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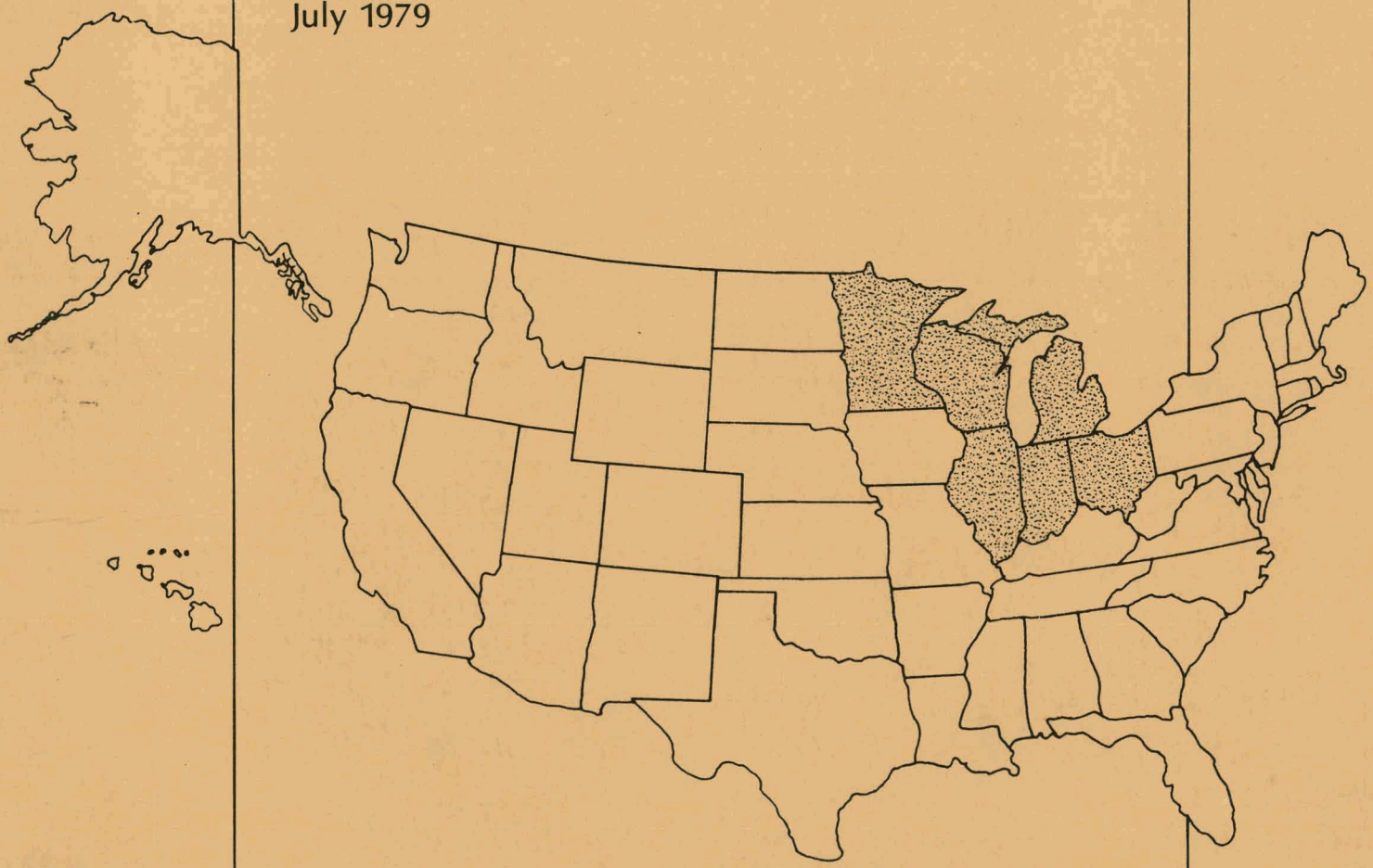
Regional Issue Identification and Assessment Program

An Environmental Evaluation of the PIES Trendlong Mid-Mid Scenario: Federal Region V

July 1979



Integrated Assessments and Policy Evaluations Group

Energy and Environmental Systems Division

Argonne National Laboratory

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REGIONAL ISSUE IDENTIFICATION
AND ASSESSMENT PROGRAM

AN ENVIRONMENTAL EVALUATION OF THE PIES TRENDLONG MID-MID SCENARIO: FEDERAL REGION V

JULY 1979

PREPARED BY

INTEGRATED ASSESSMENTS AND POLICY EVALUATIONS GROUP
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PREFACE

This report is a product of the Midwest Regional Assessment (MRA), which focuses on identifying and assessing regional responses to the development of energy supply and conservation technologies and to changes in federal energy policies. In conducting this impact assessment, consideration was given to health, environmental, and socioeconomic impacts. As part of the overall MRA program, the Regional Issue Identification and Assessment Program (RIIA) was conducted at Argonne National Laboratory for Federal Regions V and VII. A mid-level scenario for the years 1985 and 1990 was evaluated, and the results for Region V are contained in this volume. The MRA is sponsored by the Regional Assessments Division, Assistant Secretary for Environment, U.S. Department of Energy. Dr. Arthur Katz of DOE served as project monitor. Program leadership at Argonne is provided by the Integrated Assessments and Policy Evaluations Group in the Energy and Environmental Systems (EES) Division.

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SUMMARY, REGION V

KEY FINDINGS

The key findings of this DOE-sponsored impact evaluation of the PIES TRENDLONG MID-MID Scenario for Federal Region V (Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin) are as follows:

- In those areas of eastern Michigan and southeastern and central Wisconsin that have not attained National Ambient Air Quality Standards (NAAQS), there will be limited opportunities for mitigation of impacts from utility coal growth through emission offsets or improved control efficiencies. In Ohio, 30% of utility coal growth could be restricted primarily because of NAAQS nonattainment. Illinois, Indiana, and Ohio may also experience problems with oil-fired utilities in nonattainment areas, but fuel purchasing practices could reduce the air quality impacts.
- Utility and industrial siting along Lake Erie may require extensive pretreatment of effluents discharged into the Lake. Allocation of water from Lake Michigan for new facilities may become an issue in Wisconsin and Illinois where large water-for-energy demands conflict with other water uses.
- Surface mining activities in Illinois, Indiana, and Ohio are projected to disturb aproximately 200,000 acres in the period 1975-1990, causing temporary or permanent shifts in productivity and land use. Much of the land in the mining area is presently in forest and crops.
- Deaths and illnesses resulting from employment in deep mining in Region V may increase 30-40% over 1975 levels.

The results of the study are summarized in Table 1.

Table 1. The Impact of Energy Development in the Energy Information Administration (EIA) Trendlong Mid-Mid Scenario on Regional Environmental Quality in 1990 - Federal Region V (Illinois, Indiana, Michigan, Minnesota, Ohio, Wisconsin)

Federal Region V	Regional Dimensions*			Comment or Cause of Constraint or Impact
	Local	Subregional	Regional	
The Likelihood of Projected Regional Energy Use or Development Producing Significant Environmental Impacts	H[1]	M[2,5,6,8]	M[7,3]	1) Majority of utility coal increases in eastern Michigan, Ohio, and S-E and central Wisconsin projected for nonattainment areas. No mitigation likely from offsets or improved control efficiencies
**The Likelihood of not Attaining Projected Regional Energy Mix because of Adverse Environmental Impacts	H[1]	H[1]	M[3]	
**The Likelihood Specific Technologies or Resources will not Attain Projected Level of Use		H[1]		2) Illinois, Indiana, and Ohio may experience problems in several nonattainment areas. Fuel purchasing practices could reduce Air Quality impacts.
Utility:				
- Coal	H[1]	H[1]M[5,6]	M[3]	3) 22% of region's utility coal growth and 25% of the utility oil increases could be constrained due to failure to meet minimal air quality standards.
- Oil	M[3]	M[2]	M[3]	
- Gas	L	L	L	4) Restrictions may occur in some industrial areas (Chicago, St. Louis, Detroit, Cleveland). Specific restrictions depend on fuel selection and available offsets.
- Nuclear	L	L	L	
- Solar				
General:				5) Water allocation from Lake Michigan controlled by federal mandate. Water allocation may become issue with projected utility increases along Lake Michigan.
- Utility	M[4,2]	M[6]	L	
- Industry	M[4]	M[6]	L	6) Utility and industrial growth bordering Lake Erie may be constrained in Ohio. Effluents may require extensive pretreatment before discharge into the Lake.
- Mining		M[8]	M[7]	
				7) Regional occupation-related deaths and illnesses from deep mining may increase 30-40%.
				8) Major changes in land use from surface mining on forest and croplands are projected for Illinois, Indiana, and Ohio.

* Definitions:

Local: Local site specific impacts
Subregional: AQCR (Air), ASR (Water), County, State, FEA
Regional: Affects federal region as a whole

**Likelihood of falling short of projected goals:

High - Large degree of certainty that conflict will arise at several facilities with no or little opportunity for cost effective mitigation.

Medium - Specified concern could occur at a few facilities, but potential cost effective mitigation strategies are available.

Low - Conflicts unlikely to occur.

GENERAL CONCLUSIONS

Air

The states in Region V currently have over 80,000 MW of installed coal burning utility capacity, which represents the greatest use of utility coal in the nation. Industrial coal use is also the highest in the nation. The nonattainment of sulfur dioxide standards remains an issue in each of the Region V states. SO_2 problems are most persistent in the northcentral portion of Ohio and Wisconsin. Illinois, Indiana, and Ohio have significant coal reserves; however, expansion of the coal economies in these areas is difficult in a climate of restrictive sulfur dioxide regulations and unproven SO_2 control technology.

Particulate standards are also an issue in every Region V state. Although Region V states have persistent SO_2 and Total Suspended Particulates (TSP) attainment problems, the proposed siting scenario does not impose significant air quality problems in Illinois, Indiana, or Minnesota. Lower Michigan and Wisconsin, however, have over 50 percent of proposed coal growth in areas with persistent TSP standards violations. Ohio has approximately 30 percent of its coal siting proposed in nonattainment areas. As expected, urban industrial centers constitute areas having the greatest air quality problems.

Minnesota, Wisconsin and Michigan, all have Prevention of Significant Deterioration (PSD) Class I, visibility protected areas. Designated areas in these states could restrict development of major coal installations. PSD areas include northeastern Minnesota, northwestern Wisconsin and northwestern Michigan.

Water

Utility increases in the region are predicted to have the most certain impact on water resources in the region. However, projected growth of coal-use in industrial activity in areas adjacent to the Great Lakes is high in some states, and the effluents discharged from these facilities may require extensive pretreatment if they are destined for discharge to the Great Lakes. Areas of particular concern in the scenario lie in Ohio, Michigan, and Wisconsin. Transport of expected gas stack emissions from utilities located at long distances from the Great Lakes can eventually be deposited onto the surface of the lakes and affect the water quality. As a result, interregional and international issues could result because of the policy of the Great Lakes Basin Commission and the International Joint Commission to improve the quality of the lakes.

Solid Waste

The disposal of all kinds of wastes, including ash and sludge from utility and industrial coal combustion, will be more difficult in the future.

The land requirements for industrial disposal will increase by nearly 400% due, in part, to application of FGD systems. However, the total acreage required is still only 350 acres/year for the entire region. In spite of the relatively small number of acres required, there is a problem finding sites close enough to an industry so that transportatiion costs are not prohibitive. Even when a suitable site can be found, institutional factors constrain siting. Under the best of circumstances, landfills are not popular.

The effect of regulations proposed under the Resource Conservation and Recovery Act (RCRA) will be significant. Historically, regulations governing waste disposal have often been limited or nonexistent. RCRA will make finding new disposal sites more difficult and expensive, and existing sites that cannot meet RCRA standards will have to close. In addition, uncertainties surrounding certain aspects of RCRA, including the designation of ash and sludge as special wastes, could have a significant effect on disposal. Utilities, too, will be affected by new and more stringent disposal regulations. New plants should not be constrained by solid waste disposal problems although new regulations and increased public opposition will make it more difficult and expensive. The difficulty and expense of disposal may promote increased utilitization or resource recovery of these materials. Existing plants will face problems similar to those industries face when they need more disposal room. The utilities will have to transport the wastes off-site, and, in crowded urban areas, these distances may significantly increase costs.

Ecology/Land Use

The major ecological and land-use impacts in Region V are likely to be associated with coal extraction activities, which are projected to occur in southern areas of the states with an almost equal mix of forest and agricultural land uses. Current federal regulations require that surface-mined land be restored to its premining productivity after the coal has been removed. Reclamation costs in Region V may be high: reclamation has been difficult in some areas in the past because of extremely acidic conditions, and restoration of cropland or forest would require extensive soil manipulation. Restoration of the original forest ecosystem will probably not occur quickly, if at all.

Construction of a number of major new power plants projected by the scenario and the new residential development required for the local increases in population induced by these developments may remove thousands of acres from agricultural uses outside the region's major urban areas. Large utilities projected for the Ohio River Valley may affect either croplands or natural forested habitats, with attendant impacts on local wildlife populations.

A major ecological concern related to coal combustion by utilities and industry is the effect of SO_2 emissions on crops and natural vegetation. Exposure to high levels of SO_2 can cause visible damage and decreases in productivity and yield in sensitive plant species. Although coal combustion is projected to increase in Region V (see Table 3.2), SO_2-related problems are generally projected to decrease during the scenario time frame. However, the

projected 1990 SO_2 levels may still be high enough to cause damage to regionally important crops such as soybeans, wheat, hay, and fruit grown in these areas and to exposed pine forests in the northern counties.

Socioeconomic Issues

Socioeconomic impacts are expected to occur in every county where the scenario sites a new energy development, but will only potentially inflict severe and unmanageable impacts in seven counties. These counties, in Indiana, Illinois, Wisconsin, and Ohio, are expected to incur more of the negative adverse consequences of resource development since their existing workforces and infrastructures are insufficient to satisfy the excessive demands of the construction phase.

These severe impacts are projected in counties where 25% of the region's proposed coal capacity, 23% of the nuclear, 7% of the oil-steam, 21% of the combined-cycle and 20% of the new mine workers are sited. These percentages of capacity increases sited for Region V represent 1-8% (depending on technology) of the more than 70,000 MW of new generating capacity sited for Region V and therefore the percentage of total regional capacity that will have an impact. Besides experiencing downfalls in facilities and services, the counties may encounter an overburdened social infrastructure, out-migration, frustration, social dissolution, and deterioration as a result of the regional population increase by 1990. This corresponds to only 0.07% of the current regional population, but in site-specific analyses (county level), the percentage ranges from zero to more than 40 percent.

Health and Safety

Coal extraction is projected to be the primary source of occupational injuries and illneses related to energy activities in Region V. Major reserves of coal are found in Ohio, Indiana, and Illinois. The percentage of this coal recoverable by relatively low-risk surface mining techniques is declining. Deep mine extraction, one of the most dangerous occupations in the U.S., presents higher risk to workers than does surface mine extraction because of dust exposure and the potential for physical trauma. Under the Mid-Mid Scenario, as demand grows and surface mining decreases, cases of chronic respiratory disease and accidental deaths due to coal extraction may increase from 20% to 40%. Compared to coal extraction other energy related activities (i.e., oil and gas extraction and refining, electricity generation and distribution) will have a minimal impact on occupational populations.

Currently, quantifiable public health impacts from energy-related activities in Region V will result primarily from atmospheric emissions during fossil-fuel combustion by both electric utilities and industries. The combustion of coal and oil releases sulfur oxides into the atmosphere along with hydrocarbons, particulates, and trace elements. Although the number of deaths resulting from exposure to sulfur oxides in Region V are projected to decrease approximately 35% under the Mid-Mid Scenario, this number will nevertheless be significant, approaching the number of homicides in the U.S. in 1975.

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1 INTRODUCTION

1.1 RIIA STUDY DESCRIPTION

This regional Issues Identification and Assessment (RIIA), is an evaluation of the regional environmental impacts of future energy development. The study was conducted for the Regional Assessments Division, Office of Technology Impacts, Office of the Assistant Secretary for Environment, Department of Energy. The impacts described for 1985 and 1990 are based on a national energy projection (scenario) that assumes medium energy demand and fuel supply through 1990 but does not incorporate the policies of the 1978 National Energy Act (NEA). The scenario, known as the Projection Series C or the TRENDLONG MID-MID Scenario, is one of six possible energy futures produced by the Energy Information Administration (EIA) of the Department of Energy for the Department's 1977 Annual Report to Congress. The scenario was chosen as representative of the official DOE national energy projections when this project was initiated, prior to the passage of the National Energy Act. Since the RIIA program is part of an ongoing review of the regional impact of energy policies, the next phase will examine the National Energy Act (NEA) and initiatives suggested by the President's second National Energy Plan. However, since coal utilization will increase under the NEA, in general, impacts identified in the trendlong Series C Scenario should provide a framework for the discussion of impacts by NEA.

The environmental impacts discussed in this volume are for Federal Region V. There are nine companion volumes, one for each of the other federal regions in the nation (Fig. 1.1). This set of reports represents a comprehensive portrayal of the regional environmental impacts and implications of the future national energy development reflected in the scenario. A detailed description of the methodologies used at each level of this study and a summary of the data developed in the RIIA process for each state are available in Volume II of this report.

The Region V report was prepared by the Energy and Environmental Systems Division of Argonne National Laboratory as part of an ongoing regional program, which addresses energy-related issues in the Midwest, a 12-state region that includes Federal Regions V and VII and part of Region VIII.

1.2 RIIA METHODOLOGY AND ASSUMPTIONS

1.2.1 Program Methodology

In developing the national energy scenarios, the Energy Information Administration balances projections of supply and demand at the federal region level. The RIIA study used the predicted fuel mixes by federal regions derived from the TRENDLONG Series C Scenario as a starting point for its analyses. County level patterns for utility, industry and mining activities for 1985 and 1990 were then developed from these federal region totals. Energy sources addressed were coal, nuclear, oil, oil shale, gas, geothermal, hydroelectric and solar.

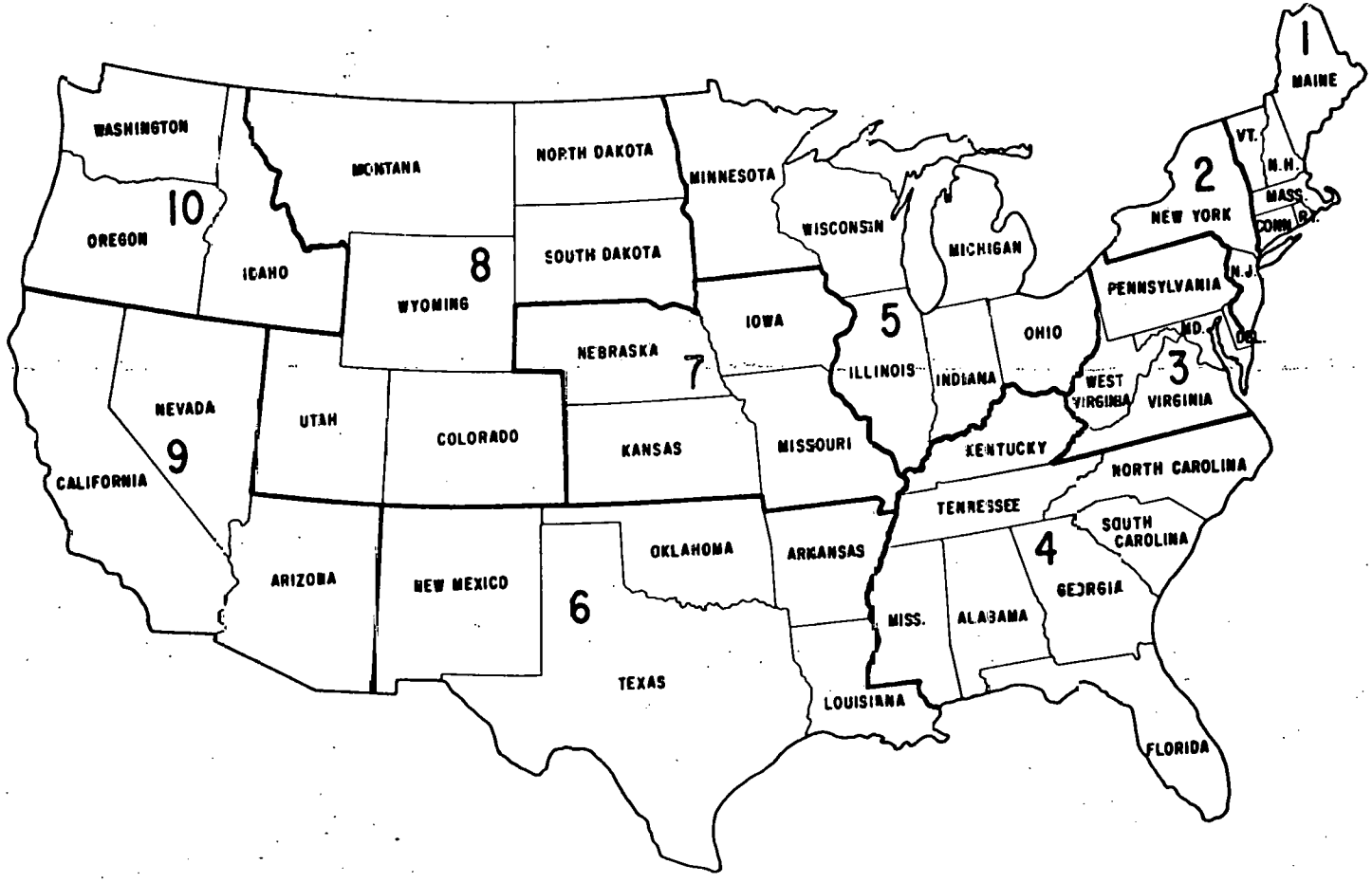

Fig. 1.1 Federal Regions

Six of the national laboratories, Argonne (ANL), Brookhaven (BNL), Lawrence Berkeley (LBL), Los Alamos (LASL), Oak Ridge (ORNL), and Pacific Northwest (PNL), undertook lead assignments to analyze the impact of these county-level patterns of utility, industry, and mining activities on the air, water, and land resources of the country and on the socioeconomic and health and safety aspects of the nation's welfare. When these tasks were complete, each laboratory focused on an assessment of the products of all of the lead laboratory analyses from the particular perspective of the states and regions for which they were responsible.

