4. Mean scores are reported without standard deviations to at least indicate variance in levels of response.

5. Likert scale scores as reported are marginal at best.

6. Data interpretations speculate on the meaning of findings (eg. these tables suggest...) because the study fails to point to any clear-cut conclusions.

7. Community and county are nonquantable concepts, yet the study continually attempts to equate these terms.

The impact of the expansion of the coal development industry with its strip mines, power plants, coal gasification plants, pipelines and transmission lines on the lifestyle of North Dakota residents should not be taken lightly. According to one sociologist, the Ludtke study is "at best a highly glossed, i.e. superficial version of these human concerns. At worst, it is in many places a distorted and misleading version of the human concerns it attempts to portray."

The citizens of this area deserve better representation of their concerns. We have been let down by both the Bureau of Land Management and our own State government. Because this study cannot pretend to be an accurate or meaningful portrayal of residents' attitudes, the entire Social Condition section of this Draft EIS is inaccurate and not meaningful. This cannot be utilized as a reference or data source by either

the BLM or the State of North Dakota in looking at current or future development plans.

There must be a new study developed with adequate research design and purposeful gathering of scientific social data to complete this EIS, and I am requesting that this be done in order for the residents of this seven-county area to have their views represented accurately.

In addition to the faults of the social survey, I find that there is yet another point on which I cannot agree in this study. The most prominent mitigating factor mentioned in this study (page 164) is the idea of local residents being hired by the incoming energy development corporations. According to Dr. Gene Summers in his address to the 34th Annual Meeting of the North Dakota Public Health Association entitled "Socio-Economic Impacts of Rural Industrialization" , the patterns of development seen in other impacted areas point to another alternative which is not considered in this study. Out migration by local young persons is not stopped or even slowed by new industry, while in migration of new young people is greatly increased. These newcomers have the skills necessary for the new industry, so rather than alleviating job shortages in our rural areas, current levels of unemployment for unskilled workers will remain, and the newcomers to our communities will hold the new jobs. The mitigating effect of more employment opportunities is quickly lost with the flux of

immigration to the area.

Finally, I would like to address the assessment of services available to residents at the present time and the needs as they are projected for Levels 1 and 2 development. By indicating future needs for physicians for example, little mention is made of the extreme difficulty encountered by communities in searching for medical personnel. There is no reason to believe that more physicians are needed than they will materialize any more readily than they do now.

There is also a tendency to quantify the material in this study without really clarifying what any particular number might mean. It is not clearly discernable to begin with, that the need for social case workers would double in Dunn and Mercer Counties, but the EIS does show this; severe social disruption is anticipated in these counties. It would be helpful to refer to other areas where similar impacts have occurred so the residents of this area could relate directly to the type disruptions we are anticipating. The child abuse case load in Gillette, Wyoming has risen from one per cent to twenty per cent of the total in Wyoming in a five-year period. Do the citizens of North Dakota have an alternative to this type of social disruption? Doubling the number of caseworkers is not a mitigating factor.

I believe that the social impact section of this study must be redone. It is a grave injustice to the needs

and
a concerns of the people of this area. Too much stands to be lost in our way of life if this document is accepted as meaningful or accurate.

MR. JOHNSON: Any questions of Susan?

MR. KAISER: I have one question, that initial section where you listed the various items, was that directed towards the social survey study?

SUSAN WESTFALL: Yes, sir.

MR. KAISER: Thank you.

MR. JOHNSON: The next speaker will be Vaudeth Oberlander.

MRS. OBERLANDER: My name is Vaudeth Oberlander, I am from New England, North Dakota; I am representing myself.

I read the summary report and as I was reading it the thought came to my mind that no news certainly is good news. The news in the report was worse than I had expected I guess. This does not mean that I look on the report as totally ineffective. I personally am very grateful for the report. I think that many good steps forward have been taken. However, I believe that there are more steps yet to go, and I would hope that a study of this kind would not be a one-time study, that there would be some vehicle worked into this so that there could be an ongoing re-evaluation of what has been done.

Your (Mr. Christianson) comment, for instance about

happens after that at this point is anybody's guess. It seems to me that a report of this kind to be fully comprehensive should include that kind of a projection. Surely it will influence again the number and the kind of energy complexes that are built in this State.

Also I would like to suggest that you do include details and study on the impact of federal coal development. This is a possibility, in my mind it looks more like a probability, and I think that you should not wait for the Federal government and depend on the Federal government study. I think that this should be done now and in this study.

In conclusion, I was happy to read the report, it gives me somewhat of an idea of what to expect living in this part of the State and of what my children can expect. I congratulate on the work that you have done so far and ask you to go further. Thank you.

MR. JOHNSON: Any questions of Mrs. Oberlander?

(None indicated.)

MR. JOHNSON: Do you have any more cards there of folks who indicated that they would care to speak? I had only these four cards. Is there anyone else in the group who would care to offer comment at this time? You are certainly welcome.

We will honor our commitment to be here until 4 o'clock, whether you are or not. Is there anyone?

the 1977 National Air Quality laws, certainly it is going to change a lot of things. Also the comment in the Air Quality sections in which it says that long-term effects are not known about trace elements, certainly there are ongoing studies at this time, and those studies would have to be also placed into this particular report in order for we people in North Dakota to make the best possible decision about the number and the size of the energy development complexes that will be built here.

The need for more study in the area of air quality is certainly evident. Right now in the area of Bismarck, North Dakota, there are cattle which are showing the effect of selenium deficiency. Nobody knows whether it is the energy development in that area that is causing it, and I think that this is itself points out that we need to have more study in the area of air quality.

Also in coal strip Montana the cattle there are suffering from lung disease. There again there is no proof that it is coming from the big energy development out there. Again I think that this points out the need for ongoing study to be implemented and placed into this report.

Also I am very concerned about the lack of study, of the complete lack in this case, where the end of development in this area. It is my belief that the energy development that is now projected will be some 35 to 40 years. What

Okay, at this time we will take a short break and we will be here until 4:00 if anyone else would care to offer comment.

Thank you very much.

(Thereupon, at 2:24 p.m. the hearing was in recess until 2:43 p.m.)

MR. JOHNSON: I would like to call this hearing back into session, please.

I had a couple of people who have indicated that they would like to provide comment at the hearing. Arlene, would you care to make your remarks? Please provide your name, address, and affiliation.

ARLENE HAUNSON: I am Arlene Haunson, and I just feel that one of the things I do not feel was properly addressed in the summary of the EIS statement was the fact that with more and more out-of-state people coming into North Dakota, and with the out-of-state energy companies that it won't be long that before the people of North Dakota that have lived here for a long time, particularly our agricultural people, will not have any say so in our legislature and its process, and I feel that the people that are coming in from out of state will probably live here for two or three years and then they will be lobbying in the legislature, and there will be more of them, and as I say, our agricultural people and those of us who have lived here for quite awhile will

completely lose control of the North Dakota legislature and our government.

MR. JOHNSON: Thank you. Do you need a name and address on that?

MRS. HAUNSON: Arlene E-a-u-s-e-o-n, Dickinson.

MR. LARDY: My name is Bill Lardy. I am a State Representative from District 37 of the City of Dickinson. My address is 920 13th Avenue West.

The few comments that I would like to make while not specifically toward any part of the draft statement, I think do go to the accuracy of the statement itself.

When the public is presented with the kind of document that we have before us today, that is the full report itself as well as this summary, that leads me believe that the citizen input is not going to be taken with anything at all as far as validity is concerned. People who have drafted those documents are going to see the citizen input in not the way that the citizens would like to have it used. In other words, the citizens are not going to be able to change anything that is in those reports at all, they will be added on as an appendix, an addendum, and therefore those additions will have far less effect on the total outcome of the report.

I guess what I am saying is this, that if the citizens want to have an input it is not going to be done in the way the hearings are being held today, and I think that

is unfortunate. I think we are missing the whole shot when we are suggesting that these hearings are going to have any valid use for the report. Thank you.

MR. JOHNSON: We appreciate your comments. Representative Lardy. Would you have any suggestions as to how more meaningful citizen input could be provided?

MR. LARDY: Well, it would seem to me there has got to be some money that can be used to rewrite those objectionable sections of the report. While perhaps not all of them would have to be rewritten, certainly perhaps not the technical aspects or the technical appendix would not have to be rewritten, but some of the more objectionable parts could be rewritten to more accurately reflect the feeling of the citizens of the area as they relate to those parts of the study.

MR. JOHNSON: Thank you. No one else has indicated to me that they desire to provide further comments. Is there any comment from anyone in the room?

Yes, if you will identify yourself and your address and affiliation, please.

MR. STEFONOWICZ: I am Bob Stefonowicz, I better spell that last name, S-t-e-f-o-n-o-w-i-c-z. I am a school teacher in Dickinson High School, a member of the Board of Directors of the Dakota Resource Council, member of the Badlands Environment Association, and working in

behalf of the Harvest for Hunger Program for North Dakota.

I would like to make some comments in regard to the study, the first one is in regard to who foots the bill. If the study, and I would ask, you know, if this is a study for the people of North Dakota to let them know the cumulative effect of coal development, then the decision as to who should be paying the bill for the study should probably have had more input into it by the people of North Dakota. If it is for the convenience of the companies that are going to be developing the energy, and I suspect probably making a slight margin of profit in the process, then perhaps the cost of the study could be borne to a greater extent by them.

The second point I would like to make in this regard is the concern about developing more energy sources and turning our society into a more energy dependent society. We have seen throughout the history of North Dakota a shifting from smaller to larger farms, the displacement of people from agricultural enterprises into urban lifestyle, and the replacement of these people from the land by machines which are of course energy consuming machines. Any one of us that carefully analyzes our household will fully recognize that we are presently using more appliances than we did as a young person while we were growing up.

Somewhat along the line I would only suggest that maybe there needs to be, you know, a holdback on this, a

stopping of the greater energy dependence we have.

My concern for the food producing capability of the land springs from my work for Harvest for Hunger and programs that try to assist people in other parts of the world feed themselves. Because we are an energy consuming society we oftentimes head statistics that suggest that we are a very efficient agricultural society. The efficiency measure can be detected in a number of ways, it is calculated out per man hour input, or you can calculate it out by way of number of calories in and number of calories out. If we take the latter of the two measuring devices and figure total energy in and total energy out, the American agricultural enterprise is not that efficient. However, we are seeing that there gets to be a greater and greater dependency upon energy all of the time.

I would suggest that maybe the study and other projects like this are making us less efficient on a worldwide scale than we would want to be. As the world population increases and the needs for power conservation of all resources is pressing in upon us, I think we should consider this as probably an alternative as well.

Thirdly, I would like to just briefly comment on the idea that the coal and natural -- or oil for that matter, as well, is a resource that is here and it has been for hundreds of thousands of years, and is it really right when we think of the history of man for us in 30, 40, 50 or even

200 years, to totally depletes these resources and leave succeeding generations with nothing there at all. I think we should probably be looking forward, spending our money on studies that would advance new resources instead, and with that I would close. Thank you.

MR. JOHNSON: Anyone on the panel care to direct remarks? Thank you.

Anyone else have any comments?

Okay, as I said, we will be here until 4 o'clock if anyone would care to make more remarks for the record. We will go off the record at this time.

(Thereupon at 2:54 p.m. the hearing was in recess until 7:30 p.m. of the same day, at which time it reconvened.)

MR. JOHNSON: We will call the meeting to order at this time, and I have several preliminary remarks to make before the hearing begins. As I said my name is Gary Johnson. I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota

which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resources ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

Our interest is in correcting errors in the draft study in order to assure the best possible resource information for decision-makers. This draft study makes no decisions concerning energy development but rather analyzes the environmental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and the Bureau of Land Management with the opportunity to receive comments from the public and private sectors. This is in addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 8, 1978.

As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1978. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me today are Chuck Stesld, District Manager of the BLM in Dickinson, Mr. Gene Christianson of the North Dakota State Health Department, Bob Kaiser, who serves as the Federal Assistant Manager on the Region SIS, and Bruce Seelig of the Public Service Commission.

An official reporter will make a verbatim transcript of this hearing. In order to ensure a complete and accurate record of the hearing, it is necessary that only one person speak at a time. Therefore, while this hearing is in session, only the designated speaker and members of the hearing panel will be recognized.

There are several procedural guidelines which we request you observe during the hearing. They are:

1. It is requested that all statements be confined to your comments on the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development.

2. This hearing is structured to receive information concerning the accuracy of the study, not to debate the study. Publicized informational meetings were previously held on the study on April 3, 4, and 5 in Bismarck, Dickinson, and Bazen respectively.

The hearing panel is here primarily to clarify comments where necessary. The panel is not here to engage in debate on the study, but to ask clarifying questions, if

necessary, at the conclusion of your remarks.

3. It is requested that speakers confine their remarks to ten minutes, if possible. This request is made in order to accomodate all those who wish to make comments in regard to the accuracy of the study. We do not wish to be unreasonable in enforcing the ten-minute time limit and will do so only should excessive demands of time be made.

4. For those of you who have both oral and written statements, it is requested that the oral statement highlight the points you wish to make. You may choose to submit only a written statement. Copies of written statements should be identified with your name, address, and the organizations, if any, which you represent. When you are called to speak, copies of your statement should be given to the reporter.

5. Registration cards are available at the table near the entrance to this room. If you have not registered for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of these cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address and the organization you represent, if any.

The comments made here today will be addressed by

resource specialists is proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

Has anyone indicated a desire to provide testimony this evening? I have received no cards from individuals indicating a desire to comment at this hearing.

Is there anyone in the audience who would care to provide comment concerning the adequacy of the Regional EIS draft, you are certainly welcome to make comment at this time.

(No response indicated.)

MR. JOHNSON: If there are no comments pertaining to the adquacy of the draft we will go off the record for the hearing.

The hearing was publicized as being in session from 7:30 to 9:30 p.m. Someone will be here until 9:30 p.m. to take testimony should anyone care to offer such.

We will now go off the record and remain here.

(Thereupon the hearing was in recess from 7:37 p.m. until 7:55 p.m. at which time it reconvened.)

MR. JOHNSON: We will now reconvene the hearing, we have had the introductory remarks for those of you who arrived late, and now we have two individuals who have indicated a desire to comment at this time.

Our first speaker this evening will be Representative

Rick Maixner.

MR. MAIXNER: From what I have been able to go over in the study and then to review the one supplementary document that I have, the Clean Air Quality supplement, I guess I would to say that basically it is a very superficial study. It is quite optimistic about the effect of coal development on the area. I guess as I was going through the one thing that I thought as I looked at coal development and strip mines, and particularly reclamation, the book is -- my response to the book would be something like the book that Emory Bomhach wrote, and that is, "If life is a bowl of cherries, then what are we doing in the pit?"

The Climate and Air Quality section doesn't -- in the text doesn't address the problem of acid rainfall, that is addressed in the Climate and Air Quality supplement. There are some pretty optimistic projections as far as economic and health impact that just aren't borne out by the facts. There are congressional studies that show that sulfur dioxide at half the allowable Federal level can cause up to 15 per cent increase in wheat yields, and that health problems may occur far below this.

I might compare our North Dakota Health Department Newsletter which mentions that North Dakota has a cancer rate that is statistically significantly lower than the national rate, it doesn't mention the reason for it.

I might also mention in the City of Durango, Colorado where they had 300 per cent rise in respiratory disease after the beginning of operation of the Four Corners facility, 80 miles from the Four Corners plant. You might compare that town to the Bismarck-Mandan area west of the smelting plant in that area. The possibility of acid rainfall isn't really addressed in the study, it is in the supplementary text, but there doesn't seem to be a lot of concern about it.

We talk a little about the future. The fact is that the figures that are on page 86 of the study, there are two acid rainfalls that have occurred, what I would call acid rainfalls, in North Dakota already that would most likely relate to energy development in the Bismarck-Mandan area, the one of them occurring on 8-21-77, ph readings of 6.7, 6.8 and 4.4 at the Bismarck station, and 6-14-77 a ph of 4.6 at Mandan station. There were some acid rainfalls before in the state, but not relating to this type of activity. Those aren't addressed at all in either here or in the draft study and I think they should have been.

It just doesn't seem logical that health hazards will not exist in North Dakota from additional sulfur dioxide emissions when they have occurred elsewhere.

Also there was no mention in either the Climate Quality or in the draft statement about the possibility of livestock losses due to white muscle disease. We have had

livestock losses in the energy development area where Doctor Hastings has related to energy development, and is attempting to get funds to either prove or disprove his theory, and he hasn't been able to do that. I think that is something that should have been addressed in both the draft statement and in here.

Trace element emissions are again pretty much left out of the document. On page 102 of the study there is some interesting observations which if carried a little further might have helped the credibility of the study. It says the highest trace element concentrations are found in the small particles, less than 10 microns in diameter, and then, typical emission control efficiencies of those smaller particles are less than 85 per cent, though they make up a small fraction of the total fly ash they are the highest concentration trace elements.

We have already had in North Dakota a case of trace element poisoning that occurred near Griffin in the burning of lignite. This is a case of molybenum being emitted from the facility that was burning the coal to extract uranium. This molybenum went down in the grass, came up and was eaten by cattle and interferes with their metbolism and this trace element poisoning is going on today. They still give copper shots to their cattle and the cattle still die. After a certain period of time this doesn't seem to have an effect any

more. This isn't mentioned at all in the study, and it might be appropriate to put something in as it has already occurred.

There is no mention in the study so far as I can see of the possible effects of particulate emission on precipitation. Doctor Schlussner (ph), former director of the Institute of Science at the Dakota School of Mines and Technology, and now director of that institution, brought that out during his presentation at Fort Union conference in North Dakota some time ago. Congressional studies have shown that there is a definite possibility that we will experience a decrease of annual rainfall due to heavy particulate loading of the atmosphere, and this hasn't been addressed in here. 84

Some general comments about the study. Apparently the authors didn't know the North Dakota law very well. The comments made about our reclamation law on surface protection shows this. When we originally started this EIS some time back we were told that each concern listed by a citizen then at the public meetings that were held would be addressed. I think that those concerned should have been listed and answered specifically or referred to as part of the text. It hasn't been done. 85

Projections of reclamation of environmental damage appear to be overly optimistic to me. Comments by or items submitted by two individuals that I know in State government were almost entirely left out of the study. One of them is

automobiles and buildings, but I doubt it would be much below the 4.5 level. 87

MR. CHRISTIANSON: Then another question which relates to the Griffis incident that you referenced. Were you aware that the State Department of Health was the one or the agency that uncovered that problem?

MR. MAIXNER: No, I wasn't, but if they have that background then I would think something like that would have been included in here as a matter of concern.

MR. CHRISTIANSON: Okay; that was -- with respect to the lignite ashing and uranium, you mentioned that that problem is still occurring?

MR. MAIXNER: Yes.

MR. CHRISTIANSON: Even with copper shots?

MR. MAIXNER: Yes. Yes, I personally know the rancher that raises cattle on the land.

MR. CHRISTIANSON: Maybe I could get that name afterward?

MR. MAIXNER: Sure.

MR. CHRISTIANSON: And we can look into that.

That is all the questions that I have.

MR. KAISER: I was wondering if you could be more specific in terms of the surface owner protection act, the specifics there that were missed. 88

MR. MAIXNER: Okay. The specific item that I am

the Indian study section, the other one a submission by a member of the Governor's staff.

It looks to me that once again the people of this area have been hoodwinked into lending credibility to a travesty of public participation in the name of environment protection. That is all that I have.

I understand that if we have a question we address the panel?

MR. JOHNSON: We request that some of the panel be able to lay some questions for purposes of clarification.

If you would, please?

MR. CHRISTIANSON: I think I have some questions. I would like to see your testimony. I think it is more our responsing to some of the questions that you have raised.

I was just curious though on ph and rainfall, what you considered as being the maximums? I know there is some -- even the experts aren't sure of it, what would you consider as being an acid ph level? 86

MR. MAIXNER: Well, realizing that about acid rainfall, it is about 5.7, 5.0 -- I think that we have ph in the vicinity of 4.4 or 4.5 or 4.6 that would be considered acidity. Actually anything more acidic, and naturally rainfall would be in some ways detrimental to environment. Probably would leach into the soil and cause decrease of crop yield. I don't know at what level we will begin to see deterioration of

referring to is a statement in the study that surface owner permission had to be obtained before strip mining a piece of land. That is not true. In effect our North Dakota law gives the mineral owner in effect an eminent domain over the surface owner. If he can obtain permission voluntarily to mine his minerals under private surface, then he can go to Court, take the owner to Court, and obtain that permission and the Court can determine what proper compensation is.

The second thing is the mention of the Federal law that -- the new Federal Strip Mine law which says that now mineral developers of Federal coal under private surface have to have the written consent of the surface owner prior to mining. That is in there. What they don't mention in this booklet is that most of the land that has Federal coal under it already has been granted surface easements by the surface owners, that back in the days when we didn't have the clause in the Federal law which just passed in 1977, that coal operators went out and brow beat landowners into signing permission to mine, saying, "If you don't sign we are going to mine it anyway, because we don't need your permission."

So the fact is that surface owner consent just isn't a reality.

MR. JOHNSON: Mr. Seelig?

MR. SEELIG: Nothing.

MR. JOHNSON: I have several, Representative Maixner.

I am sure you realize the more the specific the comments the more specifically we can address them.

I don't recall your exact wording, but early on in your comments you referenced the fact that the economic studies conducted in the EIS bear no relationship to the economic facts of the situation. In there some reference you could provide us on that?

MR. MAIXNER: Well, I think mainly the things that were left out were the cost to North Dakota of environmental damage. How much is it worth to North Dakota to have a 15 per cent reduction in its annual wheat crop due to sulfur dioxide pollution in the atmosphere? How much is it worth to North Dakota to have some decrease in annual rainfall in the vicinity of these facilities? How much is it going to cost the State of North Dakota for the health problems that are caused by environmental problems? These are some of the economics that aren't addressed at all in the study.

MR. JOHNSON: Okay; then one other would be you referenced several congressional studies relating to air quality, particularly for the benefit of the Health Department. Could you cite more specific references to those, now or later?

MR. MAIXNER: Yes; I can get them to them.

MR. JOHNSON: Thank you, sir.

The next comments will be presented by Mr. Ronald

that there is such a thing as an east wind, that there is such a thing as drainage and basin pollution. But more importantly and of more immediate concern is the fact that Fort Berthold Reservation encompasses approximately 60 per cent of the shoreline of Lake Sakakawea, and is receiving significant impact in the form of tourist and recreation. Also the Fort Berthold Reservation is not laid out like the rest of the country. There are no public section lines for people to get from Highway 23 to the lake or other points to the lake, they have to cross private land, and there has been significant encroachment upon it. And it is disturbing because in these days of four-wheel drive vehicles, off-the-road vehicles, they have been scarring the earth. And when we live out in this country and talk about scarring of the earth, it is significant.

In anticipation of being here tonight I visited a place on the shores of Lake Sakakawea where I was five years ago, where some fool took a four-wheel drive pickup and went up the hill, and I decided I would check to see if those ruts were still there and they are. Five years ago. And they can be seen from at least 200 yards away.

There is impact on the Fort Berthold Reservation, there will be impact on the Fort Berthold Reservation, and it is not considered within the study.

That I suppose may be attributable to the fact that,

Reichert.

MR. REICHERT: My name is Ronald Reichert.

Members of the panel, I would like to address myself twice to this particular problem, and the reason for that being is first of all I would speak on behalf of the Three Affiliated Tribes of the Fort Berthold Reservation, and secondly I would like to speak as a concerned citizen living in southwestern North Dakota.

The Three Affiliated Tribes of the Fort Berthold Reservation are supposed to be encompassed within this study. The participation of the concerned persons of the Three Affiliated Tribes to my knowledge, in asking them, have not been consulted. More specifically Hugh Baker, who heads up the Indian action team task force, who has been working on air quality controls, water quality controls, water task force studies, for the past three years, was not consulted.

It is amazing to me to go through the Environmental Impact Statement, the public copy so-to-speak and many of the supplements and at the end of practically each and every area run into a statement about the Fort Berthold Reservation that says, "We are not going to do anything on Fort Berthold Reservation so therefore there is going to be no problem. We don't have to address ourselves to these concerns."

Well, the people of Fort Berthold Reservation and myself believe that there is such a thing as a southwest wind,

"Well, the Indian people have their own routes. They have dealt with the Federal government much before and long before the State of North Dakota dealt with the Federal government, and they understand that there are certain rules of the road, certain ways to get things accomplished that are not available to the citizens of North Dakota, and to the political subdivisions of the State of North Dakota."

But that is no reason for putting out an Environmental Impact Statement with Federal participation in saying that there is going to be no impact upon the Fort Berthold Reservation, because it simply is. The Fort Berthold Reservation is a geographical part of North Dakota, and people traverse it, trespass on it, come across it, the wind blows across it, and the water flows through it. And speaking on behalf of the Three Affiliated Tribes we consider the Environmental Impact Statement completely inadquate as far as Indian concerns, and as such take the natural reaction that we won't be bound by it in any way.

Then I would like to speak on behalf of myself living in this area. The other day I decided to take a canoe trip down the Little Missouri River, which I do every spring, kind of a spring ritual, and I start out at Dickinson and I got just by Belfield and there was this big black cloud going all the way to Bowman. It looked like rain falling. Well, some oil company was burning off some pit or something

was wrong, so until I put in the Little Missouri River I had that vivid picture in my mind of the visual degradation of the prairie. And I started down the Little Missouri and I got about 25 miles and started hearing in the distance a bang, bang, bang, bang, and I heard that for the next 40 miles, and that wasn't there two years ago. And 40 miles later that stopped, and in camping for a night I looked up at the low lying clouds and thought I must have made a wrong turn, there is something wrong here, because I camped next to Minneapolis. There can't possibly be this much light in the sky. Well, I finally found out what it was, about 50 miles away of where I was at the time it was the Little Knife field and the flaring of the Little Knife field which I understand is going to stop. You can see it 50 miles away. And then of course as I drove home I drove from Grassy Butte over to Killdeer and came through the Little Knife field and decided I would turn off and go through the field itself and see what it is like. Well, it kind of looks like Cleveland. But after looking at that I began to go back to the statement and wondering how the coal development that is planned for this particular region would be amplified and magnified by the extensive oil activity that is going on. And I don't see that, and I recognize that this may -- it is a kind of Johnny come lately, this kind of development, but I think we also have to recognize that that development is now only started and that a significant revision

of the impact is going to have to be done with the oil development in mind, the oil development and its associated industries.

And, of course, you know, like I say, it is come lately and it comes very fast, so the drafters of the statement cannot be faulted for that, but I think in addition to if anything new is considered and anything further is done on it that the development of the -- potential oil development should be considered.

Also maybe Case, you understand that, do those wells as they presently now exist, do they violate Class III air standards?

MR. CHRISTIANSON: No.

MR. REICHERT: I see. There is not enough sulfur dioxide --

MR. CHRISTIANSON: We are cutting the wells back at the moment. They are cutting those wells back and as they come on line and get their testing of the capacity of the well they are cranking them back to 100 barrels a day until this new gas line comes along.

MR. REICHERT: That is not dangerous to the people that are now there?

MR. CHRISTIANSON: No, we got air sampling equipment in the area, monitoring. It is not good, no question about it. It is not good quality, but not violating standard

air pollution standards.

MR. REICHERT: I have no further comments, if any of the members of the panel --

MR. CHRISTIANSON: I think I would have one comment and I think that is very pertinent, the point that you brought up about oil development, and my comment would be that our Department doesn't care whether it is sulfur dioxide coming from coal development or oil development or gas development, sulfur dioxide is sulfur dioxide, and we look at cumulative effects, not just from one industry or one plant, but from multiple industries within an area in looking at air quality effect. This is a very valid point you bring out, and I think we will be addressing that even though it is out of the seven-county regional EIS, that certainly it has bearing on the seven-county area, being that we are talking about Billings County which is out of the region EIS study, but it is related, so we will be addressing that.

MR. REICHERT: Well, there is significant wells --

MR. CHRISTIANSON: In the Knife field?

MR. REICHERT: Yes.

MR. CHRISTIANSON: Yes, right.

MR. JOHNSON: Any of the panel, any questions?

I just have a couple, Mr. Reichert, you are aware of the fact that an Indian concern technical report was prepared?

MR. REICHERT: I am aware, I don't see much of it incorporated, however.

MR. JOHNSON: You recognize the name of Clarice Shettler?

MR. REICHERT: I recognize it very well. As a matter of fact -- well, like I say, I have seen it and I haven't seen anything in there from it.

MR. JOHNSON: Thank you.

Anyone else in the audience who would care to offer comment at this time?

MR. CASMIR PAVLICEK: I would want to bring up --

MR. JOHNSON: Excuse me, sir, could you provide your name?

MR. PAVLICEK: My name is Casmir Pavlicek, Dickinson.

MR. JOHNSON: Do you have a card for this gentleman for the reporter?

Okay, go ahead, sir.

MR. PAVLICEK: What I have to bring up, I just got a letter from Senator Young, about saving fuel or energy, and they don't give us fuel in time it might bring us to the needs and the matter of some years even though we have oil now but isn't sufficient.

There is a thing that I have to bring up, I have a testimonial letter that I could furnish to Washington and it

is very -- where you can save a lot of fuel, but I can't -- or there is a lot of other people that have something that they have to offer the government, but at no time -- I have not seen Senator Burdick shut it, so there would be some kind of a compensate to the -- government would compensate some, there is no such a thing. Now I do not say it is a patent, no such a -- it would be suggestions, but if that suggestion is used by the government and by notarizing it and sending it down there, and if they don't want to use it -- I would like to see them get payment. Now you take today somebody goes out on a TV and can you name that song, or can you name something else and get as much as 25 or 50 or up to 100 thousand dollars. Here you offer them maybe the United States saves a billion barrels in a day, and nothing.

Well, how can -- there is nobody, nothing there, no initiative over what you -- what is the word, to go ahead. There is a lot of young people and older people have I know -- that I could -- there is right in this town, I could suggest things that could be done and would save from ten to 20 dollars a month on the fuel, just on the gas fuel. It is nothing but adjustments made on the furnaces and stuff like that. But I hate to offer all of this kind of stuff to nobody who as much as says, you so and so. That is not right. I think the government or whoever it is, there should be a law in Washington for suggestions, anybody that produces something

is the deal here? We should look into this. Because this is -- this tax business the way the government is running, wants to tax this land, pasture, crop land, I don't see where $2.50 for the surface is enough. That is my opinion.

I have got some land myself under the same thing. I don't know, quarter section that I own is mineral rights, but I am in the same fix there. I would never even tend to disposing that surface, probably, nothing less than $500 an acre. And that should be it. Or I would go for 50 per cent. I think many of these farmers, they were here since 1890, maybe some of them that homesteaded this land and everything else and bought some land from the railroad, bought some land alongside where the railroad is or bought from the railroad company, the surface. I happened to be one of the lucky ones, I mean, I bought the railroad land and being that the section of land I bought it was owned there -- was the first time they built this track here, and they wasn't -- probably 1880 or something they bought it in a Wisconsin bank, and they didn't require the mineral rights at that time, and they just sold. So it is probably the only section in the country that the railroad company land is not -- they didn't have reserved the rights, but otherwise they reserved the rights over all the other land. And I just can't see it. After a person with so many years on that land, build up the buildings -- there is most of these farms probably $100,000 worth of buildings on

good, and there will be a lot of them. If this come -- it would advertise, anybody has suggestions send to certain office, and if they used it, go ahead and pay them. Not free of charge. This is probably one of the things that I thought -- I talked to Burdick and he said he would look into it, but there ain't nothing done.

MR. JOHNSON: Thank you, sir.

Anyone else care to offer comment at this time?

If not, we will go off the record at this time and the hearing will remain in session until someone else may show up or care to comment. We will remain here until 9:30. Thank you.

(Thereupon at 8:11 p.m. the hearing was in recess until 8:31 p.m. at which time it reconvened.)

MR. JOHNSON: We will call the hearing back to order at this time. One of the gentlemen has indicated that he should have some remarks for the record. Please proceed.

MR. PAVLICEK: About the surface owners, on coal for example, and a party has got some or other company owns the coal. Now what I would like to know, since I am going to attend a meeting tomorrow afternoon, our taxes are up so much now that they are valuing some of this land as much as three to five hundred dollars an acre. And in one case here some broker approached a farmer nearby South Heart trying to buy the surface of this farm, and he offered him $2.50. Now what

them, and going to throw them out and say, "Here, here is your $2.50, or $10.00 or $100.00," is no price for it. That should be, in my opinion, 50 per cent should be going to the mineral -- to the surface owner, that is my judgment. And anybody that was homesteaded since 1900 or 1910, up to 1910 or something like that, a lot of this land was bought by the government back during the thirties or actually was dropped to the government because in the thirties they couldn't even pay, they lost their land, and the government took the land back on FCA loans or some loan, and they reversed the land and give it back to the farmers. But they reserved the mineral rights. And that wasn't fair either. I think that they should give at least half back to North Dakota. They give that to the farmers. I got some land back in North Dakota and they -- they reserved half, and I got half, and that is the way it was. And I think the United States government should have done the same thing.

That is about all that I would like to present. If you can do us any good it would be appreciate, because it is very important. I tell you in many cases once they start mining here and if this is not settled that will be a lot of fighting going on here. I have been told that some of these farmers would be takes for that $2.50, somebody would put that claim or what they call it, condemn the land and get right in there, somebody -- if these farmers they

could get worked up enough, get pretty hot about it, there can even be some shooting or stuff like that. Because it is their property and they don't like to have that destroyed, the surface. Once destroyed I don't care, they claim they can reclaim it, it is not going to be as what it is right now.

MR. JOHNSON: Thank you for your comments.

Are there comments from anyone else in the room at this time? If not, we will adjourn the hearing at this time.

(Thereupon at 8:37 p.m. the hearing was in recess 8:53 p.m. at which time it reconvened.)

MR. JOHNSON: One more individual has expressed a desire to provide comments this evening. If you would give we your name, sir, and your affiliation and your address, please.

MR. CUSKELLY: Don F. Cuskelly, city engineer for the City of Dickinson, mailing address Box 606, Dickinson, North Dakota, 58601.

MR. JOHNSON: Please proceed.

MR. CUSKELLY: One of the questions that I have, the City of Dickinson is faced with a raw water quality problem for about 25 years now, since we have had problems with the present dam, and I am very concerned about getting raw water over to western North Dakota, particularly Dickinson.

And my question is, is what the long-term effects

74

of good water quality would be so far as the people are concerned in the City and the surrounding area, versus a short-term degradation of the air quality, which as I understand the plants and most of them would be in the range of 40 years in duration. Because the water would be more or less perpetual, and the effects would be likewise as far as the individual is concerned. That is the one question that I have.

The second question that I have, if it relates to this again and I am not sure, they talk about gasification plants which would seem to be a particularly good avenue for bringing raw water, and I am wondering what the energy supply underground, where you would recapture the surface and so forth, would be versus the electrical generating plant, where you would towers overhead. Now maybe that doesn't fit into this.

MR. JOHNSON: Could you clarify that in terms of what beneath ground -- are you talking about pipelines?

MR. CUSKELLY: Pipelines, right. So far as the total energy picture is concerned. It would seem to me to be more logical, easier to recover the ground surface for use, because you can only put so many towers on so much land. It seems to be getting a little overcrowded right now according to some of the farmers. This again I am probably selfish again looking for a raw water supply.

The other question I have is, and I am not taking

75

issue, but on the population showing a growth for the City and Stark County, I believe it did, and I don't remember the exact chart that it showed or the narrative under which section, but I wonder -- I seriously consider taking whatever is in the study on the population and the age group, whether the population actually would go up in the absence of say the oil industry and/or the coal industry. I think in my own way of projecting a population, if the two were present -- the oil was present, there would definitely be an increase and then a leveling, but I think in the long range it would probably decrease because of our age. I think it is up in the forties where the migration was from the farm into the city, and I think this would be somewhat detrimental not only for jobs, but for people out here in western North Dakota, including water supply.

A minor question I have is -- relates to, I don't know if that is the way they meant to present it, but in one of the statements, on the impact if something were built in Dunn County, for the City of Dickinson I think there would be an impact, fairly sharp impact, based on what we are experiencing now with this oil field, which is relatively the same distance from the City of Dickinson. I think they are finding it quite convenient to travel, and maybe that is not the way they intended this in the report, but that is the way I read it. There wouldn't be much of an impact according to

the report, but I guess there again selfishly we are going to be looking for funds that are also once removed into a different government jurisdiction, and it is happening now, and most of it has been done. We are facing the problems here.

I think that is about all that I have in regard to that.

I have one other question -- and this is more or less -- have they ever simulated or anything just mixed in the area, whether it would be just mixed or with or without plants? And what would happen to the water in case -- has that ever been undertaken?

76

MR. JOHNSON: Your comments will be addressed in going from draft to final status on the EIS.

MR. CUSKELLY: That is all that I have.

MR. JOHNSON: Okay, thank you for your comments and we will close the hearing at this time.

MR. CUSKELLY: I appreciate your time, I am sorry I kept you.

MR. JOHNSON: No problem at all.

(Thereupon at 8:55 p.m. the hearing was adjourned.)

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CERTIFICATE OF REPORTER

This is to certify that the foregoing proceedings before the Chairman and Hearing Panel, in the matter of West-Central North Dakota Regional Environmental Impact Study, held in the First National Bank Building, Dickinson, North Dakota, was held as hereinappears, and that this is the original transcript thereof for the file of the Bureau of Land Management.

John B. Carney, RPR

JOHN B. CARNEY
NOTARY PUBLIC - MINNESOTA
HENNEPIN COUNTY
My Commission Expires Jan. 31, 1982

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Additional information is presented relating to the long-term effect of trace element emissions from energy conversion facilities in Part 1, "Trace Element Effects," Climate and Air Quality. This information supplements the short-term (annual) effects noted in the Draft Study. The trace element effects discussion was included in a Technical Supplement to the Draft, since this information, with supporting documentation, was not available when the Draft Study went to press.

The synergistic effects due to the interaction of several pollutants in the ambient air were not addressed in the Draft Study. The attempts to define synergistic effects in the scientific literature, through epidemiological and animal-vegetation studies to date, have proven to be inconclusive. This is an area which needs further study. To provide a factor-of-safety in this interim, reliance is relying on the prevention of significant deterioration provisions of the Clean Air Act to prevent the additive synergistic effects of air pollutants.

A statement in the testimony was made that "particulate emissions from power plants and gasification plants are far more dangerous than those from other sources." This is a generalization which does not take into account questions of relative risk. The same chemical constituents found in the emissions from the power plants and gasification plants are found throughout the environment. For example, there appears to be a greater relative risk to human health from the fine particulate matter (suberizon particles) in the air from areawide sources such as unpaved roads and agricultural operations in the maximum impact area than from Level 1 and Level 2 sources. This is discussed more at length in "Air Pollution Effects," Part 1, Climate and Air Quality.

A discussion of acid rain was presented in the Climate and Air Quality Technical Supplement to the Draft Study. This information is updated under "Air Pollution Effects, Part 1, Climate and Air Quality.

Also see response #21.

"Acid rains"

"The area source contributions (Level 1 and Level 2) of sulfur dioxide to the ambient air would be insignificant and would have negligible impact on the environment within the seven-county study area. This is also true for reactive sulfur (yielding sulfuric acid) since it is directly related to sulfur dioxide emissions." (Technical Supplement for the Climate and Air Quality Section 1978).

RESPONSE TO KEMPTON TRANSCRIPT

#40

Additional information is presented in Climate and Air Quality, Part 1, which relates to the significance of a general reduction in overall air quality in the seven-county study area. The maximum impact area of Level 1 and Level 2 projects is expected to occur in Mercer and Oliver Counties and within eight miles of Beulah.

The maximum
impact area was examined in terms of air pollution effects upon human health, vegetation, animals, materials, visibility, and water quality. These are individually discussed under "Air Pollution Effects," Part 1, Climate and Air Quality, along with a discussion of acid rainfall, trace element effects, radiation impacts, and effects on weather.

Concern over the statements made in the Draft Study, "emphasizing that Level 1 and Level 2 development would not violate Federal or State air pollution standards," is appropriate in view of news media accounts that effects have been noted occurring at pollution concentrations below the federal standards; however, the effects upon the environment from Level 1 and Level 2 Beulah projects do not support this concern. This is discussed in Part 1, Climate and Air Quality.

In the interest of brevity, summary comparisons to the state and federal standards were used in describing the projected air pollution effects. The projected ambient air quality concentrations resulting from Level 1 and Level 2 sources are well within the standards. It is the concentration of pollutants in the ambient air which determines whether or not the effects upon the environment will be perceptible.

The expected quantity of emission of pollutants in tons per year and tons per 40 years from the Level 1 and Level 2 projects are indeed large. The significance of these emissions and expected effects of these emissions is not demonstrated by tons per year or tons per 35 years. As noted above, it is the increases in pollutant concentrations in the ambient air which determines the effects upon the environment.

The reference to "Class I air" is not appropriate. The class designations established under the 1977 Clean Air Act Amendments, and prior to that under EPA and state regulations, relate to class "areas," not class or rank or air quality. It is possible to designate an area as a Class I area in which the air quality is worse than that found in a Class II area. The class of area determines how much future development will be allowed in that area or in adjacent areas based upon allowable increases, or increments, of pollutants such as sulfur dioxide and particulate matter.

Area soils tend to be alkalins with soil reaction ranging from 7.5 to 8. The reaction range of pH 6 to 8 (slightly acid to slightly alkaline) is generally favorable for the common agricultural plants. Corn and grains grow relatively better at a more acid reaction, and alfalfa does better at a more alkaline reaction (Truog 1930).

Extreme hydroxyl-ion concentrations, such as one represented by a pH value greater than 8, probably have a direct toxic effect to plants. Iron manganese, copper, zinc, and boron appear to be less available when the pH becomes more alkaline than the neutral point (pH 7), and this also may limit plant growth (Truog 1930). Soluble salt increases with increased alkalinity also impair plant growth through reduced plant water intake.

The pH scale is based on logarithms of the concentration of the hydrogen (acid) and hydroxyl (alkaline) ions. This means that a solution of pH 5 has 10 times the hydrogen concentration of a solution of pH 6 and 100 times the concentration of a solution of pH 7.

When soil is treated with lime (or conversely, given a treatment of acid or acid-forming amendments such as reactive sulfur, sulfuric acid, or "acid rain") in order to adjust soil reaction toward neutrality, enough lime (or sulfuric acid) must be added to react not only with the so-called free hydrogen (or free hydroxyl ions of the soil solution, but also with those held in the less active form (in chemical combinations and mixtes of adsorption on the surfaces of soild particles). From one half to four tons of limestone per acre would have to be applied to soil, depending on the range of soil texture from sandy to heavy clay, to adjust an acid soil of pH 5.5 to a neutral pH of 6.5.

Soils become acid through a process that is almost the direct reverse of the liming process. Tons of sulfur would approximately counter balance equal amounts of lime (Allaway 1957). High amounts of calcium, such as occur in the predominately calcareous soils of west central North Dakota, tend to have soil reaction stabilized near pH 8, due to the buffering action of calcium carbonate in the soil solution. Acid and acid-forming amendments such as "acid rain" react with the lime in the soil to form gypsum, with reduced effectiveness in altering soil reaction toward neutrality (Coleman and Mehlich 1957).

From a soil reaction standpoint, acid rain from Level 1 and Level 2 proposals would have a negligible, but slightly positive effect on plant growth by altering soil reaction toward neutrality.

Technical Supplements were limited in quantity only because the average reader did not request the additional analytical details supporting the conclusions of the main text. They were, however, easily available to all those who requested them (see page i of the Draft Study).

#41

The Draft Study did discuss some of the problems concerning the current status and art of reclamation as follows:

1. Page 155, fourth column, and page 156, first column. (Note: the word "unlikely" in line 15 of the fourth paragraph of the fourth column of page 155 should be changed to "likely.")

2. Page 174, third and fourth columns, and continued on page 174.

3. Appendix to Chapter 4, pages 229 through 231.

The art of reclamation is deficient in quantifying or qualifying residual adverse impacts because there is no documented evidence where reclamation has attained 100% of the pre-mined productivity. Past reclamation programs have not utilized all current techniques and technology; present reclamation programs vary concerning usage of current techniques and technology; and in many cases, inadequate time has not allowed assessment of these results.

However, it has been reaffirmed by several reclamation research experts (Agricultural Research Service, Northern Great Plains Experiment Station, Mandan; and Bureau of Land Management) that with present reclamation technology 100% productivity for croplands and grassland communities can be attained within 3 to 5 years after mining. Time is needed for absolute proof. There is considerable concern by most research experts as to whether this productivity can be maintained over long periods of time (20 to 30 years) due to climatic cycles, ecological successional trend, management practices, and numerous other problems which could arise during this 20 to 30 year timeframe. No one has proven what will occur because no one has reclaimed any land using current technology and had a sufficient time lapse of 20 to 30 years to establish the degree of success.

Since it has to date not been fully demonstrated that the reclamation as defined in the Surface Mining Control and Reclamation Act of 1977, PL 95-87 would occur, the state of North Dakota has the option of writing their own regulations under the law. Enough time has not yet passed to see if on-the-ground reclamation will occur. Until it has been established that reclamation would occur under the current laws and regulations, leases and permits for surface mines will have provisions addressing what would happen if the mined land cannot be reclaimed. It is possible that the permit and leases would be provisions and there would be some action to insure reclamation or the permit and lease would be cancelled.

Reclamation costs are spread over (1) design, engineering, and overhead; (2) bonds and permit fees; (3) backfilling and grading; and (4) revegetation. Reclamation costs vary at any single operation as well as from one site or region to another. The many variables that affect reclamation cost differences include but are not limited to terrain, soil, vegetation, type and thickness of overburden, coal bed thickness, ground and surface water, climate, size and type of equipment used, method of mining, reclamation laws and regulations, and the individual operator's method of r reclaiming the land. Data collected in 1976 by the U.S. Bureau of Mines in a region encompassing northeastern Wyoming, southeastern Montana, and west central North Dakota revealed average total reclamation costs per acre for three study sites to be $5,050, $3,140, and $2,500. The range for total reclamation costs per acre at these same sites was $4,200-7,200; $2,670-6,340; and $2,220-3,600, respectively (U.S. Bureau of Mines 1977).

Reclamation cost estimates for west central North Dakota coal mining activities are currently being updated by the North Dakota Public Service Commission.

The timespan between mining and reclamation is critical because of erosion hazards, but the current Public Service Commission rules and regulations governing mining and reclamation will minimize the chance for harmful erosion during this timespan. Under Chapter 69-05-14, Revegetation, of the Rules and Regulations for Surface Coal Mining and Reclamation Operations, 69-05, revegetation of all disturbed lands with suitable cover is required during the first normal growing period. The Rules and Regulations also require mulching as added protection against soil erosion (69-05-14-04). Also see response #51.

Apparently the 336,134 and 92,461 acres referred to come from Tables 3-67 and 3-69 on pages 104 and 105 in the vegetation section of Chapter 3.

The 336,134 acres do not represent the lands that would be leased by the federal or state government. The figure represents the total number of acres within the project boundaries including state, federal, and private acreages.

An estimate of federal and state coal acreages that could be leased, should leasing occur, is shown in Tables 1-17, 1-18, 1-21, and 1-22, page 19, of the Draft Study.

There should be little or no surface disturbance on the 243,673 acres in excess of the estimated developmental needs of 92,461 acres. Indirect effects as a result of mining and energy conversion, such as noise, air pollution, visual intrusions, etc., would occur, and have been discussed throughout Chapters 3 through 8 of the Draft Study.

The Surface Owner Protection Act, NDCC 38-18-06, item 2, requires that the Public Service Commission not issue a permit to surface mine land unless the application is accompanied by statements of consent, executed by each surface owner within the permit area, to have surface mining conducted upon his land. However, NDCC 38-18-06, item 5, states that if surface owner consent cannot be obtained, action by district court can be taken authorizing the Public Service Commission to issue the mining permit without the surface owner's consent. To issue this order, the court must be satisfied that the surface owner will be adequately compensated for lost production, lost land value, and loss of the value of improvements due to the mining activity. This compensation will continue until the PSC releases the mining company from its bond. The payments must be made annually to the surface owner during this time.

Also see response #68.

#42

See Part 1, Social Conditions, and response #55.

#43

Page 194 of the Draft Study states that "areas in need of this energy supply could experience problems with respect to employment and production." This statement intentionally does not restrict itself to the state of North Dakota in recognition of the fact that the majority of energy produced at these facilities would be consumed out of state.