1.2.2 Assumptions

The major control technology asumptions used in this analysis are shown in Table 1.1. In addition to those listed, other, more specific, technology assumptions were made in some of the regional assessments of areas or states in which energy production and distribution differed significantly from national trends. For instance, in Region V, combined-cycle facilities were assumed to use coal as their primary fuel. Solar and "other" technologies contributed only a small amount to the total increases in generating capacity projected for the region and were assumed to be small decentralized facilities. The amount of hydropower projected for the region was negligible.

1.2.3 Criteria for Ranking of Impacts

The discussions of each region and for each state within the region include a summary matrix displaying the severity of specific environmental, health, social, and economic impacts of energy development and technologies imposed by the scenario. The severity is rated as high, medium or low according to criteria described in Table 1.2.

Table 1.1. Control Technology Assumptions

	UTILITY	INDUSTRY	MINING
AIR	EMISSIONS AND LOCAL AIR QUALITY: COAL • EXISTING PLANTS – UNCONTROLLED EMISSIONS BASED ON FPC COAL CHARACTERISTICS FOR ASH, HEAT AND SULFUR (1976) • PLANTS WITH STARTUP DATES PRIOR TO 1983 – SIPS OR NSPS REQUIREMENTS • PLANTS WITH STARTUP DATES AFTER 1983 – BACT, 85% AND 90% CONTROL OR REMOVAL OF SO_2 CONSIDERED OIL • SIPS REQUIREMENTS GAS AND METALLURGICAL COAL • UNCONTROLLED	EMISSIONS AND LOCAL AIR QUALITY COAL • NEW LARGE SOURCES (250 X 10^6 BTU/HR) — SO_2: BACT, 80% REMOVAL; PARTICULATES: BACT, 99% REMOVAL • NEW SMALL SOURCES (100–250 X 10^6 BTU/HR) — SO_2: 1.5 LB/10^6 BTU; PARTICULATES: 0.05 LB/10^6 BTU • NEW NON-MFBI PLANTS (100 X 10^6 BTU/HR) — SO_2: SIPs WITH PHYSICAL CLEANING; PARTICULATES: SIPs, CYCLONES • EXISTING LARGE SOURCES (250 X 10^6 BTU) — SO_2: SIPs FOR MFBIs; PARTICULATES: SIPs FOR MFBIs • EXISTING SMALL SOURCES (100–250 X 10^6 BTU/HR) — SO_2: SIPs FOR MFBIs; PARTICULATES: SIPs FOR MFBIs • EXISTING NON-MFBI PLANTS (100 X 10^6 BTU/HR) — SO_2: SIPs USING LOCALLY AVAILABLE COAL; PARTICULATES: SIPs USING SETTLING CHAMBER/EXPANDED CHIMNEY & CYCLONES OIL AND GAS • SIPs LIMITATIONS ON SULFUR CONTENT OF FUEL, AS A WEIGHT FRACTION. • EMISSIONS FACTORS IN USEPA "COMPILATION OF AIR POLLUTANT FACTORS"	NO ASSUMPTIONS MADE. AIR POLLUTANTS FROM MINING ACTIVITIES NOT CONSIDERED.
WATER QUALITY	BPCT, EFFECTIVE JULY 1977 BACTEA, EFFECTIVE JULY 1984 NSPS, EFFECTIVE JULY 1977 UTILITY GENERATING LOAD FACTOR – 56%	BPCT, EFFECTIVE JULY 1977 BACTEA, EFFECTIVE JULY 1984 NSPS EFFECTIVE JULY 1977	MINE DRAINAGE: "COAL SUPPLY REGION" (CSR) DRAINAGE DATABASE – COMPLIANCE WITH EFFLUENT LIMITATIONS ASSUMED. COAL WASHING: ASSUME 50% OF COAL IS CLEANED, 96% OF THAT BY WET METHODS. ALL FACILITIES HAVE ZERO DISCHARGE IN CSRs 7 – 10, 60% OF FACILITIES HAVE ZERO DISCHARGE IN CSRs 1 – 6, CSR 11 AND CSR 12. 40% OF FACILITIES IN THOSE CSRs PRODUCE 2,150 LITERS/METRIC TON OF COAL WASHED. COAL REFUSE FILE: 40% OF ANNUAL PRECIPITATION IN EACH CSR RESULTS IN EFFLUENT RUNOFF. 7.08×10^6 HECTARES/METRIC TON OF COAL CLEANED ARE EXPOSED TO RAIN FOR ONE YEAR. RECLAMATION: SEDIMENTATION CAN ACHIEVE 80% CONTROL EFFICIENCY. OTHER RUNOFF RATES ARE FROM EPA NATIONAL ASSESSMENT OF NON-POINT SOURCE POLLUTION.
WATER AVAILABILITY	COOLING OPTION: NUCLEAR (1000 MW) WITHDRAWAL (MGD) / NUCLEAR (1000 MW) CONSUMPTION (MGD) / FOSSIL (1000 MW) WITHDRAWAL (MGD) / FOSSIL (1000 MW) CONSUMPTION (MGD) ONCE THROUGH: 1400 / 4 / 830 / 3 POND OR CANAL: 42 / 26 / 28 / 15 WET COOLING TOWER: 28 / 17 / 19 / 10 DRY COOLING TOWER: 0.3 / 0 / 0.2 / 0	DATA BASE • WATER CONSUMPTION DATA DEVELOPED FOR THE WATER RESOURCES COUNCIL	WATER REQUIREMENTS FOR COAL EXTRACTION AND WASHING, DUST CONTROL AND REVEGETATION ARE ASSUMED TO BE NEGLIGIBLE.
SOLID WASTE	• COAL CHARACTERISTICS IN 1985 AND 1990 ARE THE SAME AS IN 1976 DATA FROM FPC TAPES. • USE OF ELECTROSTATIC PRECIPITATORS AND FLUE GAS DESULFURIZATION WITH LIME/LIMESTONE SLURRIES ASSUMED FOR 1985 AND 1990.	• NSPS AND SIPs REQUIREMENTS USED TO DETERMINE ASH AND FGD SLUDGE PRODUCTION AND LAND REQUIREMENTS.	• CONVERSION FACTORS FOR COAL MINING RANGED FROM 0.0818 ACRES/1000 TONS (COAL MINED) IN DEEP MINING IN EASTERN KENTUCKY TO 0.235 ACRES/1000 TONS IN STRIP MINING IN ARKANSAS • PAST BUREAU OF MINES DATA AND MINRES PROGRAM WERE USED TO DETERMINE MINING RESIDUALS.

ABBREVIATIONS:

BACTEA	BEST AVAILABLE CONTROL TECHNOLOGY ECONOMICALLY ACHIEVABLE
BEA	BUREAU OF ECONOMIC ACTIVITY AREA
BPCT	BEST PRACTICABLE CONTROL TECHNOLOGY
BTU	BRITISH THERMAL UNIT
FGD	FLUE GAS DESULFURIZATION
FPC	FEDERAL POWER COMMISSION
MFBI	MAJOR FUEL BURNING INSTALLATIONS
MGD	MILLION GALLONS PER DAY
MW	MEGAWATTS
NSPS	NEW SOURCE PERFORMANCE STANDARDS
SIPs	STATE IMPLEMENTATION PLANS

Table 1.2. Definition of Criteria for Rating of Impacts

IMPACT CATEGORY	HIGH IMPACT	MEDIUM IMPACT	LOW IMPACT
AIR QUALITY	MAJOR FACILITIES IN PROPOSED SITING SCENARIO COULD BE CONSTRAINED BY ONE OR ALL OF THE FOLLOWING ISSUES. A) PERSISTENT AND CONTINUED VIOLATIONS OF PRIMARY NATIONAL AMBIENT AIR QUALITY STANDARDS. B) INABILITY TO ATTAIN ACCEPTABLE PSD INCREMENT LIMITATIONS. C) LIMITED PROBABILITY THAT IMPROVED EMISSION CONTROL EFFICIENCIES OR OFFSETS WOULD RESULT IN NAAQS ATTAINMENT.	SOME MAJOR FACILITIES IN PROPOSED SITING SCENARIO COULD BE CONSTRAINED BY HIGH IMPACT ISSUES. VIOLATIONS OCCUR BUT ARE AMENABLE TO EXTENSIVE CONTROL TECHNOLOGY, FUEL (COAL AND OIL) PURCHASING POLICY, AND/OR OFFSET.	AIR QUALITY AND EMISSION LEVEL ARE WITHIN ACCEPTABLE STANDARDS. NO MAJOR ADJUSTMENTS TO SITING OF PLANTS BECAUSE OF AIR QUALITY ISSUES.
VISIBILITY	THERE IS A SIGNIFICANT DECREASE IN CALCULATED VISUAL RANGE IN CLASS I AREAS.	THERE IS A MODERATE DECREASE IN VISUAL RANGE BUT THE REDUCTION IS AMENABLE TO MITIGATION MEASURES.	NO DECREASE IN VISUAL RANGE OR NEW SITING IMPACTS AMENABLE TO MITIGATION MEASURES. NO MAJOR ADJUSTMENT IN SITING.
WATER QUALITY	SIGNIFICANT ECONOMIC BURDEN TO MEET WPCA REQUIREMENTS.	TREATED EFFLUENTS MEET EFFLUENT STANDARDS BUT OCCASIONAL LOCALIZED STREAM STANDARD VIOLATIONS WILL OCCUR IN RECEIVING WATER BODY.	RECEIVING BODY CAPABLE OF HANDLING ALL PROJECTED EFFLUENT ADDITIONS. FEW OR NO VIOLATIONS OF STREAM STANDARDS ANTICIPATED
WATER AVAILABILITY	NO WATER AVAILABLE WITHOUT MAJOR SHIFTS IN CURRENT WATER USES, E. G., EITHER ENERGY DEVELOPMENT OF AGRICULTURE, EVEN WITH LOW-FLOW AUGMENTATION, OR WATER AVAILABLE THROUGH MAJOR STRUCTURAL AND NON-STRUCTURAL ALTERNATIVES, E. G., STRUCTURAL - CONSTRUCTION OF DAMS AND RESERVOIRS. GROUND WATER MINING WITH NO RECHARGE POTENTIAL.	WATER AVAILABLE AT MODERATE ECONOMIC COST TO THE REGION. GROUND WATER MINING WITH RECHARGE POTENTIAL AVAILABLE OR POSSIBLE.	NO CONFLICTS EXCEPT FOR RECREATIONAL USES. GROUND WATER WITHDRAWAL WHERE ANNUAL RECHARGING OCCURS.
SOLID WASTE	SEVERE POTENTIAL CONTAMINATION PROBLEMS LIKELY TO REQUIRE COMPLETE CONTAINMENT OF WASTES.	MINIMAL ENVIRONMENTAL IMPACTS WITH PROPER CONTROL TECHNOLOGY. INDICATION THAT MANY AREAS MAY EXPERIENCE PROBLEMS AND IN SOME OF THESE AREAS SUITABLE OPTIONS MAY NOT BE AVAILABLE.	MINIMAL ENVIRONMENTAL IMPACTS WITH PROPER CONTROL TECHNOLOGIES. SOME POTENTIAL PROBLEMS BUT GENERALLY AMENABLE TO CURRENT TECHNOLOGY OPTIONS AT ADDITIONAL COST.
ECOLOGY	CRITICAL NATURAL HABITATS WILL BE DISTURBED.	CRITICAL NATURAL HABITAT OR LARGE ACREAGES OF CROPLAND MAY BE DISTURBED.	LOCALIZED IMPACTS WHICH MAY BE READILY MITIGATED BY STRUCTURAL OR SITING ALTERNATIVES.
LAND USE	CONFLICT WITH HIGH VALUE LAND USE, SUCH AS LOSS OF HABITAT, PARKLAND, SEISMIC RISKS, SCENIC RESOURCES, INDIAN LANDS, AGRICULTURAL LAND.	SIMILAR CONFLICTS, WITH ALTERNATIVE SITES OR MITIGATION MEASURES COSTLY BUT AVAILABLE.	FEW CONFLICTS; OR A RANGE OF ALTERNATIVES AVAILABLE.
PUBLIC HEALTH	SIGNIFICANT INCREASES IN MORBIDITY AND MORTALITY RATE DUE TO EXPOSURE TO ENERGY RELATED POLLUTANTS.	MODERATE INCREASES IN MORBIDITY AND MORTALITY RATE DUE TO EXPOSURE TO ENERGY RELATED POLLUTANTS.	NO SIGNIFICANT IMPACT. ALL IMPACTS SUBJECT TO MITIGATION.
OCCUPATIONAL HEALTH AND SAFETY	SIGNIFICANT INCREASES IN OCCUPATIONALLY RELATED DEATHS, INJURIES, AND DISEASE DUE TO INCREASED ENERGY DEVELOPMENT.	POTENTIAL SIGNIFICANT INCREASES IN RESPIRATORY AND OTHER DISEASES BUT IMPROVEMENTS IN OSHA, NRC AND EPA REGULATIONS AND WORKPLACE CONDITIONS EXPECTED TO ALLEVIATE MUCH OF THE PROBLEM.	NO SIGNIFICANT INCREASES IN OCCUPATIONALLY RELATED DEATHS, INJURIES, AND DISEASE DUE TO INCREASED ENERGY DEVELOPMENT.
LOCAL SOCIOLOGICAL FACTORS	IMPLEMENTATION DELAYED OR POSSIBLY BLOCKED DUE TO POTENTIALLY SEVERE CHANGES IN A COMMUNITY'S QUALITY OF LIFE; HEAVY DEMANDS PLACED ON PHYSICAL INFRASTRUCTURE INCLUDING SERVICES, FACILITIES, HOUSING; CONFLICT IN VALUES AND LIFESTYLE BETWEEN IMMIGRANTS AND LONG-TIME RESIDENTS; IMMIGRANTS REPRESENT A STATISTICALLY SIGNIFICANT PORTION OF THE BASELINE POPULATION; EXTENDED NEGOTIATIONS LIKELY BETWEEN DEVELOPER AND AFFECTED COMMUNITIES; AFFECTED COMMUNITIES WILL HAVE GREAT DIFFICULTY ABSORBING HIGH SOCIAL AND ECONOMIC COSTS OF PROJECT WITHOUT OUTSIDE ASSISTANCE.	POTENTIAL DELAYS DUE TO COMMUNITY AND LOCAL GOVERNMENT RESISTANCE TO FACILITY; POTENTIAL INCREASED COSTS TO LOCAL GOVERNMENT; SOME COMMUNITY FEARS FOR CHANGES IN THE QUALITY OF LIFE ACCOMPANYING INFLUX OF POPULATION; MITIGATION STRATEGIES AVAILABLE, BUT USUALLY COSTLY; MODERATE CAPACITY OF AFFECTED COMMUNITIES TO ABSORB THESE IMPACTS.	MINOR CHANGES IN LOCAL GOVERNMENT'S INFRASTRUCTURE; FEW IMMIGRANTS OR FEW CULTURAL AND LIFESTYLE CLASHES EXPECTED; MITIGATION COSTS EASILY ABSORBED BY AFFECTED COMMUNITIES.
LOCAL ECONOMICS	IMPLEMENTATION BLOCKED DUE TO UNACCEPTABLE ECONOMIC DEMANDS ON LOCAL INFRASTRUCTURE.	POTENTIAL DELAYS DUE TO LACK OF SKILLED PERSONNEL, FINANCIAL IMPACTS ON LOCAL GOVERNMENT.	INFRASTRUCTURE IMPACTS MINOR. ADAPTABILITY OF COMMUNITY GOVERNMENT HIGH.
REGIONAL ECONOMICS	CAUSES ADVERSE CAPITAL OR EMPLOYMENT IMPACTS ON REGION. DECREASES COMPETITIVE POSITION COMPARED TO OTHER REGIONS.	POTENTIAL EMPLOYMENT, CAPITAL OR COMPETITIVE IMPACTS, BUT MITIGATION STRATEGY POSSIBLE.	NO SIGNIFICANT IMPACTS.
INSTITUTIONAL AND LEGISLATIVE	PROHIBITION OF IMPLEMENTATION BASED ON AVAILABLE STRONG LEGAL CONSTRAINTS, ANTICIPATED LEGISLATIVE PROHIBITION, ABSENCE OF EFFECTIVE ORGANIZATIONAL RESPONSIBILITIES, STATUTES, ETC.	DELAY POSSIBLE DUE TO LEGAL OR POLITICAL CONSTRAINTS. LOW TO MODERATE PUBLIC OR PRIVATE INTEREST IN ENFORCEMENT.	NO SIGNIFICANT OPPOSITION, LEGAL CONSTRAINTS, OR ORGANIZATIONAL PROBLEMS.

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2 REGIONAL OVERVIEW*

In 1977, the states in Region V had a population of 45 million people and an average density of approximately 148 people per square mile. The population densities of Illinois, Indiana, Michigan and Ohio range from 144 to 260 people per square mile; Wisconsin and Minnesota have 81 and 48 people per square mile, respectively. The average annual increase in net population has slowed significantly in the last several years. In the 1950-60 period it was 1.6%, in 1960-70 it was 1.1%, and from 1970-76 it declined to 0.3%. Although these states have not experienced a large migration rate relative to population growth, the development of new households has slowed, and there is an older median age (27.4).

The median income in the region is $10,376, and there is a high average per capita income of $6,594 (1976), which is 102.4% of that for the United States. The primary industries in this region are farming, with employment ranging from 26,500 to 48,800 workers, and manufacturing, which employs 107 persons per thousand population (1975).

Coal use is a central energy issue in Federal Region V. Extensive reserves of high sulfur coal exist in Indiana, Illinois and Ohio, and historically these have been the preferred sources of fuel for much of the industry in the region. However, the 1970 Clean Air Act required the use of low sulfur coal or the installation of desulfurization devices. This has led to concern about massive unemployment in the coal mining areas, particularly in Ohio and to a growing solid waste problem as increasing amounts of sludge from flue gas desulfurization systems require disposal. Mandated control of SO_2 emissions is expected to improve the air quality in many areas of Region V. In 1975, areas around Minneapolis/St. Paul, Gary, Peoria, Indianapolis, Lansing, and most of the industrial urban centers in Ohio were in nonattainment for SO_2. This potentially affects not only human health but vegetation as well. Damage induced by SO_2 exposure can result in decreased productivity and yield: soybeans, wheat, small grains, vegetables, and fruits and berries are major crops of all or part of the region and are particularly sensitive to high SO_2 levels. The coniferous forests of the northern part of the region are also sensitive to SO_2. Increases in atmospheric levels of SO_2 in the last 20 years have also contributed to the formation of acid rain; precipitation in much of Region V is below a pH of 5. Acid rain has significant agricultural and ecological implications because it increases the mobility of nutrients and metals in the soil.

Federal emissions regulations and the trade-off policy could make it difficult to locate new coal-fired electric generating plants in the urban areas of the region, where both energy demand and pollutant emissions are highest. As one of the most important alternatives to coal in electric utility baseload generation, nuclear generation has been growing very quickly. Since the sixties, nuclear baseload units have gained wide acceptance among utilities in the Midwest, where Commonwealth Edison of Illinois owns much of the nuclear plant capacity. The disposal of radioactive and other hazardous wastes is becoming a serious environmental issue in the region, however, and

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*Much of the material in this section is excerpted from the Regional Energy-Environment Data Book (draft) for the Midwest Region (Argonne National Laboratory, October, 1978).

representatives from several major utilities have expressed the concern that the development of nuclear power cannot continue until an environmentally acceptable waste disposal method has been found. The state of Wisconsin has a legislated moratorium on the construction of nuclear plants.

Region V lies primarily in the Ohio, Great Lakes, and Upper Mississippi drainage basins. The major water quality problems in this area result from municipal and industrial loadings that often exceed the assimilative capacity of the stream. The Ohio River and its tributaries have experienced particularly severe industrial pollution, including thermal pollution from power plants. Streams in Ohio, Illinois, and Indiana are often excessively polluted by acid mine drainage from abandoned coal mining operations.

The Upper Mississippi River Basin is predominantly agricultural, and runoff from agricultural land contributes large amounts of sediment as well as nutrients and pesticides to receiving streams. Reducing the discharge of nutrients, particularly phosphorus, into the lakes is a major goal of Great Lakes planning agencies. The mesotrophic status of some deep water parts of Lake Michigan and the advanced eutrophic state of some shorelines and bays are the major water quality problems. The water in many parts of central and northern Minnesota and Wisconsin is considered to be of good or superior quality and is a valuable resource to the entire region.

Historically, water availability has not been a major problem in Region V: the Great Lakes and the Mississippi, Ohio, Illinois, and Wabash Rivers have provided plentiful supplies for utilities and industry. Large withdrawals in the Chicago area, however, have led to a U.S. Supreme Court ruling limiting withdrawals by Illinois. Allocations could be extended to other states if activities requiring large amounts of water continue to expand. Activities that may affect water quality and water supply in the Great Lakes are also subject to international agreements. These considerations, as well as state shoreline development policies and Coastal Zone plans, may affect the siting of large energy or industrial facilities along the Great Lakes.

Though the region is one of the most industrialized in the U.S., most of this development is limited to Ohio and the southern shores of the Great Lakes. Extensive forests remain in the northern parts of Michigan, Wisconsin, and Minnesota, and large acreages of federal and state recreational lands can be found in these areas. Both sport and commercial hunting and fishing are economically significant, but the dominant land use in Region V is agriculture. The major crop areas are in Illinois and Indiana and in the southern parts of Wisconsin and Minnesota, where the original prairie vegetation was easily converted to cropland. The region is one of the most important producers of corn and soybeans in the nation, with nearly 30 million acres devoted to corn and 19 million acres to soybean crops in 1974.

The counties in the region can be categorized by socioeconomic assimilative capacity (a classification technique employing a multivariate clustering algorithm, developed at Argonne National Laboratory/Energy and Environmental Systems Division). The categories (high, moderate, low, and extra-low assimilative capacity) in this classification method are rough measures of the

adequacy of public services, facilities, and infrastructure of a county and thus of its ability to absorb population growth induced by energy or other local developments. The factors that are most influential in determining the assimilative capacity are population density, proximity to an urban center and basic economic activity.* Within Illinois, Indiana, and Ohio the distribution of counties having high and moderate assimilative capacities are predominantly in the northern and central sectors. The southern counties are of primarily low and extra-low assimilative capacity. This distribution is reversed for the states of Wisconsin, Michigan, and Minnesota, which have their population centers in the southern parts of the state. The finding that counties in all four assimilative categories are distributed evenly throughout the region is consistent with the fact that 75% of the population in 1975 was estimated to be urban.

*Stenehjem, E.J., Argonne National Laboratory, unpublished information.

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3 THE TRENDLONG MID-MID SCENARIO

3.1 THE NATIONAL SCENARIO

The Mid-Mid Scenario represents a mid-range, i.e., 1985 to 1990, projection of energy development based on the assumption of medium supply, medium demand, and constant world oil prices. It projects the future, on the basis of the continuation of polices prior to the implementation of the National Energy Act (NEA). These are the basic assumptions for the scenario:

- A slight increase in domestic oil production due to Alaskan oil field and outer continental shelf development.
- A continued decline of natural gas production in the lower 48 states.
- A dramatic increase in coal production, particularly in the western states, due to an increasing demand coupled with rising domestic oil and gas prices.
- A decrease in the growth of electricity sales from the historic 7% to 4.8% per year, representing saturation of air conditioning and major appliances that penetrated the market during the 1960s. The projected growth is consistent with 5% growth from 1970 to 1976 and 4.2% from 1976 to 1977.
- A shift in the industrial sector from gas to oil, and, to a lesser extent, to electricity; indicated by fuel shares in the industrial sector.

Table 3.1 shows the overall Mid-Mid Scenario projections for energy supply and demand for 1985 and 1990. Total energy flow is projected to increase from 72.6 quadrillion BTU (Quads) in 1975 to 110.9 Quads in 1990. The total electricity distribution in 1975 was 2,036 billion kilowatt hours, and the scenario projects that it will reach 3,045 billion kilowatt hours in 1985 and 3,692 billion kilowatt hours in 1990.

Figures 3.1-3.3 show the patterns of popultion, employment, and energy growth rates, by Bureau of Economic Analysis (BEA) regions, that were used in the scenario.

3.2 THE REGIONAL SCENARIO

The energy supply and demand scenario for Federal Region V is summarized in Table 3.2 and Fig. 3.4. These projections were the basis for the county-level utility (Figs. 3.5-3.7), industrial, and mine siting patterns (developed by ORNL, BNL, and MITRE), which, in turn, provide the basis for the impact assessments.

Table 3.1. 1975, 1985, and 1990 Energy Supply/Demand Balance (Quadrillion Btu per year)

Projection Series[a]	1975	1985	1990
Domestic Production			
Crude Oil	17.9	19.0	18.0
MGL and Butane	2.6	2.0	1.8
Shale Oil	0.0	0.1	0.3
Natural Gas	19.0	17.2	16.7
Coal	14.6	23.1	27.5
Nuclear	1.8	6.2	10.3
Hydro and Goethermal	3.2	4.2	5.0
Total Domestic Production	59.1	71.8	79.6
Imports			
Crude Oil	8.7	16.5	20.9
Petroleum Products	3.8	6.7	7.8
Natural Gas	1.0	1.9	2.6
Total Imports	13.5	25.1	31.3
Total Supply	72.6	96.9	110.9
Domestic Consumption			
Oil	32.8	43.9	48.5
Natural Gas	20.0	19.1	19.3
Coal	12.8	21.2	25.4
Nuclear	1.8	6.2	10.3
Hydro and Geothermal	3.2	4.2	5.0
Total Domestic Consumption	70.6	94.6	108.5
Exports			
Coal	1.8	1.9	2.1
Refinery Loss	.2	.4	.3
Total Consumption and Export	72.6	96.9	110.9
Domestic Consumption by Sector			
Residential	14.7	19.0	21.2
Commercial	11.3	13.5	15.0
Industrial	26.0	40.7	49.0
Transportation	18.6	21.4	23.3
Total Domestic Consumption	70.8	94.6	108.5

[a]For the EIA Mid-Mid Projection

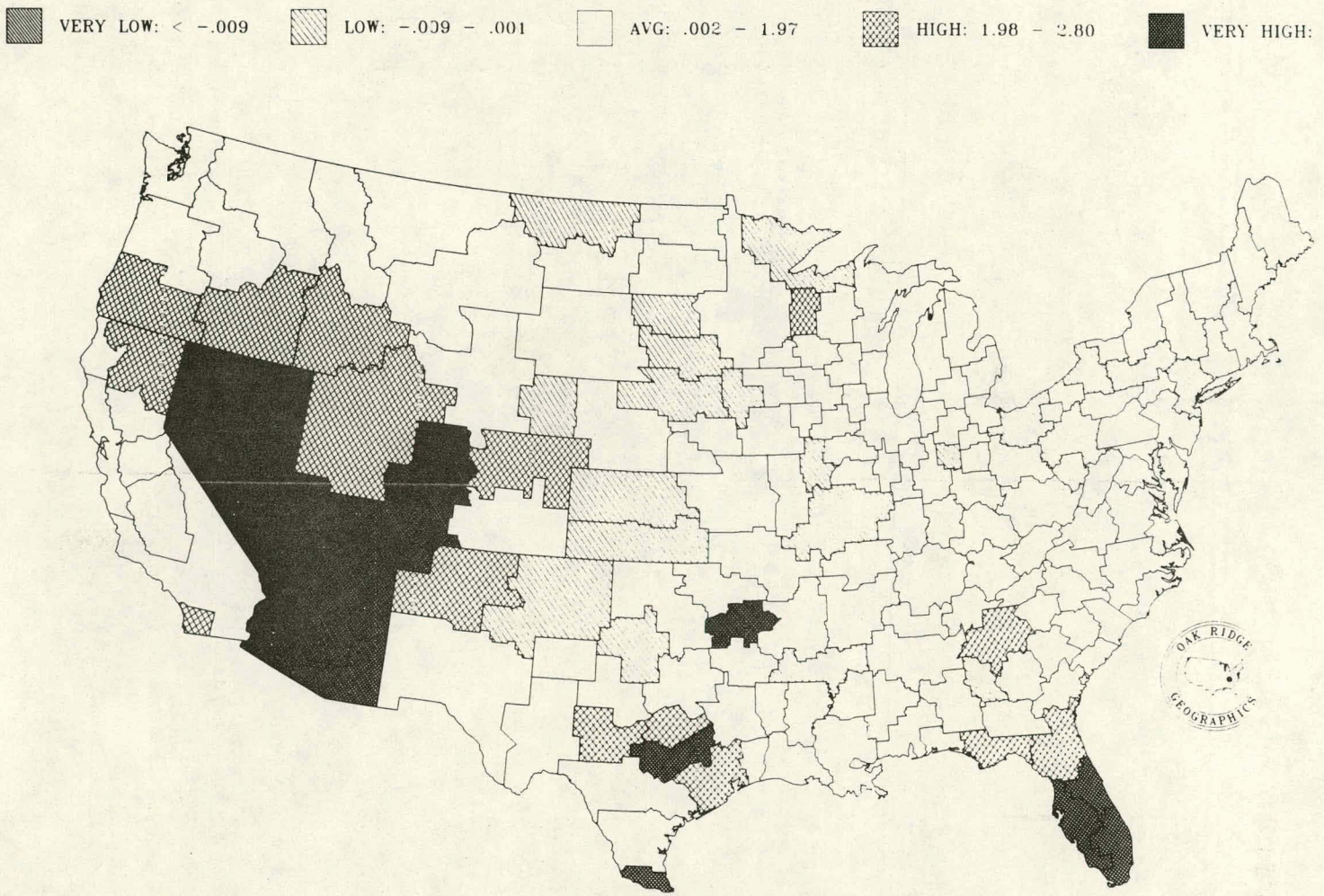

Fig. 3.1. Population Growth, 1975 to 1985, PIES Mid-Mid Scenario, Average Annual Percentage Growth Rates

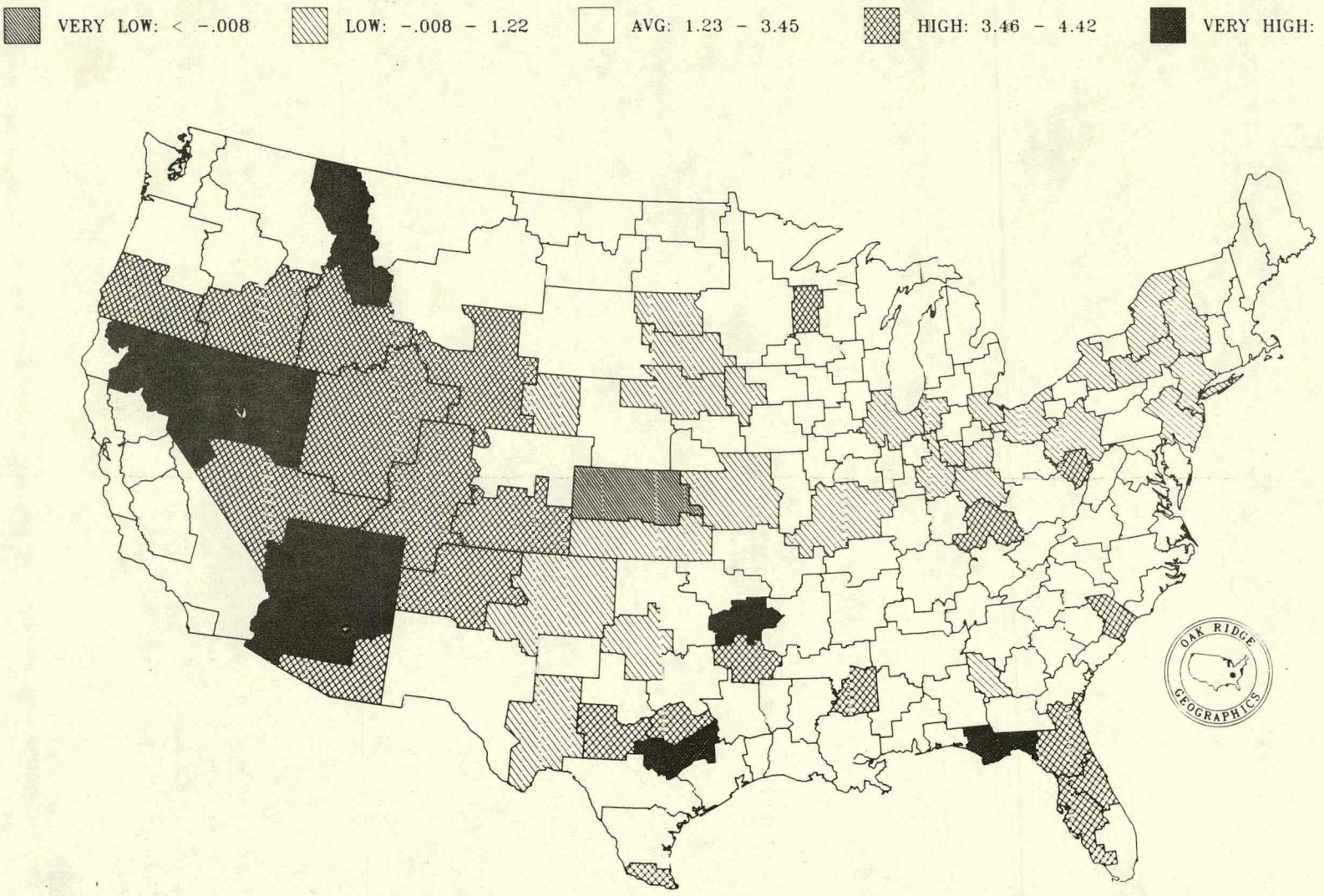

Fig. 3.2. Employment Growth, 1975 to 1985, PIES Mid-Mid Scenario, Average Annual Percentage Growth Rates

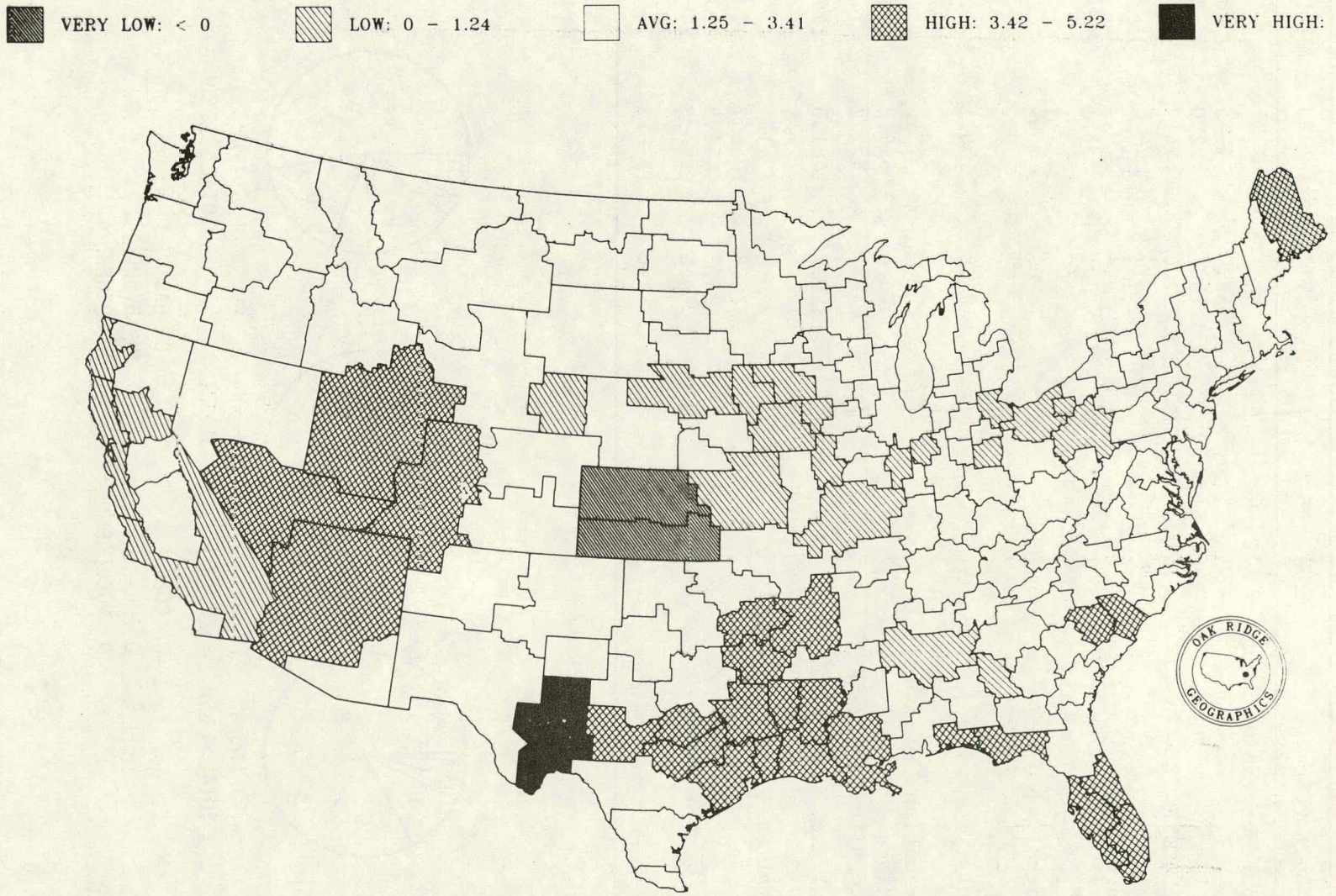

Fig. 3.3. Energy Growth, 1975 to 1985, PIES Mid-Mid Scenario, Average Annual Percentage Growth Rates

Table 3.2. Projected Electrical Generating Capacity, Coal Extraction, and Industrial Fuel Use - Region V

Energy Source	1975	1985	1990
Electrical Generating Capacity (10^3 MW)			
Coal	63.9	79.5	86.9
Oil	15.5	22.0	26.2
Gas	2.4	4.7	4.1
Nuclear	9.7	24.3	34.5
Combined Cycle	0.2	0.2	5.6
Hydro	3.1	3.1	3.2
Solar	0	0.1	0.6
Geothermal	0	0	0
Other	0	2.2	2.2
Total	94.8	136.1	163.3
Coal Production (10^6 tons)			
Deep Mines	476.6	629.8	669.9
Surface Mines	839.1	851.7	795.3
Total	1315.7	1481.5	1465.2
Industrial Fuel Use (10^{12} Btu)			
Coal	16.3	1056.7	1109.4
Oil	296.3	459.3	531.8
Gas	0.4	0.3	0.3
Total	313.0	1516.3	1641.5