#44

The question of what the environmental conditions will be after the projects are terminated is discussed throughout the Draft Study under each environmental component (especially in Chapters 5, 6, and 7). However, detailed treatment of this subject would be highly speculative. The commitment of an applicant to dismantle a facility at the termination of a project would have little influence on what was actually done 40 years from now. Economic pressures and societal needs would weigh much more heavily than "commitments" made during preliminary environmental analyses.

It is stated in the Draft Study (Economic Conditions) that, because of the uncertainty surrounding the timing and magnitude of future energy and economic development beyond Level 2, it is impossible at this time to forecast the magnitude or timing of any possible downturn in economic activity.

#45

See response #28.

#46

A seven-county, regional, cumulative approach focuses interest first on the overview of what total effects are on each environmental component.

#47

The public comments and interest are vital to this study. Money was available to revise the Draft into a final in whatever manner was most practical, useful, and economical. The only monetary issue was whether or not changes would warrant a costly reprinting of the entire study. The federal and state review group made the decision that, although some substantial changes are reflected in the Final Study, and although it is more difficult to use the Draft and Final together, an entire reprint of a study that is over 90% accurate did not warrant the cost or time of such an undertaking. Specialists, therefore, have focused, not on reformatting of existing accurate information, but on essential changes which relate directly to public comment and other data deficiencies.

Simply reprinting public comment and testimony would, as the comment indicates, be a total waste of public money and the public's time. Hopefully, the Final Study indicates that serious consideration was given to every public comment. The two-part format of the Final Study is an attempt not only to address public comments individually, so that the public can see what was done with a specific comment, but also to group key changes by environmental area so that they actually supplement the study. The State of North Dakota and the Bureau of Land Management sincerely hope that the approach taken herein is the most satisfactory to the most people possible.

Also see the Introduction, Part 1, and responses #60, #65 (paragraph 1), #160, and #164.

#48

The study is not the final assessment of the effect of massive federal coal leasing. Although the present policy and procedure may change since it is undergoing national

review, it is presented on page 18 of the Draft Study. The process shows that other environmental assessments and public review and comments are necessary prior to final leasing decisions.

Currently, the policy and procedures are undergoing review, and an environmental impact statement is being prepared on the total coal leasing program. Such a statement is required before any major coal leasing can take place. In addition, site specific and other regional assessments are necessary prior to leasing of specific coal tracts. Also see Introduction.

#49

Details on the 243,673 acres have been covered in response #41.

#50

See Part 1, Climate and Air Quality.

Sustained production of reclaimed lands cannot be assessed from any one year's results or even a 2 to 5 year period of results. It must be assessed over a decade or several decades of time. In the short term of 2 to 5 years after mining, it is agreed by most reclamation research experts that pre-mined productivity can be achieved over 90% of the proposed Level 1 and 2 mining areas. However, as discussed in the Draft Study, page 156, first column, seventh full paragraph; and in Appendix 4, there is considerable question as to the sustained pre-mined productivity over the long term of 20 to 30 years.

Upward Migration of Sodium

Upward migration of sodium appears to be concentrated in the upper 4 inches of surface materials (Reclamation Research Staff 1975). Where suitable plant growth material exists in quantities sufficient to bury sodic spoil to greater depths, no vegetative effects of upward sodium migration are anticipated. This concept is elaborated upon in review comments by Bruce Seelig, Environmental Scientist for the North Dakota Public Service Commission:

> "We seriously question the assumption that in areas where less than 30 inches of suitable plant growth material will cover highly sodic materials, that this will result in productivity reductions. These soils are not very productive in the first place. The effects of a high sodium content which have been attributed to mining are also prevalent in the pre-mined soils. In these areas there could very well be an increase in productivity because mining activities would break up the impervious hard pan which often develops in these soils. Another consideration is if within property ownership boundaries there are areas with more than 30 inches of suitable plant growth material; the mine operator is required to save this material and it is available for averaging over the entire disturbed area within the property ownership. Rule 69-05-07-07 of the Public Service Commission (PSC) regulations requires sodic spoil material be covered with a minimum of four feet of non-toxic material (suitable plant growth material), provided four feet of such material is available."

In this light, sodium-related hazards in mined land reclamation are considerably diminished. With separate removal and respreading of topsoil, and with provision for use of suitable plant growth material from the overburden to bury sodic material, reclamation potential also is enhanced. Too, detailed soil survey data will more accurately delineate

RESPONSE TO MAIXNER (JACQIE) TRANSCRIPT

#51

As stated in comment #41, it has been reaffirmed by several reclamation research experts, in consultation with members of the Public Service Commission, Division of State Planning, and the Bureau of Land Management, that from a technological standpoint, reclamation to 100% of the pre-mined productivity of croplands and grasslands can be attained within a 3 to 5 year period after mining. This assumption does not consider state bonding laws or regulations or present practices of reclamation. This assumption is purely from a technology standpoint and it further assumes that no special problems such as excessive subsidence, extremely dry climatic cycles, upward sodium migration problems, etc., will occur.

It is true that reclamation is usually two to three years behind mining under present methods, but regarding reclamation potential and availability, there is no technical justification for this time lag. In order to reduce erosion potential, induce subsidence, and start a reclamation program, it would appear that leveling and grading should occur immediately after mining. Irrigation of raw spoils may be necessary to induce subsidence prior to respreading topsoil and reseeding. The Draft Study points out that the reclamation program should be implemented immediately after mining, which would increase the degree of reclamation success.

The study cited in Appendix 4, Table 3, shows reduced yield after the second or third year, but seasonal rainfall was also below normal and there was a significant drop in the third year. This study does not compare adjacent unmined lands during that same time. Also, topsoil depths range from 0 to 12 inches over raw spoils. On page 12 and Table 5, page 14, of the Appendix, it shows that yields tend to increase with soil depth up to about 30 inches (topsoil plus subsoil).

In attempting to draw conclusions from any or all of these experiments, one can always find exceptions, conflicting research results, or questions (either way) as to the applicability of these results under large scale reclamation programs. The experiment where wheat yields in the second year of reclamation were 77% of the pre-mined yields was not considered as absolute proof of projecting 100% reclaimability on all lands, but was mentioned simply to show what had occurred on one site and what would be expected in the fifth year assuming average annual rainfall, and that no hail losses or other problems would occur.

areas with sodic material near the soil surface. This detailed information, along with overburden analyses, is essential in the decision-making process, on a site-specific basis for each mine application presented to the North Dakota Public Service Commission.

Scrambling of Topsoil With Sodic Overburden

Scrambling of sodic overburden with topsoil would not occur. By application of both federal regulations (30 CFR 715.16) and North Dakota PSC required procedures (Rule 69-05-07), the topsoil would be separately removed, stockpiled, and replaced over the reshaped spoil. The high organic matter (1.5% or higher) topsoil materials would not be mixed and diluted with subsurface unweathered material.

Erosion Hazards Between Mining and Reclamation

"To minimize wind and water erosion mentioned on page 91 (between mining and the reclamation process), there is now a requirement (PSC Rule 69-05-14-04) to mulch all areas where suitable plant growth material has been respread, except, as approved by the PSC, annual grains may be used to establish a protective cover prior to seeding to a more permanent vegetative cover" (Bruce Seelig, Environmental Scientist, North Dakota Public Service Commission).

Federal regulation (30 CFR 715.20(g)) requires that "topsoil stockpiled must be seeded or planted with an effective cover of non-noxious, quick growing annual and/or perennial plants or protected by other approved measures . . ." Revegetation to a "diverse, effective, and permanent vegetative cover of species native to the area of disturbed land or species that will support the planned post-mining uses of the land" (30 CFR 715.20(a)) would be conducted "during the first normal period for favorable planting conditions after final grading" (30 CFR 715.20(c)). Disturbed areas "shall be planted with a temporary cover of small grains, grasses, or legumes at a commensurate level with that needed to establish adequate cover to control erosion" (30 CFR 715.20 (c)). Federal regulations cited were extracted from Federal Register, Vol. 42, No. 239, Tuesday, December 13, 1977.

"Mulch shall be used on all regraded and topsoiled areas to control erosion, to promote germination of seeds, and to increase the moisture retention of the soil. Mulch shall be anchored to the soil surface where appropriate to ensure effective protection of the soil and vegetation. Annual grains such as oats, rye, and wheat may be used instead of mulch," if "the substituted grains will provide adequate stability and that they will later be replaced by species approved for the post-mining land use" (30 CFR 715.20 (d)).

Suitability Classes for Mined Land Reclamation

Soil classes for mined land reclamation suitability, as on Map 3-7, were based on U.S. Soil Conservation Service ratings delineated in Table 3-30 on page 92. Important soil properties are moisture consistency, texture, percent coarse fragments by volume, sodium content, soluble salts, stoniness, inherent fertility, and lime content. These factors were rated to define soils as good, fair, or poor. The least suitable categories present specific problems in precipitation intake, erosion, droughtiness, surface sealing, and in establishment of vegetation. The least suitable (sodium affected) soils contained exchangeable sodium in amounts exceeding 15%.

Since the development of these criteria for mined land reclamation suitability, the North Dakota Public Service Commission has further refined plant growth material ratings to the following criteria:

1. Suitable Plant Growth Materials
   a. Electrical conductivity less than 4.0 millimhos per centimeter, indicating soluble salt content.
   b. Sodium adsorption ratio less than 10.0, indicating alkalinity.

2. Best Plant Growth Materials
   a. Electrical conductivity less than 2,0 millimhos per centimeter, indicating soluble salt content.
   b. Sodium adsorption ratio less than 4.0, indicating alkalinity.
   c. Calcium carbonate equivalent (lime) less than 10.0.
   d. Organic matter 1.5% or greater.

Such factors enumerated by the U.S. Soil Conservation Service as moisture consistency, texture, coarse fragments, stoniness and inherent fertility were not directly listed by the PSC, as these same factors exist in the pre-mining soil environment and would remain relatively unchanged in the post-mining environment by implementation of PSC required reclamation procedures.

The term, sodium effected soils, as utilized in the study, referred to the soil material having exchangeable sodium percentages in excess of 15%. Of these soils, those with the sodium affected material presently at depth greater than 30 inches from the soil surface were defined as being of "moderate" hazard. "High" hazard soils were defined as those having sodium affected material within 30 inches of the surface.

Prime Farmland

Consideration for national prime farmland is given in mining decisions and in energy facility siting. Lands designated as prime farmland must meet the following criteria (30 CFR 716.7(b)):

(1) The soils have--
(i) Aguic, udic, ustic, or xeric moisture regimes and sufficient available water capacity within a depth of 40 inches or in the root zone, if the root zone is less than 40 inches deep, to produce the commonly grown crops in 7 or more years out of 10; or
(ii) Xeric or ustic moisture regimes in which the available water capacity is limited but the area has a developed irrigation water supply that is dependable and of adequate quality. (A dependable water supply is one in which enough water is available for irrigation in 8 out of 10 years for the crops commonly grown); or
(iii) Aridic or torric moisture regimes and the area has a developed irrigation water supply that is dependable and of adequate quality.
(2) The soils have a soil temperature regime that is frigid, mesic, thermic, or hyperthermic (pergelic and cryic regimes are excluded). These are soils that at a depth of 20 inches have a mean annual temperature higher than 34 degrees F. In addition, the mean summer temperature at this depth in soils with an O horizon is higher than 47 degrees F; in soils that have no O horizon the mean summer temperature is higher than 59 degrees F.
(3) The soils have a pH between 4.5 and 8.4 in all horizons within a depth of 40 inches or in the root zone if the root zone is less than 40 inches deep.
(4) The soils either have no water table or have a water table that is maintained at a sufficient depth during the cropping season to allow food, feed, fiber, forage, and oilseed crops common to the area to be grown.
(5) The soils can be managed so that, in all horizons within a depth of 40 inches or in the root zone if the root zone is less than 40 inches deep, during part of each year the conductivity of saturation extract is less than 4 mmhos/cm and the exchangeable sodium percentage (ESP) is less than 15.
(6) The soils are not flooded frequently during the growing season (less often than once in 2 years).
(7) The soils have a product of K (erodibility factor) x percent slope of less than 2.0 and a product of I (soil erodibility) x C (climatic factor) not exceeding 60.
(8) The soils have a permeability rate of at least 0.06 inch per hour in the upper 20 inches and the mean annual soil temperature at a depth of 20 inches is less than 59 degrees F.; the permeability rate is not a limiting factor if the mean annual soil temperature is 59 degrees F. or higher.
(9) Less than 10% of the surface layer (upper 6 inches) in these soils consists of rock fragments coarser than 3 inches.

As part of the National Cooperative Soils Survey, the U.S. Soil Conservation Service in North Dakota presently is identifying prime farmland and Additional Farmlands of Statewide Importance. Updated acreage figures for seven North Dakota counties in the study area are given in Table 1. The figures are based on the published soil surveys for Burleigh, Morton, Oliver, and Stark Counties; and the completed but not published soil surveys of McLean and Mercer Counties.

The soil surveys are detailed and published at a scale of 1:20,000, except Morton which is 1:62,500.

TABLE 1

Prime Farmland and Additional Farmlands of Statewide Importance

	County Acreage	Acreage of Prime	Acreage of AFSI	Other Land & Water
Burleigh	1,054,720	66,113	601,946	386,661
Dunn	(Figures not available - Soil survey not complete)			
McLean	1,321,600	134,610	850,837	336,153
Mercer	710,400	78,010	221,500	410,890
Morton	1,237,120	118,592	221,568	896,960
Oliver	461,312	49,548	213,985	197,779
Stark	844,160	52,618	380,018	411,524

SOURCE: U.S. Soil Conservation Service, August 11, 1978.

For specific proposals, the applicant must submit to the regulatory authority a detailed plan of mining and restoration of any prime farmland within the proposed permit area (30 CFR 716.7(e)). The plan must include:

(1) A description of the original undisturbed soil profile showing the thickness of each soil horizon that is to be removed, stored, and replaced.
(2) The proposed method and type of equipment to be used for removal, storage, and replacement of the soil horizons in their natural occurring sequence;
(3) The location of areas to be used for stockpiling the soil horizons and plans for its stabilization before redistribution
(4) If applicable documentation such as agricultural school studies or other data from comparable areas that supports the use of other suitable material instead of the B or C soil horizon to obtain on the restored area equivalent or higher levels of yield as non-mined prime farmlands in the surrounding area under equivalent levels of management; and
(5) Plans for seeding or cropping the restored mine land and conservation practices to control erosion and sedimentation during the first 12 months after regrading is completed. Proper adjustments for seasons must be made so that regraded land is not exposed to erosion during seasons when vegetation or conservation practices cannot be established due to weather conditions.
(6) Agricultural school studies, company data, or other scientific data that prove that the permittee using his proposed method of reclamation will achieve the equivalent or higher levels of yield after mining as existed before mining.

For all prime farmland to be mined and reclaimed, the following requirements must be met (30 CFR 716.7(g)):

(1) All soil horizons to be used in the reconstruction of the soil shall be removed before drilling, blasting, or mining to prevent contaminating the soil hosizons with undesirable materials. Where removal of soil horizons result in erosion that may cause air and water pollution, the regulatory authority shall specify methods of treatment to control erosion of exposed overburden. The permittee shall--
(i) Remove separately the entire A horizon or other suitable soil materials which will create a final soil having an equal or greater productive capacity than that which existed prior to mining in a manner that prevents mixing or contamination with other material before replacement;
(ii) Remove separately the B horizon of the natural soil or a combination of B horizon and underlying C horizon or other suitable soil material that will create a reconstructed root zone of equal or greater productivity capacity than that which existed prior to mining in a manner that prevents mixing or contamination with other material; and
(iii) Remove separately the underlying C horizons or other strata, or a combination of such horizons or other strata, to be used instead of the B horizon that are of equal or greater thickness and that can be shown to be equal or more favorable for plant growth than the B horizon, and that when replaced will create in the reconstructed soil a final root zone of comparable depth and quality to that which existed in the natural soil.

(2) If stockpiling of soil horizons is allowed by the regulatory authority in lieu of immediate replacement, the A horizon and B horizon must be stored separately from each other. The stockpiles must be placed within the permit area and where they will not be disturbed or exposed to excessive erosion by water or wind before the stockpiled horizons can be redistributed on terrain graded to final contour. Stockpiles in place for more than 30 days must meet the requirements of Section 715.16(e).

(3) Scarify the final graded land before the soil horizons are replaced.

(4) Replace the material from the B horizon, or other suitable material specified in paragraph (g)(1)(ii) or (g)(1)(iii) of this section in such a manner as to avoid excessive compaction of overburden and to a thickness comparable to the root zone that existed in the soil before mining.

(5) Replace the A horizon or other suitable soil materials, which will create a final soil having an equal or greater productive capacity than existed prior to mining, as the final surface soil layer to the thickness of the original soil as determined in paragraph (g)(1)(i) of this section in a manner that--

(i) Prevents excess compaction of both the surface layer and underlying material and reduction of permeability to less than 0.06 inch per hour in the upper 20 inches of the reconstructed soil profile; and

(ii) Protects the surface layer from wind and water erosion before it is seeded or planted.

(6) Apply nutrients and soil amendments as needed to establish quick vegetative growth.

The Draft Study should state that at the time of the writing of the draft the Rules and Regulations (promulgated under North Dakota Century Code ch 22-18 [Rules and Regulations] of the Energy Conversion and Transmission Facility Siting Act did place prime farmland as a unique farm soils into the exclusion criteria for plant siting. However, the Rules and Regulations were revised in February 1978.

The Rules and Regulations under Article 69-06 Energy Conversion and Transmission Facility Siting Section 08-01-16, Criteria, dated February 1978 states:

> "Prime farmland and unique farmland, as defined by the land inventory and monitoring division of the Soil Conservation Service, United States Department of Agriculture, in 7 CFR Part 657; provided, however, that if the Commission finds that the prime farmland and unique farmland that will be removed from use for the life of the facility is of such small acreage as to be of negligible impact on agricultural production, such exclusion shall not apply."

RESPONSES TO WESTFALL TRANSCRIPT

#55

The interview form used in data collection on residents' attitudes was indeed subjected to Department of the Interior and Office of Management and Budget reviews, as required under OMB Circular A-40. The draft instrument submitted by the researcher was changed in format, and, to a lesser extent, in substance. Some of these required changes increased the utility of the research, while others adversely affected the internal consistency of the instrument. Both BLM and the researcher agreed that the changes were not of the magnitude that would justify canceling or redesigning the project, however.

The survey findings are an important contribution to the Social Conditions section, Chapter 2. By no means, however, do they represent the only significant aspect of this part of the assessment report. The researcher who completed the research is the chairman of the Department of Sociology, University of North Dakota. His qualifications include a doctorate in sociology, extensive social research experience in North Dakota, and a solid regional and national reputation for research.

The research was integrated with similar efforts, by the REAP Socio-Economic Monitoring project, funded by the State of North Dakota. Personal interviews were employed within a stringent scientific sampling procedure to obtain reliable data. The sample size more than adequately permits the making of inferences to the total population.

Form and town categorization of findings is a simple, straightforward, and important means of contrasting the attitudes of persons from differing occupational groups.

The assertion that "farmers and Dunn County residents" are reported in a negative context as "unfamiliar with industry and do not likely to see its advantages," was not intended to be interpreted as a judgment of character. It was intended to simply indicate a general lack of exposure for most residents. There is no implication as to whether they should or should not be.

Reporting of standard deviations and all other potential findings would result in a more lengthy document and would be of dubious value. Statements such as "these tables suggest" reflect the author's interpretation of the findings. Other persons may interpret them differently.

Likert scores were not used in the assessment.

#52

Assuming that the commentor's reference is to Teble 3-117 on page 142, the figures do not include some of the assumptions of permanent acreage disturbance used in Table 3-57, page 103. Table 3-57 shows more accurate acreages of permanent disturbance for Level 3 projects. Portions of Table 3-57 addressing "Other" and "Railroads and Roads" are synonymous with permanent acreage disturbance or disturbance that would occur for the life of the facility. "Other" from Table 3-57 are areas with some kind of permanent structure, including plant sites, equipment storage areas, parking lots, evaporation ponds, and storage areas (such as soil storage areas, etc.). Permanent disturbance would occur on about 6,440 acres.

The figure for Natural Gas Pipeline Company of America's plant site came from the site-specific Environmental Assessment prepared by the Natural Gas Pipeline Company of America and from other detailed information provided by the company.

#53

It is true that the actual transmission line routing would not always be the straight line mileage. However, the companies show that the Coyote project transmission line mileage would not change and the Antelope Valley project transmission line mileage should increase over the straight line mileage only by about 4%. This would increase the Antelope Valley project 500 kilovolt line to 286 miles from the 275 reported in Table 1-8, page 10 of the Draft Study. Also, the 345 kilovolt line mileage would be increased from 50 miles to 52 miles.

Surface owner consent and the Surface Owner Protection Act are discussed in response #68.

#54

See comments #41 and #51.

No attempt was made to equate the social concept of community and the administrative concept of county. County of residence was simply used as an important background variable. It is, however, also a politically meaningful concept.

Mitigation of social impacts through employment of local residents is a straightforward proposal. The Chapter 5 (Residual Impacts) Social Conditions section stated, however, that "it is unlikely that social impacts would be mitigated."

Persons responsible for preparation of the social impacts assessment visited Gillette, Wyoming, and interviewed social workers, mental health specialists, law enforcement officials, and similar representatives of Gillette. Their views, ideas, and suggestions are incorporated into the analysis that is presented. This incorporation is generally implicit, since space does not permit complete elaboration in impact assessment or in any type of report.

Placement of additional social workers into impact communities is a valid mitigating measure. As Chapter 2 (Social Conditions) makes clear, however, it is very unlikely that this and other measures would be adequate in dealing with the potential social disruptions that may occur in the area due to rapid coal development.

Also see Part 1, Social Conditions.

RESPONSE TO OBERLANDER TRANSCRIPT

#56

See response #22 and Introduction.

#57

The number, size, and location of energy development complexes in North Dakota will be determined by Class I areas and examination of the interaction of emissions from these complexes. As is discussed in the section entitled Analysis of Draft Study Proposed Level 1 and Level 2 Projects, Part 1, Climate and Air Quality, Class I areas have already affected the site location of the Natural Gas Pipeline Company gasification plant which had been proposed for siting in Dunn County.

The comments concerning the need for more study of air quality effects are quite appropriate. Questions such as the long-term effects of trace elements and effects upon cattle, such as selenium responsive diseases, need to be addressed in order for people in North Dakota to make the best possible decision about the number and size of energy development complexes that should be built here. This study need was expressed in the Draft Study and in the Climate and Air Quality Technical Supplement. Paragraph 4 on page 149 of the Draft Study summarizes this need. To quote:

> "The assessment of the impacts of the proposed developments has been presented within the scope of present knowledge of relationships between air contaminants, human health, and the environment. Research in the future may clarify these relationships. In this event, air quality standards may be adjusted accordingly in the public interest, whether more stringent or more lenient, so that hazards to health, safety, property, and welfare of North Dakota citizens would not occur. Any proposed energy development which presents a hazard to health, safety, and welfare of the citizens of North Dakota through degradation of air quality by emissions of regulated air contaminants will not be allowed."

Updated information concerning the effects of air pollution is presented in Climate and Air Quality, Part 1.

#58

Although the Draft Study does not project the number and kinds of energy projects expected after the proposed action has been finished, it does cover productivity and resource commitments beyond the life of the projects. This information can be found in Chapters 6 and 7, pages 181 and 189 respectively, of the Draft Study.

RESPONSE TO HAUGEN TRANSCRIPT

#59

This Summary item is addressed more fully under Government/Politics, pages 138 and 140 of the Draft Study.

For details on federal coal, see Introduction, Chapter 1 (pages 17-20), and "Federal Coal Study Areas" headings under each environmental component in each chapter of the Draft Study. The study was a cooperative effort between the State of North Dakota and the Federal Government.

RESPONSE TO LARUE TRANSCRIPT

#60

We sincerely hope that this Final, which includes all the comments and the specialists' responses, meets the desires of all citizens who helped us with written or oral comments. Also see responses #47, #60, #65, #160, #164, Introduction, and Part 1.

RESPONSE TO STEFONOWICZ TRANSCRIPT

#63

Law requires that the agencies having primary jurisdiction for granting permits must do an environmental analysis on the proposals. The intent of the National Environmental Policy Act is to weigh the pros and cons prior to making any decision.

Applicants submit their own site-specific environmental studies with their proposals. This base information is then further researched and expanded (such as in the case of a regional where a broad overview is needed) into a formal environmental impact statement according to state and federal needs. There is great expense on all sides, but this hopefully leads to better decisions.

#62

An alternative on energy conservation can be found on page 202 of the Draft Study. This alternative also encouraged readers to consult three other documents which give greater detail on energy conservation. These documents are: National Energy Outlook (Federal Energy Administration 1976), Energy Alternatives (University of Oklahoma 1975), and the Final Environmental Impact Statement Proposed Coal Leasing Program (Bureau of Land Management 1975).

On reclamation, see response #51.

The comment on "two individuals" whose comments were "almost entirely left out of the study" does not provide us with adequate information to pursue the matter. We made every effort to meet the intent of any comments. Certainly, the Governor's staff who oversaw the project, would have pointed out any objections to state or federal project personnel. See Figure 5-1, page 205.

#66

See responses #40, #41, #51, #63, and Part 1, Climate and Air Quality.

#67

See Part 1, Climate and Air Quality.

#68

The Surface Owner Protection Act, NDCC 38-18-06, item 2, requires that the Public Service Commission not issue a permit to surface-mine land unless the application is accompanied by statements of consent, executed by each surface owner within the permit area, to have surface mining conducted upon his land. However, NDCC 38-18-06, item 5, states that if surface owner consent cannot be obtained, action by district court can be taken authorizing the Public Service Commission to issue the mining permit without the surface owner's consent. To issue this order, the court must be satisfied that the surface owner will be adequately compensated for lost production, lost land value, and loss of the value of improvements due to the mining activity. This compensation will continue until the PSC releases the mining company from its bond. The payments must be made annually to the surface owner during this time.

The Federal Surface Mining Control and Reclamation Act of 1977 states in Section 714(c) that the Secretary of the Interior shall not enter into any lease of federal coal until the surface owner has given written consent to enter and commence surface mining operations and the Secretary has obtained evidence of such consent. Also, Section 714(d) states that the Secretary shall consult with the surface owner whose land is proposed to be leased and ask the surface owner to state his preference for or against the offer for lease. The Secretary shall, in his discretion, but to the maximum extent possible, refrain from leasing coal for development by methods other than underground techniques in those areas where a significant number of surface owners have stated a preference against the offering of the coal for lease. In relation to the provision, if a surface owner has given consent to a third party before the Act was enacted, that does not mean that the consent is valid for the consent required by the Department of the Interior. The Secretary must still consult the surface owner in accord with Section 714(d).

RESPONSE TO MAIXNER (RICK) TRANSCRIPT

#63

A 15% reduction in wheat yield from air pollution would be a significant loss to the state's agricultural economy and the world supply of wheat since wheat is a major crop in North Dakota. Perceptible wheat yield reductions are not expected to occur in the maximum impact area of Mercer and Oliver Counties and, for that matter, the rest of the seven-county study area. The concern is justified; however, not warranted. This is discussed further in Part 1, Climate and Air Quality, "Vegetation Effects."

A discussion of the relationship of cancer and other chronic diseases, including white muscle disease, to air pollution can be found in Part 1, Climate and Air Quality, "Human Health Effects." Increased incidence or seriousness of disease is not expected to occur in the maximum impact area as a result of emissions from Level 1 and Level 2 projects near Beulah. White muscle disease is also discussed briefly in the Draft Study on page 108, column 4. The increase in respiratory problems in the city of Durango, Colorado, mentioned in the testimony, has not been confirmed to be due to the operations of the Four Corners facilities, some 82 miles away. The reliability of that conclusion is seriously questioned.

A discussion of acid rain is presented under "Acid Rainfall," Climate and Air Quality, Part 1. This is an update on the information in the Climate and Air Quality Technical Supplement to the Draft Study. The five locations in Western North Dakota which had rainfall pH values less than pH 5.0 (4.4 to 4.9) on three days in 1977 did not appreciably affect the average of pH 6.0 measured at these three sites in the period from March to October of 1977. Attempts by the Department of Health to relate the comparatively low (pH 4.4 to 4.9) pH values to industrial sources in the region were inconclusive.

A discussion of the effects of stack effluents upon clouds and precipitation can be found in Part 1, "Effects on Weather," Climate and Air Quality. While some effects are possible, the magnitudes of changes are expected to be minor such that natural year-to-year variations will obscure detection of the effects.

#64

See response #68.

#65

See page 205, column 3; and the Public Concerns document, published October 1976, which was sent to all persons who requested a copy after attending seven public meetings prior to beginning the study.

The Federal Surface Mining Control and Reclamation Act also provides in Section 522 that persons who are or may be adversely affected by surface mining can petition the regulatory authority to have the land in question designated as unsuitable for all or certain types of surface mining. The regulatory authority has up to one year to act on the petition. Section 522 is scheduled to go into effect at the time a state has an approved State Regulatory Program.

A survey of the surface which has been leased over coal within five of the seven counties of the study area indicates an average of 60% of the surface has been leased.

#69

See response #63 and Part 1, Climate and Air Quality. Also, the lack of agreement among specialists concerning health effects, rainfall reduction, and impacts upon crops makes it impossible to say anything meaningful about the economic ramifications of these issues. Once agreement has been reached on these issues and firm data is available, it would then be possible to assess the economic impacts.

#70

See comment #63.

RESPONSE TO REICHERT TRANSCRIPT

#71

Several Draft Study work groups included a representative from the Fort Berthold Reservation, the North Dakota Indian Affairs Commission, and the Bureau of Indian Affairs. All reservation information was based on data provided by those representatives. They also prepared a Technical Supplement which provides a detailed treatment of impacts to the Fort Berthold Reservation.

Also see comments by Schettler at Twin Buttes, responses #115 through #129, and response #9.

In terms of air quality specifics, the effects of pollutant emissions are discussed in Part 1, "Air Pollution Effects," Climate and Air Quality. The primary focus of this discussion is directed to the environmental effects in the maximum air quality impact area, Mercer and Oliver Counties, within 5 miles of Beulah. The Fort Berthold Reservation and the other five counties of the seven-county study area are expected to have less potential for air pollution effects, with distance, from the Beulah projects. Concern over air pollution effects upon human health, animal health, vegetation, and other environmental aspects is justified. However, in view of expected effects in the maximum impact area, no perceptible environmental effects should be expected to occur on the Fort Berthold Reservation.

As is discussed in Climate and Air Quality, Part 1, "Analysis of Draft Study Proposed Level 1 and Level 2 Projects," the Clean Air Act Amendments of 1977 resulted in a significant reduction of sulfur dioxide primarily from the Antelope Valley Power Plant.

These sulfur dioxide emission reductions were reflected in lower expected sulfur dioxide concentrations in the ambient air. Further, the NDPL Coal Gasification Plant, proposed for siting in Dunn County, must reevaluate its plan with respect to a new location probably outside of Dunn County and away from direct interaction with emission of sulfur dioxide from the major facilities which have already received permits for construction. The designation, by Congress, of the Theodore Roosevelt National Park as a Class I area resulted in both of these changes.

The oil and gas development in the Little Knife Field has gone from a discovery well in December 1976 to an extensive, further expanding, production field in less than two years. These developments and their environmental impacts are discussed in "Influence of Oil and Gas Production," Part 1, Climate and Air Quality.

RESPONSE TO PAVLICEK TRANSCRIPT

#73

Questions of this nature should be referred to a private attorney for legal advice. Also see response #68.

#72

Although the assessment of impacts from oil and gas development is outside the scope of the study, this development is part of the baseline and was taken into account in assessing the impacts of the proposed action. The oil and gas development that was used as the basis for Draft Study was prepared is provided on page 23 of the Draft Study. The air quality component has taken the development into account in their analysis of the proposed projects, because this would affect the issuance of any Permit to Construct.

As of December 1979, 74 producing wells had been drilled. Before the gas plant became operational during the summer of 1978, the wells were restricted by law to 100 barrels of oil per day, with the gas being flared. Between 45 and 74 additional wells are expected to be drilled during 1979. The Little Knife Field should be producing 9 million cubic feet of natural gas per day and between 8,000 and 20,000 barrels of oil per day.

Also see responses #34 and #36.

RESPONSE TO CUSKELLY TRANSCRIPT

#74

The problem of Dickinson's water supply was addressed to the extent of indicating that a problem exists and that some solutions have been proposed. The concept of bringing water to Dickinson as a part of the coal development was not addressed because municipal water-supply planning is not within the province of gas pipeline and coal-mining companies and was outside the scope of this study. None of the proposed projects would compete with the city of Dickinson for available water supplies, nor would they adversely affect the city's potential water sources.

There is also nothing in the proposed actions that would justify a hope that after gasification plants cease to operate their water supply would then be available to Dickinson. However, if constructed, the physical facilities would be in place and presumably available for use. Also see responses #92, #93, and #94.

The Federal Clean Air Act Amendments of 1977 designated Class I areas in the State of North Dakota. These designated areas are the North and South Units of the Theodore Roosevelt National Park and the Lostwood Wilderness Area. The Theodore Roosevelt National Park, North and South Units, have the greatest limiting factor on proposed projects as described in the Draft Study. This is described in Climate and Air Quality, Part 1, "Prevention of Significant Deterioration." A more detailed explanation and discussion of such things as allowable contamination limits for a Class I area are described in that discussion. Filling of the allowable Prevention of Significant Deterioration PSD Class I sulfur dioxide increments in the Theodore Roosevelt National Park had a significant influence on the construction of the NDPL Coal Gasification Plant. As discussed in Part 1, Climate and Air Quality, "Analysis of Draft Study Proposed Level 1 and Level 2 Projects," the proposed NDPL Coal Gasification Plant would not be allowed to be constructed at the site indicated in the Draft Study.

There is no increment available for construction of the NDPL facility at the proposed site. The projects which have preceded the Natural Gas Pipeline Company in the permit process have consumed the increment available. No Permit to Construct would be granted by the North Dakota State Department of Health for this facility in light of this finding. The decision to proceed with the Coal Gasification Plant under the Clean Air Act Amendments of 1977 at the Dunn County proposed site would depend upon decisions by federal land managers and the Governor of the State of North Dakota.

or by the Governor with the concurrence of the President of the United States. A more thorough discussion of variances and the roles that the federal land manager, Governor, or President play in such variances is discussed in "Prevention of Significant Deterioration," Climate and Air Quality, Part 1.

The question of water availability vs. deterioration of air quality is only one of many questions which will be considered, no doubt, in the years ahead because of the limitations that prevention of significant deterioration of air quality places upon future developments, either in the vicinity of the development or areas of development around Class I areas. The purpose of documents such as the Draft Study is to provide information to the public and decision-makers to aid in weighing the "trade-offs" involved.

#75

Assuming that the speaker is concerned about the likelihood of settlement in Dickinson as a result of energy development in Dunn County, we agree that there would be a population increase in Dickinson. However, the already well developed infrastructure in Dickinson appears capable of handling increases of the magnitude projected. It is for this reason that the impact level was termed "negligible."

#76

The subject of impacts from mining, gasification, and power generation on the water resources was discussed specifically in Chapter 3 on pages 97-99 of the Draft Study. In that section, the amount of water to be used specifically for mines (vs. gasification and power plants) is identified. The volume of water to be used solely for mining would be small compared to that used to manufacture or generate power.

Dakota Resource Council

P.O. BOX 254
DICKINSON, NORTH DAKOTA 58601
(701) 227-1651

June 15, 1978

Governor Arthur Link
State Capital Building
Bismarck, ND 58505

Dear Governor Link:

We have completed our study of the draft West-Central North Dakota Regional Environmental Impact Study which I told you we were preparing during our last meeting. Three members of our Board of Directors delivered testimony (enclosed) at the hearing in Dickinson on behalf of the Dakota Resource Council in which we detailed our objections to the EIS's handling of the following areas: air quality, reclamation, and social impacts.

In all of these areas, DRC feels that the EIS gives such misleading or inadequate information on the impacts of massive coal development that it is unthinkable for the citizens of this state to use this document as a tool for planning the course of coal development in North Dakota. Moreover, the form in which the Study is presented is such that most people are reluctant to even read it, as was indicated by the low turnout at the hearings last week.

In addition to DRC's review of the draft Study, we are now at liberty to release the comments (enclosed) of Dr. Raymond Gold, Director of the Institute for Social Research at the University of Montana, who is acclaimed as one of the foremost impact sociologists in the nation. Dr. Gold's comments are directed at the Survey Study upon which the EIS bases its sections on Social Impacts.

DRC feels that all sections of the EIS which deal with the above mentioned areas are in need of considerable revision before an accurate assessment of the cumulative effects of coal development, and subsequent planning, can take place. It is our understanding, however, that most of the money allocated for the Study has already been spent on the draft, and that there are very limited funds available for any type of meaningful revision. In addition, we have learned that key people involved with the Study have already moved or are moving on to other positions unrelated to the EIS. Without sufficient funds of the expertise of competent people who are familiar with the Study and the unique aspects of coal development in North Dakota, we fear that the final EIS will be yet another study which represents nothing more than a waste of time, money, and the good faith of the people of North Dakota.

The Dakota Resource Council calls upon the government of the State of North Dakota to ensure that the draft EIS is revised so that it accurately and meaningfully reflects the cumulative impacts of coal development.

Sincerely,

Evelyn Stenton
DRC Chairperson

Enclosures

cc: Gary Wicks
Dave Durgin
Gary Johnson

Dakota Resource Council

P.O. BOX 254
DICKINSON, NORTH DAKOTA 58601
(701) 227-1651

June 15, 1978

Dr. Gary Johnson
Regional Environmental Impact Study Office
1533 North 12th Street, Suite F
Bismarck, ND 58501

Dear Gary:

We are now at liberty to release the comments of Dr. Raymond Gold, Director of the Institute for Social Research at the University of Montana. Dr. Gold's comments (enclosed) are directed at the Ludtke Survey Study and were written in response to my letter to him (enclosed). I would like both my letter and Dr. Gold's comments to be added to the testimony I delivered at the hearings for the draft Regional EIS in Dickinson. If some other arrangements must be made in order for this material to be included among the citizen's comments, please let me know. Also enclosed, please find a copy of the letter from DRC's chairperson, Evelyn Stenton, to Governor Arthur Link regarding our position on the draft EIS and the use of citizen's comments.

Sincerely,

Susan Westfall
DRC Board of Directors

RESPONSE TO NEWTON LETTER TO GOVERNOR LINK

#77

See Introduction, Part 1, and responses #67, #68, and #65.

University of Montana
Missoula, Montana 59812

INSTITUTE FOR SOCIAL RESEARCH
(406) 243-6411

May 23, 1975

Ms. Susan Westfall
Dakota Resource Council
P.O. Box 254
Dickinson, North Dakota 58601

Dear Ms. Westfall:

Here are my comments on Richard Ludtke's BLM-sponsored study of "human concerns related to industrial development based on coal" in several North Dakota counties.

1. I agree with the methodological criticisms of the report which you listed in your letter of a few weeks ago. The research design is inadequate (see attached copy of my review of the study proposal); the analysis is superficial; and the questions and presumptive contain many slanted, biased, and otherwise loaded statements.

2. Why Ludtke agreed to do the study after his basic information-generating device (the questionnaire) was tampered with by interior and OSM is quite beyond me. Acquiescing to this meddling made it impossible to produce a sound professional report.

3. As noted above, the research design does not provide for generating meaningful data. Questionnaire data alone are not meaningful in the sense of clearly conveying the meanings which the people studied attach to the topics of inquiry. The report continually speculates on the meaning of questionnaire findings (e.g., "these tables suggest that . . .") because the study failed to provide for doing probing interviews of sociologically representative residents of the places studied to find out from them how to explain these findings. Questionnaires, by their very nature, reveal much about what is, little if anything about how come. To obtain knowledge of the latter, painstaking fieldwork must be done by skilled interviewers.

4. Equating community to county makes no sociological sense, yet this is exactly what the report does (see section on community goods, pages 13-16). No wonder it ran into so much trouble trying to get the people to deal with this unbelievable stuff.

5. Page 10, second paragraph, refers to items 35, 51, and 52, which, it is claimed, measure emotional intensity of attachment to home and place of residence. These items cannot adequately measure what they purport to measure because they do not ask the respondents to identify their sociocultural roots, indicate where, why, and how they are placed, and how they feel about this root system. Nor do these items even begin to ask about conditions the respondents consider essential for enjoying life in their present (or in any) residence/community.

Equal Opportunity in Education and Employment

DAKOTA RESOURCE COUNCIL
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DICKINSON, NORTH DAKOTA 58601
(701) 227-1151

Raymond L. Gold, Director
Institute for Social Research
University of Montana
Missoula, Montana

Dear Dr. Gold:

Enclosed you will find a copy of the Ludtke study. This study is interesting to the social condition section of the draft Regional EIS done recently as a cooperative effort involving the BLM and the state of North Dakota. I neglected to ask you during our recent conversation whether you had seen a copy of this EIS, if not, and you would like to have one we will be happy to see that you get a copy.

I see many areas in this study that I question. Two are of a general nature: 1) the introduction by Ludtke indicates BLM direction to the overall study including designing the questionnaire, and 2) the questionnaire itself is complex to a point where it seems impossible to distinguish anything meaningful-ie the degrees of importance and satisfaction relating to living conditions are reported on tables 38-56 without any real definition of the differences between the terms.

Specifically I have other points of contention with the study:

1. There is no occupational breakdown reported in the study. I have requested this and am waiting for the information.

2. "Farmers and Dunn county residents" are reported as one category and generally in a negative connotation. "unfamiliar with industry so not likely to see advantages, etc."

3. It is unlikely that a sample of residents from these four rural counties would have an educational level of 10.5 years with an average of 50.6 years as is reported in the study. READ dates indicate that the educational level should at best be 9.1 years for these four counties.

4. Nonresponse categories to certain questions are as high as 45.3%, yet the use of percentage tables doesn't clearly indicate this.

5. Mean scores are reported without standard deviation to at the least indicate variance in levels of response.

6. Likert scale scores reported on pp. 8-10 are probably within the levels of acceptability, but some of them seem marginal at best.

I know you appreciate the intentions of the BLM and certain state officials here in N.D. This particular study is being scrutinized a centerpiece of cooperation between state and federal planning agencies. I recognize my own bias in reviewing this study so I really appreciate your willingness to look over this study. If you would like to see how this study was used in the EIS, please let me know and I will see to it that you have a copy.

Thank you.

Susan Westfall

6. In some places in the report (e.g., page 16), Dunn County is portrayed as a deviant case among the several counties studied. Yet, no concerted effort was made to explain why these appears to be so different.

7. Question ten, page 18, is an example of a loaded statement. A person almost has to be unamerican to disagree with this statement.

8. The report relies too much on census categories, too little on sociological ones, to carve much light on "human concerns related to industrial development based on coal." That is, for example, data are classified by county, race-ethnic and farm (yes/no), when it would make more sense to classify by occupation, way of life, type of membership in the community (not the county), kind and degree of commitment to living in the area, etc.

9. The section on orientation toward newcomers (page 26) is an example of how simple minded the tables are. No effort is made to them to show under what circumstances given kinds of newcomers would and would not be welcome. Such errors of omission abound.

10. At the bottom of page 28 and thereabouts, an effort is made to head off criticism to which the author may here sensed he was vulnerable. He says, "It is apparent that people are aware of the various trade-offs involved in rapid industrialization. To suggest that they were not would run contrary to the evidence presented above." Well, if one looks at this evidence and on the fuller breakdown of this information in table 112, one cannot help but notice that nearly all the evidence is made up of information on economic, socioeconomic, and community service variables. Conspicuous by their absence are the really critical social, behavioral and cultural trade-offs, such as expected effects on way of life, on informal life-support systems (e.g., on "neighboring"), on family and church, and on other core social groups.

The study obviously has deficiencies in design, execution, and reporting. Perhaps not as obvious, but no less serious, is that the report can easily persuade the ordinary reader into thinking that in adequately, faithfully, and accurately portrays the coal development-related views, understandings, hopes, fears, and other "human concerns" of the residents of the several counties studied. In fact, the report is, at best, highly biased (i.e., superficial) version of these human concerns. At worst, it is in many places a distorted and misleading version of the human concerns it attempts to portray.

I do not mean to suggest that any of those concerned in the conception and execution of this study deliberately tried to warp it up, to misrepresent the research scene, or the like. I believe that they are probably sincere and conscientious people who, alas, are unable to recognize that this exceedingly difficult kind of research should be attempted only by social scientists

Ms. Susan Westfall
May 23, 1978
page 3

who are extraordinarily good at doing fieldwork on community change. Whether they are willing and able to face up to and correct the study's deficiencies remains to be seen.

Sincerely,

Raymond L. Gold
Director

RLG/jm
enclosure

Paul Myers
November 26, 1975
page 2

Finally, let me say something complimentary for a change. I think that Ludtke's approach makes a lot more sense than that of Slavins, Thompson, et al. in their Old West proposal. At least Ludtke is not so precommitted to a mathematical model that there is not much room for genuine sociological discovery.

jm

INSTITUTE FOR SOCIAL RESEARCH

November 26, 1975

TO: Paul Myers, Bureau of Land Management, Billings, Montana

FROM: Raymond L. Gold, Director, Institute for Social Research, University of Montana, Missoula, Montana

RE: Richard L. Ludtke's proposal, "Human Impacts of Energy Development: A Panel Design"

It takes awhile to figure out what Ludtke is proposing to do, and then one is told only that he wishes to do a socio-demographic profile and monitor changes in attitude toward (one surmises) development-related matters of various sorts. It is usually all too easy to raise searching questions about how an investigator plans to develop a questionnaire, validate it, reality check his findings, and the like, so I'll spare you this sort of thing concerning Ludtke's proposal.

What probably bothers me most about his proposal is that his approach to studying attitudes is distressingly usual--and therefore not very useful. For an attitude survey to be a useful study of social change, careful provision must be made to generate data on the dynamics of attitudinal change. The spaced, cross-sectional study Ludtke proposes would leave too much space between the data-gathering periods and force the investigator to rely heavily upon his imagination to answer questions about how attitudes are formed and shared, do and do not provide frameworks for perceiving, deciding, and acting, and so forth. To answer such questions directly and certainly would require a processually oriented longitudinal study. Accordingly, the very least that he should do is a small sample of ongoing case studies to help processualize what otherwise is sure to be time-bound data. No statistical magic can turn three snapshots into motion pictures. He needs to provide for some participant-observation, especially case studies, in the design and to use skilled interviewers to obtain ethnographic data while administering questionnaires. Then, for the study to approach being longitudinal, he should set it up for at least three years, preferably for however long it takes to get data on "before," "during," and "after" the times significant social impacts occur.

Moreover, I'd like to see Ludtke measure changes in quality of life from the standpoints of those whose lives are affected as well as from the standpoint developed through using standard social indicators. And I'd like to see him commit himself to being accountable for findings to his respondents no less than to any other category of people.

RESPONSE TO WESTFALL LETTER TO GOLD,
GOLD LETTER TO WESTFALL,
AND GOLD LETTER TO MYERS

#78
Refer to response #55 and Part 1, Social Conditions.

DAKOTA RESOURCE COUNCIL
P.O. BOX 254
DICKINSON, NORTH DAKOTA 58601
(701) 227-1251

TESTIMONY OF EVELYN NEWTON, CHAIRPERSON OF THE DAKOTA RESOURCE COUNCIL CONCERNING THE DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY-MONDAY, JUNE 4, 1978, DICKINSON, NORTH DAKOTA

I'D LIKE TO THANK THE BUREAU OF LAND MANAGEMENT AND OUR STATE FOR THIS OPPORTUNITY TO COMMENT ON THE DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY. SINCE THIS STUDY IS SUPPOSED TO BE LAYING THE GROUNDWORK FOR PLANNING WITH REGARD TO POTENTIAL COAL DEVELOPMENT IN THIS AREA, IT IS ESSENTIAL THAT THE PEOPLE WHO LIVE HERE TAKE AN ACTIVE PART IN ITS PRODUCTION.