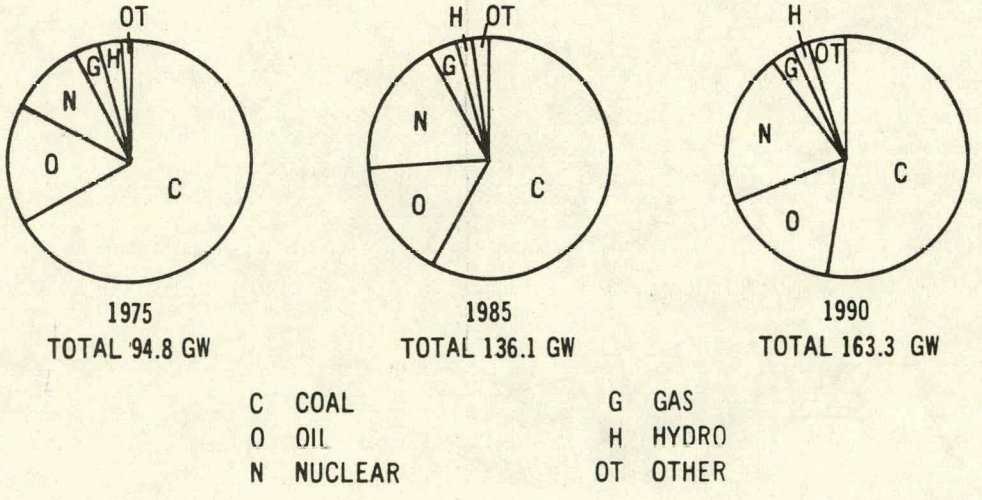

Fig. 3.4. Projected Electrical Generating Capacity by Technology, Region V

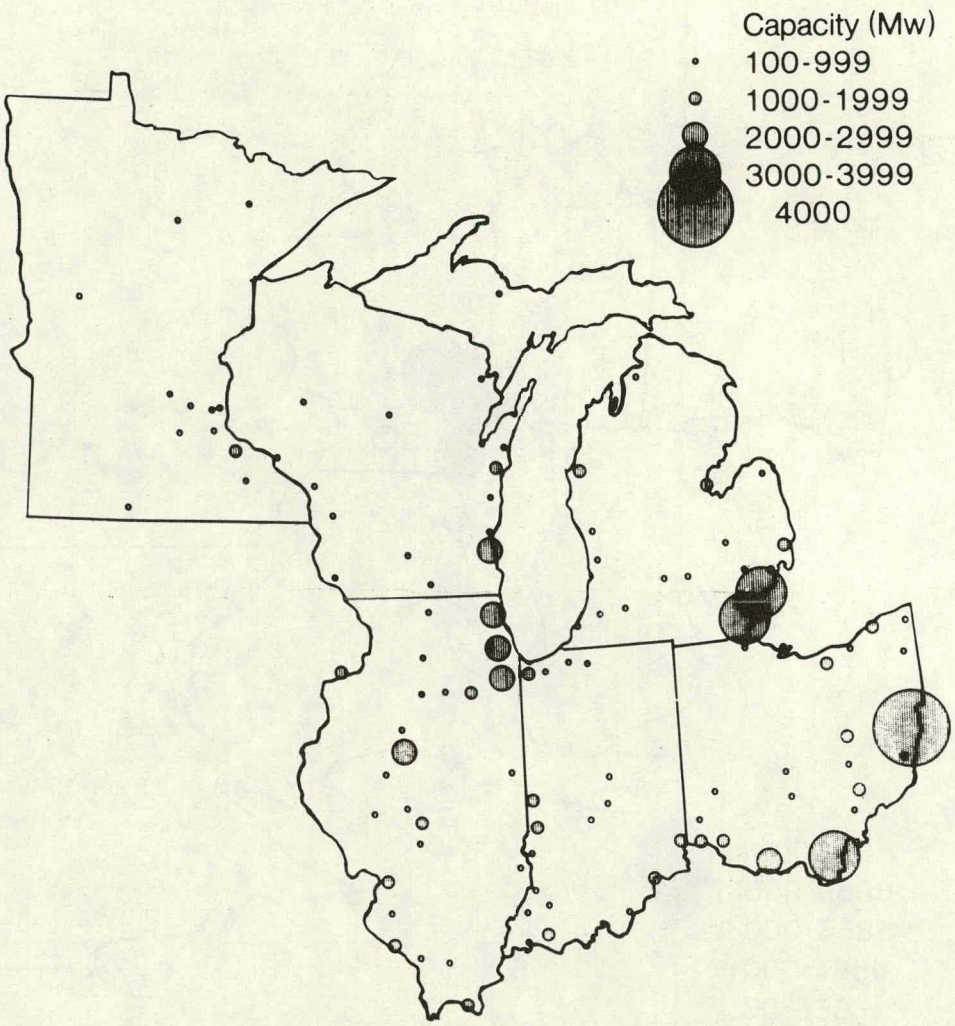

Fig. 3.5. 1975 Electrical Generating Capacity--Region V--PIES Mid-Mid Scenario

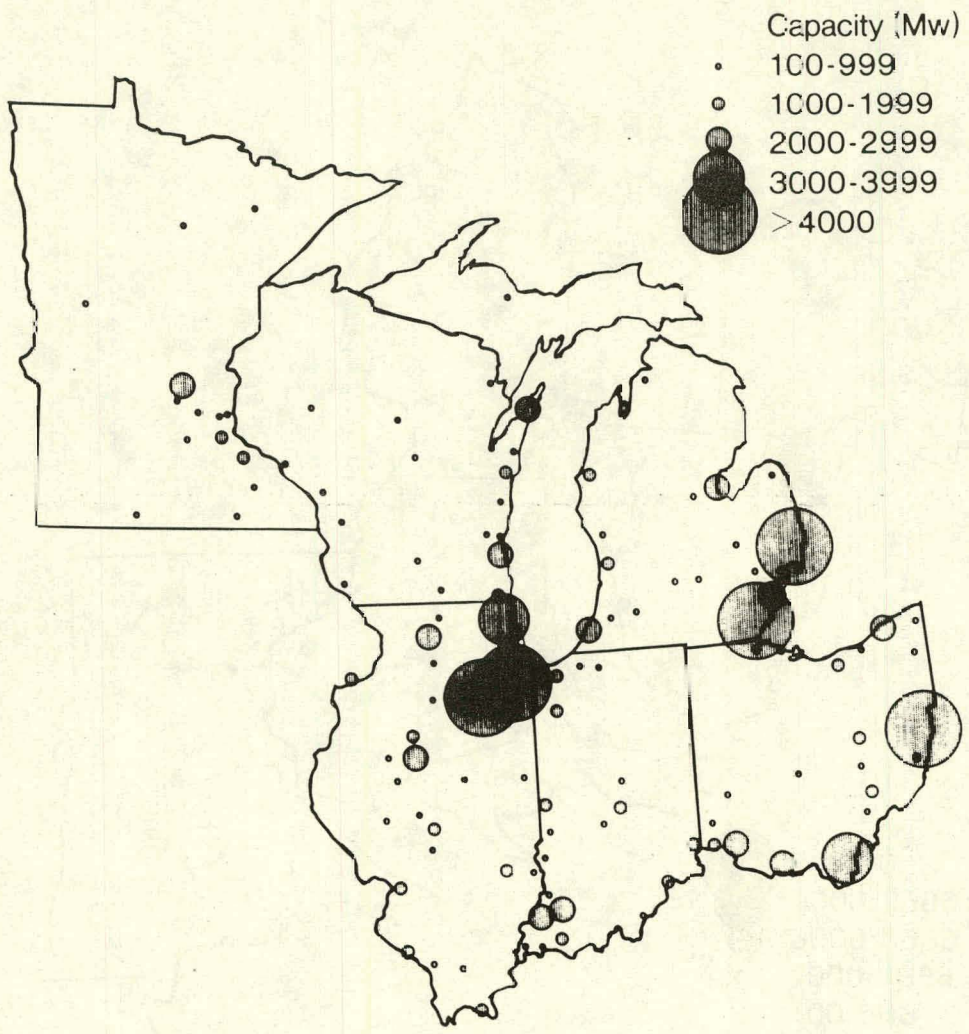

Fig. 3.6. 1985 Electrical Generating Capacity--Region V--PIES Mid-Mid Scenario

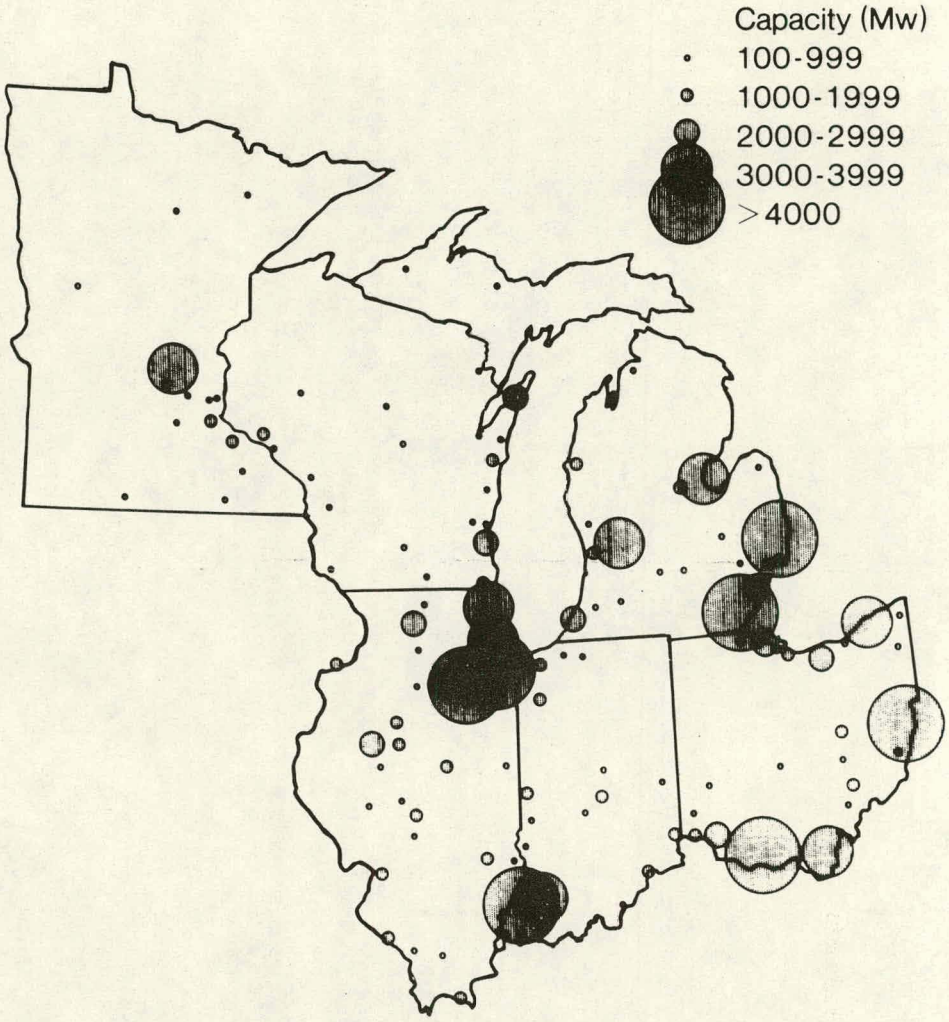

Fig. 3.7. 1990 Electrical Generating Capacity--Region V--PIES Mid-Mid Scenario

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4 REGIONAL ASSESSMENT

4.1 NATIONAL OR MULTIREGIONAL ISSUES WITH REGIONAL IMPACTS

A number of issues cannot be limited to state or even regional boundaries because they are effectively the product of national or multi-regional developments. Issues included in this category are national socioeconomic impacts, long-range transport of pollutants, and interregional natural water systems. National issues are of great importance because individual regions may bear disproportionately both the impacts and the cost of proposed remedies. Regional impacts from these broad-range issues are shown in Table 4.1.

Table 4.1 Disaggregation of National Impacts to Regional Level: Federal Region V

Energy Source	Air Quality		National Socioeconomics	Water Resources
	Visibility	Long Range Transport		
Coal	L	L[1]	L	L[2]
Oil	L	L	L	
Gas	L	L	L	
Nuclear	L	L	L	L
Solar	L	L	L	

High - Large degree of certainty that conflict will arise at several facilities with no or little opportunity for cost effective mitigation.

Medium - Specified concern could occur at a few facilities, but potential cost effective mitigation strategies are available.

Low - Conflicts unlikely to occur.

[1]Long range transport of pollutants may become an issue in local areas where ambient levels for criteria pollutants are near standards. While the average contribution from long range transport may be small, it may, nevertheless, be sufficient to "push" ambient levels over national standards.

[2]Water allocation issues may arise for proposed utility or industrial facilities located along the Great Lakes.

4.1.1 Long-Range Transport, Visibility

Although states have traditionally established and enforced regulations restricting the placement and character of air pollutant sources, the federal government has expanded its role in the establishment of national programs that have impact on development of new major sources across the country. Most of the national issues that have local and regional impacts have been dealt with in the Clean Air Act Amendments of 1977. Such issues include the establishment and promulgation of National Ambient Air Quality Standards (NAAQS), Prevention of Significant Deterioration (PSD) Class I federal areas, visibility protection for clean and pristine areas, federal new source performance standards (NSPS), national emission standards for hazardous air pollutants (NESHAP) and requirements for new state implementation plans (SIPs) in nonattainment areas, i.e., areas that have not attained national air quality standards.

Total exposure of the population to concentrations of SO_2 and sulfates is high in Region V--average SO_2 and sulfate concentrations due to long-range transport rank third in the nation. Long range transport of these pollutants adds to the impact of local emissions on local air quality, and the contributions to ambient air quality from long range transport increments of SO_2 and sulfate could make areas with marginal air quality into nonattainment areas. The number of "marginal attainment" areas in Region V is large enough so that long-range transport should be considered in attainment planning, although it is not likely that long-range transport will have severe impact on energy development in the Midwest.

Another interregional impact of long-range transport is that on local visibility. Congress has taken steps toward assuring visibility protection in Class I areas. Although EPA regulations will not be promulgated until 1980, it is safe to assume that significant plume blights or significant decreases in visibility will not be permitted in Class I areas. Region V has two states where visibility protection regulations could influence projected fossil siting. In northeastern Minnesota, approximately one-seventh of the proposed coal growth could be subject to visibility protection regulations. In northern Michigan, small increases in oil, coal, and combined-cycle generating capacities are projected for counties adjacent to protected areas and may be subject to visibility standards.

4.1.2 National Socioeconomic Impacts*

The National socioeconomic impacts described here are those projected to occur in the Midwest as a whole (Federal Regions V and VII). The national analysis was not conducted on a federal region basis.

Capital costs associated with the construction of the energy facilities are expected to increase by an annual average of 0.8% through 1990. The principal increases in capital expenditures are calculated to be in the construction of low-Btu coal-fired power plants, oil refineries, gas-distribution facilities, light-water nuclear reactors, and electricity-distribution

*This section contains the analysis of computer outputs from Lawrence Berkeley Laboratories.

facilities. The largest capital expenditures are associated with nuclear reactor construction, for which annual investment is expected to be $2.8 billion (1977 dollars), or 20% of the total annual cost for all energy facilities.

Manpower requirements during the construction phase are expected to exceed 1.2 million man-years between 1976-90 and to be concentrated in the same sectors as the large capital investments. Annual labor demand is projected to increase during the construction phase and to be primarily composed of demand from the gas-distribution facility, light-water reactor and electricity-distribution facility sectors. These three sectors will require 50% of the total construction manpower needs through 1990.

The operating costs of the energy facilities will increase at an annual rate of 2.0% reaching a peak of $4.2 million in 1990. The sectors that have the greatest operating expense include underground coal mining, coal transportation, oil refineries, oil tank trucks, gas distribution , and electricity-distribution facilities. These sectors will account for 63% of the total annual operating costs attributable to the energy facilities. Manpower requirements will increase in the operating phase from 1.2 to 1.8 million man-years. The greatest manpower demands will be concentrated in the sectors with the most significant operating costs. These sectors will account for 75% of the annual manpower requirements during the years 1976-1990.

Since the Midwest is heavily industrialized, the manpower and resource requirements will not negatively affect the existing industries, but instead may have significant indirect impacts. The increased demand throughout the states for equipment, goods, and services from both the development inside and outside the region may slow the loss of businesses from this region. Any problematic impacts could be mitigated through interstate cooperation and effective regional planning.

4.1.3 Inland and Coastal Water Resources

The water quality of the Great Lakes is a matter of international treaty between the United States and Canada, and adverse impacts from energy-related activity would be addressed by the two countries. Therefore, effluent discharges from energy activity to the lakes are expected to be closely monitored and movement of energy activity away from the Lakes may be necessary. The water levels of Lake Michigan are a subject of regional concern. Energy activity withdrawals sufficient to affect lake levels may create interstate conflicts in Wisconsin, Michigan, Illinois, and Indiana.

4.2 REGIONAL ISSUES

The issues described below are summarized in Table 4.2.

4.2.1 Local Air Quality, Visibility

In Region V, Michigan, Wisconsin, and Ohio are the states most likely to experience regulatory impediments as a result of the scenario-projected

Table 4.2. Environmental Impacts of the Energy Information Administration (EIA) Trend Long Mid-Mid Scenario at the Regional Level--Region V [a]

	Air	Water	Land			Health and Safety	
Energy Source	Quality	Quality/Availability[b]	Ecology	Use	Solid Waste	Occupational Safety	Public Health
Utility:		Regional water quality/availability					
-Coal	M	impacts were not				L	L
-Oil	M	identified with cer-				L	L
-Gas	L	tainty for the				L	
-Nuclear	L	regions. However,				L	L
-Combined Cycle	M	because of upstream					
-Solar		consumption and					
-Hydro		pollutant loading					
		from all future					
General:		economic activities,					
		the impact on down-					
-Utility	M	stream basins could	L	M	L	L	L
-Industry	H	become an issue,			M		L
-Mining	L	based on best basin	M	M		L	
		management practices.					

[a] Criteria for ranking impacts found in Table 1.2. Blank entries indicate either no impact or impact not addressed. Refer to the individual state text. Criteria are not provided for socioeconomic issues because their extreme localized nature cannot be reflected in the aggregated analysis.

[b] Includes ground water.

energy development (Fig. 4.1). Michigan's primary air quality problems are expected to be in the eastern portion of the state where utility coal growth is projected to occur in nonattainment areas. Wisconsin has similar problems in its southeastern and central portions. Additional emission offsets and improved control efficiencies will not significantly mitigate air quality problems in these areas. Nearly 30% of the projected utility coal growth in Ohio could be restricted because of air quality regulations, primarily NAAQS.

The projected growth of utility oil capacity in nonattainment areas appears to be greatest in the industrial states of Illinois, Indiana, and Ohio. Mitigation of impacts through fuel purchasing practices could greatly reduce the air quality impact from these facilities. Specific areas, such as the four-county nonattainment area surrounding Chicago, might require special attention.

Industrial growth projected by the scenario could be restricted by nonattainment air quality regulations in industrialized areas like Chicago, St. Louis, Detroit, and Cleveland (Fig. 4.1). Specific restrictions will depend on fuel selection and available emission offsets in each locality.

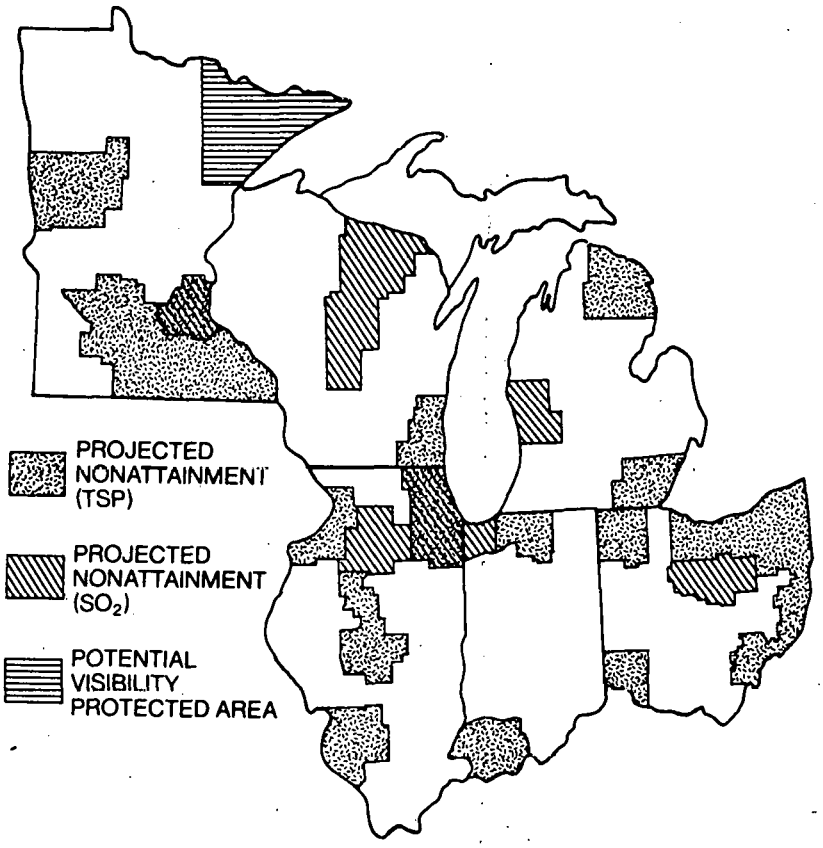

Fig. 4.1. Region V Areas with Potential Air Quality Constraints

4.2.2 Water Quality/Availability

The utility activities analyzed for water-related impacts were coal, gas, oil, combined-cycle (assuming coal type) and nuclear. Of these categories, 8.8% of the projected incremental increase in utility activity up to 1990 was identified as having a potential water-related impact (assuming that effluent treatment beyond statutory point-source requirements is implemented and/or that the 7-day/10-year low flow is maintained). This fraction represents 2.1% of the total utility activity projected by 1990 for Region V.

Initiatives to improve water quality in the Great Lakes, involving waste load reductions and limitations on additional loads, particularly to Lake Erie and Lake Michigan, are likely to be an issue in realizing the projected increases in utility activity. Technologies with phosphorus effluents (primarily coal-fired utilities and industries) will conflict with efforts to slow eutrophication in Great Lakes bays and shorelines, and advanced waste treatment involving phosphorus loading reductions of 80-90% may be required. A United States Supreme Court ruling that limits water withdrawals from Lake Michigan in Illinois will constrain energy development on the Illinois shoreline. Projected increases would result in further allocations of withdrawals and may create regional water-use conflicts.

4.2.3 Solid Waste

Disposal of all kinds of solid waste has become an important issue nationally. Historically, solid waste disposal has not been a constraint on new development; however, inexpensive dumping at nearby locations is a thing of the past.

Although all regions face the challenge of disposing of ash, sludge, and other wastes in an environmentally acceptable manner, Region V will have more problems because of the large amount of waste involved.

Industrial disposal requires a large number of small sites. Some industries have their own disposal sites, and others use municipal facilities. In crowded urban and industrialized areas, finding available land can be a problem; however, the institutional constraints associated with siting a new disposal facility can be an even greater problem. In most areas, technically feasible and environmentally acceptable sites can be found, but local opposition may block the construction of new landfills in those areas.

Industrial ash and sludge disposal problems are part of a larger general solid waste problem that affects the region. A report prepared by the Solid Waste council of the Paper Industry says that the quantity of municipal solid waste generated nationally is expected to increase 30% from 1977 to 1990, and that the 150 largest U.S. metropolitan areas will account for two-thirds of that waste.[1]

In general, the disposal of ash and sludge from a coal-fired utility does not present as many problems as disposal of those wastes from an industry, even though the quantities for the former are much greater. However, existing utilities that have to transport waste to off-site disposal areas

often have to go further to find a site because of the high degree of industrialization and urbanization in many areas of the region.

The quantity of residuals generated from industrial coal use is the highest in the nation (3.7 million tons in 1975). Industrial coal use is projected to increase 38% by 1990; however, land requirements for solid waste disposal are expected to grow by nearly 400% because the application of flue gas desulfurization (FGD) systems will increase the amount of solid waste generation.

Large quantities of waste are also produced by the utilities in this region. Coal-fired utility capacity is estimated to increase nearly 40% for the period 1975-1990, to 88,000 MW. Application of FGD systems will increase the amount of waste generated.

The Resource Conservation and Recovery Act (RCRA) will regulate solid waste disposal. Although the strictest controls will exist for hazardous wastes, the Act will have a profound effect on all waste disposal. Currently, ash and sludge have "special waste" status. The Act provides for an inventory and upgrading of existing landfills. At many waste-disposal facilities, upgrading will not be practical and their closure will result in at least a temporary shortage of landfills in the region.

There are still uncertainties about the RCRA program and the ability of both state and federal governments to implement it. The EPA's solid waste program has been small, with no regulatory responsibilities, and most states have limited solid waste management programs. When the 1970 Clean Air Act and the 1972 Water Pollution Control Act were enacted there already existed extensive pollution control programs operated on a state and regional basis by both EPA and well-staffed state agencies. The implementation of this ambitious new regulatory program will be an extremely important issue in this region.