UNFORTUNATELY, THE EIS IN ITS PRESENT FORM IS INADEQUATE AS A TOOL FOR PLANNING. IT GLOSSES OVER SOME OF THE MOST SERIOUS IMPACTS OF COAL DEVELOPMENT IN WAYS THAT LEAD AN UNSUSPECTING READER TO BELIEVE THAT MASSIVE COAL DEVELOPMENT WILL HAVE MANY POSITIVE AND FEW NEGATIVE EFFECTS ON THE LIFESTYLE AND ECOLOGY OF THE AREA. THE FACT IS, THE DEVELOPMENT OF COAL ON THE SCALE PROJECTED BY LEVELS 1 AND 2 IN THE EIS COULD BE DISASTROUS FOR THE LONG TERM WELL BEING OF THE LAND AND PEOPLE OF NORTH DAKOTA.

THE WAY THE STUDY PRESENTS THE SECTIONS ON CLIMATE AND AIR QUALITY IS ONE EXAMPLE. THE EIS STATES THAT "A GENERAL REDUCTION IN THE OVERALL AMBIENT AIR QUALITY OF THE SEVEN COUNTY AREA WOULD BE EXPECTED TO OCCUR. HOWEVER, THE APPLICATION OF EXISTING MITIGATING MEASURES...WOULD NOT PERMIT THE REDUCTION TO ATTAIN LEVELS WHICH WOULD SIGNIFICANTLY ALTER THE EXISTING QUALITY OF THE AIR ENVIRONMENT IN THE SEVEN COUNTY STUDY AREA."

STATEMENTS SUCH AS THIS, AND THERE ARE PLENTY OF THEM IN THE STUDY, LEAD THE READER TO BELIEVE THAT AIR POLLUTION DUE TO LEVELS 1 AND 2 DEVELOPMENT WOULD BE INSIGNIFICANT. IF THE VARIOUS FIGURES THAT THE EIS SPREADS THROUGHOUT THE SECTION ON AIR QUALITY ARE ADDED UP, HOWEVER, THE FACTS ARE THESE: PARTICULATE EMISSIONS WOULD TOTAL 13,024 TONS PER YEAR; SULPHUR DIOXIDE EMISSIONS WOULD TOTAL 103,303 TONS PER YEAR; NITROGEN OXIDE EMISSIONS WOULD TOTAL 59,600 TONS PER YEAR. THIS ADDS UP TO A TOTAL OF 175,917 TONS EVERY YEAR. WITH AN EXPECTED LIFESPAN FOR THESE PROJECTS OF 35 YEARS, THE AMOUNT OF THESE POLLUTANTS TO BE DUMPED INTO THE AREA'S AIR WOULD BE 6,157,095 TONS. THIS AVERAGES OUT TO 482 TONS PER DAY.

ALTHOUGH THE STUDY DOESN'T GIVE ALL OF THESE TOTALS, IT DEFENDS THE AMOUNT OF POLLUTION WHICH WOULD FOUL OUR AIR BY REPEATEDLY EMPHASIZING THAT LEVELS 1 AND 2 DEVELOPMENT WOULD NOT VIOLATE FEDERAL OR STATE AIR POLLUTION STANDARDS. IT DOESN'T INDICATE, HOWEVER, THE AMOUNT OF DAMAGE WHICH CAN OCCUR AT LEVELS WELL WITHIN THE FEDERAL CLASS II STANDARDS. WHAT'S MORE, THE STUDY FAILS TO ASSESS THE IMPACTS WHICH CLASS I AIR STANDARDS WOULD HAVE ON THE AREA. IT SEEMS TO TAKE FOR GRANTED THAT EVERYONE IN THE AREA IS CONTENT WITH CLASS II DESIGNATION, WHICH IS NOT THE CASE AT ALL.

THE EIS REPORTS THAT THE STATE DEPARTMENT OF HEALTH'S PHASE I STUDY ON TRACE ELEMENT EMISSIONS "INDICATES THAT THERE IS A LOW PROBABILITY OF SHORT TERM ADVERSE EFFECTS RESULTING FROM THE EMISSIONS OF TRACE ELEMENTS FROM ENERGY CONVERSION FACILITIES." THE DAKOTA RESOURCE COUNCIL CONSIDERS THE THIRTY TO FORTY YEAR LIFE EXPECTANCY OF THESE PROJECTS AS SHORT TERM, BUT AS IT APPLIES TO THIS STUDY, THE "SHORT TERM" IS ONLY ONE YEAR. THE EIS DOESN'T POINT THIS OUT, HOWEVER. TO FIND THAT OUT, THE READER MUST CONSULT THE TECHNICAL SUPPLEMENT ON CLIMATE AND AIR QUALITY.

IT SHOULD BE NOTED HERE THAT AT THE INFORMATIONAL MEETING FOR THE STUDY WHICH WAS HELD IN DICKINSON, WE WERE TOLD THAT THE TECHNICAL SUPPLEMENTS WERE LIMITED IN QUANTITY AND WERE MEANT TO BE USED ONLY BY PEOPLE WITH EXPERTISE IN THOSE RELATED AREAS.

WE DON'T HAVE EXPERTISE IN THE FIELD OF AIR POLLUTION, BUT WE ALSO FOUND THAT THE AIR QUALITY SUPPLEMENT ALSO ADMITS THAT THE LONG TERM EFFECTS OF TRACE ELEMENT EMISSIONS ARE NOT KNOWN. THE EIS DOESN'T POINT THIS OUT, EITHER. THE SUPPLEMENT ALSO LISTS A CONSIDERABLE AMOUNT OF MATERIAL WHICH DEALS SPECIFICALLY WITH TRACE ELEMENTS, BUT THE EIS DOESN'T CITE ANY OF THEM.

THE EIS DOES NOT ADEQUATELY ASSESS THE SYNERGISTIC EFFECTS OF POLLUTANTS WHICH BECOME HIGHLY TOXIC WHEN COMBINED. IT MENTIONS THAT SUCH POLLUTION IS POSSIBLE, BUT FAILS TO DETAIL THE POTENTIAL FOR SUCH PROBLEMS AS THEY RELATE TO THE DEVELOPMENT PROPOSALS.

THE EIS QUANTIFIES THE PARTICULATE EMISSIONS WHICH WILL OCCUR IN THE AREA AND NOTES THAT MOST OF THEM WILL BE COMING FROM UNPAVED ROADS, AGRICULTURAL ACTIVITIES, AND MINING OPERATIONS. IT DOESN'T QUALIFY THESE EMISSIONS, HOWEVER, AND CALLS THE PARTICULATE EMISSIONS FROM THE COYOTE 2 POWER PLANT "INDISTINGUISHABLE" IN COMPARISON TO THE OTHER SOURCES. IT OVERLOOKS THE FACT THAT PARTICULATE EMISSIONS FROM POWER PLANTS AND GASIFICATION PLANTS ARE FAR MORE DANGEROUS THAN THOSE FROM THESE OTHER SOURCES.

THE STUDY SAYS NEXT TO NOTHING ABOUT THE POSSIBILITY OF "ACID RAINS", DESPITE THE FACT THAT THEY HAVE OCCURRED IN OTHER PARTS OF THE UNITED STATES AS WELL AS EUROPE AS A RESULT OF HIGH SULPHUR EMISSIONS.

OTHER AREAS OF THE STUDY ARE EQUALLY DEFICIENT. THE EIS ALSO STATES THAT " AS A RESULT OF THE CURRENT STATE OF THE ART OF RECLAMATION...ESTIMATES OF THE RESIDUAL ADVERSE IMPACTS ARE SPECULATIVE AND IN MOST CASES BEYOND CALCULATED PREDICTIONS," AND THAT "WHILE PRE-MINED PRODUCTIVITY MAY BE ACCOMPLISHED ON POST-MINED LANDS, NO ONE REALLY KNOWS WHAT PRODUCTION LEVELS WILL BE ON RECLAIMED LANDS IN 20 TO 30 YEARS."

DESPITE THESE STATEMENTS, AND WITH NO EVIDENCE OF ANY LAND IN NORTH DAKOTA BEING RECLAIMED TO 100% OF ITS ORIGINAL PRODUCTIVITY, THE EIS BASES FIGURES IN THE SECTIONS DEALING WITH LAND USE, SOILS, VEGETATION AND GEOLOGY ON 100% RECLAMATION IN A 3 TO 5 YEAR PERIOD.

THE EIS GIVES NO ESTIMATES OF THE COST OF RECLAMATION. THIS IS ESPECIALLY IMPORTANT AS IT RELATES TO BONDING REQUIREMENTS IN NORTH DAKOTA, AND SHOULD BE INCLUDED TO PROVIDE AN IDEA OF WHAT WOULD BE INVOLVED IF THE STATE HAS TO TAKE OVER THE RECLAMATION PROCESS.

THE STUDY STATES THAT THE TIMESPAN BETWEEN MINING AND RECLAMATION IS CRITICAL BECAUSE OF EROSION HAZARDS. IT FAILS, HOWEVER, TO RELATE THESE POTENTIAL HAZARDS TO NORTH DAKOTA'S RECLAMATION LAW.

IN THE SECTION CONCERNING LAND USE, THE EIS PROJECTS THAT THE TOTAL AMOUNT OF LAND TO BE LEASED BY ALL PROJECTS IN LEVELS 1 AND 2 DEVELOPMENT IS 336,134 ACRES. THE AMOUNT OF LAND IT PROJECTS WILL BE DISTURBED IS 92,461 ACRES. THE EIS SAYS NOTHING ABOUT WHAT WILL BE HAPPENING ON THE 243,673 ACRES OF LAND WHICH IS IN EXCESS OF THE DEVELOPMENTS' NEEDS.

THE STUDY ALSO IMPLIES, IN THE LAND USE SECTION, THAT SURFACE OWNERS HAVE "VETO POWER" OVER THE MINING OF COAL WHICH IS OWNED BY ANOTHER PARTY. THIS IS NOT ALWAYS THE CASE IN NORTH DAKOTA.

The Social Impacts sections are based on a survey which has been called "in many places a distorted and misleading version of the human concerns it attempts to portray," by one of the leading impact sociologists in the nation. Here, as in many other sections, the EIS quantifies without qualifying, and as a result it fails to adequately portray the meaning of the statistics. 81

The EIS presents a slanted view of the alternative of no further development. For instance, the EIS says that "the primary residual adverse effects of this alternative would be the non-availability of the energy" for jobs and production. This implies that the energy would be used for jobs and production in North Dakota, when in fact most of the energy produced by these projects would be sent out of the State. The EIS doesn't mention this, however. 82

There are other areas where the Study is in need of considerable revision; the EIS fails to assess the impacts which will affect the area when the proposed projects would come to an end; Natural Gas Pipeline Company's proposed gasification plant near Dunn Center should not have been included in Level I development; MGPL has not even filed the necessary applications with the Public Service Commission or the Department of Health, and has been denied a permit by the State Water Commission; in general, the EIS would have been better organized had it been broken down by subject rather than by study process. 83 84 85

All of these areas represent serious flaws in the EIS and should be revised to accurately reflect the real impacts of massive coal development.

We've been told that citizens' comments are intended to be an important part of the final document, but that there's no money available to do a revision of the Study. It's been suggested to us that citizens' comments will simply be added as an attached volume to the Draft. If citizens' input is given so low a priority as this implies, these hearings are of little value. Simply attaching citizens' comments to the Draft would effectively nullify them because of the difficulty there would be in applying them to a document as massive and complex as this EIS. Many people are already inhibited by the sheer size of the Study, and adding these critical corrections in a separate volume would only make matters much worse. 86 87

In conclusion, the Dakota Resource Council opposes the use of this Study as the final assessment of the effects of massive new Federal coal leasing. The cumulative effects of such leasing should be studied in much greater detail in and of themselves.

RESPONSE TO NEWTON TESTIMONY

#79 through #7

See responses #40 through #50 for response to transcript accompanying this testimony. There appear to be no differences warranting different responses.

TESTIMONY ON THE DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY ON ENERGY DEVELOPMENT
JACQUIE MAIXNER, JUNE 5, 1978, DICKINSON, N.D.

My name is Jacqie Maixner. I live southwest of New England, North Dakota. I have been studying the Land Use sections of the Draft EIS and also the Soils and Vegetation sections.

I have criticisms in four areas of the Land Use sections: the first is that the study assumes that there will be 100% successful reclamation in three to five years, the second concerns statements about plant siting, the third critism has to do with new transmission line mileage, and the fourth concerns the rights of surface owners who do not own the minerals under their land. 88

The statements made in the Draft EIS concerning the amount of land which will be out of production at a given time and the statements as to loss of productivity and income are predicated on the assumption that there will be 100% successful reclamation within three to five years after mining. There are several reasons why this is not probable.

Our state reclamation law requires 40% of the bond when backsloping and grading are completed, 30% when respreading of plant growth material is completed, and the final 30% when reclamation has been accomplished "as provided here-in." "As provided here-in" does not necessarily mean that the land must be restored to 100% of it former productivity. The reclamation law provides for a permit term of three years.

Another three years after the termination of the permit term are allowed for the completion of reclamation. However, if reclamation is not complete by that time, two years of automatic extensions are added. This brings us to eight years from the beginning of mining. After this time, more extensions may be added at the discretion of the Public Service Commission. Under these conditions, it looks highly improbable that reclamation will be completed in three to five years.

One problem with reclaiming land in this seven-county area is the upward migration of sodium into the topsoil and subsoil of reclaimed land. According to page 187 of the Draft EIS, "Soils disturbed by mining activities would be scrambled and soil profile identity will be established only after extended time, perhaps over 100 years." This scrambling causes the sodium from deeper layers to be mixed with other layers and end up closer to the surface and the soil to deteriorate and yields to decrease as years go by. According to the soils section of the Draft EIS, (page 36), twenty percent of the land in the study area has sodium affected soil material of high hazard classification and another eighteen percent has sodium affected soil material of moderate hazard classification. Studies have not been going long enough to determine how long this soil deterioration will continue, but a definite trend of soil deterioration has been seen. According to the Draft EIS, "Where less than thirty inches of suitable plant growth material exists to bury sodium affected materials, problems could result in reduced agricultural productivity.

Although the Draft EIS assumes that reclamation will progress only two or three spoil piles behind reclamation, this is, in actuality, not feasible and not the way it is presently being done. The norm has been for reclamation to begin two or three years behind mining. At this rate, with the automatic six to eight years timespan allowed by the state reclamation law, reclamation would just barely be beginning during the three to five years allowed by the Draft EIS. The Draft EIS points out that water and wind erosion can cause much damage during this time between stripping and the establishment of reclamation. This further decreases the chances of 100% successful reclamation.

As the Draft EIS points out, there are federal and state laws authorizing deletion from mining plans areas not suitable for reclamation. This may be true, but hasn't been done. Table 3-31, page 92 shows that less than one-half of land permitted for level 1 strip mining is in the suitable to most suitable categories, and more than one-half is in the less suitable to least suitable categories. If we mine land that is not considered suitable for reclamation, I doubt that we will achieve 100% successful reclamation.

The Draft EIS is very contradictory. While pointing out some of the problems with reclamation, they assume that every square foot of every mined acre will be returned to its former productivity when making the computations of loss of production and income. The only clue I could find in the Draft EIS as to why the authors believe that 100% reclamation is possible is on page 135. In discussing an experiment in which 77% of the pre-mined productivity was attained in the second year of reclamation at the Glenharold Mine, they draw the conclusion that full reclamation would be expected within the five year reclamation period. However, according to the study printed in the appendix, yields began to decrease after the second year due to the upward migration of sodium causing deterioration of the topsoil. (Figure3, page 13) In one experiment with created wheatgrass at four mine sites, the third year yields dropped to about one-half the second year yields. The 77% of pre-mined productivity is most likely the best reclamation possible, since it was attained in the second year and most experiments have shown a decrease in production beginning with the third year. In another report, NORTH DAKOTA PROGRESS REPORT ON RESEARCH ON RECLAMATION OF STRIP-MINED LANDS--UPDATE 1977, experiments with ten cool-season grasses, six wildryes, ten miscellaneous grasses, six warm-season grasses and five legumes planted on spoil plus six inches topsoil, the yields dropped drastically from the first year to the second and from the second year to the third. Rather than assuming that productivity of reclaimed land will automatically improve with time, the evidence points to the opposite conclusion.

In order for the EIS to be an effective tool in assessing loss of production and income from strip-mining, the conclusions and figures should be revised to reflect reclamation success that has been attained so far and a more realistic time frame for the completion of reclamation.

The draft EIS states that our siting law for energy conversion and transmission facilities protects culturally important or environmentally sensitive areas from project siting, particularly prime farmland and irrigated land. The state siting law does no such thing; it merely directs the Public Service Commission to write regulations. These regulations have recently been changed and do not explicitly protect prime farmland. The Draft EIS states that "the Public Service Commission could require that an alternate American Natural Gas Coal Gasification Plant and Antelope Valley Power Plant site be chosen which would avert locating on 535 acres of prime farmland." The permit has already been granted for the site on the land containing 535 acres of prime farmland.

The Draft EIS states that plant sites for level 1 would permanently remove from production 3,203 acres of agricultural land. Checking with the Public Service Commission I found that the plant site for the Antelope Valley Power Plant is 448 acres, the plant site for the American Natural Gas Coal Gasification Plant is 792 acres, and the plant site for the Montana-Dakota Utilities Coyote 1 Power Plant is 2,483 acres. So far this adds up to 3,723 acres, already 520 acres more than the Draft EIS figure with only three out of the four plants included in level 1. No figure is available for Natural Gas Pipline Company of America's plant site because they have not yet applied for a permit. This figure should be revised and where no figure is available the EIS should point out that the figure given does not include all projects.

Table 3-122 on page 144 of the Draft EIS titled, "Level 1: New Electrical Transmission System Mileage by County and Type" is inaccurate because all mileage distances are figured on a straight line distance between origins and destinations. Although this is pointed out in a footnote, I would not want to see these mileage figures used in planning for development. I would think that there could be a multiplier devised to give us a more realistic picture of these mileages, allowing for the lines going around exclusion and avoidance areas.

The Draft EIS has barely mentioned the problems of surface owners who do not own the minerals under their land. On page 21 is a statement that surface owner consent must be secured before the Public Service Commission can issue a permit to surface mine land. This statement is very misleading because the surface owner has no choice in the matter. If the mineral owner has consented to strip-mining, the mining company makes an offer to the surface owner to cover damages. If the surface owner is not satisfied with the offer, his only alternative is to sue for more payment. If the court rules that the offer was a fair one, the surface owner must pay the court costs and attorney fees. At no point does the surface owner have a say as to whether or not the mining will take place. On page 166 of the Draft EIS is a statement that state law requires that surface owners be compensated for loss of production. The fact is, that without a veto power the surface owner has a very poor bargaining position to receive adequate compensation. The EIS should point this out and

address the problem of surface owner protection in greater depth as it is one aspect of energy development that will greatly affect many North Dakotans.

I recommend that the Draft EIS be reviewed and revised in these areas that I have mentioned.

RESPONSE TO MAIXNER (JACQUE) TESTIMONY

#88 through #90
See responses #81 through #84 for response to transcript accompanying this testimony. There appear to be no differences warranting different responses.

TESTIMONY OF SUSAN WESTFALL, DICKINSON, NORTH DAKOTA,IN REGARDS TO THE DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY.

My name is Susan Westfall, and I am testifying here today as a concerned citizen of North Dakota. While I am concerned with the total impact of coal development in Western North Dakota, I have chosen to limit my comments to the area in which I am personally most qualified to comment.

As a trained sociologist I am extremely disturbed by the Social Conditions section of this Draft EIS. Social conditions can not be measured, quantified, or regulated with the same kind of precision as air quality or water availability. There is no federal regulation requiring a set degree of satisfaction with living conditions, so the measurement of such conditions becomes much more difficult.

Human social data is derived directly through social survey and indirectly through statistical data which theoretically combine to present an accurate picture of the attitudes, satisfactions, and lifestyle of the residents of an area. As a social scientist, I appreciate the difficulty of achieving an accurate picture of social conditions, but I do not believe that this difficulty is insurmountable or that it should serve as an excuse for poor research.

The social attitude survey directed by Dr. Richard Ludtke of the University of North Dakota is immediately suspect if one only reads the introductory statements. Dr. Ludtke disassociates himself with the study, at least in part, (and I am not sure why he did not quit the entire study) because he states that there was substantial interference by Department of Interior (BLM?) and the Office of Management and Budget in altering the interview schedule. My first reaction to such a statement is that any data generated by such a study is questionable at best and biased, slanted, and totally unreliable at worst.

Specifically, the study is subject to serious methodological criticisms of which the following are only samples:

1. No occupational breakdown is reported within the study, dispite the fact that it is used in tables as significant data.

2. "farmers and Dunn County residents are reported as one category and generally in a negative context;ie."unfamiliar with industry and so not likely to see its advantages."

3. The nonresponse category to some questions is as high as 45.5%, yet the use of per centage tables doesn't clearly indicate this.

4. Mean scores are reported without standard deviations to at least indicate variance in levels of response.

5. Likert scale scores as reported are marginal at best.

6. Data interpretations speculate on the meaning of findings (eg. these tables suggest....) because the study fails to point to any clear cut conclusions.

7. Community and county are nonequatable concepts, yet the study continually attempts to equate these terms.

The impact of the expansion of the coal development industry with its strip mines, power plants, coal gasification plants, pipelines and transmission lines on the lifestyle of North Dakota residents should not be taken lightly. According to one sociologist, the Ludtke study is"at best, a highly glossed (ie. superficial) version of these human concerns. At worst, it is in many places a distorted and misleading version of the human concerns it attempts to portray."

The citizens of this area deserve better representation of their concerns; we have been let down by both the Bureau of Land Management and our own state government. Because this study can not pretend to be an accurate or meaningful portrayal of residents' attitudes, the entire Social Conditions section of this Draft EIS is innaccurate and not meaningful. This can not be utilized as a reference or data source by either the BLM or the state of North Dakota in looking at current or future development plans.

There must be a new study developed with adequate research design and purposeful gathering of scientific social data to complete this EIS, and I am requesting that this be done in order for the residents of this seven county area to have their views represented accurately.

In addition to the faults of the social survey, I find that there is yet another point on which I can not agree in this study. The most prominent mitigating factor mentioned in this study (p. 164) is the idea of local residents being hired by the incoming energy development corporations. According to Dr. Gene Summers (in his address to the 34th Annual Meeting of the North Dakota Public Health Association entitled "Socio-Economic Impacts of Rural Industrialization"),the patterns of development seen in other impacted areas point to another alternative which is not considered in this study. Out migration by local young persons is not stopped or even slowed by new industry, while in migration of new young people is greatly increased. These new comers have the skills necessary for the new industries so rather than alleviating job shortages in our rural areas, current levels of unemployment for unskilled workers will remain, and the new comers to our communities will hold the new jobs. The mitigating effect of more employment opportunities is quickly lost with the flux of immigrants to the area.

Finally, I would like to address the assessment of services available to residents at the present time and the needs as they are projected for Levels One and Two Development. By indicating future needs for physicians, for example, little mention is made of the extreme difficulty encountered by communities is searching for medical personnel. There is no reason to believe that because more physicians are needed that they will materialize any more readily than they do now.

There is also a tendency to quantify the material in this study without really clarifying what this particular number might mean. It is not clearly discernable,to begin with, that the need for social case workers would double in Dunn and Mercer Counties, but the EIS does show this; severe social disruption is anticipated in these counties. It would be helpful to refer to other areas where similar impacts have occured so that residents of this area could relate directly to the type disruptions we are anticipating. The child abuse case load in Gillette, Wyoming has risen from 1% to 20% of the total in Wyoming in a five year period. Do the citizens of North Dakota have an alternative to this type of social disruption? Doubling the number of caseworkers is not a mitigating factor,

I believe that the social impact section of this study must be redone. It is a grave injustice to the needs and concerns of the people of this area. Too much stands to be lost in our way of life if this document is accepted as meaningful or accurate.

RESPONSE TO WESTFALL TESTIMONY

#91

See response #55 for transcript accompanying this testimony. There appear to be no differences warranting different answers.

CITY OF DICKINSON

P. O. BOX 808

DON F. CUSKELLY, CITY ENGINEER PHONE: 225-6785 EX. 68 DICKINSON, NORTH DAKOTA 58601

June 8, 1978

RECEIVED
JUN 12 1978 BLM
DICKINSON, N. D.

Mr. Charles Steele
District Manager
Bureau of Land Management
Pulver Hall
Dickinson, N. Dak. 58601

Dear Mr. Steele:

This is a written summary of the comments that I made to the study team in regard to the West Central North Dakota Regional Environmental Impact Study on energy development on June 5, 1978. The following written statement may vary somewhat as to the taped remarks, however, they are basically the same.

My question is has there been any study made as to the long-term effects of water quality verses the short-term effects of air degradation. Western North Dakota will get good quality water when and if industry is allowed in the region and particularly the coal industry. The life of the plants using coal is estimated at thirty to forty years, however, if they brought good quality water, this would in all probability last forever. I think the effects of good quality water in relation to health and the effects of some minor air degradation during that period should be analyzed. 92

My next question dealt with the use of gasification plants verses electrical generating plants in producing energy. The gasification plants would provide energy via underground piping, where as the electrical generation would require overhead towers. There seems to be some question as to the long-term effect on the use of towers and how many we can get on the land without some form of degradation of the land. The surface over the underground pipe could be recovered and used very readily. 93

My next question dealt with mines in our particular area and their use with plants or without. Again, I am concerned about water being brought to the mines and whether slurry, etc., would be considered and whether we could be the beneficiaries of such water use. 94

My next question related to impact for Dickinson based on activity in Dunn County. It is quite well known now that with the oil exploration going on in Dunn County, which is approximately forty miles away, that a sizeable amount of impact has occured in Dickinson. Another question relates to the population projection for the county and the city of Dickinson. In the absence of any industry such as oil and coal, I think we would definitely be losing population. This is based on the fact that other studies have shown our particular age group through farm to city migration is basically in the late 40's. I do not think this would be a very good situation for the future of the city or the county. 95

Mr. Steele -2- June 8, 1978

I am deeply concerned with the water for Western North Dakota. We are going to receive a impact from the oil industry which in no way will provide any source of raw water. The coal industry, by contrast, if properly handled and programmed, could relieve Western North Dakota of a serious water problem by bringing the raw water to the area as the coal is developed. Water in Western North Dakota will play an important part in regard to health and future economic well-being. It will provide us with the foundation for a better agricultural base and the attraction to many future unknown businesses at the present time. 96

Sincerely,

Don F. Cuskelly
Don F. Cuskelly
City Engineer

DFC/mg

RESPONSE TO CUSKELLY LETTER

#92

The long-term effects of mining, power generation, and gasification on water quality are not precisely known. Part of the problem is that each site considered is unique in terms of geochemistry, water movement, and water supply.

Good quality water would be brought to plants, such as the NGPL Coal Gasification Plant. However, those water supplies are "single purpose," to supply plant needs alone. Furthermore, the Natural Gas Pipeline Company has detailed plans for removing its pumping plant when the gasification plant is abandoned. If that water supply system were to be converted to municipal or irrigation use, arrangements would have to be made with the company and a water right secured from the State Water Commission.

Another aspect of the problem concerns overall water needs of the Dunn and Stark County area. Regional and local water needs have been the subject of several water studies, one of the latest of which is the recently completed Yellowstone Level B Study. Also see responses #74 and #94.

#93

Impacts as a result of pipeline and power line construction and operation are addressed throughout the Draft Study and in the site-specific environmental assessments for the various proposals, written both by the companies and the government agencies.

#94

Water being brought in would be appropriated for use at the plants (and mines). No provision has been indicated for making it available to other users. Such action would have to be a contract between the industrial firms and the interested parties. Most would be for operation of the plants; the mines alone would not need water from Lake Sakakawea or the Missouri River. Slurry pipelines have not been considered for any of the proposed projects and generally are considered unsuitable for transporting North Dakota lignite. Also see responses #74 and #92. The water problems of western North Dakota have been analyzed by the State Water Commission. The solution of those problems was not regarded by the proponents of the various industrial proposals as within their jurisdiction.

#95

See response #75.

#96

See responses #74, #92, and #94.

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

ORIGINAL

Public Hearing

in re

WEST-CENTRAL NORTH DAKOTA REGIONAL

ENVIRONMENTAL IMPACT STUDY

Community Building

Kildeer, North Takota

June 6th, 1978

CARNEY, GRAUSAM AND ASSOCIATES
REGISTERED PROFESSIONAL REPORTERS
P.O. BOX 1036
ROCHESTER, MINNESOTA 55901

Presiding: Mr Gary Johnson, Chairman
North Dakota Natural Resources Council
Bismarck, North Dakota

Panel Members: Mr. Charles Steele
District Manager
Bureau of Land Management
Dickinson, North Dakota

Mr. Oliver Degerness
N. D. Public Service Commission
Bismarck, North Dakota

Mr. Robert Kaiser
Federal Assistant Manger
Regional EIS
Bismarck, North Dakota

Mr. James Miller
North Dakota State Health Department
Bismarck, North Dakota

Mr. Jay Crawford
North Dakota State Health Department
Bismarck, North Dakota

Speakers:

MR. JOHNSON: We will call the hearing to order at this time.

Good afternoon, my name is Gary Johnson. I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information and views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

Our interest is in correcting errors in the draft study in order to assure the best possible resource information for decision-makers. This draft study makes no decisions concerning energy development but rather analyzes the environmental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and the Bureau of Land Management with the opportunity

to receive comments from the public and private sectors. This is in addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 9, 1978.

As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1978. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me today are Charles Steele, District Manager, Bureau of Land Management; Mr. Oliver Degernes, North Dakota Public Service Commission; Robert Kaiser, Federal Assistant Manager, Regional EIS; and Mr. James Miller, North Dakota State Health Department.

An official reporter will make a verbatim transcript of this hearing. In order to ensure a complete and accurate record of the hearing, it is necessary that only one person speak at a time. Therefore, while this hearing is in session, only the designated speaker and members of the hearing panel will be recognized.

There are several procedural guidelines which we request you observe during the hearing. They are:

1. It is requested that all statements be confined

to your comments on the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development.

2. This hearing is structured to receive information concerning the accuracy of the study, not to debate the study. Publicized informational meetings were previously held on the study on April 3, 4, and 5 in Bismarck, Dickinson, and Hazen respectively.

The hearing panel is here primarily to clarify comments where necessary. The panel is not here to engage in debate on the study, but to ask clarifying questions, if necessary, at the conclusion of your remarks.

3. It is requested that speakers confine their remarks to ten minutes, if possible. This request is made in order to accomodate all those who wish to make comments in regard to the accuracy of the study. We do not wish to be unreasonable in enforcing the ten-minute time limit and will do so only should excessive demands of time be made.

4. For those of you who have both oral and written statements, it is requested that the oral statement highlight the points you wish to make. You may choose to submit only a written statement. Copies of written statements should be identified with your name, address, and the organizations, if any, which you represent. When you are called to speak, copies of your statement should be given to the reporter.

5. Registration cards are available at the table near the entrance to this room. If you have not registered for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of these cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address, and the organization you represent, if any.

The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

Is there anyone present who would care to make comment concerning the study at this time?

Seeing none, I will declare this hearing recessed until such time as someone cares to make comment. We will be here until 4:00 p.m. for the convenience of the public.

Thank you.

(Thereupon, at 1:45 p.m. the hearing was in recess until 3:43 p.m. of the same day, at which time it reconvened.)

MR. JOHNSON: We will adjourn the hearing at this time.

(Thereupon, at 3:44 p.m. the hearing was adjourned

until 7:30 p.m. of the same day, at which time it reconvened.)

MR. JOHNSON: I would like to call this hearing to order, please.

Good evening, my name is Gary Johnson. I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

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The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

Our first speaker this evening will be Mr. Claude Brown.

MR. BROWN: I can use my paper in giving this, can I not?

MR. JOENSON: You certainly can. Mr. Brown, would you give your remarks from up here, if you would, please.

MR. BROWN: Mr. Chairman, members of the committee, ladies and gentlemen. My name is Claude Brown, and I have a farm and ranch operation north of Dunn Center, North Dakota.

I would like to compliment the effort that was made to assess coal development in this seven-county region and I would like to thank all those who contributed to the study. I realize there has been much criticism over the study, but I don't think it is all that bad.

I think our State has generally handled coal development well. Our Legislature and local governments have planned for it, Governor Link has set a keynote of "going slow" and a lot of North Dakotans agree. I believe that if the impact communities' needs continue to be recognized, there will be no great problems. For all of us who have lived in an area that was declining, certain adjustments will be necessary, but I believe we can make them and that growth can be accepted by most people.

I have lived in Dunn County for 60 years. I have seen many changes in the County and in North Dakota over the years. I look around the countryside where I live and I see farmstead after farmstead abandoned. There have been vast changes in agricultural practices since the day when I farmed with horses.

Farming practices today take not only more liquid fuel -- such as gasoline, but take many different forms of hybrid seeds, fertilizers, pesticides and insecticides. Energy is used to produce them and has to come from somewhere.

My generation has used up all the readily available

cheap energy. Homes and farmsteads need more energy, and we can't survive in isolationism. Our farm products such as wheat and beef cattle have to be shipped and processed with energy in order to be consumed. We are just as dependent on other regions in the country for their goods and services as they are on us for our farm products.

Lately it's appeared that no one has been saying that the creation of job opportunities was a good thing -- that although coal and oil development disrupts some things, there are more good things that come from the utilization of our natural resources than bad.

Some people also talk about preserving the excellent quality of life in North Dakota. Well, so do I want to preserve this quality of life, but it takes jobs, economic stability by diversifying our State's economy, and personal income, to enjoy the quality of life of this great state. I get tired of people who don't live in Dunn County telling us in Dunn County what is good for us. I shudder as I think of most situations in small towns in western North Dakota. School enrollments are declining and a fear is expressed that the level of education that residents want for their children can't be continued.

I go to church and I seldom hear a baby cry, for there are few young parents left. Main Street has suffered and declined in my small town of Dunn Center. The school had

to close, young people have had to leave home and the State to find job opportunities. Their time and talents are being used to develop areas other than their own home towns. Are we going to risk losing a chance in a lifetime by demanding air that is better than what is needed to sustain all living things? And demanding higher taxes on coal than what is needed to support development? We have good protection for our air quality from the North Dakota State Health Department and the United States Environmental Protection Agency. We have good protection for reclamation of our surface mined lands through the North Dakota Public Service Commission and the Federal Surface Mining Act. We have adequate tax money from the North Dakota Coal Severance tax being returned to the impacted areas.

Are we going to scuttle this growth for some pot of gold at the end of the rainbow, or are we going to face up to reality and say we want the development of natural resources in our area?

MR. JOHNSON: Thank you, Mr. Brown. Are there any clarifying questions from the members of the panel?

(No response indicated.)

MR. JOHNSON: Thank you. The next speaker who has registered this evening is Mr. Guet Mittelstedt.

MR. MITTELSTEDT: I am Gus Mittelstedt from Dunn Center.

I haven't read the study enough to make any comments on it, but I would like to comment about a few other things. It seems like people are so concerned about using our natural resources in the ground they act as if we are going to use everything up in a few years. It took -- they figure the world is four or five billion years old, and what we do in a few years I don't think is going to make very much difference. I am not out to waste as everybody knows that knows me, but I don't think we can just sit on everything we have and think we are going to get everything from somebody else and not give anything.

They say this is an agricultural state, and it has been and I am sure it always will be. Strip coal in our State represents about two per cent if what I hear is right, and if we still have 98 per cent left after all the coal that is possible to strip is gone, well I think we are still going to be an agricultural state.

So I am not concerned about the future. The world was here long before I was and it will be here long after I am gone, and I don't think anybody else should be as concerned as some people seem to be.

Thank you.

MR. JOHNSON: Thank you, Mr. Mittelstedt. Any clarifying questions of the panel of Mr. Mittelstedt?

(None indicated.)

MR. JOHNSON: The next speaker who has indicated a desire to comment is Mr. Randolph Nodland.

MR. NODLAND: Well, first of all I would like to ask a couple of questions which could be discussed later, but the questions are, why was Peoples Gas project included under Level 1 development when they have no permits and have no application pending. 97

And second question is, why weren't the impact that will affect the area when the energy development project comes to an end discussed?

And if I could I would like to read about three paragraphs out of the book regarding irretrievable commitments, and then I would like to comment on it.

On page 18E, "Construction of the nine aquifers in each mine would be irretrievable commitment in each mine, and the water levels in the mine parts of the aquifers would be lowered. The impact would be permanent. The destroyed water would be replaced by a water table aquifer in the base of the spoil. The water would likely have a higher concentration of the dissolved solids than the waste water and the water is replaced aquifers does."

And in the NGPL and ANG in pilot plant, "The addition of ash and sledge in the plant waste would further degrade water quality."

And then under Reclamation, from the book, and this

is in our S-5 area which is the area at Dunn Center, "The wind erosion is severe in tract S-5 overlying NPL project area with 52 per cent of the land cover having severe wind erosion susceptibility. The worst case situation soil losses 51 tons per acre annually. Soil productivity in terms of agriculture loss experienced due to top soil erosion -- " or -- "due to erosion losses."

"And present sodium would permanently result in destruction of forage and crops."

And then I have one more. I think the Federal strip mine bill -- this is my own comment, the Federal strip mine bill requires reclamation equal or better than before mining. And I am wondering how this is going to be handled.

And then under air quality, they expect the area source sulfur gas emissions for Oliver and McLean County and Mercer County and Dunn -- I got Oliver, McLean, Mercer and Dunn I guess it is, by 1980 will equal 903 tons per year, that is the area sources, but the expected point sources of plants will contribute 82,916 tons per year, or 160 times as much. 98

And one of the things the study has not done is research on the effect of power plants on livestock. There has been some more selenium deficiencies cropped up this spring, and I don't think -- I haven't heard that anything has been done or is being done on this. And I think the study

should have some research on this.

And my whole point is I don't see where there can be any justification for the BLM to even consider leasing the coal in the S-5 area when their own impact study showed all of these adverse effects. And the farmers who lease this coal under this -- or before this study came, didn't have any study to go by, and here you have it all before you to look at.

And I guess that is about all I would have to say. I did have a couple of more things, but I guess -- I will talk to you about them afterwards.

MR. JOHNSON: Thank you, Mr. Nodland. May I ask if the members of the panel have clarifying questions for the testimony given by Mr. Nodland?

MR. DEGERNESS: The question about the various impacts that are recognized in this thing, such as the selenium deficiencies in cattle, have these things been shown to be definite impact as yet or are they just a suspect?

MR. NODLAND: Well, there is a veterinarian I guess working out of Mandan and there was a news article just this week in a paper, and he is working on it, but I think there was something about the Health Department in trying to get a grant to study this. But we do think that the thing should probably be included in the impact statement.

MR. DEGERNESS: Do you have any suggested form or

any suggested wording for the inclusion in the Impact Statement, or would you like to have it included that the -- a study will be pursued at a later date?

MR. NODLAND: Well, I'm sure it would have to be at a later date if it hasn't been done already.

MR. DEGERNESS: Yes, but would you want it to be done necessarily before the final Impact Statement is written or would you say that they could include in the final Impact Statement wording to the effect that it will be done?

MR. NODLAND: I would think that would be all right.

MR. DEGERNESS: Would that be satisfactory, do you think?

MR. NODLAND: Yes.

MR. JOHNSON: Please have the record show that the statement being referred to is the Regional West-Central North Dakota Regional Environmental Impact Study, not statement.

MR. CRAWFORD: A point of clarification. I might say that the Health Department has submitted a proposal to the Department of Energy for a study such as this and we have not received any word from the DOE as to the status of the funding of that, and until that funding has been -- the status of funding has been clarified we can't say that the study will be done, only that we are pursuing funding and we will do the study if and when funding is available.

MR. JOHNSON: Mr. Kaiser?

MR. KAISER: One question that I had here regarding your statement about the mine aquifers and the wind erosion. Was that just in reference -- you were just making a comment that we had this in there?

MR. NODLAND: Yes.

MR. KAISER: You are not saying that you had a problem that you want to specifically address with regard to those?

MR. NODLAND: No. I was reading these things, and my whole point was that when these things are in there -- well, I believe that especially that BLM before they lease they have got the whole thing before them there. Well, that is the purpose of the study, I believe.

MR. KAISER: That is correct.

MR. JOHNSON: Thank you.

The next speaker this evening will be Mr. John Combs.

MR. JOHN C. COMBS: My name is John Combs, my comments are addressed on behalf of the Killdeer Area Development Corporation of which I am president, and we went over this study, briefly -- it is too deep to go into too far, we don't have the time, but we drew up a little resolution concerning this, and it goes as follows:

Whereas 17 federal and 32 state agencies completed

an
A environmental analysis of Burleigh, Dunn, McLean, Mercer, Morton, Oliver and Stark Counties prior to federal coal leasing, and

Whereas North Dakota's mining law requires restoration of mined land to 100 per cent of its original productivity, that is on page 15 of that condensation, and

Whereas air standards adopted by the North Dakota Department of Health are equal to or more stringent than federal Standards, and that is on page 10 is this report..

We notice that this study, the EIS, mentions a petition circulated in Dunn County to establish more restrictive air standards, that is mentioned on page 6, but that report fails to note that the Dunn County Citizens Committee for Common Sense, Bob Roquette, Killdeer, North Dakota, Chairman, has circulated a counter petition to keep Dunn County in Class II, or the present air standards; and now over 800 signatures have been recorded on these petitions and they will be presented at a time to be decided by that committee, and

Whereas federal, state and local regulations concerning water quality standards will be observed, and these regulations would protect surface water on such areas as Lake Sakakawea, Antelope Creek, Spring Creek, Aldrin Creek and the Knife River, also where springs or wells are destroyed by mining, mine owners are committed by federal and state statutes to replace lost water supplies, and this is on page

18 of that report, and

Whereas even under Level 2 development this report states that a total of about five townships in the seven-county area will be mined in about a 30-year period, thus in this 30-year period only about one and a half per cent of the total land area of the seven counties will be disturbed by mining.

Further, at any one time, only a small fraction of these five townships would be in an erodable or unvegetated condition, and

Whereas we are part of a rural area suffering from constantly increasing taxes on our real estate, also we are suffering a constant out migration of our youth, due to a lack of lucrative employment in our area,

Therefore, in light of the many safeguards illustrated in this report for our land and water, we the directors of the Killdeer Area Development Corporation believe that industrial development as outlined in this report is desirable and needed for our area.

Regulated industrial development in our area will result in a broadened tax base for maintaining schools, city and county government, as well as creating new jobs for our young people.

Also we will be doing our part in solving the nation's energy requirements with our vast reserves of lignite

plants, locate the route for more coal, and we just haven't had it, because nobody wants to stop using energy.

And so with that I would like to leave and we just -- this energy has to come from some place, and I guess it is from coal. I am not -- I don't care for mining, myself, but there is the only source we have, and I guess we have to use it. It is there. That is all I have to say.

MR. JOHNSON: Thank you.

Is there anyone else present who would care to make comment at this time?

If there are no other comments at this time we will recess this hearing for a short while. We will be here until 9:30 as indicated to receive any additional comments. The hearing stands recessed until additional comments are forthcoming.

(Thereupon at 8:01 p.m. the hearing was in recess until 9:15 p.m., at which time it reconvened.)

MR. JOHNSON: We will reconvene the hearing at this time.

Is there anyone else present who would care to make comment at this time?

Seeing no one expressing a desire to comment we will adjourn this hearing. Thank you.

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coal.

MR. JOHNSON: Thank you, Mr. Combs.

May I ask, are there clarifying comments of the panel?

(None indicated.)

MR. JOHNSON: Thank you.

I have no further cards from individuals who have indicated a desire to make comments at this time. If there is anyone in the audience who would care to provide comments on the accuracy of the study we will be glad to hear from you at this time.

MR. PETER A. SUDOWSKY: Mr. Chairman --

MR. JOHNSON: Would you give us your name?

MR. SUDOWSKY: My name is Peter Sudowsky, I am a farmer, and I am a director of the Farmers and McKenzie Electric with an office in Watford City, and our Board of Directors all the time constantly work with energy, and it is getting to the point where sometimes we have meetings with Basin Electric and the word is we are going to run out, and it seems like it is around the corner. But it seems that nobody wants to conserve energy, everybody wants to use it as we please as we need it, and come to the switch and turn it on, and we have power.

It is a fine thing, but these cooperatives and everybody always have to look ahead, have to plan, build

CERTIFICATE OF REPORTER

This is to certify that the foregoing proceedings before the Chairman and Hearing Panel, in the matter of West-Central North Dakota Regional Environmental Impact Study, held in the Community Building, Killdeer, North Dakota, was held as herein appears, and that this is the original transcript thereof for the file of the Bureau of Land Management.

John B. Carney, RPR

RESPONSE TO MOOLAND TRANSCRIPT

#97

For details on why the NGPL proposal was classified as a proposal in Level I development, see response #28.

For information about the impacts to the area after the proposed action ends, refer to response #38, paragraph 1.

For information on reclamation, see response #31.

Note: The quotation starting on line 14 of the transcript is correct, except the first word should be destruction, rather than construction, and in line 23, the word sledge should be sludge.

#98

The areawide sources, as described in the Draft Study, are the hundreds of small individual sources of pollutant emissions, such as furnaces used for space heating, unpaved roads, agricultural operations, and small industries. In contrast, the point sources are fewer in number, larger in terms of individual pollutant emissions. The existing and projected areawide source emissions cannot be ignored in evaluating air pollution effects. The cumulative total of areawide sources, although individually lower in emissions, could present a greater risk to human health, animal health, and vegetation than from the point source emissions since the areawide emissions are typically released closer to the ground level, thereby resulting in higher pollutant concentrations in the breathing zone and vegetation environment. "Air Pollution Effects," Part 1, Climate and Air Quality, addresses the subject at more length.

The effects of air pollution upon animals including selenium responsive animal disease, is also included in Part 1, but more research regarding sulfur emission influences upon selenium deficiencies in animals is needed. At the present time, a positive sulfur-selenium relationship has not been established. Animal health symptoms, such as white muscle disease and above-normal calf deaths, may be treated with a selenium-rich diet supplement such as a small amount of wheat bran. A veterinarian should be consulted prior to administering diet supplements, should these symptoms occur. Research into this question will determine the cause of the selenium-responsive diseases noted on ranches in the Bismarck and Stanton vicinities, whether due to sulfur emissions from energy conversion facilities or other factors such as animal stress or natural biological unavailability of selenium to the animals.

THE KILLDEER AREA DEVELOPMENT CORPORATION, KILLDEER, N. DAK.
John C. Combs, President

Whereas 17 federal and 32 state agencies completed an environmental analysis of Burleigh, Dunn, McLean, Mercer, Morton, Oliver and Mercer Counties prior to federal coal leasing.

and Whereas North Dakota's mining law requires restoration of mined land to 100 % of its original productivity.(Page 15-report)

and whereas air standards adopted by the N. Dak. Department of Health are equal to or more strin-ent than Federal standards (Page 10-report)

We notice that this study (120) mentions a petition circulated in Dunn County to establish more restrictive air standards. (Page 6)

That report fails to note that the Dunn County Citizens Committee for Common Sense; Bob Bennette, Killdeer, N. Dak. Chairman; has circulated a counter petition to keep Dunn County in Class II or (the present) air standards. Over 200 signatures have been recorded on these petitions and they will be presented at a time to be decided by that committee.

and Whereas federal, state and local regulations concerning water quality standards will be observed. These regulations would protect surface water on such areas as Lake Sakakawea, Antelope Creek, Spring Creek, Alkrim Creek and the Knife River.

Also where springs or wells are destroyed by mining, mine owners are committed by federal and state statutes to replace lost water supplies. (Page 15-report)

and whereas even under Level 2 development, this report states that a total of about 3 townships in the 7 county area will be mined in about a 30 year period. Thus in this 30 year period only about 12% of the total land area of the seven counties would be disturbed by mining.

Further, at any one time, only a small fraction of these 3 townships would be in an erodable or unvegetated condition.

continued,

RESPONSE TO COMBS TRANSCRIPT

#99

The North Dakota State Department of Health has received a petition to keep Dunn County as a Class II area. This petition is counter to a petition filed earlier with the Department which requested reclassification of Dunn County to a Class I area. The petition for reclassification to a Class I area was referenced in the Draft Study. The petition to keep Dunn County as a Class II area was not referenced because the counter-petition had not been filed with the Department prior to publication of the Draft Study. The matter of reclassification of Dunn County is pending before the Department.

and Whereas we are part of a rural area suffering from constantly increasing taxes on our real estate.

Also we are suffering a constant out migration of our youth, due to a lack of lucrative employment in our area.