4.2.4 Ecology/Land Use

The large acreages disturbed by surface mining present the greatest possibility for adverse ecological and land use impacts in the region. Mining in the region is projected to occur in central and southern Illinois, southwestern Indiana, and estern Ohio, areas where the present land use is a mix of forested tracts and row crop agriculture (Fig. 4.2). State and federal (Office of Surface Mining) regulations require that mined lands be returned to their original productivity and land use.[3] Reclamation costs in Region V will be high since mining in most of the region is most likely to disturb row crops or forested land. Mining in foreted areas will have additional ecological impacts since restoration of the original ecosystem, if it occurs at all, would have to occur naturally over a long period of time.[4]

Levels of SO_2 are projected to decrease below damage thresholds throughout the region in 1985, but in some urban-industrialized areas they are projected to increase again in 1990, primarily because of industrial coal use. Levels would be high enough in these areas to cause damage to regionally important crops such as soybeans, wheat, and fruit trees (Fig. 4.2).

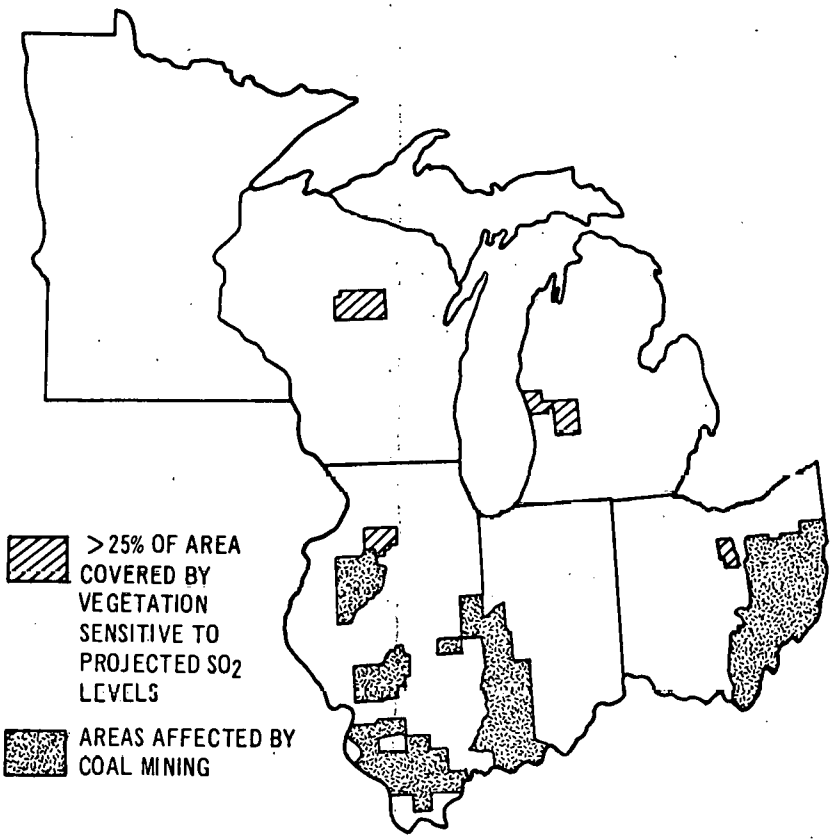

Fig. 4.2. Coal Mining Areas and Potential SO_2-Induced Vegetation Damage

4.2.5 Socioeconomic

Facilities of more than 70,000 MW of new generating capacity are sited for Region V. The senario indicates that the majority of these new facilities are to be located in low and extra-low assimilative capacity counties (Fig. 4.3). Depending on the proposed timing of the developments, size of the facilities, and the types of technologies to be sited, adverse socioeconomic impacts (resulting from a population increase greater than 10% during only one year) will occur in many of these counties. There are other sited energy developments throughout the region that will incur adverse impacts, but the negative effects encountered will be overshadowed by increases in employment, growth in local income and tax base, and other beneficial socioeconomic effects. These counties possess a moderate or high assimilative capacity and because of their economic and demographic characteristics the projected population growth due to the employment and capital requirements of the sited development(s) did not exceed 10% of the baseline population.

Severe socioeconomic impacts are projected in counties absorbing 25% of the region's proposed coal-capacity increases, 23% of the nuclear increases, 7% of the oil increases, 21% of the combined-cycle increases, and 20% of the new mine workers. These capacity increases represent from 1% to 8% of total regional generating capacity. This conservatively estimated range indicates the percentage of the megawatt capacity increases projected for the

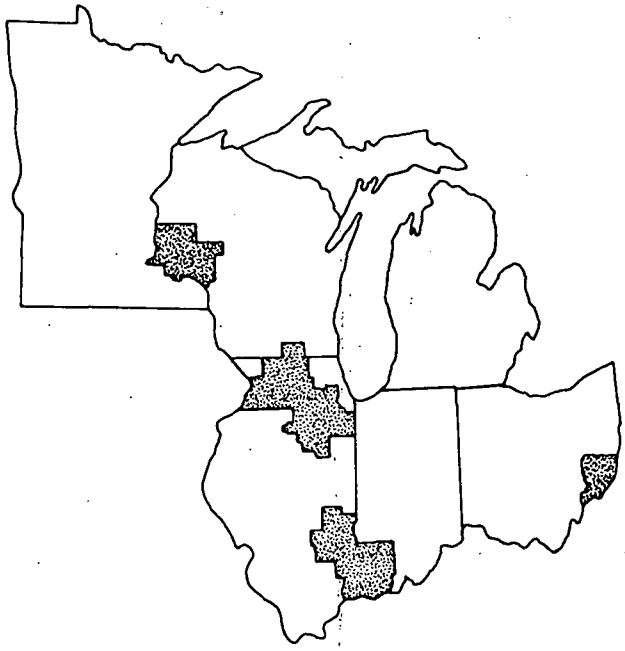

Fig. 4.3. Areas in Region V Potentially Subject to Adverse Socioeconomic Impacts

region that would cause socioeconomic and societal impacts if the present siting distribution is realized. There are seven counties in Region V that would experience rapid population increases, extensive economic growth, sociocultural impacts, and institutional problems. These counties are expected to incur more of the negative adverse consequences of resource development since their existing workforce and infrastructure are insufficient to satisfy the manpower demands during the construction phase(s) and therefore require the in-migration of a transient labor force. In Indiana, Illinois, and Wisconsin the negative effects of development are primarily attributable to coal and nuclear facility construction. The states of Michigan and Minnesota are not projected to incur severe negative impacts; Ohio has the potential of a larger than marginal impact if demands for the state's high sulfur coal are increased beyond the scenario specification.

The effects of the energy developments are projected to be pervasive within the seven susceptible counties. It is expected that the communities in these areas will experience shorfalls in facilities and services needed to house and provide for the in-migrants and that the frustrations caused by an overburdened social infrastructure will tend to increase turnover at the workplace with increasingly frequent in- and out-migration. Such experiences are not uncommon in these situations and often lead to social dissolution and deterioration.[5-7] Such impacts and their effects on energy development cannot be aggregated to a regional level and therefore must remain a component of site-specific analysis.

The affected counties are expected to experience a population increase of 30,000 new permanent employees and their dependents by 1990, or 0.07% of the current regional population (1976). This estimate of the extent of

in-migration is conservative since it is based on a projected population growth profile of the region that did not incorporate a detailed skill classification category. The exclusion of this variable may understate the true external workforce requirements for the affected sub-regions, and consequently, the region as a whole.

4.2.6 Health and Safety

Large amounts of energy related activities, ranging from extraction to electricity generation, occur in Region V. Extraction, specifically coal extraction, presents the highest risk of occupational health impacts. Occupational impacts of deep mining--injuries, disease, and deaths--are historically more severe than those from strip mining because of differences in dust exposure and accident risk.[8] Illinois, Indiana, and Ohio contain the major coal reserves found in Region V. Death, injuries, and disease from coal extraction in Region V account for approximately three-quarters of all energy-related occupational health impacts (Fig. 4.4). Regional impacts of oil and gas extraction and refining and electricity generation are minimal, although these activities account for a significant percentage of impacts in Michigan, Wisconsin, and Minnesota where coal extraction does not occur.

The scenario projects an overall 11% increase in tons of coal extracted in Region V, and an increase in the proportion mined underground (from 36% in 1975 to 45% in 1990). This could cause a 20-40% increase in the number of accidental deaths and injuries due to coal mining (Fig. 4.5) during the scenario timeframe. Cases of chronic respiratory disease (CRD) and deaths due to CRD could increase 35-40% (Fig. 4.6).

The public health impacts that will result from fulfillment of increased energy demands are dependent on the amount and type of pollutants

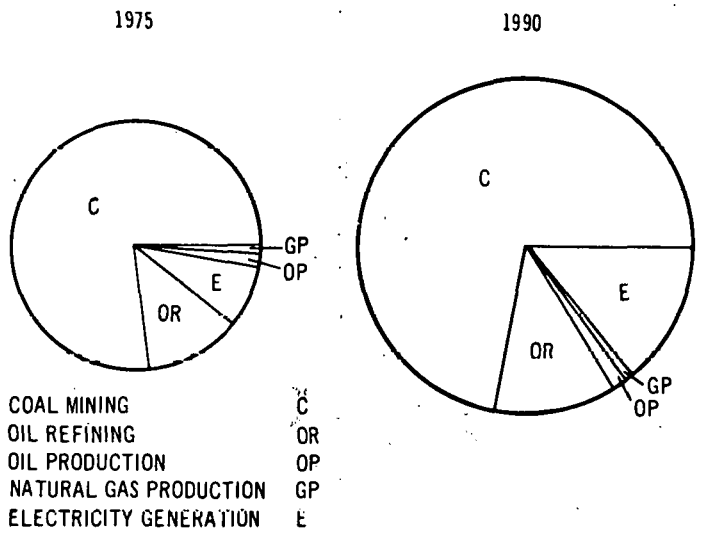

Fig. 4.4. Relative Contributions of Major Energy Activities to Energy-Related Occupational Deaths in Region V Under the Mid-Mid Scenario

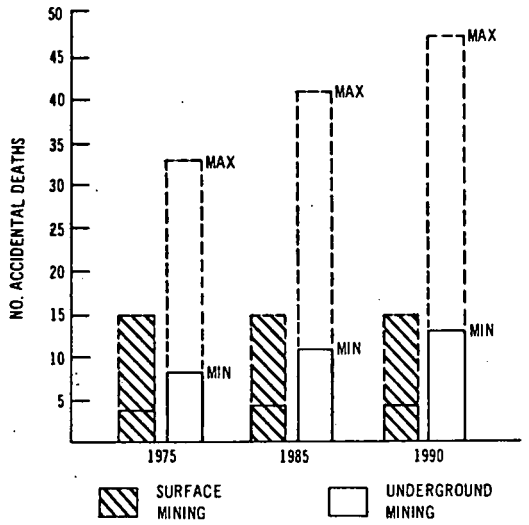

Fig. 4.5. Range of Potential Accidental Deaths in Region V Coal Mines Due to Implementation of the Mid-Mid Scenario

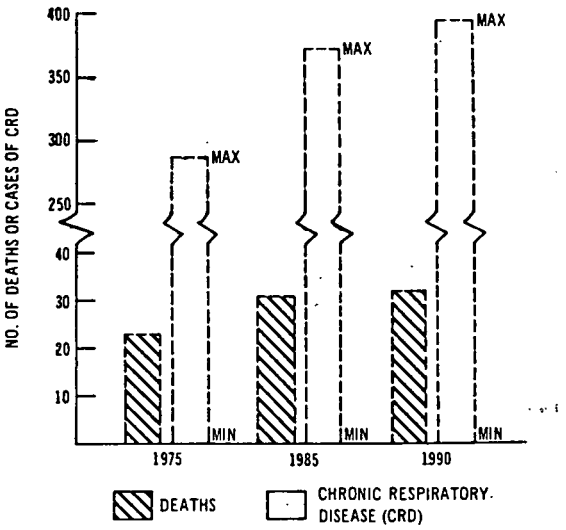

Fig. 4.6. Range of Potential Deaths and Cases of Chronic Respiratory Disease (CRD) in Region V Due to Coal Mining Occupational Exposure Under the Mid-Mid Scenario

released throughout the energy cycle and on the magnitude, age structure, and location of the exposed population. Utility and industrial fossil fuel use is the primary source of energy-related effluents that affect public health in Region V. Most fossil fuel use occurs near densely populated areas. When fossil fuels are burned near highly populated areas, adverse health impacts increase. Although combustion of fossil fuels produces many effluents, the adverse impacts of sulfur oxides (SO_x) and particulates are best documented. Inhalation of these pollutants can adversely affect exposed populations--most severely the high risk groups such as asthmatics and young children, cardiovascular patients, and the elderly.[9] Fifty to sixty percent of all deaths in Region V are attributable to cardiovascular and respiratory diseases, both of which are aggravated by emissions from fossil fuel use.[10]

Public health impacts of sulfates released from industrial and utility fuel combustion in Region V are projected to decrease despite an increase in electricity generation of 40% and an increase in industrial fuel use of 240% by 1990 (Fig. 4.7). The decrease is primarily due to sulfur emission controls instituted during the assessment time frame as dictated by the Clean Air Act. Public health impacts, measured in terms of individual risk and potential number of deaths, will drop by 48% and 35% respectively. However, the magnitude of impacts resulting from fossil fuel use will not be insignificant: the projected number of deaths is roughly equivalent to the number of homicides in the U.S. in 1975.[10] The interregional, easterly dispersion pattern and long residence time of sulfate in the atmosphere will increase the adverse health impact in the eastern sections of the region.

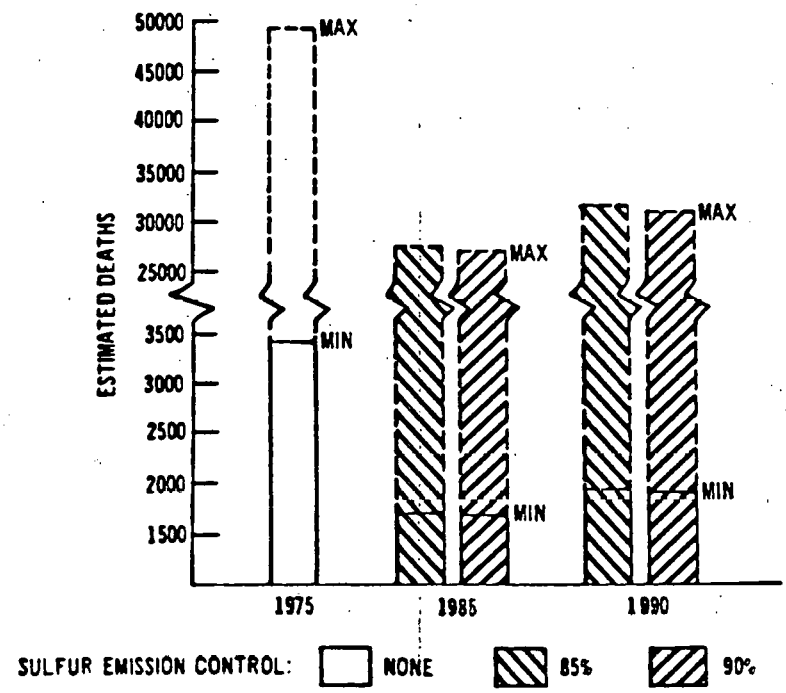

Fig. 4.7. Estimated Range in Deaths in Region V from SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use Under the Mid-Mid Scenario

5 ILLINOIS

The scenario projects an additional 14,571 MW of electrical generating capacity in Illinois by 1985 and 21,622 MW by 1990 (Table 5.1). Coal production is projected to increase from a 1975 value of 59.7 million tons per year to 68.5 million tons per year in 1985 and 70.2 million tons per year in 1990. More than half of the coal is mined underground.

Seventy percent of the fuel used in Illinois was imported from out-of-state in 1975, including 25% of the coal, 99% of the natural gas, 77% of the liquid fuels and all of the uranium. Illinois, which ranks fourth in coal production in the U.S. exports 40% of the coal mined in the state. The sulfur content of Illinois coal is high (3-5%). The impacts discussed in the following sections are summarized in Table A-1 (Appendix).

Table 5.1. Projected Increases in Electrical Generating Capacity (MW) - Illinois Mid-Mid Scenario[a]

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	2665	2794	1231	7840	0	35	14,571
1975-1990	5558	4067	1111	8796	0	2090	21,622

[a]Base year: 1975.

[b]Includes conventional hydro and pumped storage.

[c]Includes solar, combined cycle, and "other".

5.1 AIR QUALITY/VISIBILITY IMPACTS

- Air quality should improve throughout Illinois between 1975 and 1990 assuming attainment by existing sources due to the enforcement of SIPs and to improved control technologies.
- Continued TSP and SO_2 primary NAAQS violations are projected for several areas in five AQCRs. Forty-three percent of the projected 1990 utility oil increases and 33% of the combined cycle increases sited by the scenario in these areas are subject to review.
- Over 65% of projected growth of industrial capacity may occur in nonattainment areas. Proper emission offsets may be required in these areas.

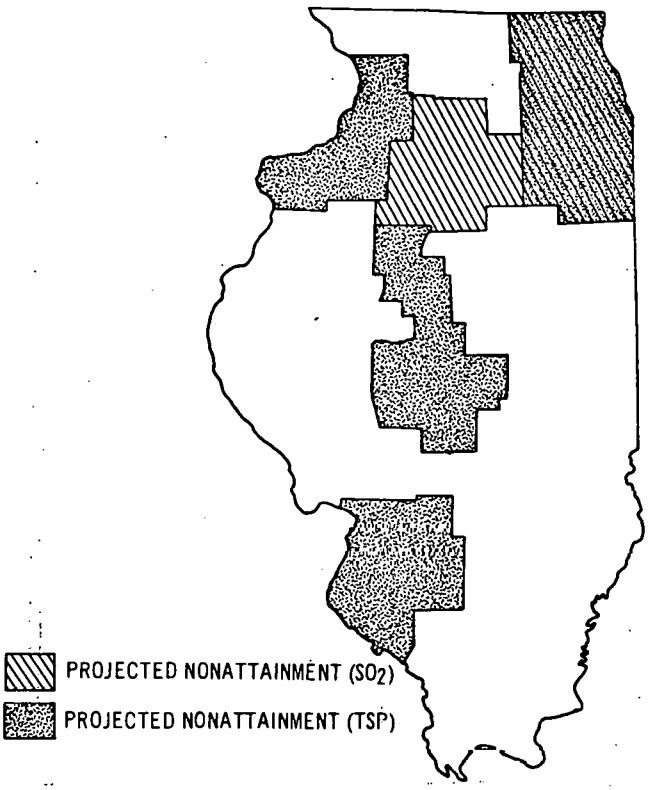

Fig. 5.1. Illinois - Potential Air Quality Impact Areas

5.1.1 Description

Despite its vast coal reserves, Illinois consumes over twice as much fossil fuel as it produces. Illinois produces over 61,500 x 10^3 tons of coal annually (second largest producer in the region).[11] The majority of Illinois coal is burned locally or shipped to adjacent states. Because of its large and rapidly expanding energy requirements, Illinois must import increasing amounts of scarce fuels. The state currently imports over 740 billion cubic feet of natural gas annually. Faced with an increasing demand for fuel and dwindling supplies of available fuels, pressure to meet fuel demands with local coal production may increase. Expanded use of coal creates a greater environmental problem than might otherwise exist. Illinois coal has an average sulfur content of 3.2%[12] and use of fuel with such a high sulfur content places greater control requirements on new facilities.

5.1.2 Background Issues

- Illinois air quality problems are most pronounced in the northeastern, central, and southwestern portions of the state.

- In the metropolitan Chicago Interstate AQCR, major industrial centers are prevalent, and nonattainment sites within that area have been designated for TSP standards. With increasing economic activity additional demand will be placed on new source development.

- The air quality in the metropolitan St. Louis Interstate AQCR is characterized by TSP standard violations, and the air quality of Granite City has been ranked the worst of ten sites within the state. Decreases in the occurrence of violations in the area have not been noticeable even with more restrictive air pollution standards.

- The metropolitan Dubuque Interstate AQCR has displayed an improvement in total particulate emissions with fewer violations of primary particulate standards.

5.1.3 Scenario-Induced Changes

- Illinois does not have scenario-projected coal utility siting in nonattainment areas of the state. Although new source performance standards, control efficiencies, and local regulations must be satisfied, no significant air quality issues exist for utility coal expansions.

- Over 43% of the proposed utility oil growth is expected to occur in nonattainment areas. The northeastern corner of the state will be most affected by utility oil development. Selective fuel purchasing policies will mitigate air quality problems caused by emissions, but unavailable offsets and nonattainment provisions could constrain development.

- One-third of the proposed combined-cycle capacity could be constrained because of the inability of local areas to attain NAAQS air quality standards. Fuel selection for these plants will depend on the availability of appropriate offsets.

- Approximately 2/3 of the proposed industrial growth in Illinois will occur in nonattainment areas. Fuel use, emission limitations, and offset requirements may be necessary for these plants to meet new source review requirements.

5.2 WATER QUALITY/AVAILABILITY ISSUES

- More stringent waste load allocations and/or river basin management will be required to alleviate projected total dissolved solids, copper, chromium, and sulfate violations in the Fox, upper Illinois, and Sangamon Rivers (Illinois River Basin).