Therefore in light of the above safe-guards; illustrated in this report; for our land air and water, we the directors of the Killdeer Area Development Corporation believe that industrial development as outlined in this report is desirable and needed for our area.

Regulated industrial development in our area will result in a broadened tax base for maintenance Schools, City and County government as well as creating new jobs for our young people.

Also we will be doing our part in solving the nations energy requirements with our vast reserves of lignite coal.

John C. Combs, President
Killdeer Area Development Corporation

RESPONSE TO KILLDEER AREA DEVELOPMENT CORPORATION RESOLUTION

#100
See response #99.

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

ORIGINAL

Public Hearing

in re

WEST-CENTRAL NORTH DAKOTA REGIONAL

ENVIRONMENTAL IMPACT STUDY

Highway Department Auditorium

Bismarck, North Dakota

June 7th, 1978

WRITTEN COMMENT

West-Central North Dakota Regional Environmental Impact Study
on Energy Development

If you do not wish to make an oral statement today, but would like to submit comments in writing, this form is provided for your convenience.

COMMENTS:

Just a note- The Killdeer City Commission went on record at their June 5, 1978 meeting as being in favor of the study material listed in the Summary, Draft West-Central North Dakota - Regional Environmental Impact Study on Energy Development.

The Commission believes that industrial development as outlined is needed and feasible.

****

Name: Jerry Bender, Member City Commission

Address: Killdeer, North Dakota 58640

You may submit your written comments today by giving them to the person at the registration desk or you may mail them to the following address by June 8, 1978.

Regional EIS Office
1533 North 12th Street, Suite 2
Bismarck, ND 58505

Presiding: Mr. Gary Joyenson, Chairman
North Dakota Natural Resources Council
Bismarck, North Dakota

Panel Members: Mr. Charles Steele
District Manager
Bureau of Land Management
Dickinson, North Dakota

Mr. Robert Kaiser
Federal Assistant Manager
Regional EIS
Bismarck, North Dakota

Mr. Gene Christenson
North Dakota State Health Department
Bismarck, North Dakota

Mr. Dwight Connor
N. D. Energy Management & Conservation
Bismarck, North Dakota

Mr. Jerry Fiterman
Dickinson District Office
Bureau of Land Management
Dickinson, North Dakota

Speakers

addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 9, 1978.

As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1978. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me today are Mr. Charles Stasle, District Manager of the BLM in Dickinson, Mr. Gene Christianson of the North Dakota State Health Department, and Mr. Bob Kaiser, who serves as Federal Assistant Manager, Regional EIS.

An official reporter will make a verbatim transcript of this hearing. In order to ensure a complete and accurate record of the hearing, it is necessary that only one person speak at a time. Therefore, while this hearing is in session, only the designated speaker and members of the hearing panel will be recognized.

There are several procedural guidelines which we request you observe during the hearing. They are:

1. It is requested that all statements be confined to your comments on the accuracy of the draft West-Central

MR. JOHNSON: This session will please come to order. Good afternoon, my name is Gary Johnson, I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

Our interest is in correcting errors in the draft study in order to assure the best possible resource information for decision-makers. This draft study makes no decisions concerning energy development but rather analyzes the environmental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and the Bureau of Land Management with the opportunity to receive comments from the public and private sectors. The is in

North Dakota Regional Environmental Impact Study on Energy Development.

2. This hearing is structured to receive information concerning the accuracy of the study, not to debate the study. Publicized informational meetings were previously held on the study on April 3, 4, and 5 in Bismarck, Dickinson, and Hazen respectively.

The hearing panel is here primarily to clarify comments where necessary. The panel is not here to engage in debate on the study, but to ask clarifying questions, if necessary, at the conclusion of your remarks.

3. It is requested that speakers confine their remarks to ten minutes, if possible. This request is made in order to accommodate all those who wish to make comments in regard to the accuracy of the study. We do not wish to be unreasonable in enforcing the ten-minute time limit and will do so only should excessive demands of time be made.

4. For those of you who have both oral and written statements, it is requested that the oral statement highlight the points you wish to make. You may choose to submit only a written statement. Copies of written statements should be identified with your name, address and the organizations, if any, which you represent. When you are called to speak, copies of your statement should be given to the reporter.

5. Registration cards are available at the table

near the entrance to this room. If you have not registered for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of these cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address, and the organization you represent, if any.

The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

I ask at this time if any cards have been received by individuals expressing a desire to speak?

Is there anyone present who would care to make comments at this time concerning the accuracy of the Regional Environmental Impact Study?

There being no desire from the audience to submit comments concerning the accuracy of this study, I will declare this hearing in recess at this time. The hearing panel and myself will remain present until 4:30 as previously indicated for the receipt of any comments which you or additional individuals should care to make.

The hearing is recessed at this time.

(Thereupon at 1:43 p.m. the hearing was in recess until 3:59 p.m. at which time it reconvened.)

MR. JOHNSON: If the panel and the reporter are ready we will call the hearing in session.

Is there anyone present who would care to make comment on the hearing at this time? More correctly, comment on the Regional Environmental Impact Study at this time?

Seeing none, I declare this hearing adjourned.

(Thereupon at 4:01 p.m. the hearing was adjourned until 7:48 p.m. of the same day, at which time it reconvened.)

MR. JOHNSON: The hearing will please come to order.

Good evening, my name is Gary Johnson, and I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

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cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

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As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1978. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me today are Mr. Jerry Pittman, who is with the Bureau of Land Management in Dickinson, Mr. Gene

Christianson, North Dakota State Department of Health, Mr. Robert Kaiser, who served as Federal Assistant Manager on the study.

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The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study

on Energy Development.

Another member of our hearing panel has appeared, Dwight, would you please join the other gentlemen seated in front.

This is Mr. Dwight Connor of the North Dakota Office of Energy Management and Conservation.

The first speaker who has indicated a desire to speak this evening is Dr. Don Hastings. 101

DR. HASTINGS: Thank you very much. Dr. Don Hastings, Bismarck, North Dakota, veterinarian.

Seeing that I had some input into the draft of the Environmental Statement, in reading it I thought some errors could be corrected and if you want to refer to page 108, which under the section of domestic animals, talking about studying selenium deficiencies, it is more or less indicated that we realize that or could realize that other stock emissions are causing the problems as we have seen them in our livestock, and I think possible the final sentence in one, two, three, four -- the fifth paragraph under domestic animals should be modified, in which the other trace elements that have been known to cause selenium deficiencies, could cause problems. It sounds in the written statement that -- that we have an idea that other -- these other trace elements are the cause of our problems that we are seeing with our livestock.

Looking under the mitigating circumstances I am a

little bit troubled in looking in areas in which the individual applicants shall take and monitor by some means, which is unknown, probably research hasn't particularly shown methods of monitoring -- I do feel that that is a little loose as far as something that could protect the individual rancher. 102

And is the final thing I would like to say that I am a little bit concerned over situations in which we have apparent losses of either livestock or possibly crops because of sulfur dioxide or other elements having the ability to damage crops. And if our applicants or if a power company is meeting their -- both the State and Federal levels of air quality, I really would like the answer of -- are the companies still liable for the damage?

And then secondly is, how can my small rancher who has let's say theoretically suffered either livestock loss or damage to crop of alfalfa loss, how is he able to get claims from an industry in an area that probably belonged or in which three or four or two sources are possibly the source of the problem?

And I don't know whether this is something that should be covered here or not, but I would like to put it in. 103

Otherwise just reading briefly of the -- through it, why I would say it is very well written and you should be commended on doing an excellent job.

This past year in our same valley where we initially

had livestock losses back in 1966, we have had another rancher who had some -- very difficult to diagnose problems, and whether or not it could be related to a -- the same type of environmental problem we saw in 1966, it's very difficult to say. But the rancher was -- I thought that maybe he would be able to come here tonight to explain what he had. I don't see him here, but if he does show up I would think you may be interested in his testimony.

Any questions?

MR. JOHNSON: Thank you, Doctor Hastings. I will ask, are there any questions of the panel members for purposes of clarification?

(None indicated.)

MR. JOHNSON: Thank you very much.

I have received no further cards from individuals indicating a desire to comment at this hearing.

I will ask at this time if there is anyone in the audience who would care to make comment concerning the accuracy of the West-Central North Dakota Regional Environmental Impact Study at this time?

Seeing no response to that question, I will declare this hearing in recess at this time.

The panel and myself will remain until 9:00 p.m. as previously indicated to receive any comments that may be forthcoming. This hearing is in recess.

(Thereupon at 8:01 p.m. the hearing was in recess until 9:18 p.m. at which time it reconvened.)

MR. JOHNSON: I am calling the hearing back to order at this time.

Is there anyone present who would care to comment at this time?

Seeing that there are none present who would care to offer comment at this time, this hearing stands adjourned.

\- - - - - - - -

CARNEY, GRAUSAM AND ASSOCIATES
REGISTERED PROFESSIONAL REPORTERS
P.O. BOX 1036
ROCHESTER, MINNESOTA 55901

RESPONSE TO HASTINGS TRANSCRIPT

#101

We believe that the paragraph in queation is qualifiad sufficiantly to make it clear that the causa of tha observed metabolic ealanium deficiancy in the vicinity of Mandan ia still unprovan. However, the laat sentence in that parsgraph would be more accurate if instead of seying thet the metals listed ". . . can also affect eelenium intake by animals . . ." it aaid that the metals listed ". . . may be abla to cause selenium daficiency in aome snimals . . ." It should also be added thst "the potentiel significance of thie problem in the seven-county study srea is unknown but is believed to be not very great bacausa the disease is uncommon snd csn ba effectively treatad with vitamin E."

Mitigating meaeures involving monitoring of trace elemant concentrationa sre discusaed on page 159, column 3, tenth full paragraph and paga 151, column 2, first and second full paragraphs.

Also aee Psrt 1, Climste and Air Quality, "Animal Health Effacts."

#102

Where damages hava occurred on or to private proparty as a result of the operstion of an energy facility, land-ownars should contsct tha sppropriata federsl or stste regulatory agency and thair privete attorneys.

#103

Refer to the Climate and Air Quality Technical Suppla-mant; end Part 1, Climata and Air Quality.

CERTIFICATE OF REPORTER

This is to cartify that tha foregoing procaedings befora the Chsirman snd Hearing Psnel, in tha matter of West-Cantrsl North Dskota Regionsl Environmental Impact Study, hald in the Hghway Depsrtment Auditorium, Bismarck, North Dskots, was held ss herain eppeers, and that this is the original transcript tharaof for the file of the Bureau of Land Managament.

John B. Csrney, RPR

CARNEY, GRAUSAM AND ASSOCIATES
REGISTERED PROFESSIONAL REPORTERS
P.O. BOX 1036
ROCHESTER, MINNESOTA 55901

REAP

North Dakota Regional Environmental Assessment Program

NORTH DAKOTA LEGISLATIVE COUNCIL

JOHN J. HOWLEY
DIRECTOR

June 7, 1978

West Cantral Environmantsl
Impact Study
Suita 2, Capitol Place
1533 North 12th Street
Biamarck, ND 58505

Gentlemen:

At your open invitstion, I wish to respond to the drsft Environmental Impsct Study, distributed racently to sll interested parties. First of all, let me asy that the dreft report is very well organized and extremely attractive. The effort that went into this to mske it undarstsndsble to the citizens of North Dakote is to be commended. The fact that thia is a compendium of existing knowledge is not to ba understatad. It should be of great use to a large number of orgsnizations in the years to come. There are, however, s number of concerne and comments that I would like to provide.

Perhaps the most visible part of thia study is tha illustrationa; it is important that thase be ss sccurste and ss complete aa possibla. For thie raason, I have spent most of my time on this report reviewing those illuatrstions. In sddition to the addendum, dsted 9 March 1978, there sra a number of corrections and suggeations that may help to improve the illustrationa. Of genersl concern ie the fsct that the citad references for the meps and figures are almost alwsys missing from the referances cited in the beck of the report. For example, Map 2-20 citea Emmons, Map 2-21 cites Emmons, et sl., Map 2-39 cites Araki, Tsbla 2-68 citea Swaaney, Map 2-51 cites Lsraon, and Msp 3-7 and an esrlier soil map cite Pointer. These names are not included in the referencea cited. 104

Additional specific concerns are as listed:

(1) Msp 1-3. "Stste Subsurface Ownership (100% or less)." This is extremely mislaeding because zero is less thsn 100%, snd I do not believe that thie is intended to imply that. 105

(2) Figure 1-33, psge 17, "Total Strippsble Cosl" is mis-lesding; I assume you mean "totsl coal proposed to be stripped." 106

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(3) Map 1-9. The S and N should be explained on the map, not just on page 19.

(4) Figure 2-1. "Occurance"--misspelled.

(5) Table 2-7. "Values Less Than Lower Detectable Limit of 26.1." Why, then, include 26.1 for those months?

(6) Map 2-12. The classes should either be defined in the legend or a page reference noted.

(7) Map 2-14. Erodibility is either "severe" or "low"; it seems illogical that there is no moderate susceptibility.

(8) Map 2-18--out of place; it should precede page 41.

(9) Animals section, page 4Bff. cites relative densities--relative to what? Coyotes, for example, are high or low; no moderate density. "Relative" should be explained in the text.

(10) Page 51, Threatened Animals--The Yakima Curlew is included now as extinct and should not be in that list. Also, "There has been a definite decline in prairie dog towns." This statement is not valid. REAP Report 76-4, Vertebrates of Southwestern North Dakota, by Robert Seabloom, states "Current estimates of numbers and total acreage of prairie dog towns in North Dakota are greater than those reported by Grondahl (1973) and Bishop and Culbertson (1976)" (page 387). Seabloom hypothesizes that an increase in numbers is probably due to cessation of poisoning programs in North Dakota.

(11) Page 52ff. There are no paleontologic sites included in the inventory. Such sites have been identified (REAP Report 77-3, Paleontologic Sites in North Dakota through 1976), F. S. Holland, Jr.). These should be evaluated in the report.

(12) Map 2-29. Visual Sensitivity Zones are not readily understandable from the map or the text, e.g., why are the zones bordering existing roads?

(13) Page 89. Stratigraphy--"A surface mining operation generally inverts the overburden." This statement is not true; Winczewski, 1977, unpublished M.S. thesis, UND, refutes that supposition.

(14) Map 3-24 is grossly generalized and, therefore, misleading.

I trust that these comments will be useful to you in the revision of the draft report. Finally, I would like to add that the report, although very well done, is, by necessity and design, very much generalized. Its usefulness as a rough planning document is very good; it must not, however, be construed as a complete and detailed environmental assessment. The citizens of North Dakota must be made aware of this fact.

Very truly yours,

John R. Reid

John R. Reid
Associate Director for
Natural Sciences

JRR/lh
cc: John J. Bowley

RESPONSE TO REAP LETTER

#104

At the last minute, it was decided that it would be helpful to add the authors as sources for all "in-house" maps, tables, and figures. The authors and their "at al." work groups are listed in Chapter 9.

#105

We feel that ownership of 100% or less will not be interpreted as zero.

#106

Total Strippable Coal, as shown on Figure 1-33, page 17 of the Draft Study, refers to the total coal resource that can be recovered by strip mining methods and not just the coal that is proposed to be mined. Strippable coal is coal that can be mined where the maximum overburden to coal ratio is less than 10 to 1, up to a maximum depth of about 150 feet, and a minimum coal thickness of about 5 feet.

#107

Corrections noted in Climate and Air Quality, Part 1.

#108

The classes for Map 2-12 are defined on page 35, column 1 of the Draft Study, but should also have been included in the map legend. "Low Hazard Areas" on Map 2-14 should read "Low to Moderate Hazard Areas." Also see response #91.

#109

Maps should follow their first text reference.

#110

The population density maps are intended to generally show where various wildlife species are most abundant. "Relative" means "comparative," in the sense that population densities in one area are compared with population densities in other areas. This note should have been included on all such maps.

According to the U.S. Fish and Wildlife Service, the Yakima curlew is not extinct. Fish and Wildlife Service's attitude is still about as described in their 1973 publication titled, "Threatened Wildlife of U.S.," namely, "Apparently very rare. Known only from one or two migrants seen occasionally in spring migration, and one recent fall migrant specimen. No record since 1963. Present breeding and wintering range unknown."

The commentor is correct in stating that prairie dogs are no longer declining, as stated by Grondahl (1973) and Bishop and Culbertson (1976). Fish and Wildlife Service Wildlife Damage Control personnel substantiate the statement made by Seabloom et al. (1978) that the "black-tailed prairie dog is increasing in North Dakota, probably because of the cessation of government sponsored control efforts." Also see Part 1, Animals.

#111

We question why a copy of the REAP materials REAP suggested we use was not attached with the comment, but a copy of "REAP Report 77-3, Paleontologic Sites in North Dakota" was obtained and reviewed. This report was published after the literature search for the Draft Study had been completed. The published REAP report added very little data to the information published in the study; however, several maps and additional data as to locations of sites and kinds of fossils were deleted from the published REAP report. A letter requesting the deleted maps was sent to REAP September 11, 1978. As a result of other attached correspondence with REAP and the North Dakota State Historical Society concerning justification of need and proposed changes, no further effort was made to increase the level of analysis.

#112

As discussed in the Draft Study on page 55 and in Appendix 3 (page 214), visual sensitivity mapping was based, in part, on major roadway corridors. Visual sensitivity is high in areas frequently seen by a large number of people. Thus, the viewing distance from major roadways and other human-use areas becomes a significant factor in the delineation of visual sensitivity zones.

#113

On page 89, column 2, Stratigraphy, the second sentance should be revised to read "A surface mining operation generally brings deeper overburden near the surface at many places." (Winczewski, L.M. 1978)

#114

This map is highly generalized since it is a composite of individual maps which are themselves quite generalized. The individual maps and composite are explained on page 312, column 4, paragraphs 4 and 5. Despite the admitted generalizations, Map 3-24 does, when used in combination with Map 3-25, allow the identification of areas, such as several sections in the vicinity of Stanton, where special concern for wildlife is warranted because of high wildlife values and potential reclamation problems in areas of current and future energy development.

SEP 11 1978

In Reply Refer To:
1792 (962)

Mr. Lloyd Joos
Assistant Director
North Dakota REAP
316 North 5th Street, Suite 521
Bismarck, North Dakota 58505

Dear Mr. Joos:

One of the REAP comments made on the Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development was, "There are no paleontologic sites included in this report. Such sites have been identified (REAP Report 77-3 Paleontologic Sites in North Dakota through 1976, F.D. Holland, Jr.). These should be evaluated in this report."

We recently obtained a copy of REAP Report No. 77-3 in order to update paleontologic evaluation. However, the data in the report identifying paleontologic sites was not specific enough to determine if disturbance or destruction of any of the sites would occur. The report makes reference to a number of maps and a list of sites as separate items.

I understand why the maps and listed sites were not published in the report. However, before we can complete our evaluation of impacts on paleontologic remains, we should have copies of the following maps and lists: Plate 1, map of North Dakota showing 1,225 locations; Plate 12, map of Morton County, sheet 2 (northeast); Plate 14, map of Morton County, sheet 3 (west); and any additional plates or maps that include Dunn, McLean, Stark, Mercer, and Oliver Counties. It is noted that 275 sites have been identified in the report as located in those six counties.

I am also requesting Appendix C to be sent to this office.

It is understood that the maps showing site locations and lists of sites will not be printed or revised and printed in the Supplemental to the Draft West-Central North Dakota Regional Environmental Study on Energy Development.

The BLM will reimburse REAP as appropriate upon receipt of the requested maps and lists.

Sincerely yours

W. DAVID DARBY

W. David Darby
Chief, Branch of Environmental Coordination

962:DFrey:ki:cv:9/11/78:x6632

State Historical Society
of north dakota

September 26, 1978

Mr. Lloyd L. Joos
Associate Director for
Environmental Assessment
North Dakota Regional Environmental
Assessment Program
316 North Fifth Street
Bismarck, North Dakota 58501

Dear Mr. Joos:

I have received your letter of September 15, 1978, regarding release of specific site locational data to Mr. W. David Darby, Chief, Branch of Environmental Coordination, West-Central North Dakota Regional Environmental Impact Study, for inclusion in the evaluations presented in that document. Mr. Darby has stated, in his letter to you dated September 11, 1978, that the information requested will not be printed in such a form as to be a release of specific site locational data and that the information is requested only for planning and evaluatory processes by Study personnel.

Mr. Darby has requested copies of maps showing paleontological site locations within the Study's area of consideration, a copy of a map of North Dakota (Plate 1) showing 1,225 site locations, and a copy of Appendix C of Holland's Report 77-3, Paleontological Sites in North Dakota through 1976. While the Historical Society has no objection to release of the site specific data on paleontological sites within the Study area to Study personnel, it is my opinion that release of the base map of paleontological site locations in North Dakota and Appendix C, which includes the specific locations of all the known paleontological sites in the state, is unwarranted at this time. If Mr. Darby demonstrates a legitimate need for specific locational data for those areas outside the Study's area of consideration, we may approve wholesale release of this data at that time.

Should either you or Mr. Darby have any questions about this matter, please feel free to contact us again.

Sincerely,

James E. Sperry
James E. Sperry
Superintendent, State Historical
Society of North Dakota

JES/je
cc: W. David Darby

REAP

North Dakota Regional Environmental Assessment Prog

NORTH DAKOTA
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DEPT OF INTERIOR
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JOHN

September 15, 1978

Mr. W. David Darby
Chief, Branch of Environmental Coordination
West-Central North Dakota Regional
Environmental Impact Statement
Missouri Office Building, Room 105
1200 Missouri Avenue
Bismarck, ND 58501

Dear Mr. Darby:

This is to acknowledge receipt of your letter dated September 11, 1978, pertaining to location of paleontologic sites.

A provision of the cooperative agreement between REAP and the North Dakota State Historical Society requires that requests for detailed summaries of site data or precise locational data must be referred to the State Historical Society for review and action. In compliance with this provision, I am forwarding a copy of your letter to Mr. James E. Sperry, Superintendent, State Historical Society, for his response to this request.

If you do not need exact locations of sites, REAP can provide sites located to the nearest section. There is a charge for this service and the cost would depend on the magnitude of search required to meet your needs.

We will advise you of Mr. Sperry's decision as soon as it is received, unless he corresponds directly with you.

Sincerely,

Lloyd L. Joos
Associate Director for
Environmental Assessment

LLJ:ijh
cc: Mr. James Sperry

• Bismarck • North Dakota 58505 • (701)224

REAP

North Dakota Regional Environmental Assessment Program

NORTH DAKOTA
LEGISLATIVE
COUNCIL

JOHN J. HOWLEY
DIRECTOR

October 2, 1978

Mr. W. David Darby
Chief, Branch of Environmental
Coordination
West-Central North Dakota Regional
Environmental Impact Statement
Missouri Office Building, Room 205
Bismarck, ND 58501

Dear Mr. Darby:

As I previously indicated to you, Mr. James Sperry has control over release of the paleontological site location data you requested. Mr. Sperry sent you a copy of his letter dated September 26, 1978, to me pertaining to this matter.

I suggest that you furnish the required documentation for release of the data needed directly to Mr. Sperry. If I can be of any further assistance please advise me.

Sincerely,

Lloyd L. Joos
Lloyd L. Joos
Associate Director for
Environmental Sciences

LLJ:als
cc: Mr. James E. Sperry

Suite 521 • 316 North Fifth Street • Bismarck • North Dakota 58505 • (701)224 3700

UNITED STATES OF AMERICA

DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

ORIGINAL

Public Hearing

in re

WEST-CENTRAL NORTH DAKOTA REGIONAL

ENVIRONMENTAL IMPACT STUDY

Community Building

Twin Buttes, North Dakota

North Dakota Armory

Beulah, North Dakota

June 8th, 1978

Speakers:

CARNEY, GRAUSAM AND ASSOCIATES
REGISTERED PROFESSIONAL REPORTERS
P.O. BOX 1539
ROCHESTER, MINNESOTA 55901

Presiding: Mr. Gary Johnson, Chairman
North Dakota Natural Resources Council
Bismarck, North Dakota

Panel Members: Mr. Dana K. Mount
North Dakota State Health Department
Bismarck, North Dakota

Mr. Jerry Fittman
District Office
Bureau of Land Management
Dickinson, North Dakota

Mr. Robert Keiser
Federal Assistant Manager
Regional EIS
Bismarck, North Dakota

Mr. Robert Wetsch
North Dakota Public Service Commission
Bismarck, North Dakota

CARNEY, GRAUSAM AND ASSOCIATES
REGISTERED PROFESSIONAL REPORTERS
P.O. BOX 1539
ROCHESTER, MINNESOTA 55901

MR. JOHNSON: I would like to call this hearing to order. I would like to invite anyone who is interested in the proceedings of the hearings to come towards the front of the room, if you would, please. We don't have microphone facilities and this is a large room. If you are interested you might care to move up towards the front. I also offer our apologies since we thought that Twin Butte was on Mountain time rather than Central time and realize that instead of a few minutes late we are an hour and fifteen minutes late. I apologize for that.

Good morning, my name is Gary Johnson. I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

Our interest is in correcting errors in the draft

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REGISTERED PROFESSIONAL REPORTERS
P.O. BOX 1539
ROCHESTER, MINNESOTA 55901

study in order to assure the best possible resource information for decision-makers. This draft study makes no decisions concerning energy development but rather analyzes the environmental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and the Bureau of Land Management with the opportunity to receive comments from the public and private sectors. This is in addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 9, 1978.

As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1978. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me today are Mr. Jerry Pitman, who is with the Dickinson District office of the Bureau of Land Management, Mr. Dana Mount, who is with the North Dakota State Department of Health, Mr. Robert Kaiser, who was the Federal Assistant Manager on the Regional Environmental Impact Study.

An official reporter will make a verbatim transcript of this hearing. In order to ensure a complete and accurate record of the hearing, it is necessary that only one person speak at a time. Therefore, while this hearing is in session, only the designated speaker and members of the hearing panel will be recognized.

There are several procedural guidelines which we request you observe during the hearing. They are:

1. It is requested that all statements be confined to your comments on the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development.

2. This hearing is structured to receive information concerning the accuracy of the study, not to debate the study. Publicized informational meetings were previously held on the study on April 3, 4 and 5 in Bismarck, Dickinson, and Hazen respectively.

The hearing panel is here primarily to clarify comments where necessary. The panel is not here to engage in debate on the study, but to ask clarifying questions, if necessary, at the conclusion of your remarks.

3. It is requested that speakers confine their remarks to ten minutes, if possible. This request is made in order to accomodate all those who wish to make comments in regard to the accuracy of the study. We do not wish to be

unreasonable in enforcing the ten-minute time limit and will do so only should excessive demands of time be made.

4. For those of you who have both oral and written statements, it is requested that the oral statement highlight the points you wish to make. You may choose to submit only a written statement. Copies of written statements should be identified with your name, address, and the organizations, if any, which you represent. When you are called to speak, copies of your statement should be given to the reporter.

5. Registration cards are available at the table near the entrance to this room. If you have not registered for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of these cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address, and the organization you represent, if any.

The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

May I ask at this time if any speakers have been indicated?

Our first speaker this morning will be Claryce Shettler.

115

MISS SHETTLER: I would like to present this formal response statement as the authorized of the Three Affiliated Tribes and its Director Lawrence Baker, who is the administrator for the Tribal Government Development Task Force, and is the official comment on the West-Central Regional Environmental Impact Study. If you would like I can read it into the record.

MR. JOHNSON: Would you care to read it, Clarvce?

MISS SHETTLER: I will sit down and do it.

MR. JOHNSON: That is fine.

MISS SHETTLER: This assessment was an opportunity for the Three Affiliated Tribes to obtain badly needed technical and socio-economic information related to coal impacts. However, the tribes were never officially given the opportunity to delineate project plans for consideration in the proposed action. The affected tribal entities who would best benefit from this assessment were not adequately informed of the study goals and benefits. As a result development scenarios were not considered for the Fort Berthold Reservation. This impacts the ability of the Three Affiliated Tribes to properly evaluate development opportunities for the physical resources. Impacts affecting Fort Berthold seem to be described only in term of "spill over" impacts instead of

115

evaluation of the cumulative impacts from both on and off reservation development which realistically could occur.

With respect to the evaluation of "spill over" impacts to the reservation, it is felt that certain technical data is not of sufficient detail to evaluate site specific conditions. An example would be the use of North Dakota general county maps to evaluate impacts to soils, et cetera. 117

Concerning reservation social conditions there is a lack of understanding of the institutions in evidence on the reservation. This particularly affects the assessment of housing conditions in Indian communities and related water, sewer, and solid waste impacts. 118 119

Jurisdictional issues are noted but not described in any extent with respect to key impacts. Negative and positive aspects of the principal jurisdictional issues should be documented for the benefit of all affected entities. 120

Several of the technical maps, geology and recreation for instance, are illegible. In addition information with respect to land use and wildlife habitat is not given. This detracts from the ability to evaluate the spill over impacts to the reservation situation. 121

The assessment of air quality is not considered adequate in terms of the high development scenarios. 122

The treatment of recreational impact is not site specific to any tribal plans or master plans for Lake Sakakawea. 123

More detailed information is needed in order to be of value to tribal authorities. 124

The Three Affiliated Tribes recognize numerous historic sites in the impact area which have not been accounted for in the impact study. Social and economic impacts were generalized and not quantified enough to be of value to reservation or community planners. 125

No Indian community was judged to undergo the input into the RSAP-ED models. In our opinion Twin Butte as well as White Shield should have qualified as impact communities. As a result, it is extremely difficult for tribal communities to evaluate any discernable socio-economic impacts as a result of the study. But it can be rationalized that many impacts could conceivably occur.

Employment/benefits accruing to the tribe are also difficult to evaluate since no specific approach (ED model) was utilized to evaluate the reservation.

Present land use planning and zoning was not delineated. There was only cursory evaluation of reservation land use. Land use on the reservation is not documented. Various federal entities under their trust responsibility relationship are in evidence to mitigate social impacts and they are not documented or recognized. Surface water availability is assumed for all development levels. Rationale for this conclusion is not expressed in the statement. 126 127 128

Finally, it is stated in the document that no applicants have recognized responsibility to mitigate impacts on the reservation. It cannot be assumed that impacts will stop at the reservation boundary. 129

And that concludes the comments from the Three Affiliated Tribes.

MR. JOHNSON: Okay. The hearing panel members have any clarifying remarks or are they any questions concerning those?

MR. PITTMAN: None.

MR. MOUNT: None.

MR. JOHNSON: Clarice, I have just a couple. In testimony given at Dickinson on Monday night it was mentioned that Mr. Hugh Baker, who is associated with the Three Affiliated Tribes I believe, had not been contacted concerning the preparation of this study.

Since you were the individual on the study team who worked on the Indian affairs section, could you comment on that, please?

MISS SHETTLER: Yes. I would like to state that apparently Mr. Reichert was misinformed or not properly informed. Mr. Baker worked closely with me throughout at least three-fourths of the writing of the Impact Statement. He was given several drafts throughout the term of the Impact Statement to review and given the first copy of the final draft

when it was finished, and he also coordinated between me and the Tribal Council on the Impact Statement. So he was fully aware of the Impact Statement and what was going on with it.

MR. JOHNSON: Just for the record, what is Mr. Baker's affiliation with the tribe?

MISS SHETTLER: Mr. Baker is the Natural Resources Planner and Coordinator for the Three Affiliated Tribes, and he is also director for the Tribal Government Department Task Force.

MR. JOHNSON: And the remarks you read in the record today were prepared by Mr. Baker?

MISS SHETTLER: Yes, they were. And I believe I would like also to make one more comment about the BIA, the Bureau of Indian Affairs did participate. Staff from the Bureau of Indian Affairs participated both on the area level and the local Fort Berthold Agency level.

MR. JOHNSON: Thank you.

Is there anyone else present who would care to make comment concerning the accuracy of the study?

If not, this hearing will recess. We will remain here, the hearing panel and myself, until 12:00 should anyone else care to have comments on the study.

The hearing will be in recess at this time.

(Thereupon at 11:25 a.m. the hearing was in recess until 12:07 at which time it reconvened.)

MR. JOHNSON: Let me call the hearing back to order at this time if I may.

Are there any comments that you would care to make for the record at this time. We would be glad to receive them.

Sir, you want to make a comment? Could you give us your name?

MR. LINCOLN: Mike Lincoln, Sr., Twin Butte.

My comments is on springs, that it will affect the springs of our community or in our reservation from this coal development in Dunn Center.

MR. JOHNSON: Are there any questions from members of the hearing panel in terms of clarifying remark?

(No response indicated.)

MR. JOHNSON: Thank you.

Sir, did you want to make a comment concerning the comment period, the ability to comment, for the record?

MR. HOLEN: Sure. I speak for myself. I think we should be rescheduled for -- the hearing should be rescheduled so we can have more time to get more information, and then more participation with the people -- people to participate and make comments. I think we would have more, you know, better all the way around.

MR. JOHNSON: Would you give us your name?

MR. HOLEN: Eugene Holen, Sr.

MR. JOHNSON: How much time would you suggest?

MR. HOLEN: About ten days.

MR. JOHNSON: The hearing record as it currently stands is open until June 19th. You have the opportunity to request an additional hearing as you are indicating, or to submit written comment to us until the 19th of June.

MR. HOLEN: I defer to Mike, he is the man that --

MR. LINCOLN: Rehearing, I would say, before the 19th.

MR. JOHNSON: A rehearing before the 19th?

MR. LINCOLN: Yes.

(Discussion off the record.)

MR. JOHNSON: Let's open the record again, your name, please?

MR. HANDEGARD: Royal Handegard, representing the Bureau of Indian Affairs at Newtown.

We do not have an oral comment prepared, but will submit a written statement later.

MR. JOHNSON: Any other comments for the record at this time?

Thank you for your attendance.

Seeing no further desire to comment for the record I will declare this hearing adjourned.

(Thereupon at 12:13 p.m. the hearing was adjourned.)

- - - - - - - - -

MR. JOHNSON: The hearing will please come to order.

Good afternoon. My name is Gary Johnson, I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

Our interest is in correcting errors in the draft study in order to assure the best possible resource information for decision-makers. This draft study makes no decisions concerning energy development but rather analyzes the environmental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and the Bureau of Land Management with the opportunity to

receive comments from the public and private sectors. This is in addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 9, 1978.

As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1978. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me is Mr. Jerry Pittman, of the District Office of the Bureau of Land Management; Mr. Bob Wetsch of the North Dakota Public Service Commission; Mr. Bob Kaiser, who is the Federal Assistant Manager on the Regional Environmental Impact Study; and Mr. Dana Mount of the North Dakota State Department of Health.

An official reporter will make a verbatim transcript of this hearing. In order to ensure a complete and accurate record of the hearing, it is necessary that only one person speak at a time. Therefore, while this hearing is in session, only the designated speaker and members of the hearing panel will be recognized.

There are several procedural guidelines which we request you observe during the hearing. They are:

1. It is requested that all statements be confined to your comments on the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development.

2. This hearing is structured to receive information concerning the accuracy of the study, not to debate the study. Publicized informational meetings were previously held on the study on April 3, 4, and 5 in Bismarck, Dickinson and Hazen respectively.

The hearing panel is here primarily to clarify comments where necessary. The panel is not here to engage in debate on the study, but to ask clarifying questions, if necessary, at the conclusion of your remarks.

3. It is requested that speakers confine their remarks to ten minutes, if possible. This request is made in order to accomodate all those who wish to make comments in regard to the accuracy of the study. We do not wish to be unreasonable in enforcing the ten-minute time limit and will do so only should excessive demands of time be made.

4. For those of you who have both oral and written setatements, it is requested that the oral statement highlight the points you wish to make. You may choose to submit only a written statement. Copies of written statements should be identified with your name, address, and the organizations, if any, which you represent. When you are called to speak, copies

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5. Registration cards are available at the table near the entrance to this room. If you have not registered for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of those cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address, and the organization you represent, if any.

The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

The first speaker we have today is Dr. Joseph Crawford.

DR. CRAWFORD: I am not going to read all of this, I will make some references to it.

As I understand -- Joseph Crawford, Hazen, North Dakota -- as I understand, this study basically addresses impact as result of present and prospective coal development. However, there is a section in the introduction -- I believe down at the bottom of the first page of contents, it states, "Relationship to other projects and proposals."

In there states, "Northern border pipeline, northern tier pipeline," and one little paragraph on Garrison Hydroelectric expansion. And that is all. One little paragraph on that, which states nothing to any consequence with regard to the problems that are going to be created as a result of the expansion of the Garrison Hydroelectric dam. Nothing is there at all.

And I guess I want to speak, to address that today for the most part today, because the problems that are going to be created as a result of the proposed expansion of that dam are as a result of coal development. That is the point that we are going to stress. That is specifically related to coal development, and it should have been addressed in the study and has in no way been done, that is the problems that are going to be created -- socio-economic problems are going to be created as a result of that re-regulation dam, which will have to be built if the dam is going to be expanded in terms of energy production, are going to be considerable.

And that entire area should have been brought to light and should have been discussed in the major text of this study, and was not even touched upon.

That, gentlemen, is error to put it mildly. Negligence I would say would be more of a correct term.

The fact that it specifically relates to coal development can only be pointed out by those in the coal develop-

ment business to talk about the re-regulation dam.

Now first of all would be the Corps of Engineers, which at their inter-agency meeting discussed in the Hazen Star, Thursday, October 20, 1977, Mr. Richard Buse, the Corps of Engineers representative stated, that it was estimated that about 300 feet on each side of the Missouri River would be taken for the reservoir to maintain a level of 1655 feet above sea level during operating flows. The pool would be stable at 1682 feet when the hydro plant is not in operation. Buse estimated that the hydro plant would be in operation only seven and one-half hours a day to handle the peak power demand period. The power would be sold to electrical cooperatives for use in Minnesota, Wisconsin and Iowa, in addition to North Dakota.

So the more people that are building coal plants, it would seem on the surface the more demand is going to be for more peak power. And they are going to be looking toward what for that more peak power? They are going to be looking toward more hydro power, more expansion of the dam facility.

Basin Electric representative, Mr. George Perastevn (ph.), stated in a letter March 21st, 1977 to Mr. Gus J. Karahatsos, K-a-r-a-h-a-t-s-o-s, Chief in the Planning Division, Department of the Army, Missouri River Division of the Corps of Engineers, Omaha, Nebraska, "We would like to express our support to the hydro power additions including the additions

at Fort Beck and Garrison as well as the Gregory County pumping storage facility."

Even the Board of Directors of Basin Electric have stated their unqualified support for this kind of power. Why? Because it will provide peak power for their coal generated or coal conversion facilities. In other words, the more the coal conversion facilities there are the more the demand is going to be for peak power, and where are they going to look for that peak power? At the Garrison dam for one.

And what will that do? It will cause tremendous socio-economic impacts, especially socio impact. Not a word of that is addressed in this study. Not a word of it.

There was the whole business that the construction of coal power generating plants is going to create that problem that they have difficulty in being able to turn on and off that power plant. But none of that problem is addressed in here. One of the Board of Directors of Basin Electric stated -- Andrew Work, M-o-r-k, stated in the transcript of the public meeting taken at the Highway Building State Capitol grounds, Bismarck, North Dakota, December 12th, 1977, "In general a power supply company or cooperative in the case of Basin usually has as part of its capacity about 20 to 30 per cent dedicated to peaking requirements. Based on our current estimates, based on electric member system alone, will require about 600 megawatts of peaking capacity

in 1987. Basin Electric's available peaking capacity for 1987 consists of 280 megawatts of Department of Energy hydro peaking for the winter season, and 100 megawatts of Canadian peaking for the summer season. If these arrangements are completed and facilities constructed to bring this power to North Dakota and other rural electric consumers, Basin Electric will therefore require an additional 192 megawatts of peaking capacity for the 1986-87 winter season, and 350 megawatts for the 1987 summer season."

That is where they presently are. That is not taking into consideration the new power plant they are going to be building, that they are now going to demand more peak power, probably from the Garrison Reservoir or the Garrison Dam, which again will cause tremendous impact to our area.

I go on to quote in the same that, "There will be substantial benefits to the Rural Electric Cooperative of the State of North Dakota if hydro peaking and storage facilities are constructed along the mainstream of the Missouri River. The Cooperative members which have in successive annual meetings adopted resolutions calling for additional capacities to be developed on the Missouri River, so that full potential for peaking capacity on the existing mainstream dams on that river can be realized."

Then they are also continually calling for necessary authorization and funding from Congress to expedite the construction of these projects.

Why? Because for every power coal conversion facility that is constructed, the more peaking power they are going to need. And where are they going for that peaking power? They are going to create more and more pressure to destroy what is left of the Missouri River by building more dams on the Missouri River to create peaking power.

There are some company officials that feel differently. Dale Anderson, the President of Minnkota Company, which is going to the coal mining business in Garrison area, has stated on many occasions they are opposed to this because of the damage it would cause to the environment.

It is a volatile issue because what would that kind of peaking power generated from the construction of a re-regulated dam, what kind of destruction would that do? Just this one proposal alone for the present re-regulation dam would destroy a minimum of ten miles of some of the most beautiful and accessible recreation area in our State. It would turn that entire area into a slough, it would take 2000 acres of the bottom land in the process, and what is the response of the people who are going to be doing that?

They state that, "Well, it's not prime farm land."

Well, the Corps of Engineers does a number of funny things. Basically there is hardly a river in the State that can be categorized as prime farm land. Generally I suppose

the Corps is looking for work. In this situation there is a perfect object of the intention of the power companies. They are looking for work and the power companies have plenty for them to do.

I have to refer you to your own statement, page 118 on Recreation, "Impacts to recreation value at all levels of development would be caused primarily by physical disturbance on the land due to mining for facility construction and operation. The site and sounds of mining and the changing in the population numbers and composition. A large population increase and higher participation in recreation pursuits would lead to significantly more demand and needs for recreation areas and facility."

More demand for recreation. "Crowding and over-use of existing facilities, a decrease in the quality of recreation experiences requiring facilities for solitude, increased administrative and enforcement costs, and increased vandalism would likely result."

A recent study of socio-economic impact of large energy facilities -- Mountain West Research, 1975 -- indicates the importance of leisure values and recreation facilities in energy impacted communities. Availability of recreation opportunities is one of the most frequently mentioned items that residents like most about their community. Where recreation and entertainment facilities were lacking, this is one of

the most frequently mentioned items which cause concern.

You state yourself, as a matter of fact, and yet not a hint of not extending the use of that area, but not a hint in here of the destruction of that recreation area due to in effect coal development. I can't believe it. I can't believe it.

At the last meeting that you people had in Hazen we asked the questions about that, and nobody said anything about it. "Well, maybe we should look into it." But apparently none of that has occurred.

In other words, what we are saying then is, when you yourself state here that we need more recreational facilities, this type of activity is going to destroy some of what we do have.

In your maps on page 119, 121 and 123, at Level 1 Recreation Impact, Level 2 Recreation Impact, and Level 3 Recreation Impact, maps 30-30, 30-31, and 30-32 there is absolutely no note of the problem.

As a matter of fact, on your map on page 121, map 3-31, you specifically show the area that will be destroyed as an area for additional use -- additional use zone, is the exact area right there. That will be destroyed.

You actually state at Level 3 on map 3-32 that that specific area will be destroyed in an area of negligible sensitivity. There will be no -- nothing will occur in that

area. And that is the area that is, according to the Corps of Engineers and last week's statement they are going ahead as planned.

Now acknowledging this and emphasizing the concerns of the area out here, there has been plenty. It's been going on for years. Plenty that could have been included in the statement long ago.

For example, the editorial comment is almost unanimous. The editor, Oliver Borlaug, of the Washburn Leader has condemned it; the editor of the Hazen Star, Shelton Green has condemned it; the Center newspaper has opposed it. Almost all the weeklies as a matter of fact of this area have opposed it. No weekly newspaper has supported it, not one.

Last week at both the Republican and Democrat District Conventions in McLean County, both political parties condemned it. The construction of re-regulation dam and increasing hydro power on the Garrison Dam. The city -- the Garrison and Washburn Civic Clubs have condemned it. The City of Washburn as a City government has made a statement against it. The City government of Hazen has expressed concern about it. The Republican District Chairman from McLean County, Larry Borlaug, stated to me that Garrison -- or diversion is controversial), there is some support and some opposition. But he has learned of no support, no vocal sup-

port, no visible support, anywhere, for the re-regulation dam construction on the Missouri River as a result of coal development.

Now let's take a look at the environment impact for just a minute of this whole efficient energy project. I would like to refer you to your own study here, page 53 -- well, first of all, let me show you what area of the river this would destroy. This is a map that shows you the Missouri River as it is now below the dam, going down to the City of Stanton which is here. But the overleaf or here it will show you the part of the river that will be destroyed. All of the bottom land existing just north of Stanton will be destroyed.

Well, what is in that bottom land? This is a Federal now -- Federal agency that is promoting this development of this thing as a result of coal development. What is in that area? Has the Corps of Engineers even bothered to look at it?

Well, let's refer to your own Bureau of Land Management study, page 53, the entire area is listed as a northern bald eagle spring and fall migration use area. The entire area. Bald eagle is on the national endangered species list, and here you have one Federal agency that is helping to put this together, leave the whole thing out altogether, and another Federal agency, the Corps of Engineers, who wants to

destroy it.

Absolutely insane. Absolutely insane.

Issues like this illustrate the lack of real concern for impact mitigation. We have a lot of discussion in here on mitigation of impact. The Corps of Engineers says they have to build the dam to justify the care of the river banks. That is the next thing they have to do, because they had to build the first hydro dam to provide peaking power for coal generated power plants, and as part of that in the original application, for the original Garrison Dam, was repair of the river banks. Now they are saying that they have to build a new dam to justify repair of the river banks. In other words, mitigation of environmental problems is the first Garrison Dam just somehow went by the boards, apparently.

If the re-regulation dam goes through we may very well be experiencing development with which we cannot cope. If the re-regulation dam goes through we are in effect saying, "Go ahead hope, build the coal conversion facilities, which will then demand peaking power, and we will then continue to destroy the very recreation facility and access to facility that the impact study says are essential in the development area itself."

Right now, just to refresh your memory -- I am sure you are all aware of it, under construction or like or in the permit granting stage, just in terms of electrical con-

version facilities now, we have the Coyote plant, UPACPA plant at Underwood, we have Basin Electric Apple Valley Station, we have Basin Electric at Stanton, we have UPA at Stanton, and we have Minnkota at Center, and we have Garrison Dam, 4,860 megawatts of electricity within a 50-mile radius of Hazen. Almost 8,000 megawatts of electricity either presently on line, under construction, or in the conclusion of permit granting stages.

Based upon an average home using 800 kilowatt hours electricity a month, that, gentlemen, alone is enough electricity to provide for all the homes on North Dakota, South Dakota, Minnesota (including the Twin Cities), Montana, Wyoming, and most of Nebraska. Granted not industrial needs, but the housing needs of all of those people, within a 50-mile radius of Hazen.

And now for 375 megawatts to provide peaking power for more of these coal generated facilities, the proposal is destroy ten of the remaining free-flowing miles of the Missouri River and all the recreation and environmental life that is therein.

Gentlemen, we need this document for protection, not for verbage. We need this for assistance, not for chatter. And it definitely has a long way to go.

Mr. Metzger at the last session in Hazen -- Doctor Metzger, with Governor Link's staff, stated that the governor is

concerned. The governor is very concerned. That is great. Until last week the Corps' statement states that we are up in this area misinformed.

Gentlemen, I don't think we are misinformed. I think the Corps of Engineers has a lot to learn. We look to the governor and we look to you people for assistance.

We are not particularly opposed to coal development, we are opposed to our way of life being disseminated in the process. That is why I presume you are here and that is why I hope that you will do something about it.

Thank you.

MR. JOHNSON: Thank you, Doctor Crawford. The panel is here to clarify positions on the remarks.

DR. CRAWFORD: Thank you, I'll be glad to answer any questions you have got.

MR. JOHNSON: Jerry?

MR. PITTMAN: No.

MR. JOHNSON: Bob?

MR. WETSCH: No, I don't have any.

MR. KAISER: I got one. When you are talking about -- you mentioned impacts regarding the re-regulation dam from social conditions, you are referring there to after it is built or during construction or both, or can you amplify on that?

DR. CRAWFORD: Well, after the re-regulation dam is

built there will be no recreation facilities, there will be no endangered species in that area, it will be destroyed.

MR. KAISER: So you are talking then about recreation impacts rather than social as we look at it in here (study), social impact as related to doctors, to schools, and we take that a little different from recreation, which is activities.