- Water availability may restrict projected utility siting in the northern counties because of seasonal low flows of the Rock and Fox Rivers and in central Illinois on the Sangamon River. Water allocation issues may restrict siting in the Lake Michigan basin.

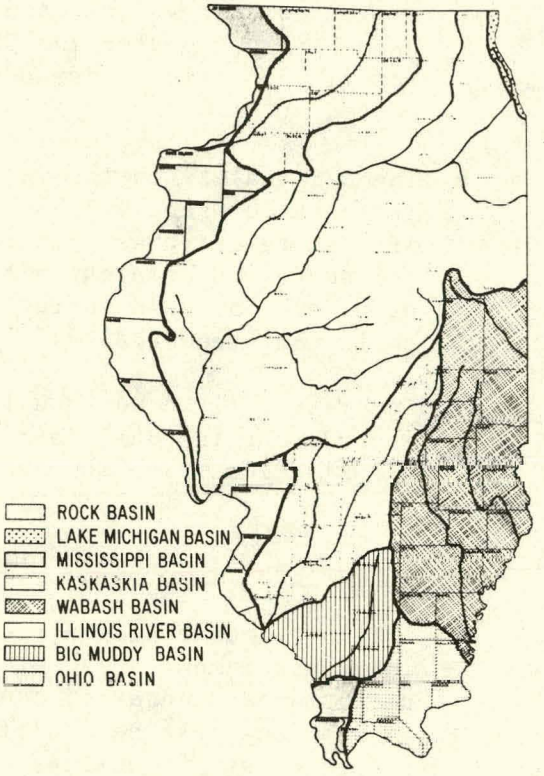

Fig. 5.2. Illinois River Basins

5.2.1 Description

Major increases in utility siting are projected in the upper Illinois River Basin and near tributaries which drain northern and northeastern Illinois. Because of artificial flow reversal of the Chicago and Calumet Rivers, the Illinois basin also receives metropolitan Chicago waste water that would flow to Lake Michigan under natural conditions.

The southern portion of the basin has a large assimilative capacity, diminishing the effect of waste loads from the northern part of the state. However, parts of the southern Illinois River Basin experience mercury, phenol, and biological oxygen demand (BOD) violations below industrialized areas and large municipal treatment facilities.

5.2.2 Background Issues[13,14]

- Illinois water quality and water availability issues are most pronounced in the northeastern river basins.

- The Fox and Sangamon Rivers are frequently unable to assimilate industrial and municipal waste loads because of seasonal low flows.

- Water removal from Lake Michigan is subject to allocation under federal mandate. Water from the lake is used for drinking water, process water, and for sewage dilution by many municipalities in northeastern Illiinois.

5.2.3 Scenario-Induced Changes

- Increases in total dissolved solids (TDS) and copper concentrations are projected in the Fox river, primarily from utility increases. River basin management and implementation of discharge standards would be expected to reduce the incidence of the copper violations.

- The assimilative capacity of the Illinois river diminishes the severity of those violations that occur upstream (Fig. 5.3). Although efforts are being made to improve the quality of the upper reaches, TDS levels are expected to increase.

- Upper reaches of the Sangamon river would experience significant water depletions from increased utility activity, causing TDS, SO_4, Cu, and Cr violations without flow augmentation and/or discharge management (Fig. 5.4). High residual concentrations would diminish downstream.

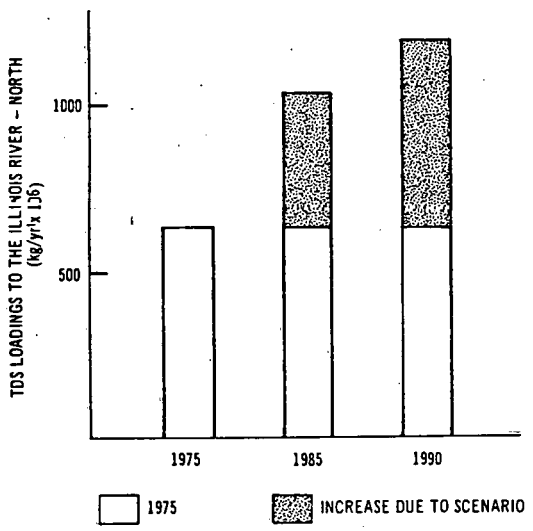

Fig. 5.3. Scenario Increases in TDS Loadings to Illinois River

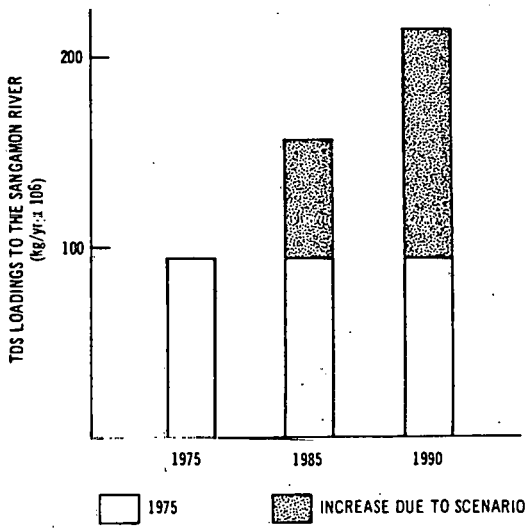

Fig. 5.4. Scenario Increases in TDS Loadings to Sangamon River

5.3 SOLID WASTE IMPACTS

- Solid waste residuals are projected to increase by 500%. Indicators show nine counties where solid waste disposal may be a problem (Fig. 5.5).
- Utilities may have to transport wastes at additional cost, but solid waste problems should not constrain new development.

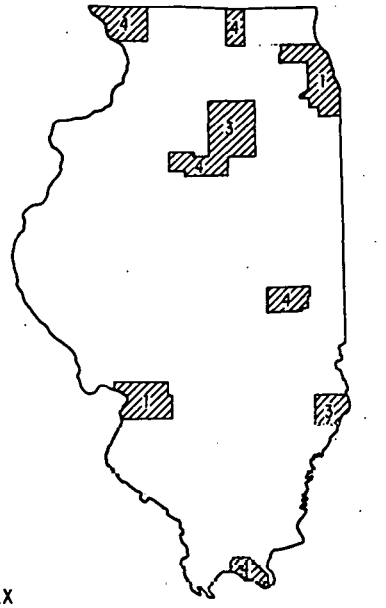

Fig. 5.5. Illinois Counties Potentially Subject to Solid Waste Impact

5.3.1 Background Issues

- Illinois has excellent physical characteristics for solid waste disposal sites. Much of the state is underlaid by thick clay deposits.
- Illinois has one of the most advanced solid waste management programs in the country, yet extensive new regulations proposed under RCRA will require the state to assume significant new responsibilities.
- Industries are advised to begin looking for alternate sites several years in advance because of the difficulties and delays associated with issuing a permit for a new site.

5.3.2 Scenario-Induced Changes

- Industrial coal use is projected to increase 43% by 1990. Solid waste residuals will increase nearly 500% because of the application of FGD systems (Fig. 5.6).

- Land use for industrial waste disposal is estimated to increase to 32 acres per year by 1990 (Fig. 5.7).

- Based on criteria relating to the availability of landfills and the potential impact on municipal sewer systems, nine counties may experience difficulty in disposing of industrial wastes. Disposal will be most difficult in areas constrained by both lack of landfill sites and inadequate sewer systems.

- Installed coal-fired utility capacity is projected to increase 40% by 1990. The lifetime land requirement for utility wastes is estimated at 4,500 acres.

- Some existing plants may find it necessary to transport wastes to an off-site disposal area at additional cost. New plants should be able to accommodate on-site disposal with proper planning.

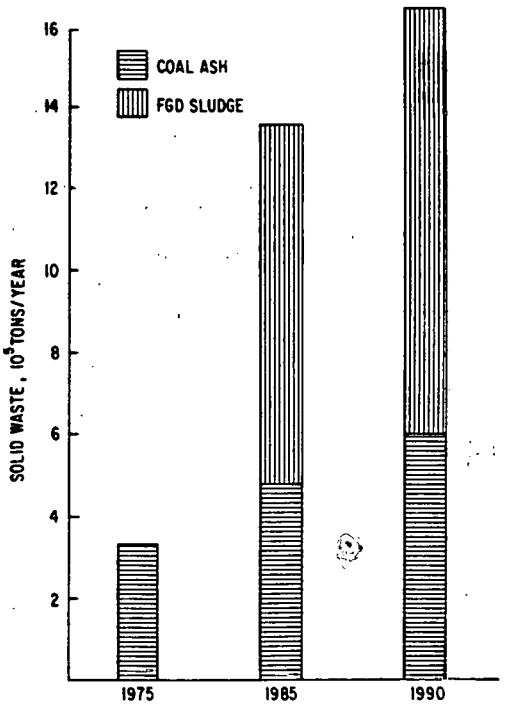

Fig. 5.6. Illinois - Solid Waste Generation from Industrial Coal Use

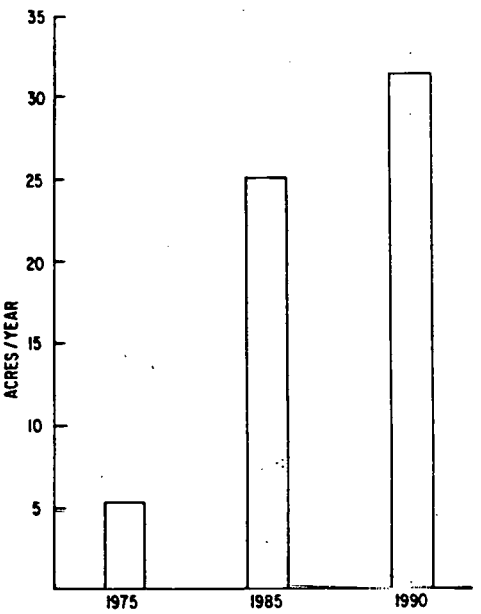

Fig. 5.7. Illinois - Total Area Used for Industrial Ash and Sludge Disposal

5.4 ECOLOGICAL AND LAND USE IMPACTS

- Large amounts of land are projected to be disturbed by surface mining in southern and west-central Illinois. Reclamation is known to be difficult in some of these areas, and permanent restoration of pre-mining row-crop productivity or forested ecosystems is likely to be difficult and costly (Fig. 5.8).

- Projected utility increases may require up to 6,000 acres in affected counties; croplands are most likely to be affected.

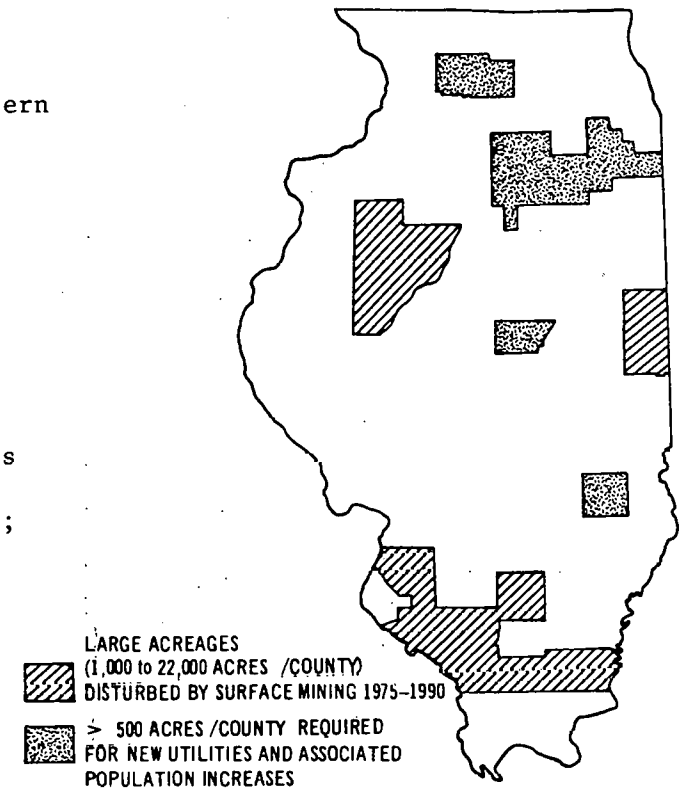

Fig. 5.8. Projected 1990 Land Use Changes by Surface Mining or Utility Construction

5.4.1 Description

Illinois is the most intensely agricultural state in Region V: croplands cover 70% of the state, and Illinois contains nearly half of the regional acreage of corn, soybeans, and wheat. The southern tip of the state is largely forested with 257,000 acres preserved in National Forest lands. Natural vegetation in the northern two-thirds of the state, originally a mosaic of prairie and forest habitats, remains along streams and rivers and as isolated woodlots and prairie remnants in an agro-urban matrix.

5.4.2 Background Issues

- The predominant use of the land over Illinois coal is agriculture, and it has been estimated that about 53% of the state's strippable reserve base is covered by land that can be classified as prime farmland.[15]

- Significant acreages of National Forests and Wildlife Refuges are found in the major mining areas in the southern half of the state.

- Land in the southern tip of Illinois has low natural fertility. This, along with acid drainage problems from abandoned mines, has made reclamation difficult in the area. High priority treatment has been suggested for strip-mined areas in Saline, Williamson, Jackson, and Vermilion counties.[16]

- Soybeans, one of the major crops in Illinois, are highly sensitive to SO_2, as are other important crops such as wheat and small grains.

- The forested areas in the southern counties are the only major large tracts of natural habitat remaining in the state.

5.4.3 Scenario-Induced Changes

- Coal mining projected to occur in the state could disturb approximately 3,800 acres per year in 1985 and 3,600 acres per year in 1990 (Fig. 5.9). A total of approximately 56,000 acres could thus be disturbed during the scenario time frame. Twenty-two counties in the state would be affected. Federal regulations require the return of strip-mined land that has been identified as prime agricultural land to its original productivity and land use, or to a higher productivity and better land use.[3] Reclamation of mined lands to row-crop agriculture is likely to be costly, and restoration of forested habitats in the southern tip of the state is problematic.

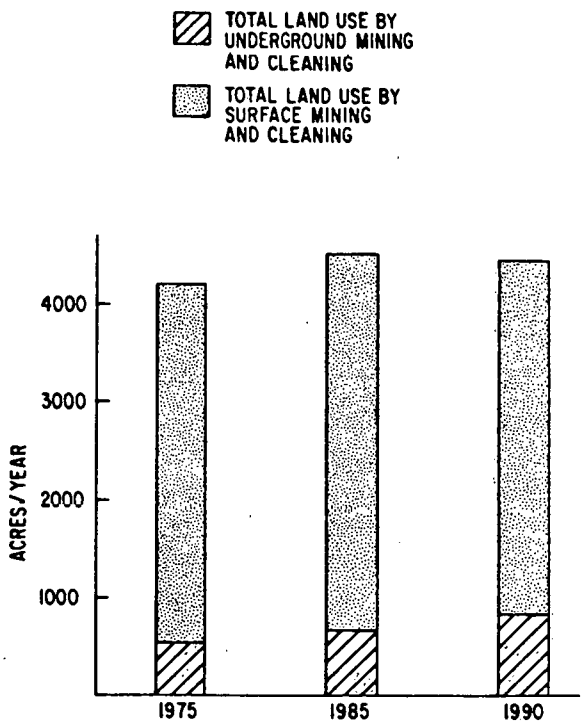

Fig. 5.9. Illinois - Land Use for Coal Production

- More than 48,000 acres are projected to be disturbed by surface mining in eight counties in southern Illinois during the period 1975-1990. Mining activities in this area may be restricted because of the large acreages in National Wildlife Refuges and National Forest lands and the low natural soil fertility in the area that has made reclamation difficult in the past (Fig. 5.10). Approximateely 20% of the total surface mined coal output is projected for the three counties most severely affected.

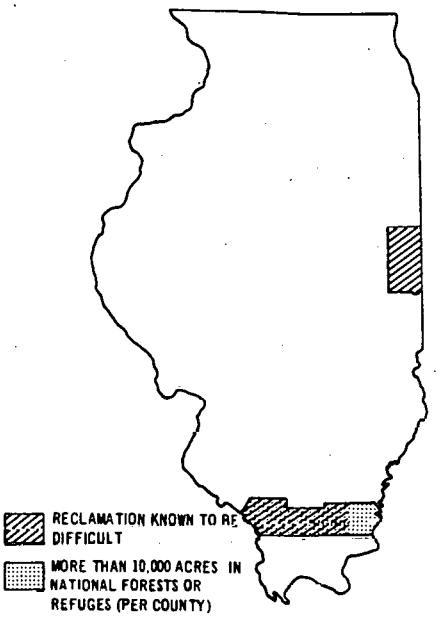

Fig. 5.10 Potential Constraints on Surface Mining Activities

- Short-term SO_2 concentrations are generally projected to decrease, although the analysis shows that they will remain high enough to cause damage to existing vegetation, including soybean and wheat crops, in several areas in the state.

- Large utilities projected for the northern part of the state and the population increases associated with them could remove up to 6,000 acres of land from other productive uses. Croplands are most likely to be affected.

- At least 12 species of plants and animals presently considered to be endangered in the U.S. were historically found in Illinois. Only one of these, the Illinois Mud Turtle, is presently known to occur in counties affected by the scenario.

5.5 SOCIOECONOMIC ISSUES

- Severe socioeconomic impacts are projected for three scenario-defined sites for energy development in Illinois (Fig. 5.11). The number of available workers in these counties and those adjacent to them may not be sufficient to fill all the newly created jobs. These areas may experience shortages of local public services as well as price effects on private sector goods.

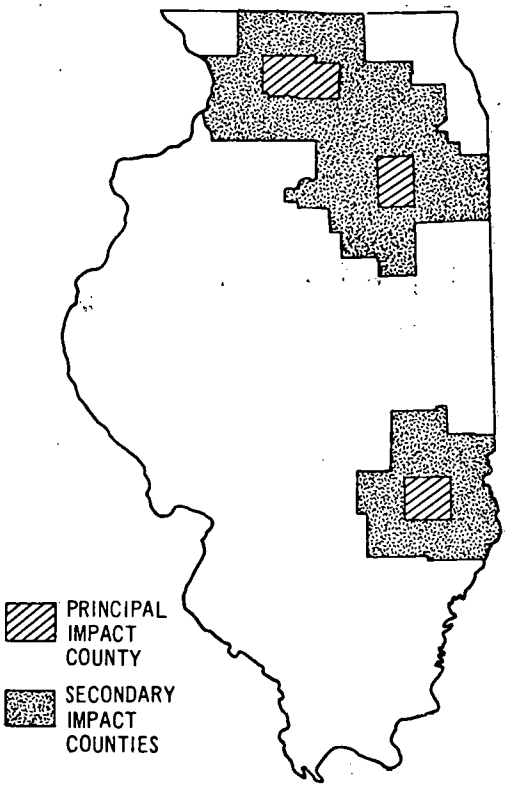

Fig. 5.11. Illinois Counties Potentially to Socioeconomic Impact

5.5.1 Description

Illinois has the largest population--11.2 million--and the highest percentage of urban residents of any state in Region V. Most of the urban population is concentrated in the northeastern sector of the state or, more specifically, around Chicago. This area strongly influences the average per capita income for the state, $6,792, since its population and density characteristics contrast sharply with those of the central and southern sectors, where the inhabitants are primarily farmers and miners.

The state economy is very diverse and therefore Illinois is better able to withstand interruptions to particular segments of the state or national economy than a state dependent on one or two similar industries. Burdensome unemployment and workman's compensation taxes, increases in state government spending, especially for welfare and education, and unreasonable wage demands by labor together with a unique tax on new plant and equipment investments have contributed to a recent loss of businesses and manufacturing industries to other regions, particularly to the sunbelt states.[17]

5.5.2 Background Issues

- Local socioeconomic impacts are defined by the demographic, economic, and social changes associated with the siting, construction, and operation of energy-generating facilities.

The interdependencies among labor supply, local public capital, and the availability of accessible sources of goods and services define the most important spheres of socioeconomic impact.

- Characteristic socioeconomic trends attributable to energy developments include:[18,19]

  - Construction of energy facilities creates an almost instantaneous demand for employees.

  - If the local labor force is insufficient to fill these demands, new workers and their families create rapid increases in local populations.

  - The timing of energy facility construction and operation and the availability of local labor determine the levels of population increase that may be realized in a given county.

  - The direct demands of the industry and the increased incomes paid to workers expands wholesale, retail, commercial, industrial, and service employment, and, concomitantly, population.

  - The larger the demographic differences between the new and existing populations, the more severe are sociocultural problems relating to social organization and particular service needs.

  - Revenue imbalance arises because of the immediate need for expenditures on services (e.g. schools, sewers, police, fire, utilities, and hospitals) and the delayed collection of revenues during plant construction.

  - Shortfalls in public revenues and subsequent inadequacies in the provision of public services may have the undesirable consequence of stimulating population turnover, thereby worsening socioeconomic impacts.

  - The provision of public services and facilities determines the quality of life that will be experienced by both the new and existing populations in the county.

  - If the quality of life decreases enough because of these problems, the productive labor force may leave, resulting in lower productivity in the energy industry, decreased provision of services, and further social dissolution.

- Increases in population of 10% or more during any given period are considered severe. Although the literature will ascribe a 7-15% increase range, the 10% figure used in this analysis is based on

Gilmore's study[19] which indicates that a 10% population increase is sufficient to result in social problems such as increased crime, divorce, out-migration, and labor turnover.

- The capacity of counties to assimilate new employment and population growth is a function of base population size and density, manufacturing employment, and distance to the nearest trade center.

- As a rough guide, counties with different assimilative capacities can absorb, without adverse levels of in-migration, the following types of energy activities:

  - extra-low assimilative capacity: no commercial scale energy facility or mine.

  - low assimilative capacity: small mining operations.

  - moderate assimilative capacity: single plants or mines of moderate size.

  - high assimilative capacity: single large-scale facilities or multiple facilities of smaller sizes.

- The Illinois counties identified as potential sites for future energy-generating facilities span the range from low to high assimilative capacity.

- Within Illinois, there are 32 high assimilative counties, 31 moderate, 26 low and 13 extra low. These correspond to 17% of the high assimilative counties within the region, 19% of the moderate, 26% of the low and 19% of the extra-low.

5.5.3 Scenario-Induced Changes

- Most of the proposed developments are sited in counties with high assimilative capacity, where population growth due to in-migration is expected to be negligible.

- Socioeconomic impacts are expected to be most pronounced in three Illinois counties, Jasper, Ogle, and Grundy, where 37% of the scenario-projected capacity increase (in MW) for Illinois is sited. (Figs. 5.12 - 5.14). The in-migration of workers and their households into these counties during the construction phase is calculated to be 14,631 people or 17% of their existing population. Only 300 (or 0.6% of their baseline populations) would be required as permanent basic operating workers.

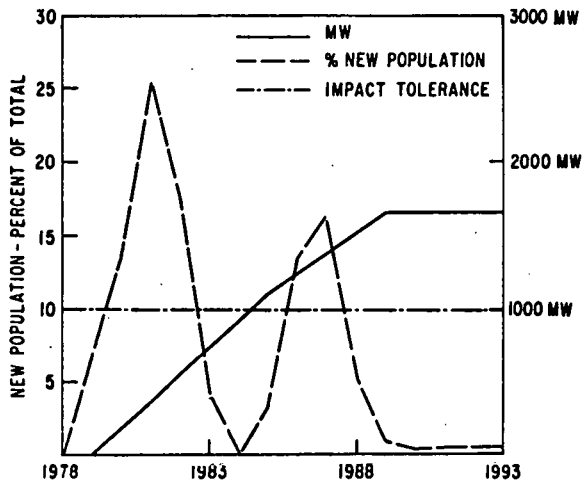

Fig. 5.12. Potential In-Migration into Jasper Co., Illinois (Low Assimilative Capacity)

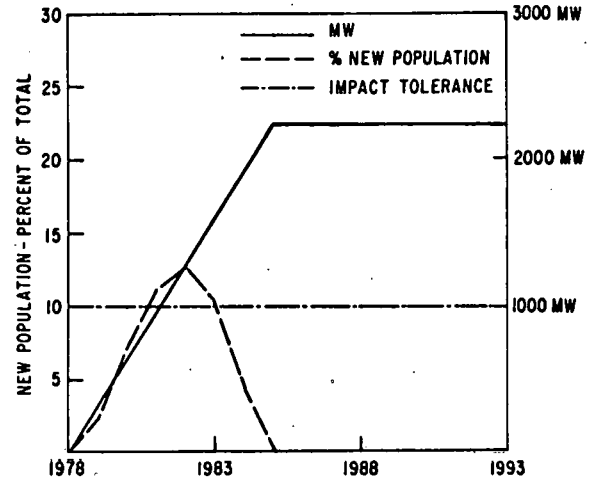

Fig. 5.13. Potential In-Migration into Ogle Co., Illinois (High) Assimilative Capacity)

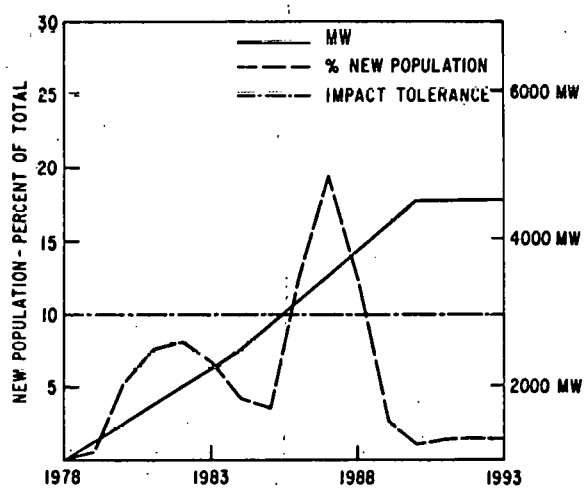

Fig. 5.14. Potential In-Migration into Grundy Co., Illinois (Moderate Assimilative Capacity)

- When the average regional public costs for the particular size and type counties are calculated, the new permanent residents (570) may incur additional public costs in excess of $300,000 annually.

- During operation of the new generating facilities, two counties, Jasper and Grundy, may require additional in-migrant labor beyond the construction phase. This additional growth could significantly increase public expenditures for water treatment, with marginal increases for all other services analyzed.

- No infrastructures are currently established to mitigate these immpacts, and many of the adjacent counties may experience similar energy and mining impacts on a smaller scale. Without proper management, control, and planning there could be adverse impacts in additional counties.

- Of the scenario-defined increases in electrical generating capacity for Illinois by 1990, Jasper, Ogle, and Grundy counties are projected to absorb 47% of the increased coal-fired capacity, 99% of the oil steam, 25% of the nuclear, and 51% of the combined-cycle capacity.

5.6 HEALTH AND SAFETY IMPACTS

- Estimated deaths from exposure to coal-generated sulfates are projected to decrease 56% because of sulfur control regulations and the location of new coal-fired facilities away from population centers.

- Occupational health impacts from coal mining will be most severe in the southern portion of the state. Deaths in coal mines are projected to increase by approximately 25%.

5.6.1 Background Issues

- Eighty-five percent of the Illinois population currently lives in counties where 70% of coal-fired electricity generation occurs.

- Potentially dangerous levels of non-energy related environmental health stresses occur throughout Illinois, e.g., record ozone levels reported in Cook, Lake, and Madison counties in 1978, and NAAQS levels for particulates were exceeded in the Chicago area.

- High sulfur coal is mined and burned in Illinois.

- In 1973, 10% of the total deaths in Illinois were due to respiratory disease and 55% to cardiovascular disease; both diseases are susceptible to aggravation by SO_x exposure.[20]

- In localized areas, mine drainage has contaminated drinking water supplies. Saline county is an example.[21]

- Subsidence from abandoned underground mines remains a hazard in southern areas of the state in Franklin, Williamson, and Jackson counties.[21]

- Most Illinois coal reserves are accessible only by high-risk deep mining techniques.

5.6.2 Scenario-Induced Changes

- Potential deaths from surface mining activities are projected to decrease whereas those from underground mining may increase because of a shift from strip to deep mining techniques. Accidental deaths from mining will increase because of the increase in coal extraction, as well as the high risk associated with deep mining (Fig. 5.15).

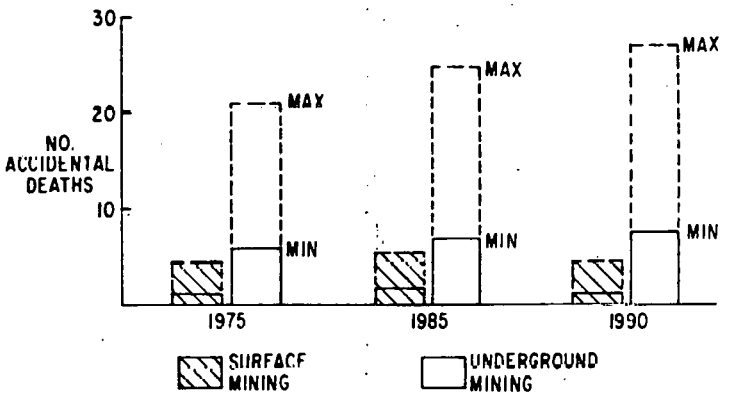

Fig. 5.15. Range of Potential Accidental Deaths in Illinois Coal Mines Due to Implementation of the Mid-Mid Scenario

- The increased health impact of deep mining will be reflected in the increase in the incidence of and deaths from chronic respiratory disease (Fig. 5.16).

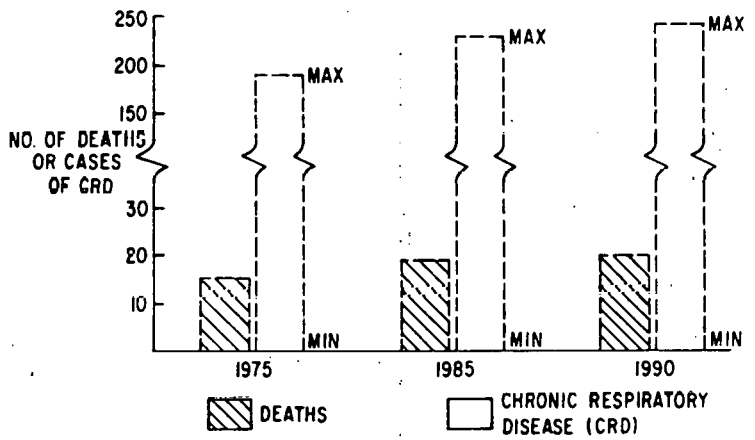

Fig. 5.16. Range of Potential Deaths And Cases of Chronic Respiratory Disease (CRD) in Illinois Due to Coal Mining Occupational Exposure Under the Mid-Mid Scenario

- Occupational health impacts of oil production and refining, natural gas production, and electricity generation will be minimal compared to impacts from coal extraction under this scenario (Fig. 5.17).

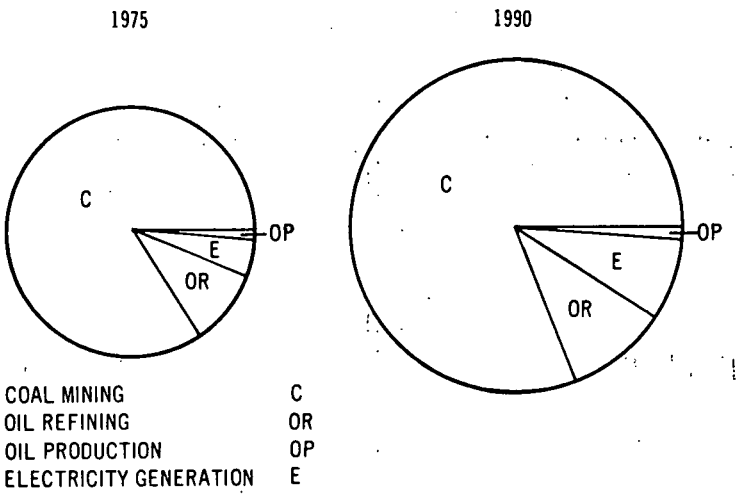

Fig. 5.17. Relative Contributions of Major Energy Activities to Energy-Related Occupational Deaths in Illinois Under the Mid-Mid Scenario

- Estimated deaths from sulfate exposure resulting from SO_x emissions from coal use may decrease approximately 56% (Fig. 5.18). The decrease, which occurs despite significant increases in coal use, is due to the implementation of sulfur control regulations to be promulgated under the Clean Air Act and also to the projected dispersion of coal use facilities in Illinois away from population centers.

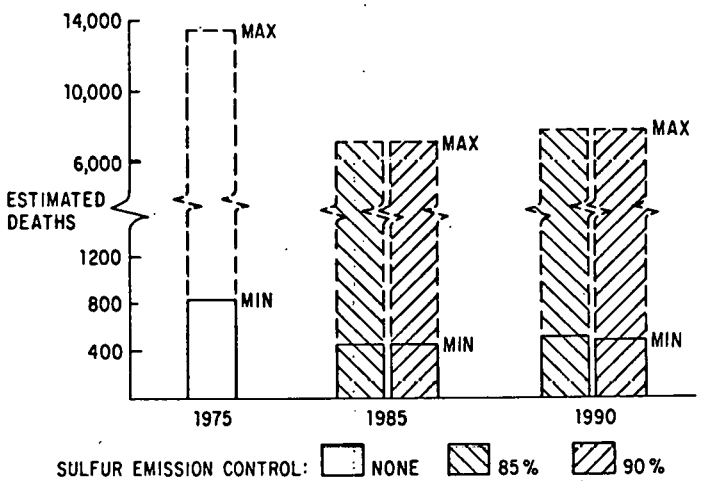

Fig. 5.18. Estimated Range in Deaths in Illinois from SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use Under the Mid-Mid Scenario

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6 INDIANA

The scenario projects an addiitonal 5,987 MW of electrical generating capacity in Indiana by 1985 and 9,658 MW by 1990 (Table 6.1). Coal production is projected to increase from 25.1 million tons per year in 1975 to 27.7 million tons per year in 1985 and 28.7 million tons per year in 1990. More than 90% of the coal will be removed from surface mines. The impacts discussed in the following sections are summarized in Table A-2.

Table 6 1. Projected Increases in Electrical Generating Capacity (MW) - Indiana Mid-Mid Scenario[a]

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	3878	1535	-71	645	0	0	5987
1975-1990	3835	2127	-71	2905	81	781	9658

[a]Base year: 1975.

[b]Includes conventional hydro and pumped storage.

[c]Includes solar, combined cycle, and "other".

6.1 AIR QUALITY/VISIBLITY IMPACTS

- Air quality is expected to improve dramatically in most nonattainment areas between 1975 and 1990, although the northwestern portion of the state is expected to continue to have primary NAAQS SO_2 air quality violations (Fig. 6.1).
- With two exceptions, TSP air quality levels throughout the state are expected to comply with federal primary standards by 1990, assuming enforcement of the SIP. Northwestern and southwestern portions of the state may continue to exceed standards (Fig. 6.1).
- Over 25% of the proposed growth in utility oil capacity and 33% of the industrial growth is sited in nonattainment areas. Proper emission offsets may be required in these areas.

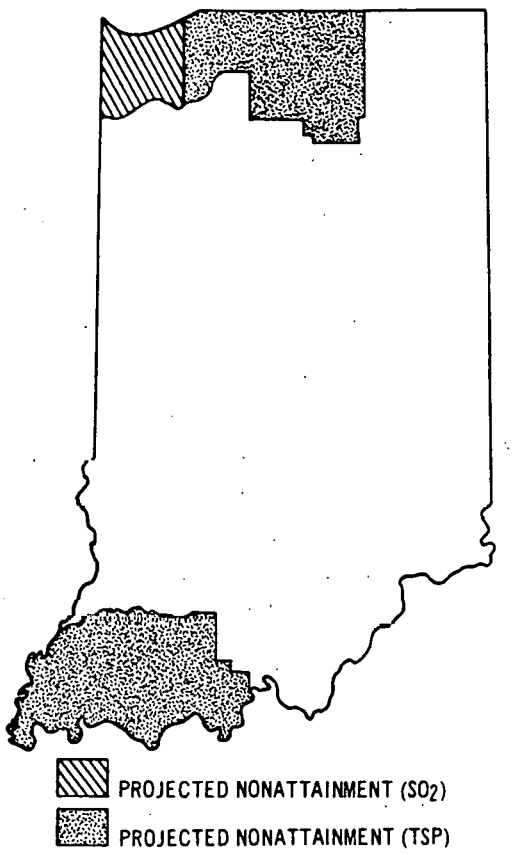

Fig. 6.1. Indiana - Potential Air Quality Impact Areas

6.1.1 Description

Coal-fired plants provided over 83% of Indiana's electrical generating capacity in 1975.[12] The major sources of this coal have been Indiana and Kentucky. The average sulfur content of Indiana coal is greater than 3.5%, which has probably contributed to the air quality problems in the state, since that is far above the sulfur level of coal suitable for burning without extensive stack gas scrubbing.

6.1.2 Background Issues

- Six counties in Indiana have SO_2 and TSP ambient concentrations that are in violation of federal primary standards.
- Indiana's air quality problem is most persistent in the northeastern part of the state, which is one of the most concentrated urban/industrial areas in the nation. Sulfur dioxide emissions in this area have resulted in air quality levels exceeding federal standards by several hundred percent.

- Though air quality problems exist in the Indianapolis area, primary standards are only marginally violated, and enforcement of the SIP could bring this area into compliance with Clean Air Act provisions.

- Indiana has no designated visibility protected areas.

6.1.3 Scenario-Induced Charges

- Indiana does not have scenario-projected coal utility siting in nonattainment areas of the state. Although new source performance standards, control efficiencies, and local regulations must be satisfied, no significant air quality issues exist for projected utility coal expansions.

- Approximately 35% of the 1985 proposed utility oil growth is expected in nonattainment areas. Central Indiana will be most affected by utility oil development. Selective fuel purchasing policies will mitigate air quality problems caused by emissions, but unavailable emission offsets and nonattainment provisions could constrain development. By 1990, this area is projected to be in attainment.

- One-third of the proposed industrial growth in Indiana could be restricted, in part, by nonattainment provisions of the Clean Air Act. Fuel use, emission limitation, and offset requirements may be necessary for these plants to meet new source review requirements.

- 1990 sulfur dioxide levels in the northwestern portion of the state may still be in violation of standards even though substantial reductions are projected to occur between 1975 and 1985.

6.2 WATER QUALITY/AVAILABILITY ISSUES

- Projected increases in utility activity in the Patoka River basin of southern Indiana may be constrained by a water availability shortfall (Fig. 6.2).

- An increase in coal mining activity in the Patoka basin projected for 1985 may exacerbate sulfate violations caused by drainage from abandoned strip mines.

- Projected increases in utility siting in the heavily industrialized northwestern area of Indiana may cause an increase in phosphorus levels in streams tributary to Lake Michigan.

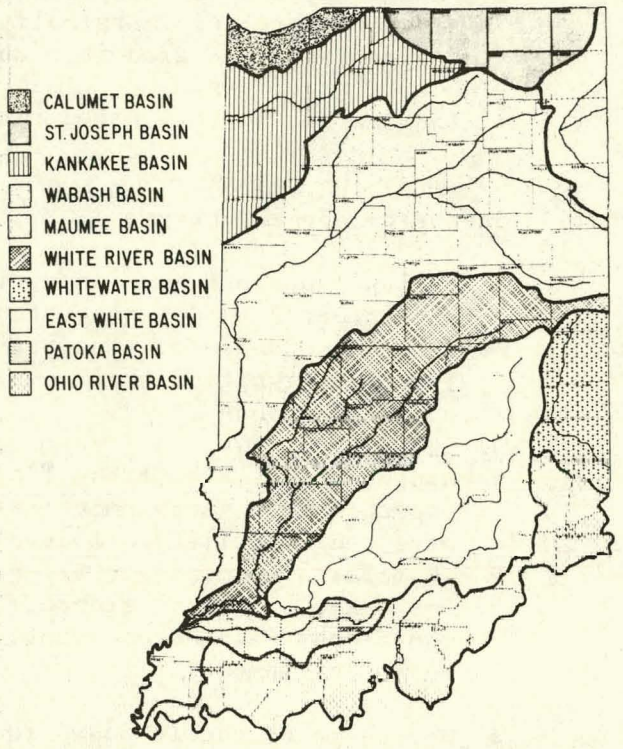

Fig. 6.2. Indiana River Basins

6.2.1 Description

Most of Indiana is drained by the Wabash and Ohio Rivers whose flows are sufficiednt to assimilate heavy waste loads.[22,23] Small portions of the state lie in basins tributary to Lakes Michigan and Erie. The northwestern industrial corridor discharges wastes to Lake Michigan via the Indiana Ship Channel and to the Illinois River basin through the Calumet Sag Channel. Water quality in the state is heavily affected by mineral extraction. One fifth of Indiana contains coal resources.

6.2.2 Background Issues

- The Patoka River Basin experiences wide-spread pollution problems associated with mining. Acid drainage from abandoned strip mines is neutralized by underlying limestone strata resulting in water very high in total dissolved solids.

- Several cities currently import water from other basins because the groundwater surface water supplies of the Patoka are inadequate.
- Phosphorus violations in streams tributary to Lake Michigan compound the eutrophication problems of the lake. By agreement among Lake Michigan states and the EPA, effluent phosphorus loading reductions of 80% are now required.

6.2.3 Scenario-Induced Changes

- Projected increases in phosphorus concentrations in the Calumet River will compound waste load allocation problems and may constrain the projected utility activity for northwestern Indiana (Fig. 6.3).

- Increases in sulfate concentrations in the Patoka River Basin will magnify the already severe water quality problems of the basin (Fig. 6.4).

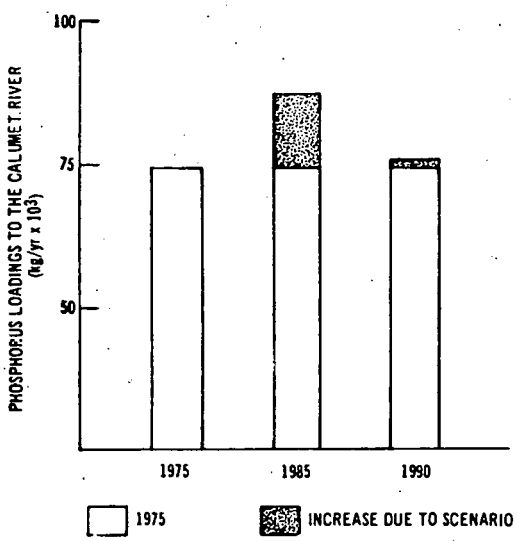

Fig. 6.3. Scenario Increases in Phosphorus Loadings to The Calumet River

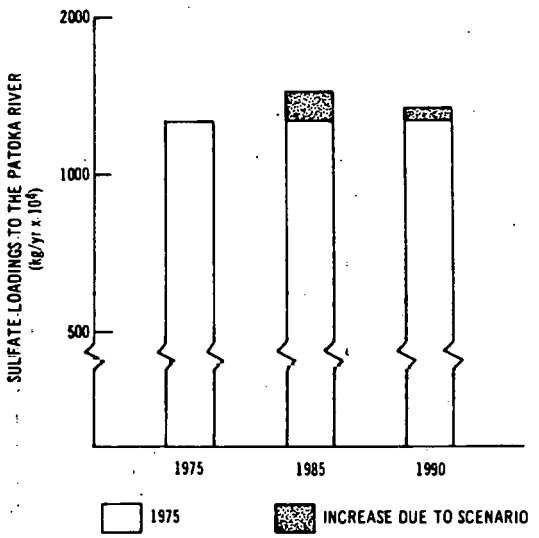

Fig. 6.4. Scenario Increases in Sulfate Loadings to the Patoka River

6.3 SOLID WASTE IMPACTS

- Industrial coal use is projected to decline, but solid waste residuals may increase because of application of FGD systems. Indicators show nine counties where solid waste disposal may present problems.