DR. CRAWFORD: Okay, I understand that. I guess based on the statements that you have there on page 118, I believe it is, that you yourself state that recreation is almost an essential service, and I guess I classify essential service whether it is recreation or sewer and water as socio impact.

MR. KAISER: But you are essentially talking about recreation activities along the river?

DR. CRAWFORD: Yes, and preservation of endangered species.

MR. JOHNSON: I have one, Doctor Crawford.

At the informational meeting in Hazen you asked some questions concerning water resources and the dam in particular. I believe Mr. Leonard of the USGS responded in letter form to some of the concerns you raised. Was that received?

DR. CRAWFORD: I received a letter from him explaining -- I think about a week or so ago, explaining that there

would not be that much water lost.

The question that I was asking was primarily with regard to the amount of water lost. He didn't think that would be very substantial and he indicated that in his letter. That is why I didn't mention it today.

MR. JOHNSON: I was just curious if you had received that response.

Thank you.

Is there anyone else present who would care to make comment on the accuracy of the study at this time?

(None indicated.)

MR. JOHNSON: I would repeat the record is open until June 19th for the receipt of written comments, should you care to mail them to the Bismarck office. That address is on a sheet provided for your comments which is also available at the front table.

I will ask once again if there are additional comments?

(None indicated.)

MR. JOHNSON: Seeing none, I will declare this hearing in recess. Should anyone else wish to comment, please let me know. We will be here for the receipt of comments until 4:00 o'clock, I guess it is that we have advertised.

This hearing stands recessed at this time.

(Thereupon at 2:09 p.m. the hearing was in recess until 3:52 p.m., at which time it reconvened.)

MR. JOHNSON: For the record we will call the hearing to order and then we will adjourn until 7:30 p.m.

(Thereupon at 3:53 p.m. the hearing was in recess until 7:35 p.m., At which time it reconvened.)

MR. JOHNSON: We will call the hearing to order at this time.

Good evening, I am Gary Johnson. I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

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mental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and the Bureau of Land Management with the opportunity to receive comments from the public and private sectors. This is in addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 9, 1978.

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Seated with me today are Mr. Jerry Pittman of the Dickinson office of the Bureau of Land Management; Mr. Bob Kaiser, who was Federal Assistant Manager of the Regional Environmental Impact Study; Mr. Bob Wetsch of the North Dakota Public Service Commission; and Mr. Dana Mount, of the North Dakota State Department of Health.

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The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

Has anyone indicated a desire to speak?

According to the registration cards no one has indicated so.

Is there anyone in attendance who would care to make comment concerning the accuracy of the draft West-Central North

Dakota Regional Development Impact Study at this time?

(No response indicated.)

MR. JOHNSON: Since no one has indicated a desire to comment on the study at this time, I will declare this hearing in recess until such time as someone should care to make comment or until 9:30, at which time we will adjourn.

Thank you.

(Thereupon at 7:48 p.m. the hearing was in recess until 9:00 p.m., at which time it reconvened.)

MR. JOHNSON: We will reopen the hearing and adjourn.

RESPONSE TO SCHEITLER TRANSCRIPT

#113

The Three Affiliated Tribes were presented with every possible opportunity to obtain and present solid socio-economic data through their tribal representative's participation in the Social and Economic Conditions Work Groups.

#116

One of the goals of the Draft Study was to involve the public early in the process. As a result of this goal, seven public meetings were held, one of which was held in Twin Buttes on the Fort Berthold Reservation. Twenty-five people attended the meeting and expressed their concerns about the proposed study and the proposed development. Those concerns were published in the Public Concerns document which was distributed to those who attended the meeting and requested a copy.

As a result of concerns raised at the Twin Buttes meeting, an Indian Community Liaison was employed under the provisions of the Old West Regional Commission grant to the State of North Dakota. After consultation with the Executive Director of the North Dakota Indian Affairs Commission, a member of the Three Affiliated Tribes and a resident of the Fort Berthold Reservation was employed in this position. This person was located in the North Dakota Indian Affairs Commission Office to more effectively coordinate the study with the tribal entities, since the person was responsible for preparation of all manuscripts regarding impacts associated with the Fort Berthold Reservation. The coordination and contacts that were made by the Indian Community Liaison are shown in detail in Chapter V, pages 207 and 208 of the Draft Study.

As the proposed development is described in the study, there are no energy proposals considered on the Fort Berthold Reservation. Therefore, impacts to the Reservation would only be those impacts that are associated with the development outside the Reservation.

Also see responses #9, 47; Reichert's testimony and panel discussion from the Dickinson public hearing; and the remainder of Schettler's testimony, the panel discussion, and the responses.

The testimony given by Ms. Schettler was said by her to have been prepared by a consulting firm in Billings, Montana; to have been telephoned to Ms. Schettler the night before the hearing; and had not been seen by the Three Affiliated Tribes.

No other Tribal representatives were present at the first Twin Buttes public hearing. A Fort Berthold resident requested that a second public hearing be held after Fort

CERTIFICATE OF REPORTER

This is to certify that the foregoing proceedings before the Chairman and Hearing Panel, in the matter of West-Central North Dakota Regional Environmental Impact Study, held in the Community Building in Twin Buttes, North Dakota, and the Armory, Beulah, North Dakota, were held as herein appears, and that this is the original transcript thereof for the file of the Bureau of Land Management.

John B. Carney, RPR

Berthold Tribal representatives, Bureau of Indian Affairs representatives, and residents could be better notified. The public hearing period was extended and a second public hearing was held on Fort Berthold. No Fort Berthold representative or resident attended.

#117

"From the soils point of view, this document can be very useful if it is used as a general planning document. The information can be used for overview studies of the area and to provide information on a regional basis. When specific management decisions will be made, this document can be used to provide preliminary information to be followed by more detailed studies."

"The information provided in this Draft Study will be useful to people making decisions on a regional or statewide basis. It will also point out areas where more information is needed. However, it will not replace the need for more detailed technical information which is needed to make management decisions on a site-specific basis." (Bruce Seelig, FSC)

#118

The Indian Community Liaison prepared the Fort Berthold section of Social Conditions.

#119

The housing conditions on the reservation and the attendant water, sewage, and solid waste impacts would not be directly affected by the proposed developments. Upgrading of the facilities and services would be the province of the individual tribal members.

#120

Soil, vegetative, geological, and wildlife impacts are not expected to extend into the reservation boundary; therefore, no jurisdictional issues are involved.

Jurisdictional issues relative to recreation impacts are discussed on page 121 of the Draft Study, and page 81 of the Technical Supplement, Oral Related Impacts to the Fort Berthold Reservation. This discussion indicates that vandalism, trespassing, and other misdemeanors by non-Indians could be difficult for tribal authorities to prosecute due to unresolved legal questions regarding Indian jurisdiction over non-Indians.

The Fort Berthold Technical Supplement was written by the Indian Community Liaison, who also wrote or reviewed all Fort Berthold sections of the Draft Study. The Indian Community Liaison position was supervised by the Director of North Dakota Indian Affairs Commission (IAC). Economic and social implications are included throughout the Study and the Technical Supplement.

#121

Only limited information was available on wildlife habitat conditions on Fort Berthold (see page 57, column 1, paragraphs 7, 8, and 9).

Several of the recreation maps, especially Map 3-32 on page 123, are admittedly difficult to use, and revisions to these maps are included in Part 1, Recreation.

#122

The proposed action does not include high development scenarios.

#123

Two site-specific planning efforts may have an effect on potential impacts to recreation in the long term. A recreational master plan on Lake Sakakawea is being developed by the U.S. Army Corps of Engineers and should be complete by the end of 1979. This plan will include allocation of lands surrounding the reservoir and a detailed recreation facility development plan. Until the plan is complete, no additional analysis is possible. The Three Affiliated Tribes have proposed tribal management for seven areas along the shores of Lake Sakakawea. Because jurisdictional questions are unresolved, no action on this proposal is expected in the near future. Therefore, the tribal proposal would not affect the analysis of impacts to recreation resources on the reservation.

#124

Although all known historical records at the State Historical Society of North Dakota were consulted for historic sites important to the Three Affiliated Tribes, the only ones on record are the earthlodge villages along the Missouri River. These were mentioned in the text of the Draft Study. Inquiries with the Three Affiliated Tribes, through the Indian Community Liaison, elicited no further information on Indian related historic sites.

#125

Refer to responses #115 and #118.

#126

Present land use planning and zoning on the reservation was considered wherever available. The study team relied on the paid reservation representatives to supply necessary data. If the data was unavailable, no assessment could be made.

#127

Refer to responses #115 and #118.

#128

Surface water availability was assumed because of the large volume of unappropriated water in Lake Sakakawea allocated to industrial purposes. In addition:

1. Permits had been requested for the Level 1 projects.

2. Only Coyote 2 Power Plant in Level 2 would represent additional major surface water use, and the quantity involved (10,000 acre-feet annually) would not seriously jeopardize existing water rights.

3. All of the Level 3 concepts were limited to mines only, and their water requirements normally are met at the sites. They have no need to import water.

#129

It was not assumed that impacts would stop at the reservation boundary. This is the reason the Indian Community Liaison prepared Indian Concerns sections for several components. These sections, and the Fort Berthold Technical Supplement, were published for the purpose of making all known reservation data available.

While some impacts--specifically on air quality, recreation, and social and economic conditions--would extend onto the reservation, most impacts on the land-based components of the environment would stop at the mine boundaries or the plant sites. Significant impacts on water resources would be confined to the mine or plant or to its immediate neighborhood.

RESPONSE TO LINCOLN TRANSCRIPT

#130

With the Hans Creek-Goodman Creek depression between Twin Buttes and the proposed Dunn Center development, the likelihood of springs near Twin Buttes being affected by mining near Dunn Center is extremely remote. This is indicated on page 99 of the Draft Study.

RESPONSE TO CRAWFORD TRANSCRIPT

#131

The main goal of the Draft Study is to address the environmental impacts of potential coal development; however, there is a subheading entitled "Relationship to Other Projects and Proposals." This section shows that there are existing, or under construction, facilities that are energy related within the study area that would have an influence upon the potential impacts of those proposals described within the proposed action. Likewise, there are other proposals that may have an influence, directly or indirectly, upon the environment that is to be impacted by the proposed action, but these other proposals are not coal related. These include oil and gas production, air quality petitions, and the Garrison hydroelectric expansion.

Whether a power plant is needed depends on the demand that the users of electricity place upon the utility firms. This demand for more electric power is independent of the type of plant constructed, i.e., coal fired, nuclear, hydropower, oil fired. Since it requires years to plan, construct, and get a plant into operation, utility companies must project the demand for electric power. Peaking power is also based on the demand of the user. However, this demand occurs at specific times each day when the users want the power at the same time. In order for the utility companies to meet the demands by the public, they must be prepared to supply additional power during those peak periods. The utilities estimate they must have between 30 and 35% of total plant capacity for this peaking power.

The Garrison expansion has been described in the Draft Study. The power generated at Garrison is used at times for base load and for peaking power at other times. Basically, Garrison is used for peaking power because of load condition as a base load for more than a few months when handling the spring runoff. The regulation dam would regulate the variation in flows as a result of the operation of the Garrison plant for peaking power.

The proposal to expand Garrison is not the direct result of construction of the coal fired facilities. This expansion could be proposed with or without these facilities. It could also be proposed had the proposed action been looking at nuclear or oil and gas facilities. The expansion is proposed because of the increased demand for electric power by the public. However, this demand could also be satisfied by construction of other peaking power type of facilities. Since the goal of the study was to address the impacts from coal development, the Garrison expansion was not included as it is not directly related to the proposed action. The impacts for the Garrison expansion and the re-regulation dam have been covered in a draft environmental impact statement prepared by the Corps of Engineers in

February 1977, revised in May 1978. A final impact statement has not been issued. The Corps of Engineers is currently seeking authorization to do a phase I advanced planning for this project, but have not been seeking authorization for construction.

NATURAL GAS PIPELINE COMPANY OF AMERICA

122 South Michigan Avenue • Chicago, Illinois 60603

June 6, 1978

Mr. Robert D. Kaiser
Regional EIS Office
Missouri Office Building
1200 West Main
Bismarck, North Dakota 58501

Dear Mr. Kaiser:

The United States Department of Interior, Bureau of Land Management, and the State of North Dakota have jointly published and are soliciting public comment on the Draft West-Central North Dakota Regional Environmental Impact Study on energy development. Natural Gas Pipeline Company of America (Natural) wishes to compliment both federal and state staff personnel responsible for successful completion of this ambitious undertaking. The study provides the public with a comprehensive, easy to read and understand document that will prove useful in arriving at future federal, state and local government decisions on regional and national energy needs.

Natural has strongly supported the preparation of this study from its inception and the material and information furnished by Natural, we believe, has provided an important contribution towards the successful completion of the draft document. Natural has attempted to review the study objectively and the following limited, but important, comments are offered in the hope of further improving the final document.

Public Finance 132

In the summary document on Page 37, Figure 23 presents a questionable conclusion. It leads the reader to believe adequate Coal Impact Office funds will not become available until 1982 when the Phase I plants come on line. In reality, Coal Impact Office funds derived from ongoing coal production will be available and will significantly exceed total revenue needs with each succeeding year, particularly when the Phase I plants come on line in 1982. In fact, over the 25-year life of the Dunn County Project, severance taxes, energy conversion taxes and federal royalties significantly exceed early impact costs.

The draft document on Page 128 substantiates the fact that Coal Impact Office funds will be available, stating that severance tax collections from over 16 million tons of coal production in the state, already in existence by 1979, would be available to local governments impacted by Level I Development. It stands to reason, these funds will be allocated to those areas most severely impacted by coal development in the state.

The treatment of Federal Coal Royalty in the draft document is of some concern. On Page 64, the draft document shows that the state received about $20,450 as its share of royalties from federal coal mined in 1975 under the old rate. Significant additional revenue from this source can be expected as the Phase I projects begin to come on line. This revenue source will be substantial from federal coal mined for the NGPL Coal Gasification Project where approximately forty percent of the coal mined consists of federal coal. This substantial source of state revenue should not be ignored when estimating revenue to the state from a coal conversion facility as shown on Page 100, Figure 3, of the Technical Supplement.

Additional revenues to North Dakota from federal royalties would be $4,158,000 using the Dunn County Project as an example wherein 13.86 million tons of coal will be mined, of which 40 percent is federal coal and a mine mouth coal cost in 1985 of $12 per ton.

(13,860,000 x .40 x $12 x .125 x .50 = $4,158,000)

Prehistoric and Historic 133

The Prehistoric and Historic section of Chapter 4, Page 160 of the draft document, under the heading, "Additional Enforceable Federal Measures," is very thorough and explicit in defining these additional measures that can be used to ensure that prehistoric and historic features are preserved. Natural supports protection of significant prehistoric and historic features; however, to state that all 119 sites within the NGPL Coal Gasification Plant Project area are significant and could possibly be nominated a National Register of Historic Places District, strictly on informal comment by the State Historic Preservation Officer, seems inappropriate and unnecessary in a study of this magnitude. Certainly, areas of North Dakota that have not been surveyed as thoroughly as Natural's project area would reveal additional areas of archaeological or historical significance.

NGPL has every intention of complying with all federal and state measures to fully mitigate the impacts imposed on the prehistoric and historic features by the proposed gasification plant in Dunn County when federal and state actions will allow the project to move forward. In this regard, Natural expects to meet with the State Historical Preservation Officer to discuss Natural's intent to cooperate with that office in completing appropriate measures to preserve historically significant sites.

Very truly yours,

A. M. Weiss
Director
Coal Development

RHH:my
Attachment

A number of minor errors and comments noted by our staff are listed below for your consideration:

Summary Document

1. Page 5, first full paragraph, line 4 - southwest should be southeast. 134
2. Page 37, Figure 23
   a. First money bag in Level 1 and Level 2 should be 285, not 385 (see Technical Supplement, Table 67). 135
   b. Last money bag in Level 1 should be 1,892, not 2,445 (see Technical Supplement, Table 67).
   c. Last money bag in Level 2 should be 3,501, not 5,319 (see Technical Supplement, Table 67).

Draft Document

1. Page 2, first paragraph, last full line - study, not statement. 136
2. Credit should be extended to Amax Coal Company for surface mining picture.
3. Page 12, fourth paragraph, line 2 - on, not or.
4. Page 72, map 2-45 - Basin Electric, ANG and MDU projects not shown on map. 137
5. Map 2-46 - Diamond in legend description should be colored green. 138
6. Page 79 thru 87 - Climate and Air Quality section needs to be updated to reflect recent gas/oil discoveries and 1977 Clean Air Act Amendments. 139
7. Page 83, last column, first paragraph, third line from bottom - overburden misspelled
8. Page 114, second column, first paragraph, third line - plant area should be study area. 140
9. Page 114, second column, last paragraph, third line - 11 Knife River Flint Quaries should read 5 Knife River Flint Quaries and 6 lithic scatters.

Draft Document (Cont'd.)

10. Page 127, last column, Public Finance, last two sentences - (comment) Impact Office funds will be available from existing coal production through the severance tax collections. 141
11. Page 149 and 150 - Climate and Air Quality sections need to be updated to reflect recent oil/gas discoveries and 1977 Clean Air Act Amendments. 142
12. Page 154, last column, last paragraph, second line - Dunn Center, not Beulah. 143
13. Page 159, third column, last full paragraph, fourth line from bottom - Table 1-10 should be Table 1-3. 144
14. Page 176, first column, recreations level 1, fourth paragraph, last sentence - (comment) Impact Office funds will be available from existing coal production through the severance tax collections. 145
15. Page 176, last column, second full paragraph - same comment as above. 146
16. Page 184, last column, last paragraph - same comment as above.

RESPONSE TO NGPL LETTER

#132

Coal Impact Office funds are indeed available at the present time; however, our analysis indicates that, based upon current dollar public service needs, costs would exceed revenues as indicated. It should be remembered that the data presented in the Draft Study pertains to a seven-county area containing several proposed energy facilities and, as such, does not pertain solely to Dunn County and the NGPL project.

#133

The status of nomination eligibility on sites in the NGPL project area remains informal only because neither BLM nor the State Historical Society has initiated written actions concerning these sites. In several meetings, the North Dakota State Historic Preservation Review Board has agreed in principle that the Knife River Flint quarries and associated sites are significant and could be nominated as a National Register of Historic Places District.

Further information supporting the importance and association of the many sites on the NGPL project area has been developed since the draft was completed in July 1977 (see Part 1, Prehistoric and Historic Features). A large area in Mercer County has been inventoried for prehistoric and historic sites (Dill 1978) in connection with mining for the ANG Coal Gasification Plant and Antelope Valley Power Plant. Although the area is less than 50 air miles from the proposed NGPL development, the site distribution is quite different. There were no flint quarries found; and of the total 105 prehistoric sites inventoried as of September 1, 1978, only 10 are lithic scatters. This would lend support to the district concept that the many lithic scatters surrounding the Knife River Flint quarries are related in some type of community, increasing the interpretive value of the complex as a whole, if it is treated an an entity rather than as separate sites.

Further complexities are present beyond those presented in the Draft Study. For a district to be nominated to the National Register of Historic Places, its component parts must be identified. At present, from the archaeological viewpoint, the known boundaries of the site concentrations are arbitrarily defined by the limits of the NGPL project area because only potential coal development areas were inventoried. The presently known highest concentration of sites in the northeast portion of the study area, along with the major flint quarry just north of the study area boundary, is suggestive of the possible center of the potential district. Further inventory should be done north, east, and south of the study area to better define the site distribution. It is suggested that under "Other Possible Measures" (Mitigating Measures--Chapter 4), BLM and the State Historical Society of North Dakota should work in conjunction to increase the archaeological data so that the exact affect of NGPL's mining plans on the potential district can be better defined.

#134

Correction noted in Part 1.

#135

Corrections noted in Part 1.

#136

Corrections noted in Part 1.

#137

A revised map showing all projects is included in Part 1, Social Conditions.

#138

The irrigated land portion of the legend should be as follows:

Irrigated land - more than 160 acres

Irrigated land - less than 160 acres

This correction is noted in Part 1, Land Use.

#139

See Part 1, Climate and Air Quality, for updates on recent oil and gas discoveries and 1977 Clean Air Act Amendments.

#140

Corrections noted in Part 1, Prehistoric and Historic Features.

#141

This comment is not at odds with the statement on page 127. Existing coal severance and conversion tax revenues are available in North Dakota and are discussed in detail in the Draft Study, Chapter 2, Economic Conditions.

#142

See Part 1, Climate and Air Quality.

#143

Correction noted in Part 1, Water.

#144

Correction noted in Part 1, Animals.

#145
Correction noted in Part 1, Recreation.

#146
See response #141.

Presiding — Mr. Gary Johnson, Chairman
North Dakota Natural Resources Council
Bismarck, North Dakota

Panel Members:
Mr. Jerry Pittman
District Office
Bureau of Land Management
Dickinson, North Dakota

Mr. Robert Kaiser
Federal Assistant Manager
Regional RIS
Bismarck, North Dakota

Mr. Gene Christianson
North Dakota State Department of Health
Bismarck, North Dakota

UNITED STATES OF AMERICA
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

ORIGINAL

Public Hearing
In re
WEST-CENTRAL NORTH DAKOTA REGIONAL
ENVIRONMENTAL IMPACT STUDY

County Court House
Washburn, North Dakota

June 9th, 1978

Speakers:

MR. JOHNSON: We will call this hearing to order.

Good afternoon, my name is Gary Johnson, I am the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

This hearing is for the purpose of receiving information, views, comments and suggestions concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development. The study is an assessment of the cumulative impacts of proposed coal and energy related developments in seven counties in west-central North Dakota which have a high potential for energy development due primarily to coal and water resource availability. A cooperative federal-state study effort was undertaken because of complex resource ownership patterns which prohibit any single entity from making unilateral resource planning decisions.

Our interest is in correcting errors in the draft study in order to assure the best possible resource information for decision-makers. This draft study makes no decisions concerning energy development but rather analyzes the environmental consequences of proposals and various alternatives. Decisions relating to specific projects will be made on the basis of similar public review processes instituted by various agencies. This hearing provides the State of North Dakota and the Bureau of Land Management with the opportunity to receive comments from the public and private sectors. This is

in addition to the written comments which have been received during the 75-day review and comment period which was scheduled to conclude on June 9, 1978.

As a result of the date of this hearing, which was moved back to accomodate as many interests as possible, the review period has been extended ten days until June 19, 1978. This hearing is one of eleven being held by the State of North Dakota and the Bureau of Land Management in six cities this week. The State of North Dakota and the Bureau of Land Management have appointed a panel to receive your comments.

Seated with me today are Mr. Jerry Pittman of the Dickinson office of the Bureau of Land Management; Mr. Robert Kaleen, who served as the Federal Assistant Study Manager on the project; and Mr. Gene Christianson, of the North Dakota State Department of Health.

An official reporter will make a verbatim transcript of this hearing. In order to ensure a complete and accurate record of the hearing, it is necessary that only one person speak at a time. Therefore, while this hearing is in session, only the designated speaker and members of the hearing panel will be recognized.

There are several procedural guidelines which we request you observe during the hearing. They are:

1. It is requested that all statements be confined to your comments on the accuracy of the draft West-Central

North Dakota Regional Environmental Impact Study on Energy Development.

2. This hearing is structured to receive information concerning the accuracy of the study, not to debate the study. Publicized informational meetings were previously held on the study on April 3, 4, and 6 in Bismarck, Dickinson, and Hazen respectively.

The hearing panel is here primarily to clarify comments where necessary. The panel is not here to engage in debate on the study, but to ask clarifying questions, if necessary, at the conclusion of your remarks.

3. It is requested that speakers confine their remarks to ten minutes, if possible. This request is made in order to accomodate all those who wish to make comments in regard to the accuracy of the study. We do not wish to be unreasonable in enforcing the ten-minute time limit and will do so only should excessive demands of time be made.

4. For those of you who have both oral and written statements, it is requested that the oral statement highlight the points you wish to make. You may choose to submit only a written statement. Copies of written statements should be identified with your name, address and the organizations, if any, which you represent. When you are called to speak, copies of your statement should be given to the reporter.

5. Registration cards are available at the table

near the entrance to this room. If you have not registered for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of these cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address, and the organization you represent, if any.

The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

Our first speaker today will be Mr. Denver Rossberg.

MR. ROSSBERG: I am not sure that I am -- let's get into the thing, I possibly would submit some later, but right now I am not quite ready to -- this is pertinent to this discussion.

MR. JOHNSON: Okay, thank you.

Is there anyone else present who would care to make comment concerning the accuracy of the draft study before we today?

(Discussion off the record.)

MR. JOHNSON: I will repeat once again, whether there are any comments to be made concerning the accuracy of

the study at this time?

(No response indicated.)

MR. JOHNSON: Hearing no comments on the study I will declare this hearing in recess at this time.

The hearing will remain in recess until such time as any individual cares to make a comment for the record or until 4:00 o'clock, at which time this hearing will adjourn for the afternoon session. The hearing is recessed at this time.

(Thereupon at 1:45 p.m. the hearing was recessed until 3:56 p.m., at which time it reconvened.)

MR. JOHNSON: We will call the hearing back to order at this time.

Our next speaker will be Mr. Chuck Rupe.

MR. RUPE: My name is Chuck Rupe, I am the manager of the Bismarck office for Natural Gas Pipeline Company of America. Our firm has made written comments on the Regional EIS, but I would just like to add a few comments on the study.

I attended the hearings or the meetings that were held when the EIS was first agreed on between the BLM and the State of North Dakota, and Dave Park of BLM outlined the kinds of critera and some of the goals for this study, and it pleases me to see that Mr. Durby had the foresight to see what kind of a document would result as a result of all this. He guaranteed it wouldn't be a wheel barrel study, it would

be a useful document, small enough that we would all be able to take in our way and use, and it is my company's belief that as a result of this effort that the State and the people in this seven-county area now have a document that provides some accumulative information on coal development and the project and their impact, that they can use in dealing with the various levels that are proposed in the study.

We compliment the professional people that have served as the workers, the staff personnel on this study. We think that they have done a professional job, even though it was difficult with all of the vast information that was provided to them.

We sincerely hope that the State and BLM will continue to do these kind of things to aid people in the region and we appreciate the opportunity to participate in this.

Thank you.

MR. JOHNSON: Is there anyone else who would care to make comment at this time?

(No response indicated.)

MR. JOHNSON: If not, this hearing stands adjourned.

(Thereupon at 4:01 p.m. the hearing was adjourned until 7:30 p.m. of the same day, at which time it reconvened.)

MR. JOHNSON: I will call this hearing to order at this time.

Good evening, I am Gary Johnson, the Acting Chairman of the North Dakota Natural Resources Council and am today serving as the Presiding Officer of this hearing.

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during the 75-day review and comment period which was scheduled to conclude on June 9, 1978.

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out, you know, and place a value or price on it. So we are feeling out our way to see where we are at, so that we can make an estimate as to how much the cost of production will be, including all the equipment and everything that we would have to have, and one has to have those figures.

So the next thing is, what procedure do you go through to get all the necessary permits? An answer yes or no right now rather than drag it over three or four years.

The coal is all on my land, I own the land, out right, no debts, no nothing. Four quarters belong to the Federal government, that is four quarters of coal belong to the Federal government. That is homestead land and therefore they reserve the coal west of a line between 43 and 44, I think it is, and so my coal is east of that line. That would be -- yes, the Nebo Road it is called, that would be six miles west of this, straight a mile south of Hensler, and everything east of the Nebo Road is not reserved by the Federal government, and in places quite a lot of coal there.

For instance, I have a high line across my land and one tar was placed -- they dug holes -- I am a little bit ahead, they dug holes 13 foot for an angle tower, one is an angle tower, an offset tower had to be a little heavier, and so they drilled holes 13 foot deep and struck coal. Good coal, hard coal. I took pictures of it. Of course, there was nobody there. But anyway, they won't pay me for the coal -- this is

for this hearing, please do so. If you wish to make a statement, either oral or written, at this hearing, we request that you fill out one of these cards. This card will be given to the presiding officer of the hearing who will call upon you for your statement. As you are called, and if you have a written statement, please present it to the reporter. We request that you begin your oral statement by stating your name, address, and the organization you represent, if any.

The comments made here today will be addressed by resource specialists in proceeding from the draft to final West-Central North Dakota Regional Environmental Impact Study on Energy Development.

At this time I would ask if there anyone present who cares to make comment concerning the accuracy of the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development?

MR. VAN OSTING: As a matter of something on the record, can I ask a few questions?

MR. JOHNSON: You certainly may.

MR. VAN OSTING: My name is William Van Osting, Hensler, North Dakota, right across the river, six miles.

I have quite a large farm there and they tell me there is some 20 million ton of coal, that is just an estimate made by Basin Electric, who needs the coal, come right out and say they do want it, the worst way now, but hesitate to come

Basin Electric, you see, they won't pay me for the coal. They won't make any agreement of any kind.

I wanted to go to Court with it, but the boss here said no, let's stay out of Court. So we stayed out of Court, and there was a case lost, you know, because for the simple reason, and it was a good trial balloon, because that is going to come up again here and there. Because according to the contract you can't build under a line or within so many feet of the line. They reserve the right to almost do anything they want under that line, for 120 feet -- I think 130 anyway, and it is a 440 line -- supposed to be 340 line, but it's actually up to 440, and my point on that, who owns the coal? Who owns the land really? I can't miss it, they won't let me go under with a piece of equipment, and so that is a question that is going to come up later on, you know, then they start mining in there.

That is why -- well, it is all something that wasn't --

MR. JOHNSON: Since you have asked to be on the record, may I attempt to clarify your question as I understand it?

It seems to me the last one you asked was, "Who owns the coal beneath that power line?"

And I think that is a question that an attorney can answer and we don't have an attorney represented on this panel

MR. VAN OSTING: I didn't expect you to, only I was trying to bring out the point that the companies are not always on the up and up with the rural people, you see. So it is one of those things. You guys can't answer it, so. Neither can anyone in town or in the State perhaps, that is it, period.

But nevertheless it is one of those things. I have to pay taxes on it.

Now there is a 20-mile strip, six towers, 150 feet wide, makes about 20 acres. I pay about $1.00 an acre on that, every year, on an escalating scale of course.

Those are the little gripes. Now maybe you can throw out all you want to because it is of no interest to you fellows, I don't know who would be interested in it, but I am just blowing off steam, put it that way.

And the point is, you know, there is a lot of truth to these fellows blocking the line, and in Minnesota and all that. Now those lines they are direct current lines, they carry more load without line loss. That is of course to the company's advantage, and that is good. But also some of these so-called experts I have talked to, several of them in California and different places, they say the corona effect, you know what that is, corona travels around the wire, the corona effect is much greater and much more dangerous to human health.

Be that as it is, I don't know. Don't know a thing

about that. Except, you listen to that.

And we come through Illinois about three years ago, I think it was, Southern Illinois, looking for a certain machine -- I went into Kansa Coal Company repair shed, and the boys showed me corn that had never ripened. This was in December, that had never ripened. Now that is prime corn country, you know, where they raise a couple of hundred bushel per acre, but under that high line nothing ripened.

Well, the farmers weren't too mad about it because they could put it in for silage, which was all right. Only then you have to have -- you can't use it yourself, you have to have an outlet for it. Corn you always have an outlet.

So a lot of things that were never mentioned, never get into the paper, are going to pop up now and then.

And what will happen later on I don't know. That is all the stuff, you know, and of course here they don't run those extremely high voltage yet. Now at -- there is one that goes clear into San Diego in California, it is at one million volts, direct current, what that will do I don't know. Of course, they stay clear of the cities with them.

MR. JOHNSON: Sir, I think that you asked if you could comment, and that should be related specifically to the study that has been prepared in addition to these remarks.

MR. VAN OSTING: Yes. I don't know what is all in the study to tell the truth because I haven't had time to go

through it.

MR. JOHNSON: Then let me ask --

MR. VAN OSTING: I kind of been browsing around a little here and there, but -- as I say, you know, how can a fellow get to work fast.

One guy had the answer, he was local -- on the local planning board, he said, "What the hell you asking me for?" He said, "Why don't you bore holes, why don't you bring in a mess of water wheels, and then you got the answer."

If you get what I mean -- outside of that why I don't have -- have anything to say, I guess.

MR. JOHNSON: Let me ask if any members of the panel wish to clarify any of these remarks or respond to this testimony?

MR. PITTMAN: I don't have anything.

MR. KAISER: Nothing.

MR. CHRISTIANSON: I don't have anything other that to say that some of the questions you raised I am not sure we can get the answers for them.

MR. VAN OSTING: If you had the answers, you couldn't make them heard.

MR. CHRISTIANSON: That would be the only comment that I would have here.

MR. VAN OSTING: So that doesn't matter. I have got all the answers pretty well in my mind, you know. For

instance like coal ownership, well -- that is where it is not reserved by anyone, they only ask the coal ownership, but where he signs the dotted line on a high line, that changes everything, see. Unbeknown to a lot of owners.

So that is going to take a lot of court action to clear that stuff up.

MR. JOHNSON: Thank you for your comments.

MR. VAN OSTING: Well, I'm just blowing off steam a little bit, you know. You get kind of so that --

MR. JOHNSON: Because we are seeking comments specific to the study I will declare the hearing in recess at this time unless someone else cares to make comment for the record.

Anyone else?

MR. VAN OSTING: I have asked that question, you know, at the legislative hearings where you had several lawyers, you know, and all that. But they hesitate. They said, "We haven't got the answer. We can give our personal opinion." But that will have to be tried in Court.

So there is ever so many things that a fellow comes across and I have come across a lot of them.

Well, we are -- the County Commissioners, as long as I was one, you come across a lot of those questions.

MR. JOHNSON: We will declare the hearing at recess at this time.

(Thereupon at 8:11 the hearing was in recess until 9:01 p.m. of the same day, at which time it reconvened.)

MR. JOHNSON: I will call the hearing back to order. This hearing is adjourned.

RESPONSE TO VAN GETTING TRANSCRIPT

#147 Sufficient facts are not available for an appropriate response. The legal questions should be referred to a private attorney.

CERTIFICATE OF REPORTER

This is to certify that the foregoing proceedings before the Chairman and Hearing Panel, in the matter of West-Central North Dakota Regional Environmental Impact Study, held in the County Court House, Washburn, North Dakota, was held as herein appears, and that this is the original transcript thereof for the file of the Bureau of Land Management.

John W. Carney, RPR

FEDERAL ENERGY REGULATORY COMMISSION

REGIONAL OFFICE
Federal Building - Room 3130
230 South Dearborn Street
Chicago, Illinois 60604

June 9, 1976

Mr. Edwin Zeidlicz
State Director
Bureau of Land Management
Suite 3, Capitol Place
1133 North Twelfth Street
Bismarck, North Dakota 58501

Dear Mr. Zeidlicz:

This is in response to the January 20, 1976, transmittal letter on page one of the Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development.

Our principal concern with developments affecting land and water resources is the possible effect of such developments on bulk electric power facilities and on natural gas pipeline facilities. Since the planned improvements in the proposed levels 1 and 2 actions encompass new facilities for both natural gas and electric utilities, we have reviewed the report with considerable interest and generally concur with its overall presentation. We note that the site-specific proposals are dealt with in individual Environmental Impact Statements.

The proposed energy developments will require water diversions from Lake Sakakawea which will result in decreased electric generation at downstream hydroelectric plants. These energy losses will, however, be negligible in relation to the overall energy gains that will result from the proposed developments.

We have one specific correction to offer and that relates to the Draft text, page 202. The total hydroelectric energy production in the United States during 1975 should be changed from 261 million kilowatt-hours to 261 billion kilowatt-hours.

148

Thank you for the opportunity to review and comment on this excellent report.

Very truly yours,

Bernard D. Murphy
Regional Engineer

RESPONSE TO FEDERAL ENERGY REGULATORY COMMISSION LETTER

#148
Correction noted in Part 1, Alternatives.

NORTH DAKOTA GEOLOGICAL SURVEY

UNIVERSITY STATION • GRAND FORKS, N. DAK. 58202 • AREA CODE 701-777-2231

EDWIN A. NOBLE
State Geologist

April 14, 1978

West-Central North Dakota
Regional Environmental Impact Study
Suite 2, Capitol Place
1533 North Twelfth Street
Bismarck, ND 58501

Gentlemen:

We have examined those portions of the draft copy of the West-Central North Dakota Regional Environmental Impact Study of Energy Development that deal with geology. With respect to the descriptions of the environment and environmental impacts in chapters 2 and 3, the report appears to be reasonably accurate and suitably thorough.

We have noted the following errors or criticisms: 149

1) The streams on the portion of the Drift Prairie discussed (Topography: page 32) flow into the Sheyenne, not the Cheyenne River, which is in South Dakota.

2) You should not state in the report that uranium in North Dakota is largely restricted to the southwest part of the state, as you do under "Other Minerals" (p. 34) as an intensive search for uranium is now being carried out on a state-wide scale. Rather then unequivocally writing off the remainder of the state, it would be better to say something to the effect that uranium has so far been mined only in southwestern North Dakota.

3) Not nearly enough attention is given to the interrelationships of the potential occurrence of coal and oil and gas on the same land. Chapter 38-15 of the North Dakota Century Code provides for the resolution of conflicts in subsurface mineral production and specifically includes oil, gas, subsurface minerals and coal, including lignite. The North Dakota Industrial Commission has jurisdiction and authority to enforce the provisions of the chapter and the State Geologist is charged with the responsibility and authority to enforce the rules and regulations of the Industrial Commission applicable to the provisions of the chapter. We have attached a copy of the chapter to this letter.

Dunn Center, N.D^rk.
June 9, 1978

RegionalEnvironmental Impact Study Office
1533 N. 12th Suite 2
Bismarck, N.Dak.

COMMENT ON WEST CENTRAL N.D. REGIONAL ENVIRONMENTAL IMPACT STUDY

Sirs:

We leased for coal,
Then took a poll.
We then protested
The leasing we contested.

22 gasification plants
Would bring in people like ants.
Air pollution and spoil banks
Thinking , turned us into cranks.

We wanted a study to help us out
We wanted to know what it was all about.

There were meetings and hearings from '72 to '78,
The results, we hope, are not too late.
You may have missed a thing or two,
But we'll all know better just what to do.

We favor development that's fair.
And doubt very much we can have CLASS ONE AIR.

Our chief concern is using methane (natural gas)
As it comes from wells in Little Knife Oil Field Land.

If processing Little Knife natural gas
Disturbs Roosevelt Park clean air,--ALAS !
How can we build another deal
That won't make our heads spin and reel ?

We need to continue to drill for oil
THE GAS MUST NOT BE ALLOWED TO SPOIL.
An Industry that's already here,
So let's get in gear

And allow more Natural gas plant sights
Help to provide us with heat and light.

Mrs. Milton Guenther
Mrs. Milton Guenther
(farmer- rancher wife)

West-Central North Dakota Regional
Environmental Impact Study
Page 2
April 14, 1978

One feature of the report that we dislike is that the format requires repeating the same information several times. An example of this is the treatment of fossils, in which we are warned repeatedly of increased collecting pressures with increased development on pages 34, 89, 170, 181, and 187 (and maybe more). The same repetitive pattern occurs with respect to other geologic concerns and probably for other concerns as well. As a result, the entire report is probably considerably longer than it really needs to be, taking into account the information it contains. Please understand that we are aware of the reasons for this format and resultant repetitiveness, but still, it seems extravagant.

Chapter 4 through 8 of the Study adequately set forth the expected effects on the geology of mining, nonmining, etc.

Sincerely,

John P. Bluemle
John P. Bluemle
Senior Geologist

Erling A. Brostuen
Erling A. Brostuen
Assistant to the Stace Geologist

crb

agency or officer thereof, for any purposes relating to the reclamation of any affected lands.

Source: S. L. 1969, ch. 393, § 13.

CHAPTER 38-15

RESOLUTION OF CONFLICTS IN SUBSURFACE MINERAL PRODUCTION

38-15-01. Policy.—It is hereby declared to be in the public interest to foster, encourage, and promote the development, production, and utilization of all natural resources of coal, oil, gas, and subsurface minerals in a manner as will prevent waste and allow a greater ultimate recovery of the natural resources, and to protect the rights of all owners so that the greatest possible economic recovery of natural resources be obtained in the state, to the end that landowners, royalty owners, producers, and the general public realize and enjoy the greatest possible good from these vital natural resources.

Source: S. L. 1971, ch. 351, § 1.

38-15-02. Definitions.—As used in this chapter, unless the context otherwise requires:

1. "Commission" means the industrial commission.
2. "Person" means any natural person, corporation, association, partnership, receiver, trustee, executor, administrator, guardian, fiduciary, or other representative of any kind, and includes any department, agency, instrumentality, or political subdivision of the state. The masculine gender, in referring to a person, includes the feminine and the neuter genders.
3. "Oil" means crude petroleum oil and other hydrocarbons, regardless of gravity, which are produced at the wellhead in liquid form, and the liquid hydrocarbons known as distillate or condensate recovered or extracted from gas other than gas produced in association with oil and commonly known as casinghead gas.
4. "Gas" means all natural gas and other fluid hydrocarbons not hereinabove defined as oil.
5. "Subsurface minerals" means all naturally occurring elements and their compounds, and natural mineral salts of boron, bromine, calcium, fluorine, iodine, lithium, magnesium, nitrogen, phosphorus, potassium, sodium, and sulfur, and their compounds, occurring more than five hundred feet below the surface of the land.

6. "Coal" means all kinds of coal, and shall include what is known as lignite coal, unless a contrary intention plainly appears.
7. "Producer" means the owner of a well or wells, or mine or mines, capable of producing coal, oil, gas, or subsurface minerals.
8. "Conflicting interests" means those interests of producers which are in conflict, so that full production and utilization by one producer is prohibited or impaired by the interests of another producer of a separate natural resource.
9. "Owner" means the person who has the right to produce natural resources either for himself or others.
10. "Natural resources" means coal, oil, gas, and subsurface minerals as defined herein.
11. "Waste" means the inefficient utilization of reserves of oil, gas, subsurface minerals, or coal, as the case may be.

Source: S. L. 1971, ch. 351, § 2.

38-15-03. Jurisdiction of commission.—The commission has continuing jurisdiction and authority over all persons and property, public and private, necessary to enforce effectively the provisions of this chapter. The state geologist shall act as a supervisor charged with enforcing the regulations and orders of the commission applicable to the provisions of this chapter. The commission has authority to make investigations it deems proper to determine whether facts exist which justify action by the commission. The commission has the authority:

1. To require the furnishing of a reasonable bond with good and sufficient surety, conditioned upon the full compliance with the provisions of this chapter, and the rules and regulations of the industrial commission prescribed to govern, satisfy, and resolve conflicting interests among producers within North Dakota.
2. To resolve conflicting interests of producers of natural resources which cannot be voluntarily concluded by them in the public interest to eliminate waste, to the end that the producer, landowner, and mineral owner realize the greatest possible economic advantage.
3. To promulgate and to enforce rules, regulations, and orders to effectuate the purposes and intent of this chapter.

Source: S. L. 1971, ch. 351, § 3.

38-15-04. Procedure.—The administrative procedure involved in the adoption of any rules or regulations, or the issuance of any orders by the commission under the provisions of this chapter shall be in accordance with the provisions of chapter 38-08 governing the procedure in the administration of the Oil and Gas Conservation Act; provided, however, that in the event of any emergencies found to exist by the commission which in its judgment requires the making, revoking, [illegible] modifying, altering, enlarging, renewal or extension of renewal, regulation, or order without first having a hearing, the emergency rule, regulation, or order shall have the same validity as if a hearing with respect to the same had been held after due notice. The emergency rule, regulation, or order permitted by this section shall remain in force no longer than fifteen days from its effective date, and in any event shall expire when the rule, regulation, or order, made after due notice and hearing with respect to the subject matter of the emergency rule, regulation, or order becomes effective.

Source: S. L. 1971, ch. 351, § 4.

38-15-05. Penalty—Injunction—Provisions applicable.—The provisions of sections 38-08-16 and 38-08-17 shall be applicable to the provisions of this chapter and to the rules, regulations, and orders of the commission promulgated hereunder.

Source: S. L. 1971, ch. 351, § 5.

RESPONSE TO NORTH DAKOTA GEOLOGICAL SURVEY LETTER

#349

The word "Cheyenne" in the topography section, page 32, should be spelled "Sheyenne."

The first sentence of the fourth paragraph in the subsection discussing Other Minerals, page 34, should read: "An intensive search for uranium is now being carried out on a statewide scale. Uranium so far has been mined only in southwestern North Dakota where it occurs in lignite and related carbonous materials."

We appreciate the additional attached information discussing the interrelationships of the potential occurrence and/or oil and gas on the same lead which is now a part of this Final Supplement. Also see Part 1, Geology.

DEPARTMENT OF THE ARMY
OMAHA DISTRICT, CORPS OF ENGINEERS
6014 U.S. POST OFFICE AND COURTHOUSE
OMAHA, NEBRASKA 68102

MROPD-M

26 April 1978

Mr. Edwin Zaidlicz
State Director
U.S. Department of Interior
Suite 2, Capitol Place
1533 North 12th Street
Bismarck, North Dakota 58501

Dear Mr. Zaidlicz:

This responds to the Draft West-Central North Dakota Regional Environmental Impact Study (EIS) designed to evaluate the cumulative impacts of large scale lignite coal development upon twelve components of the environment in seven counties in West-Central North Dakota.

Our review of the Draft Regional EIS has been completed. The document contains adequate quantitative and qualitative data about the proposed levels 1, 2 and 3 projects and accumulative impacts expected to result from their construction, operation, and maintenance.

It should be noted, however, that pursuant to the Corps of Engineers jurisdiction under Section 404 of the Federal Water Pollution Control Act Amendments of 1972, site specific impact statements determined to require such permits must contain data complying with Section 404(b) of the Act. 150

We appreciate having had the opportunity to review the draft document. Please forward a copy of the final Environmental Study when it becomes available.

Sincerely yours,

JOHN E. VELEHRADSKY, P.E.
Chief, Planning Division

BOOZ · ALLEN & HAMILTON Inc.
Management Consultants

LAWRENCE P. BEER
VICE PRESIDENT

4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20014
951-2621
AREA CODE 301

April 25, 1978

Dr. Charles F. Metzger
Energy Coordinator for Governor Arthur A. Link
Executive Office
Capitol Building
Bismarck, North Dakota 58505

Dear Chuck:

Thank you very much for sending me the "Draft--West-Central North Dakota Regional Environmental Impact Study on Energy Development" prepared by the U.S. Department of Interior/Bureau of Land Management and State of North Dakota. I am very impressed by both the document and the summary. It certainly has "sex appeal" for the public, and I suspect that it is based upon sound technical information. The only Environmental Impact Document which was "packaged" in as nice a manner that I have seen in the last 10 years was one done for a power plant in Puerto Rico. Without question, it is a compliment to you and the State of North Dakota, as well as the Bureau of Land Management.

I would like to suggest that if possible you send a copy of both the document and the summary to Dr. Eric Sloth (address indicated below). Eric is the Director of Environmental Activities for one of the most progressive utility companies--Nebraska Public Power District. Since NPPD is in the process of planning a transmission line which will extend from Nebraska to Manitoba, Canada, and since the EIS document is a superb example of what should be done, I think it would be very useful to Eric.

Please give my regards to Governor Link, and if ever we can be of any assistance please do not hesitate to contact us.

Sincerely,

BOOZ·ALLEN & HAMILTON Inc.

LPB:cm

cc: Dr. Eric N. Sloth
Nebraska Public Power District
1414 Fifteenth Street
Columbus, Nebraska 68601
402/564-8561

RESPONSE TO CORPS OF ENGINEERS LETTER

#150
The reference to Section 404(b) of the Federal Water Pollution Control Act amendments of 1972 was included in a discussion of Governmental Authorities and Procedures. For any site-specific analysis requiring a 404 permit, the data complying with that action must be included. However, none of the Level 1 projects analyzed in this study would involve fill in wetlands or streams having average annual flows of 5 cubic feet per second or more. Therefore, permits, if required, would fall under the "Nationwide Permit" system. In addition, federal regulations promulgated under the Surface Mining and Reclamation Act of 1977 prohibit the pollution of streams, waterways, or ground-water bodies.

NORTH DAKOTA STATE PLANNING DIVISION
STATE CAPITOL · NINTH FLOOR · BISMARCK, NORTH DAKOTA 58505
701-224-2818

June 12, 1978

STATE INTERGOVERNMENTAL CLEARINGHOUSE "LETTER OF COMMENT"
ON PROJECT REVIEW IN CONFORMANCE WITH OMB CIRCULAR NO. A-95

To: Bureau of Land Management/State of North Dakota

STATE APPLICATION IDENTIFIER: 7804187349

Hon. Governor Link
First Floor
State Capitol
Bismarck, North Dakota 58505

Dear Mr. Link:

Subject: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary.

This Draft EIS was received in our office March 23, 1978.

In the process of the A-95 review, the attached comments were received from North Dakota State University, North Dakota Group Sierra Club, Robert Stroup, Public Service Commission, State Forester, State Geologist, Attorney General Office, Mercer County Soil Conservation District, Director of Institutions, Indian Development Division, Tribal Attorney, State Soil Conservation Committee, Tri-College Center for Environmental Studies, Comprehensive Employment Training Administration, Employment Security Bureau, and North Dakota State Game & Fish Department.

This document and attachment constitute the comment of the State Intergovernmental Clearinghouse, made in compliance with OMB Circular No. A-95. The ND State Intergovernmental Clearinghouse requests the opportunity for complete re-review of applications for renewal or continuation grants or applications not submitted to or acted on by the funding agency within one year after the date of this letter.

Sincerely yours,

Bonnie A. Banks

Mrs. Leonard E. Banks
Associate Planner

LEB/mm

Attachment

78-344

ZOOLOGY DEPARTMENT
STEVENS HALL
NORTH DAKOTA STATE UNIVERSITY
FARGO, NORTH DAKOTA 58102

TELEPHONE (701)237-7087

RECEIVED
JUN 8 1978
State Planning
Division

June 6, 1978

State Intergovernmental Clearinghouse
State Planning Division
State Capitol
Bismarck, North Dakota 58505

Dear Sir:

I have reviewed the draft publication of the West-Central North Dakota Regional Environmental Impact Study on Energy Development. My comments follow:

Pg. 3, Table 1:	Where is the information on the Coal Creek Generator near Underwood? Also, in Table 1 there should be a column showing number of line-miles and size (kilo-volts) of new transmission lines.	151
Pg. 5:	Dakota Star, NoKota, Renner's Cove, Underwood, and Washburn mines: It should be indicated where the coal from these mines will be used.	
Pg. 8, Col. 3:	"Trace element impacts have not been totally defined...". This has a definite possibility of being critical and should be thoroughly analyzed. Aside from strip mining, this may be one of the major impacts.	152
Pg. 13, under Residual Impacts:	Chemical properties of soil would definately be altered, no possibly.	153
Pg. 15, Col. 2:	"The Glenharold and AMAX Mine areas have less than 50% of their soil classified as suitable for reclamation or better." How, pray tell, can it be reclaimed as required by law? Why not prohibit mining in unreclaimable areas?.	154

RESPONSE TO NORTH DAKOTA STATE UNIVERSITY A-95 LETTER

#151

It is assumed that only the Summary was reviewed, based upon the page listings. Detailed information on the Coal Creek Generation Station can be found on pages 22, 23, and 25 of the Draft Study. A tabulation of the various transmission line characteristics can be found in the Draft Study on page 10.

The tentative proposals to mine coal did not have specific markets designated for the coal. However, as indicated on page 14, third column, third paragraph of the Draft Study, the Nokota Mine is considering shipping the coal to a distant market. The other mine proposals have indicated that exporting the coal would be possible also, but they do not have a specific contract for the coal at this time.

#152

Trace element effects on the environment have not been totally defined and it may be many years before effects of trace elements are placed into proper perspective. Research into the complex array of multiple trace elements and their individual and synergistic reactions in the environment and environmental food chains must continue. Further discussion of this subject is presented in Part 1, Climate and Air Quality, "Air Pollution Effects."

#153

On page 13 under Geology, Residual Impacts, in the Summary, "possibly altering the chemical properties of the soil" should be deleted. The soil sections of both the Draft Study and the Summary discuss the effects on soils.

#154

For suitability definitions, see page 92, column 1, paragraphs 3, 4, and 5 of the Draft Study. Note that there is no category labeled "unsuitable." Also see Part 1, Soils. See response #51 for discussion of 100% reclamation.

#155

The statement should be reworded as follows: "Some non-game species especially tolerant of man, such as English sparrows, horned larks, and house mice, would increase in response to habitat modifications caused by a gradually increasing human population and its increasing influence on the environment."

Note that the paragraph in question refers to conditions "without the proposed action." Although not discussed in the analysis, these species would probably also increase under Levels 1, 2, and 3 of the proposed action.

-2-

Pg. 15, Mitigating Measures:	"North Dakota law requires restoration of mined lands to 100% of its original productivity." Nice, but this is folly. Same for page 21, mitigating measures.	
Pg. 23, Col. 1:	"Non-game species especially tolerant of man, such as songbirds and some small mammals, would probably increase." A false statement. With a loss of habitat from mining how could there possibly be increases?	155

As with almost every impact statement I have ever seen, this one is filled with glittering generalities. However, this report is better than no report. 156

It is obvious that coal development in North Dakota is going to be very destructive. It is not possible to restore mined lands to original productivity even though state and federal laws require this. However, every possible effort to minimize impact or restore mined lands should be made. This should include leaving unreclaimable lands unmined and preserving the most unique and productive biological areas such as wetlands and woody draws. I can only hope for a logical approach in assessing coal development problems. 157

Thank you for the opportunity to comment.

Sincerely,

John M. Wiehe

John M. Wiehe
Zoology Department
North Dakota State University
Fargo, North Dakota 58102

JMW/pl

#156

Please see the Draft Study rather than just the Summary. Also note that some Technical Supplements and site-specific analyses are available for the seven-county regional study.

#157

See response #51.

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Ms. Cynthia Amrine
North Dakota Group Sierra Club
P.O. Box 66
Judson, ND 58548

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 8 it will be assumed you have no comment.

- [ ] No comment
- [ ] Comments submitted herewith
- [X] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

Comment will follow by June 9.

Reviewer's Signature: Cynthia Amrine Date: 5-31-78

Title: ND Sierra Club Chairman Tele: 843-7271

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Edward Engleth
Public Service Commission
State Capitol

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 8 it will be assumed you have no comment.

- [ ] No comment
- [ ] Comments submitted herewith
- [X] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

We staff has not yet completed its review of the E.I.S. We will, however, have our comments forwarded to your office as soon as possible.

Reviewer's Signature: Bruce Kreiling Date: 5/10/78

Title: Environmental Engineer I Tele: 224-3400

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Robert L. Stroup
P.O. Box 446
Mason, ND 58545

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 8 it will be assumed you have no comment.

- [ ] No comment
- [X] Comments submitted herewith
- [X] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

Excellent data resource which has proven to be very useful to the Mercer County Energy Development Board.

Reviewer's Signature: W.R. Walter Date: 5/4/78

Title: Staff Director Tele: 745-6361

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Dr. Robert Johnson, State Forester
Dean, School of Forestry
NDSU, Bottineau Branch
Bottineau, ND 58318

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 8 it will be assumed you have no comment.

- [ ] No comment
- [X] Comments submitted herewith
- [ ] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

Personnel from the State Forester's Office have assisted in writing portions of the Draft West Central North Dakota E.I.S. We feel the draft statement is well written and covers many aspects of coal development in West Central North Dakota.

Reviewer's Signature: Walter Rauenzahn Date: May 9, 1978

Title: Deputy State Forester Tele: 258-2277

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

RECEIVED MAY 11 1978 State Planning Division

TO: Mr. Lee Gerhard, State Geologist
UND, University Station
Grand Forks, ND 58201

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [ ] No comment
- [x] Comments submitted herewith
- [ ] Desire to review final study

. . . .

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

Comments are attached.

Reviewer's Signature: John P. Bluemle, Sidney B. Anderson Date: May 10, 1978

Title: Senior Geologist, Assistant to the State Geologist Tele: 777-2231

We have examined those portions of the draft copy of the West-Central North Dakota Regional Environmental Impact Study of Energy Development that deal with geology. With respect to the descriptions of the environment and environmental impacts in chapters 2 and 3, the report appears to be reasonably accurate and suitably thorough.

We have noted the following errors or criticisms: 158

1) The streams on the portion of the Drift Prairie discussed (Topography: page 32) flow into the Sheyenne, not the Cheyenne River, which is in South Dakota.

2) You should not state in the report that uranium in North Dakota is largely restricted to the southwest part of the state, as you do under "Other Minerals" (p. 34) as an intensive search for uranium is now being carried out on a state-wide scale. Rather than unequivocally writing off the remainder of the state, it would be better to say something to the effect that uranium has so far been mined only in southwestern North Dakota.

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West-Central North Dakota Regional
Environmental Impact Study
Page 2
April 14, 1978

One feature of the report that we dislike is that the format requires repeating the same information several times. An example of this is the treatment of fossils, in which we are warned repeatedly of increased collecting pressures with increased development on pages 34, 89, 170, 181, and 187 (and maybe more). The same repetitive pattern occurs with respect to other geologic concerns and probably for other concerns as well. As a result, the entire report is probably considerably longer than it really needs to be, taking into account the information it contains. Please understand that we are aware of the reasons for this format and resultant repetitiveness, but still, it seems extravagant.

Chapter 4 through 8 of the Study adequately set forth the expected effects on the geology of mining, nonmining, etc.

RESPONSE TO NORTH DAKOTA GEOLOGICAL SURVEY A-95 LETTER

#158
See response (and attachment) to #149.

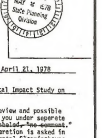
NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW



TO: Mr. Gary Wahlenmaier

Attorney General Office

State Capitol

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under seperate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [X] No comment
- [ ] Comments submitted herewith
- [X] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

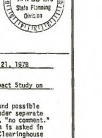
Reviewer's Signature: Gary Wahlenmaier Date: May 1

Title: AAG Tele: 2712

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received



FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Edward Klauber

Director of Institutions

State Capitol

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under seperate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [ ] No comment
- [ ] Comments submitted herewith
- [X] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

Reviewer's Signature: Edward J. Klauber Date: 4/27/78

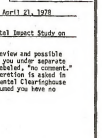
Title: Director of Institutions Tele: 2471

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

APR 26 1978



FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mercer County SCD

P.O. Box 466

Hazen, ND 58545

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under seperate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [ ] No comment
- [ ] Comments submitted herewith
- [X] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

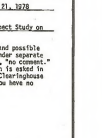
Reviewer's Signature: _____ Date: _____

Title: _____ Tele: _____

NDSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received



FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Carl Whitman, Jr.
Indian Development Division
Four Bears Motor Lodge
New Town, ND 58763

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under seperate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [ ] No comment
- [ ] Comments submitted herewith
- [X] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

Reviewer's Signature: [signature] Date: 4-27-78

Title: Executive Director IRC Tele: 627-3321

NDSIC FORM B (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

RECEIVED MAY 19 1978 State Planning Division

TO: Mr. Ronald Reichert
Tribal Attorney
235
Dickinson, ND 58601

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [ ] No comment
- [x] Comments submitted herewith
- [x] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

(SEE ATTACHED)

Reviewer's Signature: Ronald A. Reichert Date: 5/16/78

Title: Attorney Three Affiliated Tribes Tele: 225-2673
(Office) 225-6711

RESPONSE TO TRIBAL ATTORNEY A-95 LETTER

#158A
See comments and responses #9, #71, and #'s 115-129.

LAW OFFICES
FREED, DYNES, MALLOY & REICHERT, P.C.
235 SIMS
DRAWER K
DICKINSON, NORTH DAKOTA 58601

HOWARD A. FREED
GEORGE T. DYNES
HARRY L. MALLOY
RONALD A. REICHERT

AREA CODE: 701
DICKINSON: 225-8711
HALLIDAY: 638-4537

May 17, 1978

STATE INTERGOVERNMENTAL CLEARING HOUSE
State Planning Division
State Capitol
Bismarck, ND 58505

RE: NDSIC Form B (4/78)

The Three Affiliated Tribes of the Fort Berthold Reservation object to the cursory treatment of the Fort Berthold Reservation in the impact statement.

158A

The draft statement did not touch nor consider specific Indian concerns and as such we find the statement completely objectionable.

Yours very truly,

FREED, DYNES, MALLOY & REICHERT, P.C.

By: Ronald A. Reichert
RONALD A. REICHERT

RAR:ch

Enclosure

NDSIC FORM B (4/78)

SAI NO: 78-349

Date Received

APR 1978 RECEIVED STATE SOIL CONSERVATION COMMITTEE

RECEIVED MAY 26 1978 State Planning Division

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Gary Puppe
State Soil Conservation ~~Service~~ Committee
State Capitol

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [ ] No comment
- [x] Comments submitted herewith
- [ ] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

I have reviewed the Draft West-Central North Dakota Regional Environmental Impact study on Energy Development and commend all persons connected with the study. I am especially pleased to see the added emphasis given to Domestic Livestock, Plants and Soils that are so many times under rated in other impact studies

Reviewer's Signature: Gary L. Puppe Date: 5/25/78

Title: Ex. Sec. Tele: 224-2657

NOSIC FORM 8 (4/78)

SAI NO: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Harold Goetz
TrI-College Center for
Environmental Studies
NDSU, Stevens Hall
Fargo, ND 58102

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Developments, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 8 it will be assumed you have no comment.

☐ No comment

☒ Comments submitted herewith

☒ Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse. (Use separate sheets if necessary).

Reviewer's Signature: David Givens Date: 6-5-78

Title: Coordinator, Community Environmental Education Programs Tele: 701-237-8386
TrI-College Center for Env. Studies, N.D.S.U., Fargo, N.D.

who makes statements such as these realizes that he or she cannot at this time provide incontrovertible evidence that the potential hazard will indeed become a reality. However, given the basic biological and ecological principles known to be operating, it can be safely predicted that translocation and concentration of these heavy trace metals will occur. The time factor involved and the degree of hazard cannot be exactly predicted or shown at this point in time. Therefore, the scientist withholds judgement until the evidence becomes hard data.

For these reasons, I believe that it is necessary to incorporate the entire paragraph found on page 105 and 106 of the technical supplement into both the main report and the summary.

"On the basis of adverse response levels found in the literature (Appendix C), the projected depositions on environmental receptors calculated in this phase of research are not expected to cause adverse effects on ecosystems during the short-term period of one year. However, questions still remain relative to the potential long-term effects of trace element emissions in the study area. Those questions become of greater significance with a projected increase in coal utilization in the study area and the states of the Old West Region."

To do less than this is to be less than honest with the public who cannot be expected to read this entire technical report. To leave out the second sentence of the above quote thoroughly emasculates the technical report and misrepresents the evidence.

In addition, the continual ignoring of results of scientific inquiry will, in the long term, cause scientists to retreat from the current willingness to serve the public by participating in studies related to public problems.

159

The Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development does not give enough attention to the work contained in the technical supplement: Climate and Air Quality, Trace Element Effects of Energy Conversion Facilities. In fact, if a person were to read only the executive summary, which will indeed be the case for many busy government officials who have little or no technical background, then one might conclude that the potential for serious air and water contamination does not exist.

To quote from the technical supplement: "Emission limitations and/or ambient standards are all non-existent with respect to specific trace elements". It is easy to imply in the summary of the report that these trace element standards will not be exceeded in the "short-term".

It is even less responsive for the main body report to omit evidence included in the technical supplement which shows that the potential for contamination does exist. Even though we can agree that evidence of the level or degree of contamination is unknown, this does not mean that contamination is non-existent. To state that the evidence is not sufficient at this time and is under further study is also a serious error because it is stretching the truth to fit what appears to be a bias of the agencies writing the report.

In reading scientific reports and interpreting technical data, it is necessary that the reviewer understand the language of the scientist. The conclusions of the technical summary, pages 98-106, include such statements as: "trace elements present the potential for environmental impact"...or..."The fraction emitted could present a potential environmental hazard." A scientist

The reason I feel very strongly about this is that I testified about three summers ago before the North Dakota State Health Advisory Board on this very subject. My data was based only on a preliminary literature study. It is now even more evident with the publication of the technical supplement that significant trace element problems remain to be solved. Yet it is disturbing to find that very little attention is still being paid to these problems in the main body of the draft impact study.

160

I would like an answer in writing to the following questions:

a) Are these review comments required to be printed in the second draft of the study?

b) And if this printing is required, is it mandatory that the Bureau of Land Management and the state of North Dakota's representatives respond to these comments?

c) If a response on your part is required and I feel that the response is inadequate or non-responsive, do I get an additional opportunity to respond so that these final comments are included in the final impact statement?

I hope that these comments are received in the spirit in which they are intended; that through cooperative effort all segments of our population will be properly served and protected through both adequate production of energy and environmental safety.

Submitted by
David Givens, Coordinator
Community Environmental
Education Programs
TrI-College University
Center for Environmental Studies
North Dakota State University
Fargo, N.D. 58102

RESPONSE TO TRI-COLLEGE CENTER FOR ENVIRONMENTAL STUDIES A-95 LETTER

#159

The importance of trace element effects upon the environment is recognized. The major reason for presenting this subject as it was in the Climate and Air Quality Technical Supplement to the Draft Study was that the referenced report was not available when the Draft went to press in September of 1977.

Trace element potential effects are updated in Part 1, "Air Pollution Effects," of this Final Study.

#160

It is not required that we print all comments in the Final, but we have done so.

It is not mandatory that BLM and the State of North Dakota's representatives respond to all comments, but we have tried our best to do so wherever possible, in a manner we hope is most useful and acceptable to the most people.

There is no formal provision for further comments on our responses to comments on the Draft Study other than is shown herein, which is the Final to the Draft. There are, however, endless ways in which any interested citizen can remain involved in any future decisions based partially upon this study. The EIS office in Bismarck or Billings, or the Governor's participating staff, will be glad to help on any further questions or comments. Also see responses #47, #60, #65, #164, Introduction, and Part 1.

These comments relate to the West-Central North Dakota Regional Environmental Impact Study on energy development as reviewed by the State Occupational Information Coordinating Council made up of representatives of the Employment Security Bureau, Manpower Services Council, Vocational Education and Vocational Rehabilitation Departments. The S.O.I.C.C. felt that a composite response would best serve your needs. These comments then specifically address the area of economic conditions/ employment.

The narrative contained in the E.I.S. is quite complete, and in general the Council agrees with the conclusions drawn by the study.

Maximizing the employment of the residents in the immediate area will necessitate the accumulation of data describing the specific skills that will be needed as well as the specific time of need, where possible, the skills available in the area to fill these anticipated needs and the provision for providing the necessary skills through training or retraining in advance of the time of need. 161

There will be need to know what training is available in the impacted area and what is needed to provide the appropriate skill training. There will be a need to know what the traditional migrating patterns are for North Dakota workers seeking employment in major construction projects similar to this such as the missile sites, air bases, Garrison Dam, the Ndkota Anti-Ballistic Missile Site, etc.

There will be a need to know what the anticipated spin off problems will be in the local area which result from the service worker group seeking and obtaining higher wage employment in the construction or operation phases.

The history of recruiting, training and migration of workers on similar projects in the State may serve well in the planning in the area of employment needs and problems in maximizing the use of local workers in the area and insuring an adequate supply of skilled workers as various phases of the project are reached.

It may be desirable to provide a single focal point to accumulate and disseminate all information relative to skills needed for the area. This dissemination of worker supply and needs information could serve to eliminate or stabilize the possibility of a mass migration to the area of potential workers whose skills are not in demand at that particular time.

The State Occupational Information Coordinating Council suggests that this should be assigned as a responsibility of the various agencies of State Government that are involved in worker training, retraining and placement. This will serve to provide the necessary technical input through a planned coordinated effort thus avoiding overlapping and minimizing the problems of employment and unemployment for the area involved.

NOSIC FORM 8 (4/78) SAI NO. 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Keith Engbrecht
CETA
216 North 2nd St.
Bismarck, ND 58501

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

- [ ] No comment
- [X] Comments submitted herewith — See attached sheet
- [ ] Desire to review final study

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use separate sheets if necessary).

Reviewer's Signature: Keith J. Engbrecht Date: 6/2/78

Title: CETA Administrator Tele: 224-2790

RESPONSE TO CETA A-95 LETTER

#161

Paragraph 1: Information of this type was used in the modeling process.

Paragraph 2: Information of this type was used in the modeling process.

Paragraph 3: As stated in the Economic Conditions section, higher wages in the energy sector would result in some job switching which would inconvenience local employers. There are no other problems anticipated beyond those discussed in the Draft Study concerning higher wage rates in the energy sector.

Paragraph 4: Same response as paragraph 1.

Paragraph 5: The North Dakota Employment Security Bureau is currently attempting to provide this service.

Paragraph 6: We agree. More coordination on an effort this size would result in more efficient job placement. We recommended increased coordination in job placement as an important mitigating measure.

NOSIC FORM 8 (4/76)

SAI No: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

RECEIVED
APR 21 1978
State Planning Division

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Thermen Kaldahl
Employment Security Bureau
1000 E. Divide
Bismarck, ND 58505

RECEIVED
JUN 9 1978
State Planning Division

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summery

The Environmental Impact Study is referred to your agency for review and possible comments. The Environmental Impact Study has been forwarded to you under separate cover. If you consider it satisfactory, please check the box labeled, "no comment." Otherwise, please check the other appropriate boxes. Your cooperation is asked in completing this memo and returning it to the State Intergovernmental Clearinghouse by June 1. If no response is received by June 9 it will be assumed you have no comment.

[ ] No comment

[XX] Comments submitted herewith

[XX] Desire to review final study

. . . . . .

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use seperate sheets if necessary).

Reviewer's Signature: Thermen Kaldahl Date: June 1, 1978

Title: Executive Director Tele: 224-2837

RESPONSE TO EMPLOYMENT SECURITY BUREAU A-95 LETTER

#162

This comment is correct. Although events have changed with respect to the seven-county study area, it is not certain at this time what will eventually occur as far as coal gasification is concerned. Consequently, any studies designed to assess the current situation run the possibility of also being out of date in the near future. If NGPL does not occur, the seven-county regional employment levels would be reduced by an amount greater than theses directly attributable to the NGPL facility because of the secondary employment created by construction and operation of the gasification plant.

DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL
ENVIRONMENTAL IMPACT STUDY ON
ENERGY DEVELOPMENT, AND SUMMARY

BUREAU OF LAND MANAGEMENT
STATE OF NORTH DAKOTA

The Regional Enviornmental Impact Study is a joint project of the Bureau of Land Management and the state of North Dakota. The Employment Security Bureau's role in the study was that of a participant in the Socio-Economic work group. This work group leader was Loren Cabe of the Bureau of Land Management. Mr. Cabe did an excellent job of involving all participants of the work group. We feel that the Socio-Economic portion of the Impact Study accurately reflects the views of the members of the study group.

We believe the Regional Environmental Impact Study has been well prepared and represents an accurate picture of the total impact on the study area based on the facts available at the time of the study.

Events that have occurred since the study was made, could drastically change the levels of impact. This is particularly true when assessing the impact of gasification. Our main concern is how will the final Impact Study reflect the changes that have occurred since the study was initiated.

The Draft Impact Study shows that Dunn County will experience heavy impact because of the construction of a gasification plant by Natural Gas Pipeline Company. The projected peak construction work force was 3,000 in 1982 and 1983. The projected permanent work force of 612 was to have been reached in 1984. The ANG Coal Company which was to have supplied coal for the plant had a projected permanent work force of 474 in 1986. This entire project is doubtful because Natural Gas Pipeline Company has since become a partner of ANG Coal Gasification Company, which proposes to build a gasification plant in Mercer County.

Plans for the proposed ANG Coal Gasification Company plant have not been finalized. If the plant is not built, it will eliminate a construction work force which was expected to peak at 2,629 in 1980. Also eliminated would be a permanent work force which was to have peaked at 640 by 1987.

Every effort must be made to have the final Impact Study document reflect accurately the impact, if any, that gasification will have on the study area.

NOSIC FORM 8 (4/76)

SAI No: 78-349

Date Received

FROM: STATE INTERGOVERNMENTAL CLEARINGHOUSE
STATE PLANNING DIVISION
STATE CAPITOL
BISMARCK, NORTH DAKOTA 58505

RECEIVED
APR 21 1978
State Planning Division

ENVIRONMENTAL IMPACT STUDY FOR YOUR REVIEW

TO: Mr. Russell Stuart
ND USDA & Farm Department
2121 Lovett Avenue
Bismarck, ND 58501

RECEIVED
JUN 7 1978
State Planning Division

ISSUED BY: Bureau of Land Management/State of North Dakota

DATE: April 21, 1978

NAME OF PROJECT: Draft West-Central North Dakota Regional Environmentel Impact Study on Energy Development, and Summary

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[ ] No comment

[X] * Comments submitted herewith

[ ] Desire to review final study

. . . . . .

Specific comments which are to be attached to the review statement which will be submitted by the State Intergovernmental Clearinghouse: (Use seperate sheets if necessary).

* It is our understaing that the deadline for Comments has been extended. We will submit our Comments by June 19, 1978.

Reviewer's Signature: Russell Stuart Date: June 6 1978

Title: Economist Tele: 224-2260

Public Service Commission
State of North Dakota
Capitol Building
Bismarck, North Dakota 58505

Commissioners
Richard A. Elkin, President
Ben J. Wolf
Bruce Hagen
Secretary, Janet Sauter

June 9, 1978

Dr. Gary Johnson
Regional Environmental Impact Statement
1533 North 12th Street
Bismarck, ND 58501

Dear Dr. Johnson:

The Public Service Commission has had time to review only the soils sections of the draft Regional Environmental Impact Statement with any kind of thoroughness. Therefore, our comments will be limited only to those sections. We have divided the comments into two sections. There will be a section with specific comments and another section which provides a general summary of our impression of the soils information as a whole.

Sincerely,

Bruce Seelig

Bruce D. Seelig
Environmental Scientist

BDS/pae

Attachment

163

COMMENTS ON SOILS SECTIONS OF THE WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STATEMENT ON ENERGY DEVELOPMENT

A paragraph should be inserted near the beginning which indicates that the soil properties described and depicted in the maps in this report are based on general soil surveys. A detailed soil survey prepared by the Soil Conservation Service (SCS) should be consulted when small scale individual management decisions are to be made. Although this has been alluded to in some places in the report, there seems to be no place where it was clearly stated.

What soil associations have been designated as prime and who has made the designation using what criteria? It is our impression that the SCS designates prime farmland according to soil type as indicated on the detailed soils maps.

The same comment as above may be applied to farmland of statewide importance.

The system which you have chosen for soil particle classification apparently is the United States Department of Agriculture (USDA) system. The clay particles in this system are defined as less than .002 mm in diameter. The only system which defines clay particles as less than .005 mm in diameter is that used by the U.S. Public Roads Administration. If this is the system that you are using, then the silt particles should be defined as being .005 to .05 mm in diameter. Whichever system is being used, there is a definite discrepancy on page 35 which should be corrected.

The preliminary results of the Agricultural Research Service (ARS) wedge experiment should be more accurately stated on page 36 in the report. The preliminary results indicate that when more than 30 inches

-2-

of suitable plant growth material was respread over sodic spoil, the yields of various plant species did not increase. This research does not indicate that less than 30 inches of suitable plant growth material (respread over high sodium spoil) is insufficient for sustained vegetative growth, however, the vegetative yield may be lower than areas where at least 30 inches of suitable plant growth material is available for respreading over sodic spoil material.

We seriously question the assumption that in areas where less than 30 inches of suitable plant growth material will cover highly sodic materials, that this will result in productivity reductions. These soils are not very productive in the first place. The effects of a high sodium content which have been attributed to mining are also prevalent in the premined soils. In these areas there could very well be an increase in productivity because mining activities would break up the impervious hard pan which often develops in these soils. Another consideration is if within property ownership boundaries there are areas with more than 30 inches of suitable plant growth material; the mine operator is required to save this material and it is available for averaging over the entire disturbed area within the property ownership. Rule 69-05-07-07 of the Public Service Commission (PSC) regulations requires sodic spoil material be covered with a minimum of four feet of non-toxic material (suitable plant growth material), provided four feet of such material is available.

By following required procedures, the high organic matter (1.5 percent or higher) topsoil materials will not be mixed and diluted with subsurface unweathered material. This was not correctly stated on page 91.

-3-

To minimize wind and water erosion mentioned on page 91, there now is a requirement (Rule 69-05-14-04) to mulch all areas where suitable plant growth material has been respread except as approved by the PSC, annual grains may be used to establish a protective cover prior to seeding to a more permanent vegetative cover.

The PSC regulations now require the textural analyses for the overburden samples be made either by the hydrometer or pipette method, not by feel as indicated on page 153.

On page 153, Rule 69-05-07-01 of the PSC regulations now requires that during the reshaping process, all highwalls must be eliminated.

The North Dakota Century Code (NDCC) makes no requirement of double ditching for underground transmission facilities as stated on page 153. Double ditching is, however, an unwritten policy of the PSC and is included as a condition on construction permits for underground facilities if it is not volunteered by the applicant.

The NDCC makes no requirement that topsoil be segregated and respread over excavated areas in the cases of construction on transmission or energy conversion facilities as stated on page 153. This is another unwritten policy of the PSC's to include as a condition in the construction permit if it is not volunteered by the applicant.

In reference to construction and reclamation procedures outlined in 18 Code of Federal Regulations 2.69 on page 153, this only applies to natural gas pipelines. This is very important and should be pointed out.

On the wind and water erodibility maps, the degrees of erodibility represented in the legends are not positioned in a very logical manner. Also, it is difficult to differentiate between the various land suitability classes shown on map 3-7.

General Comments

From the soils point of view, this document can be very useful if it is used as a general planning document. The information can be used for overview studies of the area and to provide information on a regional basis. When specific management decisions will be made, this document can be used to provide preliminary information to be followed by more detailed studies.

The information provided in this REIS will be useful to people making decisions on a regional or statewide basis. It will also point out areas where more information is needed. However, it will not replace the need for more detailed technical information which is needed to make management decisions on a site specific basis.

RESPONSE TO PUBLIC SERVICE COMMISSION A-95 LETTER

#163
Corrections and additional information are noted in Part 1, Soils, and in responses #51 and #117. Also see Appendix 4 of the Draft Study.

Sierra Club NORTHERN GREAT PLAINS OFFICE
Post Office Box 1078, Lander, Wyoming 82520

June 15, 1978

West Central North Dakota
Regional Environmental Impact Study
Suite 2, Capitol Place
1533 North 12th St.
Bismarck, N.D. 58501

COMMENTS OF BRUCE HAMILTON
SIERRA CLUB NORTHERN GREAT PLAINS REGIONAL REPRESENTATIVE
ON
THE DRAFT WEST-CENTRAL NORTH DAKOTA
REGIONAL ENVIRONMENTAL IMPACT STUDY ON ENERGY
DEVELOPMENT

Thank you for the opportunity to submit comments on this draft environmental study (DES). I am a little uncertain how to comment since the DES is a hybrid environmental impact statement (EIS) and is no longer designed to comply with the National Environmental Policy Act (NEPA) and clear the way for any major federal decisions. Since this is not a formal EIS and has not been subject to formal NEPA review, the Sierra Club must clearly state for the record that it would object to the implementation of any of the projects covered by this DES until formal NEPA compliance has been achieved. 164

Several procedural questions remain unanswered. Does the Bureau of Land Management (BLM) plan to write a formal EIS before leasing resumes in North Dakota? Will a final federal-state impact study be prepared after comments are received on this DES? Is there or will there be a federal-state preferred alternative or proposed action? (The "proposed action" in the DES is proposed by industry but has not been accepted as inevitable and desirable by the state and federal governments, I assume.)

The DES should cover in more detail the impact of new source pollution on existing and potential Class I clean air regions. The 165

Clean Air Act Amendments of 1977 designated Theodore Roosevelt National Memorial Park and the Lostwoods Wildernees in Lostwood National Wildlife Refuge as mandatory Class I areas. There is a petetion pending before the state to designate Dunn County a Class I area. The DES should address the potential impact of Level 1, Level 2, and Level 3 air pollution on these areas. It is inadequate to restrict DES study to compliance with the lower Class II level.

The most disappointing and inadequate section of the DES was the alternatives section. This section gives only cursory attention to extreme alternatives. The DES examines extremes such as no further coal development, no leasing of federal coal, relying solely on alternative energy, and relying solely on energy conservation. It then passes these alternatives off as unrealistic. An attempt should be made to investigate real alternatives. For example, would a mix of holding back <u>some</u> projects, leasing <u>some</u> federal coal, and <u>relying more heavily but not entirely</u> on renewable energy resources and energy conservation be a realistic and environmentally desirable scenario? 166

Another problem with this section is that some very promisisg alternatives are not fleshed out enough to offer the decision-makers sufficient information. For example, the alteration of schedules alternative sounds like a promising way to minimize social impacts coused by boom and bust construction worker population peaks. But this concept is not given sufficient consideration to help the decision maker with specific choices. The same problem exists for the project modification and coal export alternatives. 167

The altennatives section is also inadequate because it tends to emphasize the adverse effects of the alternatives and deemphasizes the positive effects. For example, the loss and/or delay of coal tax dollars is cited as a major drawback of most of the alternatives. However, it is not brought out that if the alternative results in less social impact and less environmental destruction then there is less need for coal tax revenue. Similarly, the claim that the no further coal development alternative would lead to continued unemployment and population declines contradicts the fact that the counties are now experiencing population increases (page 34 of summary) and much of the unemployment comes from job seekers moving into an energy boom area.

If this DES is rewritten and a final study is prepared I would hope that the study team would come up with a set of alternatives that attempt to minimize social and environmental disruption and at the same time provide adequate energy supplies. 168

The team needs to explore and present to decision makers real alternatives that look into the following questions: How much federal coal leasing is desirable and where should or shouldn't it occur? What would be the advantages of various types of coal export policies? What would be the optimum alternation of schedules to achieve minimal adverse social impact? How much coal development could be

(3)

realistically replaced by renewable energy resource use in the 1977-2000 time frame if a concerted effort was made to emphasize use of renewable sources? Is there a need for all the proposed coal-derived energy if energy conservation is pushed not only in North Dakota but throughout the service region? Will high priced synthetic gas be able to compete with Northern Tier gas? If gas is deregulated soon will demand projections shift in the service region?

Without answers to these and similar related questions it is impossible for the decision-makers to make an intelligent choice.

One final comment on the format of the DES. The main report is so oversized that it is difficult to use, carry, and store. Next time please stick to a smaller standard size with fold out maps if necessary. The summary volume was most helpful.

Please keep me informed as to the progress of the DES and the events it covers. Thank you.

##########

RESPONSE TO SIERRA CLUB LETTER

#164

The North Dakota Regional Environmental Impact Study is not formally an environmental impact statement (EIS); however, a major objective of the study is to comply with the intent of the National Environmental Policy Act (NEPA) in apprising decisionmakers on the cumulative effects of proposals requiring federal and state actions. In addition, the public review program for the study was designed to solicit and evaluate comments from involved publics, including formal public hearings, in conformity with the public review goals of NEPA. It has never been intended that the regional study replace the formal state or federal permit or environmental assessment requirements on specific proposals. These will be dealt with on a case-by-case basis or program basis according to individual agency procedures. Hopefully, the regional environmental study will provide useful information for these specific proceedings or EISs and provide a better understanding of broad regional implications.

A revised federal coal management program is currently being developed by the U.S. Interior Department, including the preparation of a nationwide programmatic environmental impact statement. Formal NEPA compliance regarding the leasing or management of federal coal must be consistent with the requirements of that policy once it is developed and issued. It is unlikely that a duplicate regional environmental impact statement would be issued simply to comply with formal NEPA procedures. Instead, it is more likely that NEPA requirements related to federal coal will build upon the analysis already inherent in the regional impact study where applicable, and will expand upon this analysis where necessary.

Since there is no administrative machinery for developing a federal-state-local proposed energy development plan for a geographic area, the regional impact study did use industry plans, circumscribed by specific federal and state standards, as the basis for its cumulative assessment. This evaluation will be used in the completion of a seven-county land use analysis by the Bureau of Land Management, culminating in coal leasing and management decisions consistent with the new program now being developed.

Therefore, no long term federal leasing will resume in North Dakota until that plan is complete and the specific decisions in that plan are covered under formal environmental impact statements or assessments on a site-specific or cumulative basis as appropriate.

Also see responses #47, #60, #65, #160, Introduction, and Part 1.

#165

Updated information concerning the 1977 Clean Air Act Amendments and the Prevention of Significant Deterioration of Air Quality provisions of this law is discussed in Part 1, Climate and Air Quality. Reclassification of the Theodore Roosevelt National Park to a Class I area is shown therein to have a dramatic influence on sulfur dioxide emissions from Level 1 and Level 2 projects.

#166

In a document such as the Draft Study, there are a number of ways of addressing alternatives. Alternatives to the proposed action should be the alternatives capable of achieving the same desired results in net energy production as the proposed action. The Draft Study did analyze 11 specific project proposals under two levels of development, plus a third level of development assessing future coal mining activity. Federal coal study areas were also singled out. This method of analysis, in itself, provides for some alternatives. Considerable thought and discussion went into further alteration of proposals but it was realized that the number of combinations of proposals alone would become astronomical. This is not a decision-making document; therefore, it would be inappropriate to address some combinations of proposals and other alternatives without addressing all such combinations. The concept was to show the decision-maker that various combinations are possible through the use of alteration of scheduling and project modifications. It was also necessary to point out that there could be other ways of achieving the desired goal without the proposals, such as conservation and coal export. This approach left the decision up to the decisionmaker. A scenario such as proposed in the comment could be realistic and environmentally desirable, if reliable quantification of how much renewable energy resources could contribute economically and how much energy could be saved by conservation measures could be shown. If the latter cannot be obtained, then such a scenario would not be realistic in achieving the same goals as the proposed action.

#167

The intent of the analysis in this alternative was to point out the possibility and advantages of phased timing without actually suggesting a timing scenario for the plants involved. The Public Service Commission of North Dakota is the agency with the expertise, responsibility, and authority to determine a logical and efficient time table for plant construction in that state.

The population graphs on page 34 of the Summary show that net population in the seven-county study area is expected to increase in the future without Level 1 or Level 2 development. This phenomena, however, is primarily a result of people moving away from the more agriculturally-based areas such as Dunn, Mercer, and McLean Counties to communities such as Bismarck and Dickinson. Consequently, these rural areas are, as the graphs show, expected to continue to lose population in the future without energy development to those areas which have a more developed infrastructure.

#168

The alteration of schedules alternative was designed to show that social impacts could be minimized if proposals were extended over a longer construction schedule. Also, the modification of proposals provided information on the minimizing of other environmental impacts. Also see response #166.

Regarding the national federal coal leasing program, a programmatic EIS currently being prepared will address production goals and the states and regions from which these goals would be met. These production goals have been prepared by the Department of Energy and the states of the coal regions. The Bureau of Land Management does not set the policy related to production rates. The Draft Study has provided, in the impacts chapter under each of the environmental components, environmentally sensitive areas that should not be disturbed by mining. However, specific areas where mining of federal coal should or should not occur are delineated through the Bureau of Land Management planning process, as described in the third column of page 17 and in Figure 1-34, page 18 of the Draft Study. The study also has shown that federal coal leasing is not the key in controlling the proposed development, but is controlled through other permitting procedures. This was described in the third paragraph, column one, page 19 of the Draft Study.

The advantages of coal export have been covered in Chapter 8, Alternative 5, paragraph 5, page 202.

The alternative on alteration of schedules was provided to show that this is an option open to a decisionmaker. However, if the alternative specifically established the order of construction of the projects, this would probably exceed the authority established by the various statutes. Such a scenario could also be misconstrued as an endorsement and would place the study in the role of decision-making rather than introducing alternative approaches that could be taken. In order to develop the optimum, it would require analyzing all combinations of the proposals over varying timeframes. The alteration of schedules also could not achieve the goal of the proposed action by producing the needed energy supply in the requested timeframe. Also see response #167.

It is clear that on a national scale, geothermal and hydropower are the most likely candidates for increased energy production that could replace energy development for North Dakota. Much of the discussion on this topic (see Chapter 8, Alternative 6) would depend upon the breakthroughs in research that would make energy production by renewable resources methods more competitive, or the price of current energy would increase to make renewable resources competitive.

For details on the need of the proposed developments, if conservation is active, refer to Chapter 8, Alternative 7, paragraph 3, page 293.

A specific answer to the deregulation comment cannot accurately be predicted until Congressional and Presidential action has been taken on the energy legislation related to gas deregulation.

NORTH DAKOTA STATE PLANNING DIVISION

STATE CAPITOL, NORTH FLOOR, BISMARCK, NORTH DAKOTA 58505
701 224-2616

June 20, 1978

STATE INTERGOVERNMENTAL CLEARINGHOUSE SUPPLEMENTARY "LETTER OF COMMENT"
ON PROJECT ENTITY IN CONFORMANCE WITH OMB CIRCULAR NO. A-95

STATE APPLICATION IDENTIFIER: 7804157349

To: Bureau of Land Management/State of North Dakota

Honorable Governor Link
First Floor
State Capitol
Bismarck, ND 58501

Dear Mr. Link:

Subject: Draft West-Central North Dakota Regional Environmental Impact Study of Energy Development and Summary.

This Draft EIS was received in our office March 23, 1978.

In the process of the A-95 review, the attached comment was received from North Dakota Game and Fish Department.

This document and attachment constitute the further comment of the State Intergovernmental Clearinghouse, made in compliance with OMB Circular A-95. Previous comments were forwarded with a "Letter of Comment" on June 11, 1978 and June 19, 1978.

Sincerely yours,

Lonnie A. Banks

Mrs. Leonard L. Banks
Associate Planner

LEB/ms

Attachment

NORTH DAKOTA GAME AND FISH DEPARTMENT COMMENTS
ON THE
EXECUTIVE SUMMARY
DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY

Page 2. According to other available information, one alternative method for transporting product gas that has been considered would be to tie in with the proposed Northern Border Pipeline which will pass the Antelope Valley Project a short distance to the south. Apparently, NDPA plans such a tie-in. This alternative should be discussed in this document. 169

Page 3. The formation of a consortium to build the ANG plant necessitates the updating of some information presented here.

Why does Basin's planned complex require almost 20 percent more coal than Coyote I and II would, and an amount approximately equal to the needs of Coal Creek Station, a power plant with about 120 % more generating capacity?

Page 5. Again, NDPA plans to use 13.5 MTY of coal and 11,760 acre-feet of water per year, and ANG plans to use 9.4 MTY, and 17,000 acre-feet of water annually. The reasons why two large plants producing equal amounts of gas exhibit such wide ranges of needs for natural resources should, in the interests of conservation, be fully explained. Also, where will NDPA get it's electricity?

For clarity, it should be noted that the heating value of lignite is 6,660 BTU's per pound. 170

Page 10. The section on mitigating measure should make clear whether the table on the previous page was compiled from data which reflect the situation before or after such mitigating measures have been implemented, as it is it is misleading, in that the section tends to give the impression that the values given in the table will be reduced by the mitigating measures. 171

Page 20. It is noted here that Level I projects will disturb 49,670 acres, and Level II projects 92,461 acres. The Basin, Dunlap, and Proposed Action sections give these figures as 34,217 and 76,017, respectively. The reasons for this discrepancy should be given.

Page 22. In two successive paragraphs National and state grasslands, state forests, and hardwood draws are first referred to as exclusion areas, then avoidance areas. Since the distinction between "exclusion area" and "avoidance area" is an important one, this text should be clarified. 172

Page 23. The bald eagle is now an endangered species.

Page 47. The opening sentence under "Coal Export" is obscure in meaning and should be revised. We suggest something like "Most of the coal now mined in North Dakota is burned in the state and converted to electricity, most of which is in turn transported by transmission line to be consumed in areas outside the state." 173

NORTH DAKOTA GAME AND FISH DEPARTMENT COMMENTS
ON THE
DRAFT WEST-CENTRAL NORTH DAKOTA REGIONAL ENVIRONMENTAL IMPACT STUDY
ON ENERGY DEVELOPMENT

Page 1. Paras. 9. In order for the South Heskin mine to supply Coyote I, Knife River Coal Company will have to open a new mine (near Hight, we understand) to supply its present commitments. Since this new mine will involve impacts directly related to the proposed action, it should be mentioned here. 174

Page 9. Paras. 13. Why will Coyote I not use its blow-down water for ash handling and flue gas desulfurization system rather than good water, as Antelope Valley will do? This would reduce the need for a considerable discharge of blow-down water to the Missouri River.

Page 48. Para. 1. The last sentence should be changed to read, "..... pheasants and Hungarian partridge have become established." 175

Page 48. Para. 16. The last sentence should be documented or referenced.

Page 49. Paras. 3. The text in this paragraph and Map 2-26 corresponds very poorly. Portions of McLean and Burleigh counties have high sharptail densities while the remainder of these two counties, excepting the Missouri River drainage, is medium density.

Para. 16. The last sentence in this paragraph should end with the phrase "unless food and dense cover of sufficient quality and quantity are available."

Page 51. Para. 30. There are quotes around this paragraph, but its origin is not clear from the text.

Page 52. Para. 1. The paragraph needs to be updated by stating that the northern bald eagle is now classified as a rare and endangered species.

Para. 26. This passage makes no mention of the Federal Endangered Species Act, which provides for protection and rehabilitation of endangered species and their habitat. The probable effect of the law on endangered species in North Dakota in the next 20 years should be evaluated.

Page 109. Para. 13. It should be mentioned that trenching or drilling in a clay-seal wetland could break through the seal, resulting in drainage of the wetland.

Para. 14. The question of significance of power line mortality is an important one, but the term "significance" is not defined here. The location of the line is important also. Any lines which cross the Missouri River have a greater destructive potential since this is a major migration corridor for many types of birds. This discussion needs to be expanded to include such information, together with a recognition of the fact that if transmission lines are added in relatively small increments over time, their individual contributions to line mortality may be small, but their total contribution could be quite serious. Such recognition also belongs on page 111, para-

graph 11. Finally, if only 665 miles of lines will result from Level I, it must be remembered that to this must be added a certain number of new distribution lines, of the type which caused the kill shown in figures 3-8.

Para. 17. The figure of 10 small mammals per acre is extemely low in our estimation.

Page 110. Para. 8. We must disagree with the contention that raptor populations will "not measureably" be reduced through power line mortality. Recently 27 raptors were found dead under a stretch of power line in Wyoming. Depending upon the species (i.e. bald eagle), power lines have the potential of posing a serious menace to certain regional populations.

Para. 10. The last line in this paragraph implies that "successful reclamation" of wetlands, woodlands, and shrublands is a certainty. We are by no means as optimistic, especially as regards wetlands and woodlands.

Para. 17. Will special devices not be employed on intake structures to avoid entrainment of fish?

Page 111. Para. 2 We understand that this paragraph contains misinformation regarding the number of ferret sightings in the seven county area, and must be re-written.

Para. 20. Again, the term "significant" is proving to be a problem. While the Washburn Mine may have little impact on the statewide antelope population, local impacts could be severe. It could, in fact, contribute to the difference between being able to hunt antelope locally and having to travel some distance away to do so.

Page 155. Para. 27. We believe that the assertion that, because productivity on reclaimed land was 77 percent of pre-mining productivity after two years, full production would be expected after five years, is deserving of documentation, together with a statement as to the probability that such productivity will continue afterwards. 176

Page 156. Para. 1. Reclamation of native prairie with reduced species diversity would almost certainly reduce its wildlife potential. This should be discussed.

Para. 6. We have reservations about the statement, "Reclamation potential of badlands or barren lands is considered good." Even if "forage production" can be restored, species diversity would be reduced, along with wildlife potential. Esthetic enjoyment of a unique area would also suffer. While we agree forage production is important, we believe this section should direct more attention to other equally important factors.

RESPONSE TO NORTH DAKOTA GAME AND FISH DEPARTMENT A-95 LETTER

#169

The Northern Border Pipeline as a method of transporting the synthetic natural gas has been considered. The NGPL project proposes to use the pipeline as their primary means of transporting their gas, provided it is constructed and operational prior to the completion of the NGPL project. This was noted on page 5 of the Summary and page 2 of the Draft Study. The analysis of the impacts took into account the possibility of Northern Border Pipeline as the primary route for the gas from the NGPL project.

Because of the cost of gasification plants and the current financial situation, a consortium has been formed to construct the ANG Coal Gasification Plant. This group is currently made up of subsidiaries of American Natural Resources Company, Peoples Gas Company, Columbia Gas System, Inc., Tenneco, Inc., and Transco Companies, Inc.

The differences in the coal requirements are attributable to heat input for the boilers and the heating value of the coal. The rating of the units is dependent upon the size of the turbine generator, and the boiler capacity is sized to provide the equivalent heat necessary to run the turbine generator at the rated capacity. The heating value of the coal differs from 6,600 Btu per pound for Antelope Valley Station to 7,046 Btu per pound for Coyote Station.

The two gasification plans will utilize about the same amounts of coal and water. The NGPL plant will actually use 9.4 million tons per year in the gasifiers. This is the same amount that the ANG plant will use. The 13.9 million tons per year is the amount of coal received from the mine before preparation. The fines from the preparation process will then be utilized in the boilers for electric generation or marketed. ANG is purchasing its power from the Antelope Valley Station. The mining of the coal is a joint venture. Thus, the amount of coal appears to differ.

The amount of water to be used by either plant is also about the same. The 17,000 acre-feet per year for the ANG plant was based on the water permit issued by the Water Commission. Based on more recent design information, the actual consumption is expected to be around 12,000 acre-feet. Some of the differences in numbers are accounted for because the design engineering for each project is at different stages. Basically, the ANG figures have normally been more refined as their design engineering has progressed while the NGPL figures are based only on preliminary designs.

NGPL will produce its own electricity as pointed out on page 7, column 1, paragraph 9.

The reference to the heating value of lignite on page 5, column 2, of the Summary should read 6,660 Btu's per pound of coal.

#170

It is assumed that the comment on air quality mitigation refers to Figures 4 and 5 on page 9 of the Summary. The Summary is only a brief encapsulation of what is stated in the main body of the Draft Study. This subject was discussed in more detail in the complete Draft Study.

In the case of particulate matter, visibility, public nuisances, and other aesthetic environmental factors, the measures described in the section on mitigation are indeed additional mitigation measures. These measures include minimization of exposed mine surface area, orientating topsoil stockpiles to retard wind erosion, quickly restoring vegetative cover to reclaimed areas and topsoil stockpiles, and sprinkling or oiling haul roads. These mitigation actions may well reduce the values shown in Figures 4 and 5 since the values shown are the maximum, worst-case conditions without consideration of these additional measures. A more detailed discussion on mitigation is presented in the Draft Study.

#171

The figures on pages 20 and 21 of the Summary represent total disturbance, while the figures in the Soils, Geology, and Proposed Action sections represent mined acres.

See response #32, and Part 1, Recreation, for exclusion/avoidance clarification.

#172

Since the Draft Study was prepared, the northern bald eagle has been officially designated as an endangered species. This update is noted in Part 1, Animals.

#173

The first sentence under the Coal Export alternative on page 47 of the Summary should be revised to read: "A large amount of the coal currently mined in the seven-county study area is converted, within the area, to electrical energy which is then exported by transmission lines for use outside the state".

#174

The Knife River Coal Mining Company has considered the possibility of opening a mine in the New Leipzig area to supply its present commitments at the South Beulah Mine. However, at this time, there has been no definite decision to establish the mine, nor has a location been determined. The South Beulah Mine will be capable of supplying both the present commitments and the Coyote Station with some additions in equipment and a new tipple.

The Coyote Station will use blowdown water for ash handling and the desulfurization system. However, even with this use, the station will have an excess of blowdown that cannot be utilized in the plant.

#175

Page 48, paragraph 1 - Correction noted in Part 1, Animals.

Page 48, paragraph 16 - As implied by the wording in the Draft Study, this was a judgment by the Animals Work Group (see Chapter 9). We do not believe it needs to be referenced.

Page 49, paragraph 3 - A better wording for the paragraph would be the following: "Although they lack the expenses of grassland characteristic of the very best sharp-tailed grouse habitat, most of Morton, Oliver, Mercer, and Dunn Counties have high sharptail populations compared to McLean and Burleigh Counties, only parts of which are rated high (Map 2-26). Stark County is rated the lowest of the seven counties for sharptails."

Page 49, paragraph 16 - Although the sentence in question is not worded well, the suggested addition would be redundant to the next paragraph

Page 51, paragraph 20 - The reference is Bishop and Culbertson (1976) which is cited immediately above the quotation. However, this quote should be eliminated. See Part 1, Animals, for a discussion of new information on prairie dog towns within the seven-county study area.

Page 52, paragraph 1 - The comment is correct. The paragraph in question should be eliminated and the northern bald eagle added to the list of endangered birds on page 51, column 3, paragraph 8, with proper Federal Register citation. See Part 1, Animals.

Page 52, paragraph 26 - A discussion of the Endangered Species Act of 1973 is now included in Part 1, Animals.

Page 109, paragraph 13 - Although not specifically stated, we thought the wording conveyed the idea that drainage from trenching was one of several ways wetlands could be damaged. See Part 1, Animals, for a revision of this paragraph.

Page 109, paragraph 14 - We understand the term "significant" to mean having, or likely to have, measurable influence on the population in question.

We agree that location of the electrical transmission lines is important. Map 1-6 on page 10 indicates one crossing of the Missouri River (Lake Oahe) in the vicinity of the mouth of the Cannonball River. Transmission lines suspended over the water could cause considerable bird casualties. This crossing site is in a staging area for migratory waterfowl. Resort Game and Fish Department estimates indicate that peak populations of mallards in that area are 8,000-10,000. Also, winter waterfowl counts nearly always note bald eagles in the area. Efforts by the Fish and Wildlife Service failed to have the line crossing moved north of Bismarck or to a point south of the presently proposed crossing where it was believed fewer losses would occur. We agree that the piecemeal addition of unknown miles of smaller distribution line system will create additional collision mortality. See Part 1, Animals, for a revision of this paragraph.

Page 109, paragraph 17 - Losses on some areas of good habitat would amount to considerably more than 10 small mammals per acre. The figure cited (10 per acre) is an average based on field work within the study area. It may be low, but it was the best citable estimate available to the Animals Work Group.

Page 110, paragraph 8 - It is always unpopular and suspect with some groups to conclude that a certain impact will not (measurably) result in losses to a species. Perhaps a better word than "measurably" would be "significantly" since every dead individual of a species that can be found and counted is in a sense a measurment. "Significant" may be a more suitable and understandable word even if the conclusion it connotes is not acceptable to some interest groups. As used in the discussion, it means having, or likely to have, a noticeable influence on a specified portion of the population. There is evidence of eagles building nests and successfully rearing young on transmission tower structures with no apparent loss of any of the birds. Although raptors do collide with transmission lines occasionally, this does not appear to be a threat to any raptor populations. See the discussion of raptor electrocutions in response #19.

Page 110, paragraph 10 - It is agreed that the implication is not appropriate. In Part 1, Animals, the last sentence has been changed to correct the error.

Page 100, paragraph 17 - The intake structures will have screens (of as yet unspecified mesh) that will protect larger fish from entrainment. However, protective devices for preventing the uptake of newly hatched fry and very small fish that cannot withstand the intake velocities have not been developed.

Page 111, paragraph 2 - A complete revision of this paragraph is included in Part 1, Animals.

Page 111, paragraph 20 - Locally severe impacts on antelope are not anticipated from mining in the Washburn Level 2 area. The word "significant" is defined above.

6176

Refer to responses #41 and #51, and Part 1, Vegetation.

Vegetation impacts throughout the Draft Study briefly mention the potential affects to wildlife. Details of the effects are discussed throughout the Animals section. Also see the Aesthetics section.

NORTH DAKOTA STATE PLANNING DIVISION

STATE CAPITOL - NINTH FLOOR - BISMARCK, NORTH DAKOTA 58505
701-224-2418

June 19, 1978

STATE INTERGOVERNMENTAL CLEARINGHOUSE SUPPLEMENTARY "LETTER OF COMMENT" ON PROJECT REVIEW IN CONFORMANCE WITH OMB CIRCULAR NO. A-95

To: Bureau of Land Management/State of North Dakota

STATE APPLICATION IDENTIFIER: 7804187349

Honorable Governor Link
First Floor
State Capitol
Bismarck, ND 58505

Dear Mr. Link:

Subject: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development and Summary.

This Draft EIS was received in our office March 23, 1978.

In the process of the A-95 review, the attached comment was received from the State Historical Society.

This document and attachment constitute the further comment of the State Intergovernmental Clearinghouse, made in compliance with OMB Circular A-95. Previous comments were forwarded with a "Letter of Comment" dated June 12, 1978.

Sincerely yours,

Lonnie A. Banks

Mrs. Leonard D. Banks
Associate Planner

LDB/mc

Attachment

State Historical Society
of North Dakota

June 19, 1978

State Intergovernmental Clearinghouse
State Planning Division - Ninth Floor
State Capitol
Bismarck, North Dakota 58505

Re: Draft West-Central North Dakota Regional Environmental Impact Study on Energy Development, and Summary.

Gentlemen: 177

In accordance with Section 106 of the National Historic Preservation Act of 1966 (80 Stat. 915, 16 U.S.C. 470), Executive Order 11593, "Protection and Enhancement of the Cultural Environment" (36 FR 8921, 16 U.S.C. 470), Advisory Council on Historic Preservation's "Procedures for the Protection of Historic and Cultural Properties" (36 CFR Part 800), the National Environmental Policy Act of 1969 (83 Stat. 852, 42 U.S.C. 4321) or Office of Management and Budget Circular A-95, the State Historic Preservation Office (State Historical Society of North Dakota) has reviewed the above referenced document and makes the following comments:

1. The format is too large to use comfortably or to store on standard shelving. A smaller, more standard format for the text, perhaps with an oversized map section to accompany the text, would be preferable.

2. Page 53: The list of areas surveyed for cultural resources is incomplete, because only large area surveys (and not all of those) are listed. Smaller scale surveys, such as those performed for highway, transmission line and municipal activity projects have not been noted. The estimated number of sites in each county is also out-of-date and incomplete. For example, the sites recorded during the BNG survey mentioned on this page have not been included in the total for Mercer County. 178

3. Page 54: Although the suggestion that the emphasis of previous cultural resource inventory efforts have been directed toward prehistoric sites at the expense of historic sites is basically correct, work on historic sites has been conducted within the study area and should be treated in the same manner as that for the prehistoric sites as outlined in Table 2-4D. Several of the surveys mentioned in Table 2-3D included such information.

In the section entitled "Prehistoric and Historic Features: Fort Berthold", the suggestion is made that no sites outside of the boundaries of the Fort Berthold Reservation can be historically associated with the Mandan, Hidatsa or Arikara people This is an error. Many sites outside of the Reservation can be associated with these

specific groups of people at least for the Late Prehistoric and Early Historic Periods of North Dakota's history.

In the section entitled "Prehistoric and Historic Features: Federal Coal Study Areas", the information presented is outdated. The ANG/Basin Electric survey considered most of the area N-1-A. In addition, parts of areas S-1, N-2A and N-2B have been surveyed intensively. This data is available and should be updated. The EIS should also identify areas where work is in progress. The listings of work done should also include a validity date for the data presented. (Example: ..."as of (date) the following areas had been surveyed...").

4. Map 2-37: Again, the areas surveyed are incomplete; for instance, the ANG/Basin Electric area mentioned in the text has been intensively surveyed and this data is availabe and should be updated in the final document. The 1975 Garrison Reservoir Shoreline Survey, performed by the University of North Dakota has been omitted and although recorded as early as 1969, the Washburn Mound Group is not listed in this draft. This type of information should be rechecked and verified with the State Historical Society prior to publication.

5. Maps 2-42 and 2-50: Fort Clark State Historic Site and Double Ditch State Historic Site are both listed as "State School Lands". They are not. Both belong to the State Historical Society. The following State Historic Sites which exist within the study area are not mentioned at all: Menoken Indian Village, Crowley Flint Quarry, Killdeer Mountains Battlefield, Huff Earth Lodge Village, Chaska, the Steamboat Warehouse and Camp Hancock. Fort Mandan State Historic Site is marked on the map in the place where the McLean County Historical Society has a reconstruction of that fort, rather than in the place where the State Historic Site really is. The Knife River Indian Villages National Historic Site is correctly identified in the legend, but is marked on the map as a "Potential State Natural Preserve".

6. Page 114: The statement in the third paragraph that historic activites were geographically limited, and the implication that few sites exist away from the rivers and rail routes is incorrect. Historic sites such as underground coal mines and pioneer farmsteads, for instance, have a much wider distribution than indicated in this section.

7. Page 114: The suggestion in the second paragraph of the second column that the majority of the recorded sites cannot be placed in a context, is misleading; in fact, most of the recorded sites have not been adequately tested or evaluated and cannot be placed in a spatial or temporal context for that reason. If such evaluation is undertaken, most of the recorded resources may be placed in a context. The paragraph implies that the majority of the sites recorded may be of relatively little value, which simply is not a supportable statement.

8. Page 115, Table 3-81: This data is incomplete. Under the category "early coal mines," items numbers 3 and 4 under the Glenharold Mine were defined in the 1976 report on the survey of this area; forty-four historic sites were recorded in the 1977 report on the ANG project area. The source reference quoted should read "Woolworth", not "Wodworth".

9. Page 160, paragraph two: The statement that sites within the level one areas have been evaluated is misleading most of the level one area has been inventoried, but very little "evaluation" has been carried out.

10. Page 189: Although the general text accurately describes the anticipated impacts, the numerical data listed here is already outdated and misleading. Sites not yet identified should also be considered.

11. Page 194: The specific site data presented here is misleading and outdated for instance, Consol's Glenharold mining operation has already destroyed at least two historic underground mining areas without adequate recording and with no evaluation of these sites. The intent of this section is, however, clearly in accord with current preservation principles and is supported by the Society/SHPO.

12. Page 202: Alternative 5, 6 and 7 offer no consideration of impacts on cultural resources.

13. Page 224: The statement that most of the level one area has been subjected to both inventory and "evaluation" is incorrect; in fact, most of the area has received only inventory, and virtually no evaluation of the sites recorded has been undertaken. It is also our opinion that the 1940-1950's surveys performed by the River Basin Surveys section of the Smithsonian Institution, and others, in relation to mainstem dam construction are outdated and grossly inadequate. New sites within the areas surveyed during the 1950's are still being reported with a high degree of regularity. Beyond that, there are serious problems with data accuracy and evaluations of sites from data produced by those surveys; for instance, the Moe Site (32MN1) which is the site of greatest antiquity recorded in North Dakota with <u>in situ</u> cultural remains was not evaluated correctly or tested/mitigated properly during the Garrison Reservoir salvage project. The rest of this section is quite good and very supportable by this agency. We are very pleased to note that this section attempts to clarify most of the inaccurate impressions about the status of "evaluation" created by misuse of the term in earlier sections of the document.

14. Page 239 plus (References): Several ommissions were detected in this section, for instance, four of the cultural resource inventory reports referenced in the text are not listed here (Dill 1975, Loendorf 1975a and 1975b and Franke 1974).

15. General comments:
It is our opinion that this study is a fair overall effort. The authors should have dealt with philosophical aspects and considerations and left out the specific numbers used when dealing with cultural resources if the effort to get up-to-date information into the study was not to be made. Any study of this sort, of course, will be out-of-date before it is printed because new data are constantly being generated. However, if such data are to be used, the text should address the problems of putting such a data base together and keeping it up-to-date or qualify the numbers used by date validity. The presentations relating to evaluation and mitigation of cultural resources are well written and generally quite good. Given that this study suggests that consideration must be given to specific sites within specific coal lease application areas in the Environmental Analyses required by

the Bureau for each area, and in the mining plans required by the North Dakota Public Service Commission it seems pointless to try to deal with specific numbers and types of sites on the more general level of this study. It is our feeling that the cultural resource terms used in the text should be included in the glossary to aid the reader in understanding the document. The North Dakota State Historic Sites Registry is not adequately considered in the text; given the legal implications of the Registry, the involvement of the State of North Dakota in the preparation of the study document and the impacts of the actions described, we feel that the North Dakota State Historic Sites Registry should be considered. Finally, little, if any, consideration is given to the possible adverse visual impacts of energy production and mining facilities on cultural resources; some effort should be made to address this aspect of the impact of continued development.

Thank you for your consideration of these comments.

Sincerely yours,

James E. Sperry
State Historic Preservation Officer (North Dakota)
Superintendent, State Historical Society of North Dakota

JES/jm

cc: Natural Resources Council

<u>RESPONSE TO STATE HISTORICAL SOCIETY A-95 LETTER</u>

#177 and #178
(Parenthatical numbers correspond to numbered comments.)

(2,3,4)
Smaller scale surveys were included in the data totals, but not shown on the map due to their small area in relationship to the scale of the seven-county study area. The exact coverage of these small scale surveys is presently being compiled by the State Historical Society of North Dakota, and should be available from them by the end of 1978.

Data presented in the text is complete through the 1976 field season. This text was prepared during the spring and summer of 1977, and thus does not contain data generated and published after June 1, 1977.

Since that time, one major piece of research has added to the known data for the seven-county study area. The State Historical Society of North Dakota inventoried major portions of the study area for the Coteau Mine supplying the ANG Coal Gasification Plant and Antelope Valley Power Plant. There are 149 prehistoric and historic sites known as of September 1, 1978 on this project area. These sites and impacts to them have been analyzed in more detail in Part 1, Prehistoric and Historic Features.

It is basically correct that historic sites have not been considered systematically in most inventories and any such table would have been necessarily incomplete. Two areas have now been systematically inventoried for historic sites: (1) Glenharold Mine, which is covered in the Draft Study; and (2) the mine area for the ANG Coal Gasification Plant and Antelope Valley Power Plant, covered in Part 1, Prehistoric and Historic Features.

An error was made on page 54 in the section entitled "Prehistoric and Historic Features: Fort Berthold." Although it is true that prehistoric sites, except for earthlodge villages, cannot be associated with the Three Affiliated Tribes, at least one historic site can be associated with the Mandan and Arikara tribes. Fort Clark, an historic trading post located along the Missouri River south of Stanton, was built adjacent to an earthlodge village inhabitated in succession by the Mandans and Arikaras. It would not, however, be directly impacted by the various mining or energy generating proposals.

(6)
Two paragraphs on page 114 and statements on page 54, column 1, of the Draft Study emphasize that while early periods of North Dakota history are geographically limited,

homestead era features such as farmsteads, railroading features, and early coal mines could be found throughout the seven-county study area.

(7,9)
Discussions on the evaluation of prehistoric and historic features need some clarification. In most cases, in order to fully evaluate a prehistoric or historic site, it must not only be surface recorded and collected, but must also be either test excavated (prehistoric) or documented (historic) to establish its date and the significance of the information it contains. No inferences that (1) many of the known sites are valueless and (2) most sites have been <u>completely</u> evaluated without testing and/or documentation were intended. All discussions on evaluation should say that of the many sites inventoried throughout the seven-county study area, most simply cannot be totally evaluated from present documentation. Further study must be made before it is known how important these sites are.

(8)
Mine opening #3 may have been related to the Serr Mine. Mine opening #4 represents a mine operated first as the Amos 'n' Andy and later as the Stanton Coal Mine. The remains of this mine (tunnels, etc.) have been partially destroyed by modern mining.

(10)
As of June 1, 1977, nine sites had been identified as possibly impacted from ANG Coal Gasification Plant and Antelope Valley Power Plant development. Since that date, further inventory (Dill 1978) has located 137 further sites which may be impacted. Forty-four of the sites are historic and 105 are prehistoric. This inventory is treated in more detail in Part 1, Prehistoric and Historic Features.

(11)
The impacts to historic coal mines within the Glenharold Mine project area were not analyzed in Chapter 3, Environmental Impacts, because they had already been affected through earlier coal leasing decisions. The impacts to these mines were described in Chapter 2 as part of the existing situation.

(12)
Prehistoric and historic features were not considered in alternatives 5, 6, and 7 because no ground disturbing activities were definitely proposed, which made it impossible to identify any impacts to the resource.

REAP

North Dakota Regional Environmental Assessment Program

NORTH DAKOTA LEGISLATIVE COUNCIL

JOHN J. HOWLEY
DIRECTOR

June 14, 1978

Director
West-Central North Dakota
Regional Environmental Impact Study
Suite 2, Capitol Place
1533 North 12th Street
Bismarck, North Dakota 58505

Dear Sir:

This correspondence is in response to your invitation for comments on the <u>Draft West-Central ND Regional Environmental Impact Study</u>. First, I would like to comment that the report is impressive. A great deal of effort has been put into making the report understandable by the citizenry of North Dakota. The REIS staff and BLM deserve commendation for this effort. Additionally, the effort of describing, analyzing and presenting the environmental, economic, social and land use impacts of alternative levels of energy supply-related industrial development is critical. These alternatives are outlined and expressed in detail. However, there are a number of comments I would like to make that would assist in the understanding of some of the data--more specifically, some of the tables and figures used to illustrate points of interest. Secondly, a comment relating to the effectiveness of future regional and local planning efforts of which this document could be of assistance.

My comments pertain solely to the Economic sections, except for the description of baseline energy facilities.

Map 1.1 Basin Electric Cooperative's Leland Olds I and II stations are not included under the baseline scenario.

Tables 2-48 and 2-49. Table 2-48 presents unemployment rates by county, by year (1972-1975), whereas Table 2-49 presents unemployment statistics by county for 1970 by sex. There appears to be significant differences in several of the counties' unemployment rates, some of which can be attributed to the differences in years; however, it seems unlikely that differences could be so large in such a short time period. These should be rechecked and/or more explanation of the statistics in the footnote.

180 179

Suite 521 • 316 North Fifth Street • Bismarck • North Dakota 58505 • (701)224-3700

(13)
Although it is true that the River Basin surveys were done as much as 30 years ago and therefore were not up to present archaeological standards, this is not considered a significant problem for the regional study. None of the areas surveyed for mainstem dam construction on the Missouri would be impacted by the coal mining and energy production proposals analyzed by this study. The information from those surveys was used only as background for showing the range of site types in the seven-county study area. Accuracy of ground coverage and interpretation was not an issue for how the survey information was used.

(14)
For updated reference listings, see Part 1, Prehistoric and Historic Features.

(15)
In order to begin to identify the amount of impacts to prehistoric and historic features in a seven-county area, it was necessary to show numbers of sites where possible and to indicate the large areas where no data was available.

In any area such as this where there are large areas that are unknown, the data presented quickly becomes out-of-date as more research is done. All available data for the seven-county study area through June 1, 1977, was included in the Draft Study. In addition, an update through September 1, 1978 was made to include inventory data from the ANG Coal Gasification Plant and Antelope Valley Power Plant because those could be significant to the proposals. This information is found in Part 1, Prehistoric and Historic Features.

The North Dakota State Historic Sites Registry was consulted for possible impacts to sites listed. No sites presently listed will be directly affected by the proposals. An updated listing is presently being prepared by the State Historical Society of North Dakota and should be available from the State Historical Society by the end of 1978.

Visual impacts were considered in Aesthetics sections.

The changes suggested for Map 2-42, "Recreation Resources," in the Draft Study by the State Historical Society are noted in Part 1, Recreation.

West-Central Regional EIS -2- June 7, 1978

Table 2-46. It is unclear as to what the "Total" column refers to. "Total region" or "total state"?

Table 2-52. Butte population projection was omitted. 1975 Butte population = 198.

Footnote 1 should include: (assuming baseline level of development as described in Map 1-1 under "Existing or Under Construction Energy Facilities.")

Table 2-57. Footnote should more explicitly describe that severance and conversion tax revenue estimates are not based on REAP E-D Model methodology.

Table 2-60 and Table 2-61. These tables should use the "Total Employment" column from the E-D Model output reports for each county.

Footnote should list the energy projects considered in the baseline scenario.

Table 2-63. This table sources ND-REAP. I would suggest that the source be rechecked. The per capita incomes are slightly higher than indicated in the E-D output provided to REIS staff.

Table 2-64. For the baseline forecast of Personal Income, the "Total Personal Income" column of the Regional Economic Activity Report from the E-D Model output should have been used. It represents the baseline personal income estimates, without any further development than described in the baseline scenario.

Table 2-65. For the baseline forecast of Business Activity, the "Total Business Activity" column of the Regional Economic Activity Report from the E-D Model output should be used.

Tables 2-66, 2-67, 2-68, 2-69. There is no explanation or reference to the methodology used to compute the severance and conversion tax revenues. Also, the footnote should list the energy projects considered in deriving these revenue estimates, along with their coal and/or electrical conversion production.

Table 2-88. The date in the footnote should read, "June 30, 1979," not "June 30, 1978."

Table 2-70. The source should be rechecked: I don't believe it was included in the E-D output. Such data is not a standard report.

Table 3-91. Economic sectors should be numbered so that one can correspond the text with the Table. Also, under the heading "Economic Conditions: Level 1" (page 125), last paragraph, last sentence--the comment in parenthesis("3 through 11 of Table 3-91)" is unclear. It should read "(sectors 3 through 11 of Table 3-91)".

Figure 3-27. This figure indicates that cumulative indirect employment estimates for 1981 are approximately 3500 employees. However, the E-D output lists the total indirect employment in 1981 at 4543. It is important that the illustrations approximate the estimates as closely as possible.

Table 3-83. Again, the per capita income figures are slightly higher than that indicated in the E-D output provided NDIS staff. You should recheck the source.

Table 3-96A, Table 3-97, Table 3-105, Table 3-106. Again, you state the source as ED-REAP. The E-D Model output provided to the NDIS staff did not break out business volumes by sector. Recheck your source.

Table 3-101. The per capita income estimates are slightly higher than the E-D output provided the NDIS staff indicates. Recheck the source.

As a final comment and concern, I am surprised that the monitoring of economic effects of energy-related development was not mentioned in the mitigating section of the report. The projections provided in this report are based on the present "state of the art", (technology, if you will), and it should be of vital importance not only to check the accuracy of present-day projections, but to receive that data and information that would allow updates of, and refinements to, projections as the state of the art improves. Monitoring is an effective mechanism to acquire this information, and I urge you to consider its value to North Dakota.

Sincerely,

Brian Schaible
Socioeconomic Resource Analyst

cc: John J. Hawley
F. Larry Leistritz

Paragraph 13: Correction noted in Part 1, Economic Conditions.

Paragraph 14: The data in Table 3-93 comes from REAP Economic Demographic Master Run #657 and 810. Use of more recent data results are shown in Part 1, Economic Conditions.

Paragraph 15: Table 33 of the publication cited in the response to paragraph 1, above, contains this information.

Paragraph 16: The data in Table 3-101 comes from the source cited in paragraph 1, above, using REAP ED Master Runs #657 and 500. The use of more current data results are shown in Part 1, Economic Conditions.

Paragraph 17: Monitoring is an important part of economic mitigation and inclusion is now noted in Part 1, Economic Conditions.

RESPONSE TO REAP LETTER

§179

Item 3 under the existing or under construction energy facilities of the legend for Map 1-3 should read, "Basin Electric Power Cooperative - Leland Olds Station" instead of "Consolidation Coal Company - Washburn Mine."

§180

Paragraph 1: The data in Table 2-49 comes from "Socio-Economic Impacts Associated with Energy Development in North Dakota." This is a preliminary report to the Bureau of Land Management in Billings, Montana, and was prepared by the North Dakota Institute for Regional Studies NDSU, Fargo, North Dakota, January 1977.

Paragraph 2: The "total" column in Table 2-46 should read "Total State."

Paragraph 3: Correction noted in Part 1, Economic Conditions.

Paragraph 4: The methodology for the development of revenue estimators is detailed in the Social and Economic Conditions Technical Supplement.

Paragraph 5: Correction noted in Part 1, Economic Conditions.

Paragraph 6: The data in Table 2-63 comes from Regional Environmental Assessment Program, Economic Demographic Model Master Run #657. The use of more current data results are shown in Part 1, Economic Conditions.

Paragraph 7: The use of more current data results are shown in Part 1, Economic Conditions.

Paragraph 8: The use of more current data results are shown in Part 1, Economic Conditions.

Paragraph 9: The Economic and Social Conditions Technical Supplement provides an explanation of the methodology used.

Paragraph 10: Corrections noted in Part 1, Economic Conditions.

Paragraph 11: The information in this table can be found in the publication cited in paragraph 1 above, Table 33.

Paragraph 12: Corrections noted in Part 1, Economic Conditions.

LEAGUE OF WOMEN VOTERS OF NORTH DAKOTA

June 16, 1978

West-Central North Dakota Regional Environmental Impact Study
Suite 2, Capitol Place
1533 North 12 St.
Bismarck, North Dakota 58501

Gentlemen:

A joint introductory statement to the Draft EIS, by Governor Link and Mr. Edwin Eaglick, states, "Our concerns of balancing energy needs with a quality environment in North Dakota, and subsequent policy decisions reflecting those concerns, are in part dependent upon the adequacy of this Draft Study. Your comments on this document are therefore solicited and will be given full consideration, along with the comments of other concerned citizens and groups, in the preparation of the Final West-Central North Dakota Regional Environmental Impact Study on Energy Development." It was disappointing, therefore, to be told at the Bismarck public hearing, June 7, that comments relating only to the accuracy of information contained in the draft would be entertained; there would be no discussion of scope, intent, alternatives, adequacy, etc. 181

In the Summary, each of the chapters analyzing the twelve impacting components ends with Residual Impacts, those impacts that affect which will result from drastic changes in the affected area. These residual impacts, even if totally accurate, deserve to be made generally known to the people of North Dakota and their implications should be thoroughly aired and fully discussed. Any modification of soliciting citizens' comments, if the development is made that the development described will proceed, in the interest of national energy needs, despite all the residual impacts, the real cost of the resulting energy supply, including mitigating measures and other government funded aids, should also be made known.

Conservation is another factor mentioned in the Summary, the section on Alternatives, p. 47: "In fact, conservation efforts would need to be only 5.9% to 9% effective in order to equal the proposed energy production." The question may be asked, "Does the development proposed for North Dakota in the EIS make allowance for energy conservation measures amounting to the 5.9% to 6.4% reduction proposed in the National Energy Plan?" 182

A subject deserving additional attention is that of trace elements which will affect air quality and have not

been analyzed or monitored by state agencies and are not included in the Federal Air Quality Standards. What is the potential for harm in these unregulated emissions?

On behalf of the League of Women Voters of North Dakota, I express the hope that a full discussion of energy development in our state, based on information contained in the REIS, will be pursued thoroughly through all the state's media, public discussions and debate. The citizens of North Dakota deserve to be fully informed about the scope of development planned, the demands to be made by national needs and the resulting impacts, positive and negative.

Thank you.

Sincerely,

Mary Jenkins

Mary Jenkins, Energy and Environmental Quality Study
LWVND
1542 S. 9 St.
Fargo, North Dakota 58102

cc: Trudy Jacoby, President
League of Women Voters of North Dakota
1309 Walnut
Grand Forks, North Dakota 58201

WRITTEN COMMENT

West-Central North Dakota Regional Environmental Impact Study
on Energy Development

If you do not wish to make an oral statement today, but would like to submit comments in writing, this form is provided for your convenience.

COMMENTS:

It appears that this study is fairly complete. I have not had time to read the entire study, but from what I have read the information good. There may be some subjects, and areas of study that are incomplete, but overall it looks sensible.

There may not have been enough attention paid to the question of no ordinary development. How many people would the region lose if all energy development were stopped. How much would our standard of living drop if no energy development occurred? I think that we need to developme our oil and gas; and make some of the trade-offs necessary to develop our coal. 183

The area is an export economy now, but the nation seems unwilling to pay for our farm products, we should consider selling what the nation wants now, while preserving our ability to raise food. I think that industry can fully reclaim the land, if the nation is willing to pay the price. It appears that the country is more willing to pay for energy than food.

My past opposition to coal development has centered around some of the coal leases taken in the early 70's, the term is to long, and the royalty payment of 12½% of coal is the same as stealing the coal from the mineral owners. Some consideration should be given to the idea of separating the private lessee terms to the same terms as the federal lessee contract, if the landowner so desires, or mineral owner, so desires. By the time the coal is mined the 12½ per ton will be equal to about 4¢ per ton in real terms. That does not seem right. 184

The question of completeness of the study seems to depend on if you are for or against coal development, we can't know the complete effects of development until after we have developed our coal; and it appears that the advantages of development may be greater than the disadvantages. I don't think we can afford to not developd our coal

John W. Guenther, Dunn Center, ND 58626, June 17, 1978

* * * * * * * * * * * * * * * * * * * *

Name: MR. JOHN M. GUENTHER
Route 1
Address: Dunn Center, ND 58626

You may submit your written comments today by giving them to the person at the registration desk or you may mail them to the following address by June/9, 1978.

Regional EIS Office
1533 North 12th Street, Suite 2
Bismarck, ND 58505

RESPONSES TO LEAGUE OF WOMEN VOTERS
OF NORTH DAKOTA LETTER

#181

Please see public hearing transcript for Bismarck. There was no mention of entertaining no discussion of scope, intent, alternatives, or adequacy. We would have welcomed your comments, as we welcome your letter. That hearing was the time for the study team to receive comments from the public, which would later be answered in the Final, thus available for all the public. There had already been three informational meetings with the public, which offered open exchanges prior to that time.

Thousands of copies of public concerns documents, preparation plans, summaries, Draft Studies, and Technical Supplements were distributed freely throughout the entire area. All news media were also supplied with the studies, and the information was aired. The public and state agencies were offered opportunities to participate throughout the project. A liaison office with a state assistant, federal assistant, and federal and state employees was established in Bismarck. Also see Introduction (page 1), and Chapter 9, Consultation and Coordination (page 295-296) in the Draft Study. This Final Supplement will also be circulated throughout the state. Also see responses #47, #60, #65, #165, #164, Introduction, and Part 1.

The proposed development indirectly accounts for energy conservation as the demand projections for energy use would be lessened by conservation practices. Although the demand for energy increased, indicating the need for the proposed development, the demand for energy would have been greater without conservation practices, thereby creating a need for more extensive development than currently proposed. Between 1976 and 1977, conservation of energy use amounted to about 4% in North Dakota. Presently, there are no legal requirements imposing the percentage reduction of the National Energy Plan.

#182

The subject of trace elements does indeed deserve additional attention. The main body of the Draft Study did not review this subject at much length, but a major report was included in the separate Climate and Air Quality Technical Supplement. Further updated information on trace element effects is also included in Climate and Air Quality, 'Air Pollution Effects,' Part 1.

RESPONSE TO GUENTHER LETTER

#183

We assume that the question expresses concern about the economic consequences of no further development, inasmuch as the termination of current energy production would be unrealistic. See the baseline economic forecasts in Chapter 2 of the Draft Study, and the 'No Further Energy Development' alternative on page 193 of the Draft Study.

#184

Past private coal lease agreements were entered into and agreed to by private interests and the coal companies. Any future renegotiations on these past leases would be the responsibility of the individual private mineral owners.

North Dakota Chapter

THE WILDLIFE SOCIETY

June 19, 1978

Mr. Bob Kaiser
Regional EIS Office
1533 North 12th St.
Bismarck, ND 58501

Dear Mr. Kaiser:

The North Dakota Chapter of the Wildlife Society has reviewed the West Central Regional Environmental Impact Study for Energy Development. Our comments on this document are as follows:

Executive Summary

Page 7. What are the natural sources of photochemical oxidants? The table presented here indicates that the Antelope Valley plant will emit fewer particulates than either Coyote I or II, although the latter will individually produce only half the power and burn considerably less coal. Why is this? Also, why will NGPL emit twice as much particulate matter as ANG, though both will use the same process and produce the same amount of gas? 185

Page 8. If the probability of short-term adverse impacts from trace elements is low, what about the long term, wherein the serious effects from such elements as fluorine, mercury, and selenium have traditionally been observed to fall?

Page 9. Our understanding of laws relating to ambient air quality indicates that these laws and the resulting regulations are quite clear regarding what is and is not permissible. We thus are unclear, if naturally - occurring photochemical oxidant concentrations already exceed standards, how new sources of such pollutants can be allowed. Is there a precedent for this, or is North Dakota about to set one?

Page 18. Why does the Antelope Valley plant need only half as much water as Coyote I and II combined, even though both complexes will produce about the same amount of power? 186

Dedicated to the wise use of <u>all</u> natural resources

Mr. Bob Kaiser
June 19, 1978
Page 2

Page 20. We are unclear as to the reason for land disturbance figures under Levels I and II being given here as 49,470 acres and 92,461 acres, respectively, and other sections such as geology and proposed action giving these figures as 34,217 and 76,017, respectively. Please clarify this point. 187

Main Document

Page 40, Para. 11. Scientific names should be underlined or italicized. <u>Yucca glauca</u>, not glancs, is the correct name.

Page 48, Para. 15. There are several plants listed here for which scientific names do not appear to be given.

Pages 79-88. That section of Chapter 3 dealing with air quality is deficient, in that it says little or nothing about what damage NO_x, SO_2, photochemical oxidants, particulates, and trace elements can do. Impacts upon air quality have meaning only insofar as they affect people, animals, and plants; therefore, effects of these substances upon human health and structural stability are important factors in the decision-maker's analysis. 188

Page 83, Para. 9. The statement that "...a low probability of short-term adverse effects..." is expected from trace element emissions obscures the fact that historically trace element impacts have been years in showing themselves. There are many examples of industries in place for 20 years or more before problems associated with trace elements have become serious enough to become incapable of being ignored. The question to be answered in this study is: given the above facts, and also the fact that several trace elements such as mercury and fluorine are omitted essentially in their entirety, can serious <u>long-term</u> problems be expected, or are such problems unlikely?

In general, we feel that impacts on wildlife could have been addressed much better if animals and vegetation had been considered together, since wildlife is, in large measure, a function of quality and availability of habitat. The vegetation section appeared to us to be overly concerned with forage production for livestock before and after mining, with insufficient attention paid to the wildlife potential of reclaimed lands. The fact that pounds per acre of forage production will be comparable 189

Mr. Bob Kaiser
June 19, 1978
Page 3

both before and after mining means little with respect to wildlife if there are considerably fewer plant species present on reclaimed land than existed before mining began.

Thank you for the opportunity to comment.

Sincerely,

Wilbur Boldt

Wilbur Boldt, President
North Dakota Chapter of the
WILDLIFE SOCIETY

WB:lr
cc

<u>RESPONSE TO WILDLIFE SOCIETY LETTER</u>

#185

The two primary "natural" sources of oxidants have been identified in the literature as (1) ozone occasionally descending from the stratosphere during turbulent weather and (2) emissions of oxidant producing compounds from vegetation.

The expected particulate emissions from the power plants and coal gasification plants depicted in Figure 1 of the Summary are based on particulate emission rates (lbs/hour) provided to the North Dakota State Department of Health by the various companies. The annual emissions were then obtained by multiplying these rates by a projected 89% annual operating period. It should be noted that the variations in emission rates provided by the companies occur due to the method of determining the emission rates and the specific plant designs. Some numbers reflect the maximum allowable emission rates allowed by the various regulations, while others are based on actual emissions after removal by various control equipment. The emissions depicted in Figure 1 are, therefore, maximums which are conservative in nature.

The long-term effect of trace elements from Level 1 and Level 2 projects is discussed in Part 1, Climate and Air Quality.

The question of naturally occurring levels of photochemical oxidants exceeding air quality standards has caused the U.S. Environmental Protection Agency to reconsider its oxidant standard, making it more lenient. The occurrence of photochemical oxidants at concentrations near the standards is common throughout the western states.

#186

The difference in the water consumption between Antelope Valley Station and Coyote Station appears to be that the Antelope Valley Station provided average water consumption data and the data used for the Coyote Station is maximum. Also, there are some design differences in the water systems and uses which account for the rest. As an example of the design differences, the Coyote Station utilizes an open surge pond which has a water loss due to evaporation and percolation, and the Antelope Valley Station does not use a pond. Also, Coyote Station plans to use water for mined land reclamation, whereas Antelope Valley Station does not use water for this purpose.

#187

See response #171.

The scientific names on page 48, column 3, paragraph 4, should have been italicized. Yucca glanca should have been spelled Yucca glauca. Scientific names followed common names only when used for the first time.

#188

The effects of various pollutants, including nitrogen oxides, sulfur dioxides, photochemical oxidants, particulates, and trace elements, were not detailed in the Draft Study; however, these effects were covered in the Climate and Air Quality Technical Supplement, Section 2, "An Air Quality Assessment of the Proposed Energy Development in a Seven-County Area of Western North Dakota," and Section 3, "Trace Elements Effects of Energy Conversion Facilities, A Phase I Final Report to the Old West Regional Commission." In addition, numerous literature references on the effects of the various pollutants and trace elements are available therein.

Also, the effects of air pollution are further discussed in Part 1, Climate and Air Quality.

#189

It is agreed that for wildlife analysis it might have been preferable if the vegetation analysis had focused further on wildlife habitat. However, emphasis on agriculture was appropriate because of the importance of agriculture in North Dakota. It proved impractical to have one vegetation analysis strictly for wildlife and another for agriculture. The vegetative section does take wildlife habitat into consideration, especially in Chapter 2. The vegetation section in Chapter 3 briefly mentions some impacts to wildlife habitat, but refers to the Animals sections for detailed effects to wildlife.

Also, forage production for livestock is expressed in animal unit months (AUMs). These stocking rates are set or recommended by allowing ample vegetative production for watershed production and wildlife forage. While wildlife forage is not expressed in terms of animal unit months, they would generally represent about 40 to 60% of the AUMs established for livestock forage, with the remaining AUMs being allowed to return to the soil as litter for watershed protection and erosion control.

It is true that plant composition on reclaimed land would consist of fewer species than native prairies, thus impacting wildlife more than livestock species. This impact is discussed on page 108, column 1, paragraph 4; page 108, column 2, third full paragraph; page 174, column 2, paragraphs 1 and 2; page 183, column 4, under "Animals: Level 1;" and page 189, column 2, paragraph 1, of the Draft Study.

("The Contribution of the Social Environment to Host Resistance" by John Cassel, 1976, included as an attachment with comment #190, was the same article included with comment #21. Permission to reprint the copyrighted article (reproduced with comment #21) was granted by the publishers of "American Journal of Epidemiology," John Hopkins University, Baltimore, Maryland. The article was reproduced from Volume 104, Number 2.)

State Health Planning and Development Agency

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JONATHAN B. WEISSUCH, M.D.
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W. VAN HEUVELEN, P.E.
Executive Officer

June 19, 1978

Gary Johnson, Ph.D.
Governor's Office
Capitol Building
Bismarck, ND 58505

Dear Dr. Johnson:

After reviewing the Regional Environmental Impact Study (R.E.I.S.), I find there is considerable room for discussion with regard to Health Impacts of Energy Development. An important consideration by the State Department of Health is the change in the incident's rates of several diseases as a result of community change. 190

You will find enclosed a copy of an article by John Cassel; presentations by Drs. Giorgio A. Piccagli, Robert Weis, and Gene Summers at the 1978 North Dakota Public Health Association meeting; and a list of diseases and social problems associated with the stress of social change. I would appreciate your review of this information for the inclusion of this concept in the R.E.I.S.

If you have any further questions, please feel free to call me at 224-2894.

Sincerely,

R. Joseph Rude
R. Joseph Rude
Section Chief
Project Review
ND SHPDA

RJR:lb
Enc.
cc Dr. Jonathan B. Weisbuch
cc Giorgio A. Piccagli, Ph.D.

PS: The presentations are in rough draft form. When they are revised they will be made available to you for your review. The major concern here is the role of stress as an intermediary of the associated diseases cited in the enclosed list.

George Piccagli- presentation for the North Dakota Public Health Association Meeting.

I went to Wyoming to work on economic impact issues and ended up working on health. I came to North Dakota to work in Health and ended up working in Socio economic impact issues. Since I view that as a totally random process I think we have just established that there are very strong relationships between health and energy development activities. Fortunately, I am in the position to indicate that there are other sources of support for our certainty in that area. Public health and preventive health measures have been greatly responsible for many of the major improvements in the health status of the world population. Borrowing from Gene Christianson yesterday who as I recall in my American History was himself borrowing from Benjamin Franklin one of the foremost environmental engineers of his time. An ounce of prevention is worth a pound of cure, and I think we are in the same situation in the area of energy development and its effects on health. I have a number of leadins and I hope they make some sense, I will pause and try to follow these. I have to nod to Mary Ann who in warning me this morning about my appearance at the press conference said that I should without doubt make sure that I kept my comments within five minutes, so I wrote up a number of sentences and spoke what seemed to me at least a half an hour and that was merely an introduction to the topic. On the basis of that I decided to try to add very little to that introduction and hopefully I will remain within the time allotted. I have to make another disclaimer that unfortunately is necessary when I talk about socio economic issues and energy development or health issues inevitably the question comes up that I'm sure Dr. Summers has had directed to him, and that is, Am I against energy development or industrialization. The answer is clearly "No". I think there quite a few people who can point out the clear benefits to energy development or any industrialization process. There aren't quite as many people pointing out that the issues are mixed. Pointing out that they are in fact possible deleterious affects to such development does not imply that one should go ahead with such development. It merely makes it easier to develop policies

to distribute the benefits that accrue from those developments. as well as the spread some of the cost. Let me give you the punch line to the presentation, and then I will go back and start a more logical flow. The punch line is really stress now the notion of stress is not a new notion. Many of you I am sure are acquainted stress. Many of our environmental impact statements have also mentioned stress. But most of these mentions have restricted the notion of stress and its affect on health to the mental health area or to the quality of life area. Dealing in what unfortunately but frequently is referred to the fuzzy area of social science. I shave today to try to convince some of the social science concerns are not as fuzzy as some people would like to have us believe. What we are really presenting, is a change essentially from a single pathogenic affect leading to a single melody were going from that medical model to a model that introduces stress not as a pathogenetic in its own right but a mediator between pathogens and the environment, and illness. That is we go to a multi-cause of illness. We have a number of causes whether those pathogens factors or whatever you would like to call them, do indeed lead to illness or not is mediated by stress. And the affect of stress is itself it turns out mediated or determined by the whole social structure in which the individual operates. So we are in a position I hope to go through today to show how changes in social structure, changes in migration patterns, changes in life style, changes in occupational status all things that are implicit in industrialization have physical health affects. But these affects furthermore are not often taken into consideration in environmental impact statements but they are very rarely entered into however approximate a cost benefit ration one wishes to use. But regardless of that they are real affects, they involve significant policy choices. there are always trade-offs in these areas. We are often presented with the fact that even if the quality of life deteriorates effectively what we are doing is trading off higher income for that reduction in quality of life. There is some

very interesting data that entered the recently released regional environmental impact study coming from HEAP that show support let me say since I am not aware of whether these figures were in fact tested for there robustness over a series of assumptions. That suggest the net negative effect on income of the industrialization in North Dakota is negative. That is we will see a bubble thereafter personal income would be lower than it would have been without development. If that in fact is true then I can do nothing other than raise the question , where is the trade-off in this case? We are giving up the quality of life possibly, health status possibly, or income that might not be there. Now I would not make this conclusion, I am not aware of how robust that result is that HEAP developed. I think there is a significant datum that should enter public debate in that area. The other thing is we are dealing with some fairly difficult issues. There is the issue first of all of determining whether although these affects are discovered again and again and again in a number of studies of the country whether in fact they will be manifested in North Dakota, and in fact, once they are discovered if they are discovered, what do we do in terms of preventing them, alleviating them, hearing them are some fairly difficult policy options. All I want to suggest is that we don't make those policy decisions consciously. Now you see when of the effects of stress on health. They will be made in any effect, in any event either consciously by other actors or unconsciously through the unfolding of the mechanisms we are about to explore. Given that long series of introduction let me indicate what I'd like to do, then do it and hopefully indicate what I have done. I would like to take you through a number of literatures that deal with. The area I would like to review is known as the boom town literature. That also deals sometimes into very detail with health effects of industrialization. I will then try to keep very short review of some of the principal findings in the two nother disciplines of sociology and economics, I think bare on our question of the effect again of industrialization on health and then I will try to indicate some of the physical effects that have

been traced to life changes to industrialization to energy extraction activities, that come out of literature in epidemiology. I think that one of the things that Dr. Somers established for me that I would like to reinterate is that distributional affects are very rarely dealt with in cost benefit studies or the environmental impact statement. Granted they are very difficult to get at, it is very difficult disaggregate the population in such a manner that you can identify all of the relevant groups and then proceed to do cost benefit studies for each of those groups. Nevertheless, the fact that that does not occur really detracts from the attention that might be given the importance of those distributional affects. And what we'll find when we go through the epidemiological literature is that the disjunction of the groups receiving many of the benefits from the groups baring many of the costs is quite important as a determinant of stress, and through that mechanism than a determinant of health. We have another problem with the way ____ dealt with many impact statements and that is that most of the attention given to the questions of health in these statements is really directed to a question of how many more services do we need and even more often how many more facilities do we need. Not only is it focused in that area but it is often reduced from the complexity of the mechanisms recognized or unrecognized to use nothing other than linear operators on projected population, what do I mean by that? I -- we can do a surmary of the facilities presently existing in the community dealing with health, we can see what population there is. We project the population, take the ratio of the population to the present population and decide that we need to apply that exact same ratio to the present facilities, to decide how many facilities will be needed. This is often the case even when the authors of the impact statements or studies are aware that it is not very acceptable and I sympathize having tried to write some of these statements or studies myself with those authors that have to deal not only with health but questions of social service,law enforcement, income etc... It is a very complex issue. It is a task, however, would suggest that however well it is performed

it hides some of the affects we are talking about. Many of the things we will be talking about particularly in the social area are not well suited to prediction before the impact has actually occurred. One of the points I'd really like to try to pain is, that we need on the national level and on our state level a change from an absolute reliance on anti impact statements to expost monitoring efforts which would allow us then to determine how best to move our resources around to meet the needs as they are discovered. The boom town literature is rather controversial we have and I think you will hear more about it tomorrow floating around this region a notion about the Gillette Syndrome, Gillette spain is from Wyoming is still there. But we have an author who identified at some point fairly major changes in suicide rates, suicide attempts, criminality, rates of depression, rates of divorce all very interesting things. All very frightening things. Unfortunately, as I understand it all of these from the significant and important phases of some of the conclusions we want to reach. There is some question as to whether those rates did in fact occur. And there is some question also as to whether those changes should they be scientifically verified are traceable to changes in the social structure of that community occurring as a result of industrial growth or population increase for energy extraction activities, or are merely caused by incoming population stresses which is significantly younger than the previous population and carries with it if you will higher divorce rates, higher rates of vandalism, and so on. With respect to suicide attempts I think it is very difficult retrospectivel to determine whether those rates in fact did exist although Dr. Wels I believe if I understood you correctly you have some independent data you will be addressing tomorrow. There are some other aspects of that situation which given recording of it would make it fairly easy to analyze, and allow us to get some notion again of this crucial distinction as far as I'm concerned from a policy point of view. Are the disruptions that we see, that we expect, that we fear, disruptions that are carried in remain with immigrant and transit population and would therefore pass with them

when that population leaves. Or there are affects that affect the previously permanent population due to the disruption of the social structure they knew before. I don't think that the boom town literature is in the position to address that question. Very few of the environmental impact statements are in a position to address that question. Very few of the controspective studies of other sorts are in a position to address that question. Fortunately, some of the epidemiological literature both suggest strongly and demonstrates that these effects in terms of declining health status affect not only the immigrant population and are carried by it but also affect the permanent population as the social structure the whole system of interaction of production of social goods, of information exchange, that they had come to know and grown up with disrupted. Let me move on to Sociology for a minute. Before I came here I was not myself aware of some of this epedemiological literature but in looking at a large number of environmental impact statements it seemed to me that the crucial issue in socio economic impact and the issue that was again, again, and again avoided in these statements was the effect on social structure. What happens to social structure? Though we have some notions, and other studies of social change we can expect for example change in community control from local actors, to actors outside that community. From residence, permanent residence to corporate actors outside of that community. This has clear effects on control of residents of that population have over the functioning of their community. There are some other questions that are fairly difficult to come to terms with and that is or those are the question in that in many of these cases we are dealing with irreversible effects. Dr. Somers raised the question of people on fixed income who may have to give up their residences and possibly move out of the region because of the inflation encouraged or caused by energy extraction activities or industrialization. Once that development ends those people are not in a position to regain that property. What cause do we attach to that? In the sociology area some of the most important effects are the distribution effects. Though we are

are normally taken care of by other agencies. The question of increased low level criminality for example, increased drunkenes, increased vandalism, and so on. Is not something usually addressed by the health department. I would submit however, that they are clear manifestations of stress but indications that there are not sufficient resources or institutions within that community to redirect that behavior. Clearly a question of concern to us in preventive health is not often under our purview. The policy implication there I think is fairly clear we need to stop acting as individual agencies and institute a common combined human resource agency effort. Fortunately in North Dakota the Governor has taken steps to do that. So, while the health department is going to be dealing with some of the specific health effects, we can't deal with them merely through the health department. What is it that the epidemiologic material tells us? Most of us are acquainted with the affects of stress on mental well-being, on a variety of symptoms, on increased admissions to mental hospitals but not many of us are aware of the effect on stress on physical illness. Let me go back now to one of the things I introduced at the beginning, One of the difficulties we are going to have is dealing with some of these effects that emerging from a review of some of the literature. That very review suggests that stress itself is not the pathogenic agent but it mediates the effect of existing pathogents. So we have a variety of standard causes whether they will be manifested in disease depends on the level of stress experienced by the individual, or the population as a whole, and on the other hand, there are social support mechanisms within a community to mediate the affect of that stress. In the absence of such mediating mechanisms we will get any of a variety of illnesses. So we don't know before hand which particular illness. I have here a partial list that we've gotten from our review so far and it indicates that the sort of effects were talking about start with very simple things like increase of acceptability to allergies, ranged up through questions of well-being psycosis-neurosis, suicide and and up also increasing certain organ degenerative processes. I had intended to read this unfortunately,

time and time again, the fact that some of the groups benefiting are not the same groups that are bearing the costs. That seems to occurr no matter how you stratify the population, whether it is stratified by occupation, whether you stratify it by income, or whether you stratify it by opinoity. But there are some other disjunctions that are temporal disjunctions. You all know and your aware of I'm sure the front end problem in terms of funding/increasing social service or any a number of needs projected with this development. There are also special problems in that some of the unincopalities who will bare the costs in terms of acting as residents or provider of services in these areas. But whose jurisdiction is does not extend to include the plant. Will not always and certainly not directly benefit from the increased economic activity to do industrialization. The boom town literature that we left a while ago has within the certain elements seemed to strongly agree with what we know from economics. And the concept I'm dealing here with is one of substitution costs, that is when you move from one production technology to another production technology you inevitably incur substitutio costs. In economics any such change the costs are higher the greater the rate of change. This seems also to hold true in rural communities if you keep the size of the host community constant it seems that the disruption caused in some sense proportio al to the size of the incoming population and the rate to which that population comes in. If that's true as suggested by economics and observations of economics by other communities and if in fact as I hope to demonstrate later that has health affects there are some clear policy suggestions here. One is that we might consider slowing the rate of development. Not necessarily on a national scale, but for individual, local unincipality. To the extend that this lower rate applies will disrupt communication patterns social structure and so on less than we have essentially one possible preventive measure. The difficulty of course is that we in public health are not in the position to establish that policy and I think that is what you'll find throughout any examination of the health effects due to industrialization. It is not only a very difficult issue but it is one that spills over into areas that

everytime I attempt it I have difficulty pronouncing half of these illnesses. So if any of you have particular interests I'd be happy to give you the list. I think what we have established or what this suggests is it's not merely mental affects it is clear morbidity in other areas. It is physical effects these effects are manifested not only in areas that are not normally related to the health department but other areas. The question is what do we do about it? Let me indicate a couple of examples here that might substitute for my not pronouncing e number of these diseases. One of the difficulties that I think people dealing with the impact of environmental impact statements have aside from the fact that there asked to gaze into a crystal ball that is often ruddy is that they are up against significantly insufficient time constraints. They just don't have enough time to adequately deal with all of the issues and all of the areas that they must address. But there is one other thing as I understand it that is it concentrates attention within the social area or the socio economic area on short range affects. One of the things that seems to be clear from a review of the epedemiological literature is that we are not looking only at short range affects as indicated for example by the increased rate of difficulties in child birth in those situations where we have a high number of life changes and at the same time have low social connection, low social support, that's a fairly short problem, there are indications that problems of hypertension, and stroke continue 30, 40 and 50 years after the development and initiation of some of these activities. For example, a study in Appalachia looked at two groups of workers in about 1960 a plant located in Appalachia and by company policy began to hire locals. By the time the people conducting the study came along we have had 40 - 50 years pass and in some cases second generation workers. The study then addressed the different health status of the fourth generation workers. Those that for the first time had come essentially from a social system in the surrounding area revolved around kinship, decisions were made on kinship. Where you had a variety of clear signals that were tied to family status. In there lifetime they had saved

from that system to the industrial system. Where all of the cues are significantly different. The comparison between that group and the second group whose fathers had first made that switch. In various health status where applied to few populations, in every case the health status of the second generation workers was better than the health status of the first generation workers. This is one suggested fact that it is the change in social structure, the change in life style, that is one of the major determinants of stress which itself then mediates the effect of pathogens in the determination of illness. Now, the reason that suggesting cases about is because the study went on to try to control for questions of socio-economic status, age, sex, non of these normally explanatory variables seem to hold much explanatory variable value in this case. The same situation occurs again and again, it seems to occurr when your talking about hypertension, or whether your talking about a stroke. Now I'm just giving you an example of the effects essentially the changing population, the immigrant population there are other studies. There is one in Kentucky which looked at the affect of the expansion of a nearby city on what was previously a disconnected ruralnpuality which was on its way to becoming a suburb of that expanding city. What the investigators discovered there was the fact that after awhile as the evasion of this ruralnpuality continued by outside populations rates of suicide went up, an interestingly enough they went up not in the immigrant population but in the previously permanent population. So we have at least suggestive coverage that deleterious of health affects apply not only in immigrant populations but permanent population. What do we do about that? I do not know how one in fact could enlarge the time or the effort in the present state of the environmental impact statement to address this issue. Particularly since the discovery is the result we talked about really require expost investigation, we need to look at what happens after industrialization rather than trying to guess what happens before. The reason we need to do that is that while we can predict some decrease in health status, or increase in illness if preventive measures are

There are in fact some preventive measures that can be taken. One of them again is not in the novel health area but is in the question of housing and solving. To the extent that we are talking about illness that is facilitated or precipitated or what a sociologist would call cultural conflict and is manifested in the isolation and the ease in identification of two groups. The literature suggests that to the extent that those barriers are broken down stress would be reduced, not only would stress be reduced but in fact there would be more linkages to each individual at risk that would mediate the effects of that stress than reduce the likelyhood of illness. If you look at impact of communities which you see on the other hand, are areas of rapid growth mobile homes in one area very clearly separated from other residential arrangements. Again if the epidemiological literature wall established is to be believed this merely contributes to the problem. Again you see there are a number of intuitions some documented some not in the epidemiological literature about preventive efforts that can be taken not only in the health area but outside the health area. That is why one needs a coordinated human resource agency approach. To the extent that we are not successful in preventing these illnesses I would suggest an early screening, a variety is very important. We have a number of things on the horizon that we help, the department at this point is looking at a monitoring program at the same time is looking at the placement of nurse practioners in schools, I think there is a dual sort purpose to be served with this action, and we can integrate all of these pieces of knowledge we'll be in a much better position to address some of the problems that are raised in the epidemiological literature.

not taken. We are really not in a position to predict which particular illness will increase. Given that then clearly one of the things we have to do is establish some sort of monitoring mechanism. And we are moving in that direction, we will be continuing our review of the literature to isolate more diseases, not only isolate those diseases but determine what average length of time between the social change and the manifestation of that particular disease was, so that we can start at least allocating these diseases to immediate short run mid-range, and the long run. And in this area there are a number of studies that would be particularly helpful, that would not have to wait upon the results of our own monitoring effort. There have been a number of development cycles in this region and there aren't very often morbidity records kept. There must be records of a variety of sorts that would allow us to start sorting out some of the affects either from the oil boom which occurred in this region at a previous time, or any a number of other developments. Even a three or four day study of the divorce records in Gillette disaggregating them for age, length of residence in the community and so on would start giving us an idea of the rate of manifestation that we would expect in some of these areas. The other thing that I think we need to do is change from the notion of mitigating actions to be taken that are incorporated in environmental impact statements now to a notion of prevention. Let me illustrate that. If you look at the mitigating section of many environmental impact statements that currently exist and address health questions what you see is an emphasis on acute remedial care. How many more inpatients will we have? Or how many more sick people will we have. And how many physicians or facilities do we need to build or recruit? To take care of these manifestations. What I suggest is that to the extent that social structure and changes in social structure are in fact the driving force in some of these illnesses, and to the extent that social isolation particularly pops up again and again as a major determinant of personal illness.

Dr. Weis - North Dakota Public Health Association

What I would like to do is talk a little bit about some data that we have about the Gillette phenomenon I prefer to call it. I look at the Gillette syndrome literature as the equivalent of the national scientific inquiry, for that reason I squirm a little bit everytime people would use that label as if it were a scientific fact. We conducted a rather modest study last summer and are still analyzing data to allow us to credit the find just what is the phenomenon of impact on the population of people in Gillette.

We are just getting a handle on just what is this impact business. Are there some ways of measuring it in terms of social psychological, demographic variables? So we put together a survey where we sample probably five percent of the households in the Gillette and immediate surrounding area, the planning district. We divided the planning district up into blocks, which is approximately one city block, numbered all of these and selected the blocks from a random numbered table and then sign those we interviewers all of whom were experienced with some medical health expertise. To give you a little more about the sampling procedure we went to the randomly assigned block to the number of the block end if it was an odd number we started at the southeast corner and took every fifth household, started at the northwest corner we went the other direction counter clockwise and sampled every fifth household. The sex of the respondent of those who were selected at random on the table.

So we worked hard to get as close as possible to an honest to goodness random sample of the Gillette traffic planning district. We inserviewed approximately 220 respondents typically it took about an hour to two hours to line up each interview, and about an hour or so to administer it.

What I'd like to do is briefly give you some data as we go through the questionnaire and share with you some of the things that we have found. Some of the data can be compared to census information and coordination as a whole.

That average total number of persons in a household was 3.1 the U.S. mean was 2.98. 54 percent of the respondents were male, 46 percent of them were female. The immediate age of the respondents, and these are adults, heads of households was 34.9, the U.S. average is 28. 14% of the respondents were single, 75% were married, overwhelming a majority of the respondents were caucasian racial origin, 68% were employed, 32 were not. 12% were employed by the oil industry, 11% by the coal industry, 3% in ranching, 2% in government, and 4% in school, 12% in construction, 20% housewives, 14% in retail and wholesale, 4% unemployed, 16% other. The average hours per week work was 48.2%

We asked people how many years they had lived in Wyoming and Campbell County: 24% had lived there less than one year. 1% had lived there less than two years, so about 31% all totalled had lived in that locality for less then two years. Interestingly, a large proportion of those people expected to live there quite a long time. About 37% indicated that they were projecting a living there more than ten years. Apparently they see themselves as coming to settle there.

32% of the respondents indicated that they had an income of $25,000 or more that compares to the U.S. average of 17.8%. another 19% had an income of $20,000 to $25,000, so I think that is one handle we are beginning to get on, at least, the impact population of Gillette, this proportionately high number of heads of households or families actually earned very high incomes, the mean income for a family in the U.S. is $15,000. That is one little thing we are going to be working on also more with the rest of this data.

44% of the respondents lived in a house, 9% in apartments, 46% lived in mobile homes. 70% of them owned their house, 31% said they were very satisfied with their housing. 44% satisfied, 5% uncertain, 13% dissatisfied, 7% very dissatisfied. Not what you might have expected.

We asked people whether they would recommend Gillette as a place to live. 65% said yes they would recommend it, 35% said no, so much for demographic data.

The next thing that we did that I am going to spend a little more time on, we administered the life crisis unit scale. This is a scale that has been in use for about ten years, it was developed by a fellow named Wolf and a fellow named Holmes. It is the kind of scale you may have seen in the newspapers here and there that measures the overall amount of stress that an individual has experienced in the last year. It has items like: How many times did a particular event occur in their life in the past year? And what way according to some norms that were developed that seem to be pretty reliable is the very top of the stressful events is the death of a spouse. Other items were divorce, marital seperation, jail term, personal injury, marriage, fired at work, retirement, change of health, pregnancy, sex difficulties, new family member, change in financial status, death of a close friend. As you go down the list the events are less and less stressful.

The administration of the scale allows us to get scores, which are based on the relative weighing of some of these items, and the frequency in which they have occurred to the individual and we get some kind of a score. A very interesting thing here is that the mean score for the respondents on our Gillette samples was 208. The mild range is described as scores from 150-199, life crisis units, respondents in the norms samples who had that kind of a score 37% of those responded to have had 150 to 199 associated health changes in the near future. The moderate range is described as 200-299 low's for those people. 51% had had an associated health change in the near future. A major stress score is 300 and above. People in the norms who had those scores, 70% had an associated health change, in the near future.

Let me tell you a little bit more about the studies on this scale and on the particular stress on the individual has shown very strongly and very reliably whether there is a strong correlation between the magnitude of life changes and the occurrence of illness and the seriousness of the illness, and that includes

psychiatric, surgical, medical.

I ran across some interesting statements. Toppler says that we may define "Future Shock" as the distress both physical and psychological that arises from the overload of the human organs physical adapted system and the decision making processes. The scale that I am talking about basically correlates, and demonstrates that there is a strong relationship between change in life and therefore change in stimulation and usually more stimulation and the occurrence builds. It is sort of based on a human ecology approach to medicine. The individual is very much imbedded in the social environmental system around him. The changes in his life and the changes in that system are stressful. There is a direct relationship between the amount of stress and the health of that individual.

Let me give a little bit more quotation to talk about. It talks about this particular scale that was employed on some very interesting studies. Quoting Toppler again, "Research has established that alterations in life style that require a great deal of adjustment and coping correlate with illness. Whether or not these changes are higher the risk the subsequent illness will be severe. So strong is the evidence that it is becoming possible by studying life change scores to actually predict levels of illness in various populations."

Just to give you an idea of some of the ideas that we are trying to get, it seems that we can safely assume that our sample is valid and that one of the characteristics of an impacted population is that its individuals seem to be experiencing a moderate to high level of life stress. I have some interesting public health implications. So it is summerized again, the mean of our sample is 208 and one of the statements that I ran across in the literature was scores of 200 or more of life change units indicate that significant change that those people would develop within two to three years a major physical or psychological illness.

We are going to develop these results quite a bit more our analysis so far is very straight forward. Given names that we sampled in our survey used the ways in which people respond to the stresses in their lives. Things that we asked included: How did you respond to this particular stressor? No then picked out the top five as they checked out on the list. How well does that response work for you? How would you have improved the situation?

Another thing that we sampled was specific sources of stress within the community. The highest labelled sources of stress was cost of living. Other stressors were traffic congestion, overpaid services, and the lack of medical facilities. This set of stressors were the ones that people pointed in the community as the ones causing stress in concern to them.

Another thing that we did was sample resources that people saw in the community. Interestingly, the most frequently named resources was movie theater. Another frequently named resources was medical clinic, hospital, schools, churches, recreation facilities, social clubs, community theater, outdoor recreation. 8% of the people thought a health center as a resource. And then we asked people to rate the helpfulness of each resource.

Another thing we did was to administer a coping strategy scale asking people to tell us how they coped in a certain problem situation. Again I will not give more detail because time is short. Another thing we looked at is, what particular resources people went to for personnel problems. Friends, spouse, ministers, family members, relatives, professional people. By large the women in our sample were much more likely to use personal resources than the male.

Other things we looked at were, whether people perceived themselves as being masters of their lives or whether they felt that fate was that the future was not in their own control. Of whether it was a matter of fate, tolerance, frustration, delay or gratification. Then we asked people to comment on community problems that related to mental health issues.

It is rather interesting that the response here which might indicate the people do not deny that there are problems. When asked how often; do people in the area drink to much? 24% said extremely often, 36% said often. Same question on drug abusing; 16% very often and sometimes took about 66%. Family problems; 33% often, 8% exsremely often, 25% sometimes. So people, think are perceiving their social environment as having serious problems.

Then we did a mental health service need survey, for our own benefit. And then we administered a very straight forward global assessment scale. Which attempted to give us an overall clinical impression of a persons general adequacy in coping with their lives. And our sample by large tended to concentrate in the range indicating that in our eyes they seemed to be coping quite well. At least not to the point where they seemed seriously troubled.

So I give you a Non "National Inquirer" version of the Gillette Syndrome. We are looking at a rather subtle and complex variables here. What I would like to do is dissuade you from a notion that there is such a thing as a "impact phenomenon that is replicable that is from one locality to another." There are alot of other factors that pings on how a particular community and individuals react to rapid growth, It has to do with relative isolation, relative size of the community when the impact began, and the past history of that community.

In Gillette, for example, we experienced an oil boom in the 80's which had alot to do with teaching the community what to expect. It helped some people become very determined about letting it happen again.

Just very quickly, I want to skip across a few other things and then stop to allow a few questions. One of the phenomenon that occurs in a small community like Gillette, I get from a personal level you might be able to relate here. there is a loss of familiar points of reference that are very important in a community. These referents help people feel like they belong. These points of

reference have to do with relationships, as well as, physical things. If you go to a grocery store, and to the drug store two or three times a week and you see a different clerk everytime, that is a point of reference that you are denied. If you see a different policeman every time. If your doctor comes in and leaves and you have to change doctors once a year. If your neighbor changes. We have a reliance on a very subtle, but strong fabric of relationships in our lives it helps us feel like we belong that we recognize and were expected and that we can rely on acceptance and support. And alot of individuals in that network keep changing were denied that. There is a predictable strain on resources in the community, very simple things like overloaded schools, medical facilities, theaters, police, and the whole works.

Another phenomenon that I call a key reliable community information dispensers. People who are in a position to make referrals like; Who do you go to see to fix your shoes? Who is the best doctor? Where do you find such and such in case of an emergency? Where do you go for this and that? People like radio dispatchers, nurses, clerks in certain positions, like a clerk in city hall who does registrations for utilities. There is a rapid turnover of those people there is a real disruption in the flow of important information about resources that are available in the community. One of the things that we've seen in Gillette are those people change so quickly that there is loss to access of reliable information, So that you can feel like you can rely on the community.

Finally, I think there is a disruption of family life. That occurs at alot of different levels and there are so many opportunities for employment that teenagers for example, are overwhelmingly employed at a very young age such as 13 or 14. There is probably a greater inducement to quit school, or to pay less attention to school things because there is so much good money to be made in the labor market. Both spouses tend to be employed partially because the cost of living

is so high. There are some marginal living situations. The child abuse caseload in Gillette is the highest in Campbell County and is the highest in the State. In 1981 the child abuse caseload in Campbell County was only 1% of the State total, in 1976 it was 20%. So that is one very alarming index probably a disruption in the ability and the strength of the family to function well.

Does anyone have any questions?

Dr. G. Summers - North Dakota Public Health Association Meeting.

Dr. Summers received his Bachelor of Science Doctor's Degree at the University of Tennessee. Currently he is working in Norway on a research effort to determine impact of Industrialisation which that country has anticipated. He has done extensive research and writing on Industrial Development in Rural Agricultural regions. Dr. Summers is a member of the American Associological Association, the Rural Associological Society, Southern Associological Society, and the Midwest Associological Society, and the Society for the study of Social Problems. We are very happy to have you with us this afternoon.

Thank you.

Back a spell Joe Rude called me and asked if I would come out and do this talk this afternoon, he said you needed somebody to stir you up and get you excited, and I said, Well I can probably get more people hostile and agile in less time than anybody else I know. So here I am.

The comments that I will make do not bare directly and specifically on Public Health Issues, and Joe said he would like a little background and stagin for George who comes on next. That is really what I think I can do perhaps my work has not been directed specifically towards Public Health Issues, but generally the community changes as that relates to economic development in Non-Metropolitan communities in the United States, and currently doing similar work in Norway. I will focus on seven different dimensions of community change as a response to growth in manufacturing or industrial development. The five or seven points I want to make are dimensions, jobs, unemployment, income, the private sector local market growth, population change, public sector change. the relief of poverty which is unemployment, relief

from the fiscal crunch that many small local governments face, improvements in public services including the health services are all important and desirable goals, I think there should be no disagreement of those of us here, with that kind of statement. I think it is the case that jobs increase an income and expanding the tax base of a local community are all appropriate means for achieving those kinds of goals. The real question then I think is as a matter of Public Policy whether or not Industrial Growth is a good Public Policy for achieving, for the creation of jobs, increasad income, expanded tax base in the local community. What I did about five years ago with financial help from the Economic Development Administration in Washington, was to select, track down if you will as many studies that we could find that had been done in communities in the United States, Non-Metropolitan communities in the United States where a manufacturing plant or in some cases several manufacturing plants, had located in the community and someone had thought to examine what happened to that community over a period of one, two, five years following the location of the manufacturing plant. We found in our search reports from 245 communities, different communities that had been examined, been studied from 34 different states around the continental part of the United States and these studies involved total a little over 700 locations of manufacturing plants. A variety of kinds, small ones to large ones, and a variety of the kinds of products that were made in those plants. So what I want to do now is to share with you the generalizations we were able to draw from those 245 communities and the reports from them share with you their experience, what about jobs? Let me add one point there , I think that might occur to your thinking just now is that

studies of manufacturing plants and the reports of a manufacturing growths relevant to North Dakota where your concerned with energy development mining, I think the answer there is quite relevent. The kinds of processes that appear to be in in operation in these communities are processes that I think are also characteristic of North Dakota communities. So I don't think that what I'm saying here is irrelevent at all and if I did I wouldn't bother to be here. Jobs, my definition, if you add a manufacturing plant to your community or coal gasification plant or mine or whatever, there are jobs associated with that industry you have created jobs, which of course brings industry to your community, brings jobs to your community. The more important question is who gets those jobs? Where do those jobs go? Do these jobs go to the local people, the residents of the community thats hosting this industrial growth and particularly the unemployed and the under employed members of the community, the low income part of our community, with poverty and unemployment. The answer from these studies is that frequently the new jobs do not go to the people in the community. To the unemployed, previously unemployed, underemployed people and to the low income people. Why not, what are the circumstances that would help one to understand why it is that jobs are brought to the community and other people get those jobs that are created. Well there are at least three factors that I think we can identify from these studies, that seem to occur with enough frequency makes sense to pinpoint them. There may be others as well, but three that were quite common: 1) commuters people living in neighboring communities , neighboring counties drive to the plant take the jobs. 2) immigrants, people from Chicago, Milwaukee, Denver wherever arrive and take the jobs. They may have more skill than the local people, particularly of the local people that were talking about being unemployed, or under employed, or those with low income that in itself suggests that they may not have a very high skill level. And the jobs that are created may require more skill

than many of them have and the labor force drifts in from other places and takes the job so you have really not created jobs for the people that we have hoped to help. The third kind of leaking out as it were of the employment is to new entrances into the labor force. And that one may be a little bit less serious because many of those new entrances will be residents of the community, people who had previously not been in the labor market or who had not been working but now that there are job opportunities they become part of the working labor force. That's good in the sense that it helps the local community but at the same time it might not allow the jobs that had been created to provide employment for the people who were already unemployed or underemployed. I think what we can say in terms of the job is that the studies show that local labor markets operate in ways which often work against the needs of the people for whom the development had been promoted in the first place. That is something you ought to keep in mind as you approach the whole process of industrial growth. What about unemployment? Another very major point, in the case studies that we looked at approximately two-thirds of the communities experienced a decline in the rate of unemployment in their community. About two-thirds which also means that about one-third didn't experience a decline in unemployment. And the decreases that were observed, were generally very small in relation to the level of unemployment. Usually less than one percent drop in unemployment rates as a result of the addition in manufacturing. And in some communities roughly a third there was actually an increase in the unemployment in the community with industrial growth. Why are the gains not more impressive? Well again there are several factors we could identify because they have occurred in a number of these communities, and let me share these things with you. Again, we are back to commuters and immigrants as one of the major factors. The jobs were simply looked out of the community, they didn't get to the unemployed people in the community. A good example of that was in a community that I studied extensively myself for five years in Illinois where 83 percent of the work force at the steel mill

that employed a little over a thousand people, 83 percent of the work force lived outside the county or community. So there were not very many jobs created in that county. So leakage of jobs out of the community. Unemployment of course if figured on, I hope all of you are familiar I don't want to have to try and explain in detail the statistical kind of thing, if you are actively seeking work or have been working so many weeks or months during the last year or that kind of thing so one of the factors that produces the higher unemployment or at least holds down the positive gains of unemployment is the new entrances in the labor force. So often new entrants generally are less stable in the labor force than those who have had a long career of working. So you have people come into the labor force, work for a period of time and then for whatever reasons drop out of the labor force. That person now is considered unemployed, he may have been in the community before but they were not unemployed then, even though they were not working, they were not unemployed. That's another factor that helps to explain why the unemployment statistics are not more impressive in a desirable direction. I have already mentioned that the local unemployed persons, residents who are already unemployed may continue simply because they don't have the skill that it requires for the job which has been created within the community. Another factor which appears to be important in this regard is that under employment may give enough slack that new jobs do not affect unemployment. In other words there may be enough cases where a person is not working really a full time even though he may be putting in forty hours a week down at the store, quite that job and take a job at the factory the store manager said we can really get along without hiring a replacement. So you have not reduced the unemployment in the community at all, you have just moved a person who is employed from one job to another. And there has not really been any gains then. I can't pass this by without adding one more point and that is with regard to the unemployment. In some of the communities that showed a decrease in unemployment moving the direction

that one would hope, When the community dated figures for these communities were examined a little more carefully it was found that even though the community was experiencing a reduction in unemployment the number of people who were unemployed had not changed at all. And in some cases it even increased slightly. But what were doing is growing and expanding the size of the labor force. So as a matter of percentage its decreasing, but in terms of numbers of those who are out of work may in fact be no improvement at all or perhaps even more people who are unemployed. This we came across after my discussing this general topic with the people in the South, particularly a Black field worker. He called to my attention that a number of the communities were reporting decreases in unemployment may be true statistically but for the black members of the community there was no relief from unemployment there were just as many people unemployed as before. And we can begin to look a little more carefully, we found that it was not a unique situation. What does a 100 or 1000 new manufacturing jobs mean to a community? Are there multiplier factors? One of the things that community developers, industrial developers, Chamber of Commerce, is very positive about, is that if you add a given number of manufacturing jobs to your community for several reasons you can expect that given number of jobs I'd say 100 to generate some additional jobs. Payrolls are spent, and as they are spent there is more demand for people to help you spend it, clerks in stores, the bank etc... and those people earn income. So if you get some secondary multiplier effects, are there any. The evidence is yes there are. There are multiplier effects from locating manufacturing plants. The only thing I think you ought to be cautious about or be warned of is that the multiplier effect is typically considerably smaller than what most of the development literature would have you believe. There are Chamber of Commerce literature suggests a multiplier of two to three in that range. The average that we found from these communities was .3. In other words you get one additional job in the community outside the manufacturing you would have to add

that new industry does increase the per capita income within the community. I think I am correct in saying that there were no exceptions to that in the studies that we looked at. You can express that in total aggregate income if you like, you'd have the same statement. Income goes up with industrial growth. As the developer types would tell you and they are absolutely correct that is solid findings. But when you dig around just a little bit further and ask how that income gain is distributed within the community then you begin to discover that it isn't quite as positive and clear as might seem to be the case on the face of it. The new industry, industrial growth may raise the average income or the aggregate income while relatively depressing the income of some members some segments of the community. Particularly those who are unemployed out of the labor force generally, already have low incomes, in otherwords the very people again that would have hoped to help that segment of the community with the industrial development for the people who are less likely to gain to be able to gain in absolute gain and experience. And if the rest of the community is gaining they are worse off in a relative sense. We found in Wisconsin, an example where we have had some industrial development in a number of communities. That some of the people who were retired that were living in these communities were living there because they're relatively speaking low cost of living in the community. The industrial development comes in and prices begin to go up. Values of land increases, and the public sector for school etc. goes up, and as a consequence the real estate tax on those property increases, and we found members of individuals in those communities were selling their homes because they couldn't afford to keep them anymore. So that while it is the case, that there is gain in the aggregate income or per capita income or average income that is not evenly distributed among all segments of the community. Simply you should be aware of that. I think that particularly for those of you in public health those represent those kinds of

three jobs in manufacturing. So there are multiplier effects, but they tend to be considerably smaller that what a number of the literature, pieces of literature that I've read, and I've heard people talk about which suggests that you should expect, don't expect quite so much. And there are a couple of reasons for that, again the commuting thing is the most obvious. If those 83 percent of the people working in Jones & Laughlin live in neighboring the take the payroll home there and spend it. So the Putnam county does not get that much of an effect of the payroll in the community. That's one the second factor that would help to explain the low multiplier is that in many communities there is such more facility available than is being duly utilized. Underutilization of facilities, so you can handle alot more buying, shopping and building homes that have you before you reach the point of having to add significantly to the labor force in non-manufacturing. That another factor, and one that is often overlooked. Then there is also what economists call the backward and forward linkages of manufacturing. In an extreme case a company may come into a community and do nothing but hire labor , use the land. But all of the materials that go into the process were shipped in, the finished product is boxed and then shipped out. So there is no buying of material and supplies and other kinds of input to the process in the community. And there is no additional secondary processing of it after its finished. And the smaller the community is, the more likely that is to be the case. I would suspect that in North Dakota that in some of the communities that were talking about it may well be that the State of North Dakota will experience some secondary effects, suppliers of materials and resources that go into the operations here, will come from Lets say Bismarck but Cannot is not going to be the place where they buy. And it is very likely that it will not even be in Bismarck but maybe from somewhere in Milwaukee. Backward and forward linkages of the industry itself also dampen the multiplier effect. But it is there. Income , the evidence from these studies suggest that indeed

circumstances may represent very important, life stress events in the lives of some members of the communities. And they are your responsibility. Population. One of the things that I have heard people say many, many times and I'm sure you have to is that what this community needs is some new industry, so that our young people could find jobs and they wouldn't have to leave when they finish high school. Well, it is the case that with industry the decline in population in alot of small communities have been experienced is halted. Not a single instance could we find where there was industrial growth and further decline in population. But, we also found that those young people we were just referring to know we have a plant and they won't have to leave, keep right on going anyway. It does not keep the young people there. What it does do, is to bring into the community replacements for them who may be roughly the same age. So the community does in fact increase its ability to maintain a younger population but not Donny and Sandy that you were trying to keep at home it is a kind of secondary information but I have heard that point made by so many people as being one of the reasons of why they are in favor of industrial expansion in the community. I think it is unfortunate that it doesn't happen that way. Population turn-around yes unequivalently. The population does stabalize at least did not grow as a result of industrial development within the community. I might add that these people that are coming in to replace Donny and Sandy continue to leave they tend to be younger than the population of the local community generally they also tend to be better educated, they usually come from a fairly short distance which is usually less than 50 miles away. That's on the national level, in North Dakota it might stretch out a little bit. But that has implications again of public health association and the kind of things you are concerned about. Once you are able to retain the younger population in the community that suggests some shifting that is likely to be necessary in the kinds of health services that the community

will need over the next five, ten and fifteen years. They are certainly different than if you had an old population of the average age is 55 years which is not terrribly uncommon in many rural communities. We do have population growth as a result of industrial development. Let's take a quick look two remaining things: The local market situation and the public sector. First, the local market. What we found from these studies as had been suggested as was expected is that the number of pieces of real estate that are on the book increased. There is an expansion in the communities inventory as it were a real profit. Particularily in residential property. If were going to have more people its pretty likely that we are going to need more housing and there you are. But in the terms of the hope that it would improve the tax base of the community, again the indications are quite positive. We do have an increase in the inventory of real estate property within the community. Largely in residential property to serve the growing population. The industrial and commercial properties inventories in those two categories seem to be up some but not nearly as much so as in the residential property. Perhaps even more importantly is that the assessed evaluation of property across the board agricultural land, residential property, commercial and all of it In all categories increases in the accessed evaluation of property. And from a fiscal tax base standpoint that is desirable. We have in fact increased the tax ability of the community. Retail sales which in many communities, many states would generate tax to the local community even though not directly. Because the sales taxes on retail volume is collected by the State and returned to the local community. Increases clearly are associated with new industry. Even though I said a while ago that the multiplier effect is less than what one would expect it is positive and that's a good indication of it there of why it's happened. Utilities is another area of the private sector that was looked at in a number of these studies, and there to evidence of increase consumption which of course you would expect in a growing population. But in addition to the increases that one could account for

just on the basis that they have got more people drinking water and flushing the commode, turning on the lights and what have you and also here that there was an increase in some of the communities at least an increase in the per capita consumption in other words suggesting that there was a change not only in volume as a result of population growth but a change in the patterns of consumption among the people within the community, this may be back to the fact of a younger population, better educated we couldn't trace those things out. Both an increase in the aggregate and also an increase in per capita suggests some rearrangements of life styles if you will. Clearly without any question there is private sector growth that results from new industry in the community. The three areas that I have mentioned with good evidence because so many studies looked at those areas and reported positive gain. Highways, streets, was number three, and number four was health facilities and services including hospitals, and clinics. Essentially, the cost as you expect obviously are in those areas where the public sector has a responsibility for maintaining the quality of the human capital of the community.

The literature shows that the following diseases result either from stress directly or as a result of increased susceptibility due to stress and the invasion of infective or allergic conditions:

Allergies [1,6]
- Hay Fever [6]

Eosinopenia [1]

Catabolism [1]

Maternal Mortality [2]

Infant Mortality [2]

Arteriosclerosis [2]

Neoplasia [2]

Tuberculosis [2]

Mental Disorders [2]
- Psychosis [4]
- Neurosis [4]
- Alcoholism [4]
- Drug Addiction [4]

Hypertension [2,3,5] (High Blood Pressure)

Coronary Disease [2,3]

Arthritis [3]

Suicide [4]

Criminality [4]

General Adaptation Syndrome [6] (G.A.S.)

Vasomotor Rhinitis [6]

Chronic Urticaria/Angioneurotic Oedema [6]

Peptic Ulcer [1,6]

Thyrotoxicosis [6]

Migrain Headaches [6]

REFERENCES

1) Selye, N. "Forty Years of Stress Research, Principal Remaining Problems and Misconceptions." C.M.A. Journal, July 3, 1978, v115, p.53-56.

2) Cassel, John. "An Epidemiological Perspective of Psychosocial Factors in Disease Etiology." AJPH, Nov., 1974, v.64, p.1040-1043, no. 11.

3) Saxon, Graham. "The Sociological Approach to Epidemiology." AJPH, Nov. 74, v.64, p.46-49, no.11.

4) Wardwell, Walter I. "Population Density and Morbidity." AJPH, Nov. 74, v.64, p.1052-56, no. 11.

5) Henry, J.P. & Cassel, J.C. "Psychosocial Factors in Essential Hypertension Recent Epidemiologic and Animal Experimental Evidence." Am. J. of Epid. Dept. 1967, v.90, p.171-200, no.3.

6) Rees, W. Linford. "Stress Distress and Disease." Brit. J. Psychiat, 1976, v.128: p.3-18.

7) Bahnson, Claus Bahne. "Epistemological Perspectives of Physical Disease From the Psychodynamic Point of View." AJPH, Nov. 1974, v.64, pp.1034-1040, no.11.

RESPONSE TO DEPARTMENT OF HEALTH LETTER

#190

Dr. Weisz was interviewed by members of the Social Conditions Work Group at the mental health center in Gillette, Wyoming, as part of the assessment process. The Chapter 3, Social Conditions sections on Family, Public Safety, and Additional Social Impacts address the loss of reference points, generation of interpersonal conflicts, and the creation of anxieties caused by rapid population growth and social change. The work group's efforts were directly assisted by Dr. Weisz's experience and comments.

Dr. Summer's remarks on the frequent contrast between the expectations and the reality of rural industrialization are reflected in the Draft Study on page 177. The first sentence reads: "It is unlikely that social impacts would be mitigated."

Mr. Cassel's attachment on the traditionally unrecognized relationships between stress, population density, and physical illnesses is an extremely important issue continually warranting further attention, especially regarding long-range planning. We have included the article so that it may become a part of this study; however, the findings are preliminary because evidence of definite cause and effect relationships are not yet well established. The State of North Dakota is concerned and sensitive to the issue and will attempt to consider the most current findings as additional development is analyzed. The subject is implicitly reflected in the Draft Study on pages 136-141 (particularly the sections on Health, The Family, and Additional Social Impacts) and on page 177, but not to the highly detailed scientific degree found in the Cassel paper.

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Gentlemen:

West-Central North Dakota Regional EIS on Energy Development

Following is a listing of Basin Electric's principal concerns regarding the draft West-Central North Dakota Regional Environmental Impact Study on Energy Development:

1. Levels of Development. Because of developments which have taken place since the study was initiated, we believe it is necessary that the levels of development and the facilities and mines included therein should be revised. In order to facilitate this revision, we believe that a clear definition of the basis or criteria for including a facility or mine in the various levels should be specified. Both the summary and the basic document failed to give a clear and concise definition of the criteria which were used to include a given facility and a given level of development, the prime example being the inclusion of Glenharold Mine but the exclusion of the Falkirk Mine and Coal Creek Station. The apparent rationale for including the Glenharold Mine is the fact continued mining will require the acquisition of leases of coal owned by the federal and state governments. It is safe to assume that other existing mines located within the study area- specifically the Indian Head Mine, the Knife River Coal Mine and Baukol-Noonan Coal Mine will continue to be mined also. Will future mining from these mines not also require the acquisition of leases on federal and state lands? Our recommendation is that the Glenharold Mine should be deleted from study as part of Level 1 coal development since it is an existing facility, the same as other existing mines located within the study area. 191

No rationale is given for excluding the Falkirk Mine and Coal Creek Power Plant, both of which are still under construction, the same as the Coyote 1 Power Plant and associated mine expansion, as well as the Antelope Valley Station and Coteau Mine. The only difference among the facilities is that the schedule on which they are being built. It certainly makes no sense to include the Glenharold Mine but exclude the Falkirk Mine.

Further, because of recent developments, we suggest that it is no longer proper to include the Natural Gas Pipe Line proposed gasification plant in Dunn County as part of Level 1 development, because of the fact that a necessary and vital permit for that facility has been specifically disapproved by the ND State Water Commission. At the very best, the NGPL facility should now be included in Level 2 development.

One of the possible definitions or statements of criteria for inclusion of a facility in mine in Level 1 appears on the map 1-1 of the basic document, where Level 1 proposals are defined as "projects proposed by industry which would be expected to be constructed within about five years if approved." We believe that the state and ANG Coal Gasification Company have agreed that Phase 2 of ANG's proposed gasification plant will not be constructed until the first Phase has been constructed and is in operation for at least one year. Using the definition cited on map 1-1 and specifically the five year criteria, it is no longer possible for Phase 2 of ANG's coal gasification facility to be constructed within the period contemplated for Level 1 proposals. For this reason, I suggest that the Phase 2 of ANG's Coal Gasification plant and the associated expansion of the Coteau Mine should be included as a Level 2 proposal.

Level 2 proposals, which are defined on map 1-1 as being "projects proposed by industry which would be expected to be constructed by 1990 if approved" should thus include the Coyote 2 Station, the second phase of ANG's Coal Gasification plant, and the NGPL facility, although again, the NGPL facility has been disapproved and because of that fact, the citizens of North Dakota can be assured that that facility will not be constructed within five years.

2. New Laws and Regulations as They Relate to Level 2 and 3 Proposals. Page 10 of the Executive's Summary contains the following statement "Note: The analysis reflecting the 1977 amendments to the Clean Air Act was not completed in time to be included in this study but information would be available from the ND State Health Department." 192

The 1977 amendments to the Clean Air Act are of such major significance as to require something more than their dismissal in a note. We realize that the 1977 amendments to the Clean Air Act were adopted late in the course of this study; however, they are of such major and far-reaching significance as to raise questions as to whether, in fact, any energy development above those projects which have been approved (excluding the NGPL plant which has not been approved), plus a second unit at the Coyote generating plant (which could possibly be constructed under the Coyote 1 Health Department Permit to Construct, if the emissions from Unit 1 were substantially reduced), will be allowed within the vast majority of the study area.

With the exception of the Coyote 2 station, all of the Level 2 proposals consist of proposed coal mines. Given the vastly limiting effect of the 1977 Clean Air Act amendments, we submit that it is not reasonable to presume that the coal in the five mines cited will be mined unless the coal is removed and shipped to some other area not within the seven county study area. Level 3

development is simply based on the assumption that because coal exists in a given area it will be mined and burned in that area. Because of the Clean Air Act amendments, this is no longer a reasonable assumption under any circumstances.

3. The inclusion of some pictures and the captions of them appear to be an attempt to color the study. Specifically, at the top of the center column on page 29 of the Summary, there appears a picture of a transmission line. The caption of the picture reads "transmission towers dominate this landscape." If one takes a picture of a transmission tower, one is going to get a picture of a transmission tower. The picture is not one of landscape, we submit. This can be demonstrated by imagining the "landscape" shown without the transmission towers. We submit that the picture in the lower right hand corner of page 29 which is a picture of the Badlands, is a landscape. Please note that it is not dominated by transmission towers. 193

4. Anticipated socio-economic impacts based upon 1976 estimated levels of activity are interesting scenarios from a "what might happen" point of view, but are of no value in terms of developing specific planning or implementation of mitigation measures. It would be impossible to respond to future population growth using this data since the assessed base level of energy development is invalid at this time. The study from a socio-economic perspective is strictly a one-time "snapshot" taken in 1976 and of limited value for making decisions at the local level. 194

5. Color choices on many of the maps are not easily distinguishable. Either less information should be shown (some of the categories could be regrouped) or different hues should be selected. 195

We hope that the above comments will be useful to you during preparation of the final document. Thank you for the opportunity to comment.

Sincerely,

Al Peters

Al Peters
Environmental Coordinator

bbb

RESPONSE TO BASIN ELECTRIC POWER COOPERATIVE LETTER

#191

The plan to establish levels of development and the criteria necessary to determine what proposals would fit into the various levels was completed in early May 1976. The criteria for proposals to be considered in Level 1 development included the following:

1. Proposal would be expected to initiate construction within about five years.

2. Proposal had submitted applications for federal/state coal leases.

3. Mine proposals had developed a mining plan.

4. Proposal had made application for or received some required permits.

5. Proposals for energy conversion facilities should include:

a. location, type of facility, acreage requirements, plant output

b. coal consumption rate

c. emission levels expected

d. plant water requirements

e. work force levels and time when they are needed

f. waste disposal systems

g. transmission line, pipeline, and road locations

h. dollar value of capital equipment goods purchased within the state

i. any other available information regarding the facility

The criteria for additional proposals to be included in Level 2 development included the following:

1. Proposal would be expected to initiate construction by about 1990.

2. Letters of intent were received identifying proposed projects and provided the following information:

a. Mines
Location
Estimated production
Timeframe expected
Employment levels
Expected use

b. Coal Conversion Facilities
Type of facility and land requirements
Location
Coal consumption and plant output
Employment levels
Water requirements
Timeframe expected

It is true that existing mines will require additional leases on federal and state lands. However, the major difference and the reason for the inclusion of the Glenharold Mine in Level 1 development is that Consolidation Coal Company has made application for about 2,000 acres of federal coal lands in the vicinity of their mine. This application meets criteria number 2 above for Level 1 development. This application requires that an environmental assessment be completed prior to any consideration for leasing. Although some of the other existing mines may have made application for coal lands, these applications were for short term immediate needs and individual environmental assessments were being completed. As an example, an environmental assessment had already been completed on the Falkirk Mine.

Falkirk Mine and Coal Creek Power Plant were approved prior to the study; therefore, they became part of the baseline information. The projects which had not received their approvals were still considered proposals which should be analyzed for impacts upon the environment. Antelope Valley Station and Center Mine did not receive approvals until about the time the study was published. For details on the NGPL proposal and why it was included, refer to response #28.

The second phase of the ANG Coal Gasification Plant met the criteria under Level 1 development above. The statement under Map 1-1 should have read "projects proposed by industry which would be expected to initiate construction within about five years if approved." At the time the study was prepared, phases 1 and 2 met all of these requirements.

#192

An updated discussion of the influence of the Clean Air Act Amendments of 1977 on Level 1 and Level 2 projects is presented in Part 1, Climate and Air Quality. This discussion considers prevention of significant deterioration regulations which became effective in the summer of 1978.

#193

When transmission towers are built on gently rolling terrain (as shown in the photograph), they create a stark vertical contrast to the natural landscape. The towers draw the viewer's attention and become a dominant feature of the scene in which they occur.

#194

The Draft Study is a one-time scenario in that it uses assumptions and conditions valid at a given point in time to forecast economic conditions based upon those assumptions and conditions.

#195

See response #6.

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