- Solid waste disposal problems should not constrain new utility development; however, additional costs would be incurred if the material has to be transported to an off-site disposal area.

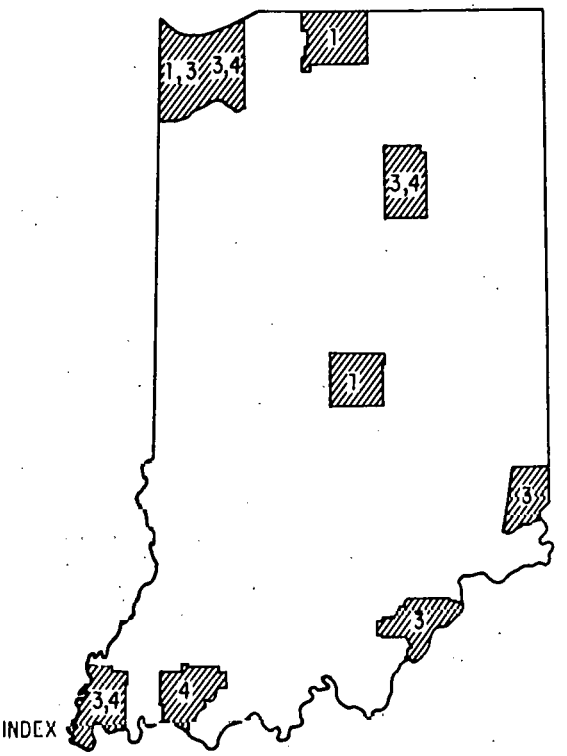

Fig. 6.5. Indiana Counties Potentially Subject to Solid Waste Impacts

6.3.1 Background Issues

- Industrial coal use in Indiana in 1975 was nearly 10 million tons, the second highest in the nation.

- Finding a suitable disposal site in portions of the southern and northern part of the state is more difficult because of the karst topography of the former and Lake Michigan sands of the latter.

6.3.2 Scenario-Induced Changes

- Projections based on the mid-mid scenario indicate that solid waste residuals will increase to 2.3 million tons per year by 1990 (or by 215% compared to 1975). The increase is due solely to FGD sludge; industrial coal use is projected to decline (Fig. 6.6).

- Land requirements for disposal are expected to increase to about 50 acres per year in 1990 from 16 acres per year in 1975.

- Based on criteria relating to land availability and sewer capacity, nine counties may have difficulty disposing of industrial wastes. Areas constrained by both lack of landfill sites and inadequate sewer systems will have the most difficulty disposing of the wastes.

- Installed coal-fired utility capacity is projected to increase to 15,000 MW by 1900 (or by 40% compared to 1975). The lifetime area requirement for solid waste disposal is projected at 3,000 acres (Fig. 6.7).

- Some existing facilities will have to transport waste off-site at additional cost. New plants should be able to plan for on-site disposal.

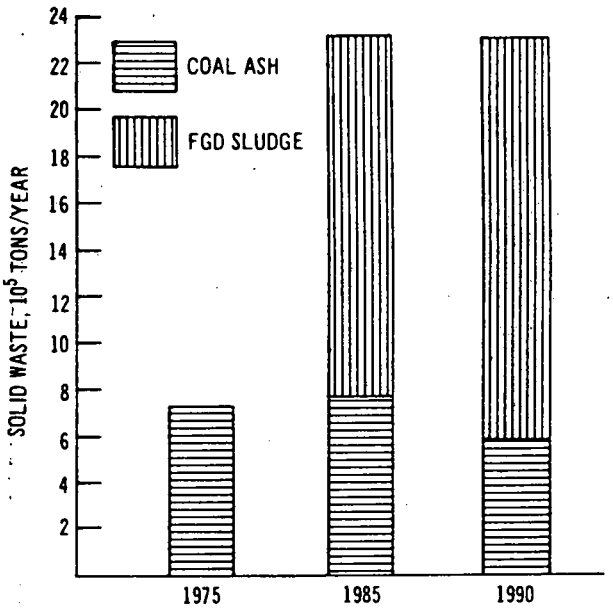

Fig. 6.6. Indiana - Solid Waste Generation from Industrial Coal Use

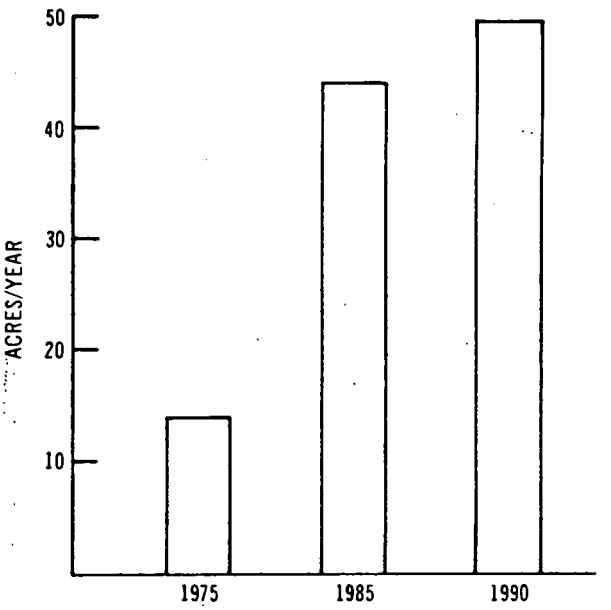

Fig. 6.7. Indiana - Total Area Used for Industrial Ash and Sludge Disposal

6.4 ECOLOGICAL AND LAND USE IMPACTS

- The potential for major land use and ecological impacts is greatest in the southwestern part of the state, where at least seven major new generating facilities have been sited, and where surface mining is projected to disturb 57,000 acres by 1990. Croplands are most likely to be affected, but the possibility of adversely affecting natural forested habitats by construction, mining, or transmission corridors is high (Fig. 6.8).

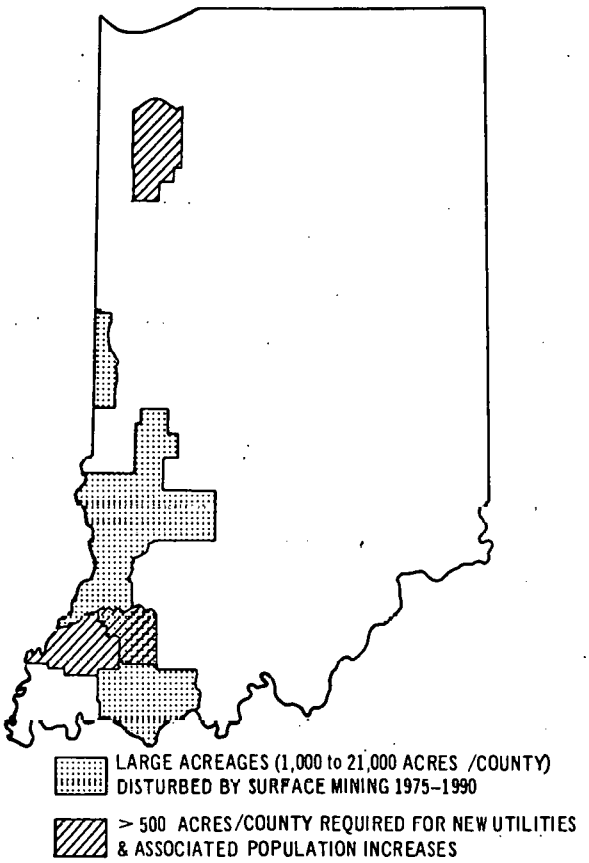

Fig. 6.8. Areas with Greatest Potential for Ecological Impacts - Indiana

6.4.1 Description

The major land use in Indiana is farming, with 61% of the state area devoted to croplands. The principal crops are corn and soybeans. Approximately 17% of the state remains forested, including 181,000 acres of National Forest lands in the south central part of the state. The major urban centers are in the northern half of the state, and the area along Lake Michigan is one of the most intensely developed industrial and population centers in the country.

6.4.2 Background Issues

- It has been estimated that as much as 45% of Indiana's strippable reserves of coal may be under land that can be classified as prime farmland.[15]

- The state's major energy demand centers are in the northern and central parts of the state. Although Lake Michigan is the major source of water for new energy facilities, siting along the Lake is difficult, because most of the shoreline has already been pre-empted for industrial, commercial, residential, or recreational use. Siting near the major water sources in the southern part of the state necessitates long transmission distances with the attendant adverse impact of transmission right-of-ways.

- Several of Indiana's major crops, such as soybeans, wheat, and hay, are highly sensitive to SO_2.

6.4.3 Scenario-Induced Changes

- Coal mining is projected to disturb approximately 4,500 acres per year in the southwestern part of the state in 1985 and about 4,300 acres per year in 1990 (Fig. 6.9). A total of 65,000 acres could thus be disturbed during the scenario time frame, and 17 counties would be affected. Since agriculture and forests are the major land uses in this area, reclamation costs of strip-mined land are likely to be high. No conflicts with National Forest lands are expected.

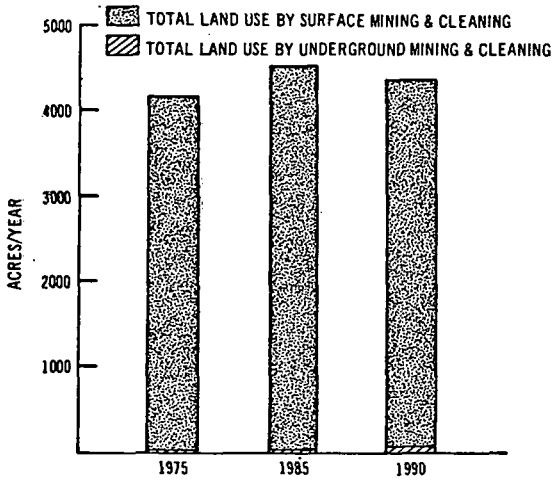

Fig. 6.9. Indiana - Land Use for Coal Production.

- Major new power generating facilities may require another 3,000 acres of agricultural and/or forest land in the southwestern tip of the state. Additional land is likely to be required for transmission lines to carry power from this less-populated area to the urban load centers. Construction of the transmission corridors may lead to disruption of agricultural activities or dissection of forested habitat.

- SO_2 concentrations in the Gary area are projected to continue at levels high enough to affect crops and natural vegetation in the area.

- At least 12 species of animals presently considered to be endangered in the U.S. were historically found in counties affected by the scenario. The critical habitat for one of these, the Indiana bat, is found in one of the counties where mining is projected.

6.5 SOCIOECONOMIC IMPACTS

- Severe socioeconomic impacts are projected for two scenario-defined sites for energy development in Indiana (Fig. 6.10). The number of available workers in these counties and those adjacent to them may not be sufficient to fill all the newly created jobs. These areas may experience shortages of local public services as well as price effects on private sector goods.

Fig. 6.10. Indiana Counties Potentially Subject to Socioeconomic Impact

6.5.1 Description

Indiana is the smallest state west of the Appalachian Mountains. It is basically a manufacturing state, with its northern counties surrounding the heavily industrialized areas of Chicago. The other important contributor to the state's balanced economy is farming.

The 5.3 million residents of Indiana are distributed over 36,077 square miles with a density factor of 147 people per square mile. The per capita income is $5,656, principally within the manufacturing and fuel development (excluding processing) sectors.

The state government has not become involved in power plant siting issues and, consequently, has been highly criticized by many academic, technical, and citizens' representatives. Substantial citizen opposition to the construction of power plants in the Indiana/Kentucky river valley has arisen.[17]

6.5.2 Background Issues

- Indiana has 31 high assimilative capacity counties, 43 moderate, 12 low, and 6 extra-low. These correspond to 16% of the high assimilative capacity counties within the region, 26% of the moderate, 12% of the low, and 9% of the extra-low, respectively.
- The Indiana counties identified as projected sites for energy development have either low, moderate, or high assimilative capacities.
- There are no state power-plant siting regulations. This has resulted in construction of plants in flood plains and a lack of coordination with respect to operation requirements.[17]

6.5.3 Scenario-Induced Changes

- New mines in the southwestern counties are expected to create more than 700 direct basic jobs.
- Two counties, Gibson and Pike, are expected to experience severe adverse impacts as a result of a peak in-migration of 10,500 people over an eight-year period (Figs. 6.11-6.12). These stable, moderately-sized industrial and farming counties are surrounded by the Ohio and Wabash rivers, have no major highway transportation routes, have only one secondary trade center within 60 miles, and have low population density relative to the rest of the state. They could incur a combined population growth of more than 23% of their baseline populations.[24]

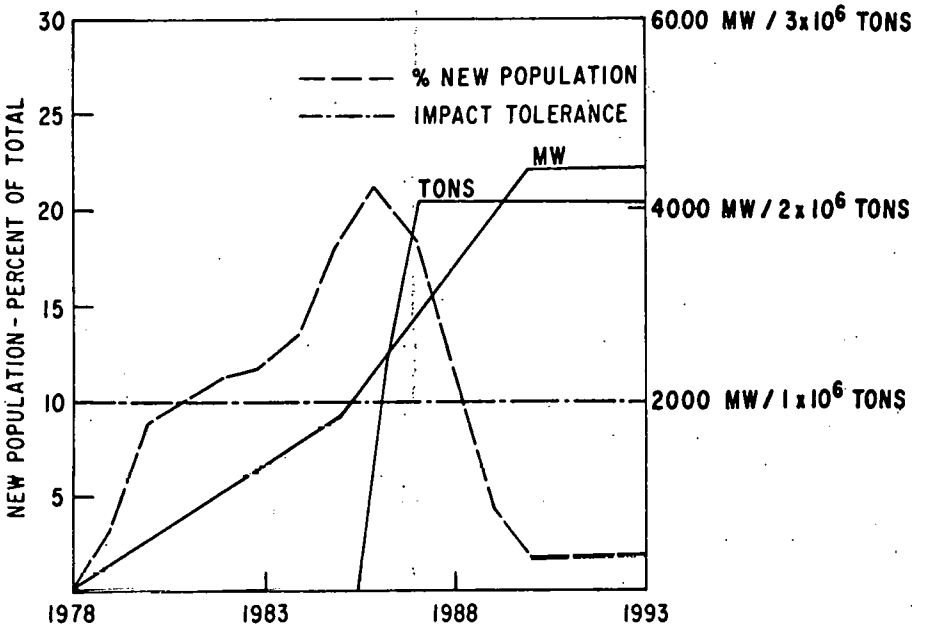

Fig. 6.11. Potential In-migration into Gibson Co., Indiana (Moderate Assimilative Capacity)

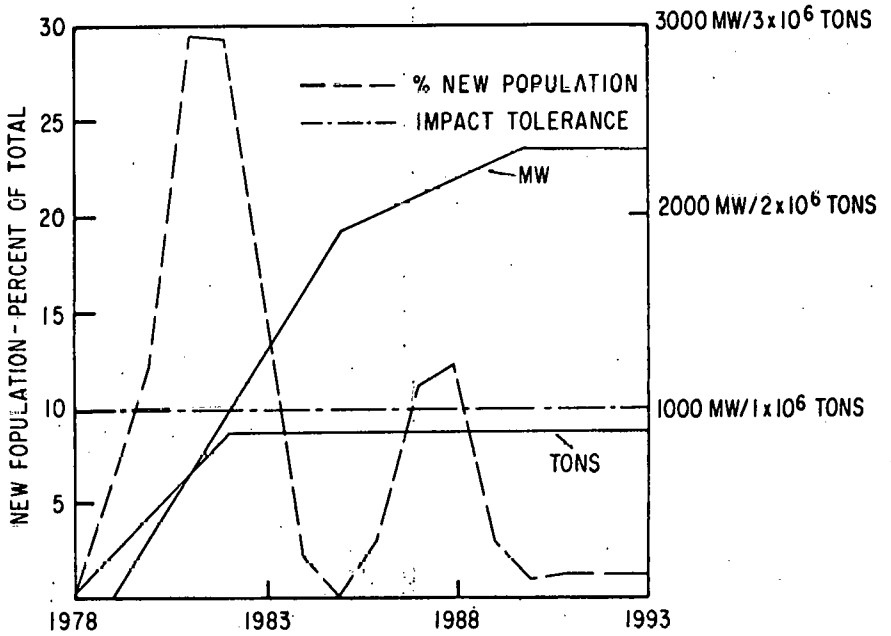

Fig. 6.12. Potential In-migration into Pike Co., Indiana (Low Assimilative Capacity)

- Of the construction population increase, 845 people may remain, so that 444 basic workers can operate the newly constructed facilities.

- Socioeconomic impacts are compounded by the fact that additional developments are projected to occur in the counties adjacent to the two principally affected. These concurrent developments can result in the employment of the calculated available work force outside the counties and, thereby, cause a greater in-migration to fulfill the demands of local developments.

- Severe sociocultural problems are expected in these counties since they are inhabited by a large number of middle aged and elderly residents, with a low per capita income ($5,200) and a relatively stable, unskilled work force.[24]

- When the average regional public costs for the particular size and type counties are calculated, the new permanent residents (845) may incur additional public costs in excess of $475,000 annually.

- No infrastructures are currently established that would mitigate these impacts. Many of the adjacent counties may experience similar impacts on a smaller scale, and without proper management, control, and planning these could also be adverse impacts.

- Of the projected increases in generating capacity in Indiana by 1990, the scenario sites 79% of the coal, 100% of the oil steam and 78% of the nuclear increases in Gibson and Pike counties. About 64% of the total increase in generating capacity by 1990 is sited in these counties.

- About 14% of the estimated 1990 mine employment in Indiana is likely to be in these two counties.

6.6 HEALTH AND SAFETY IMPACTS

- Public health impacts of sulfur released from electricity generation and industrial fossil fuel use are projected to decrease, although the number of impacts per unit of fuel use may be higher in Indiana than in western portions of Region V because of interstate transport of sulfates.

- The energy-related occupational health impacts of implementing the scenario in Indiana are expected to be minimal.

6.6.1 Background Issues

- The highly industrialized, heavy manufacturing area of northwestern Indiana has been cited in federal court for polluting air and Lake Michigan water to levels dangerous to human health.

- Respiratory and cardiovascular disease accounted for 8.5% and 54.8% respectively, of all deaths in 1973.[20] Victims with either disease are highly susceptible to atmospheric concentrations of sulfur oxides and particulates.

6.6.2 Scenario-Induced Changes

- Occupational health impacts due to energy related activities are likely to remain constant during the scenario time frame in Indiana. Coal extraction is projected to account for over 60% of the total energy-related occupational health impacts (Fig. 6.13).

- Occupational impacts from coal extraction are expected to be small because 90% of the coal mining in Indiana is strip rather than deep mining (Figs. 6.14, 6.15).

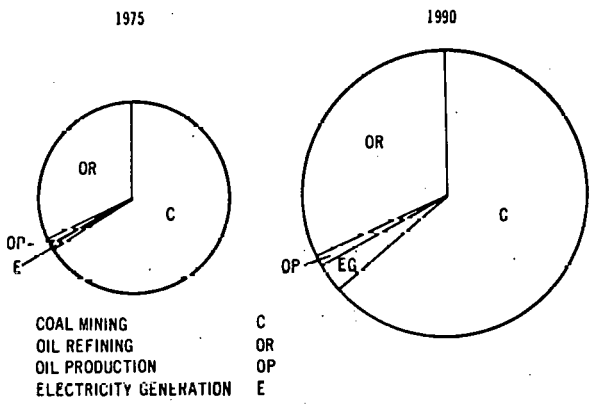

Fig. 6.13. Relative Contributions of Major Energy Activities to Energy-Related Occupational Deaths in Indiana under the Mid-Mid Scenario

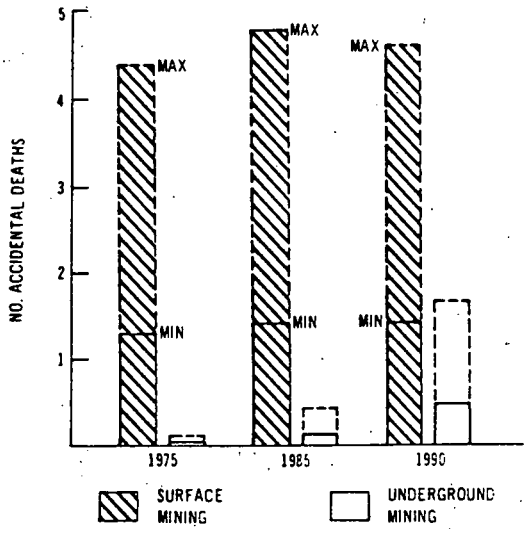

Fig. 6.14. Range of Potential Accidental Deaths in Indiana Coal Mines Due to Implementation of the Mid-Mid Scenario

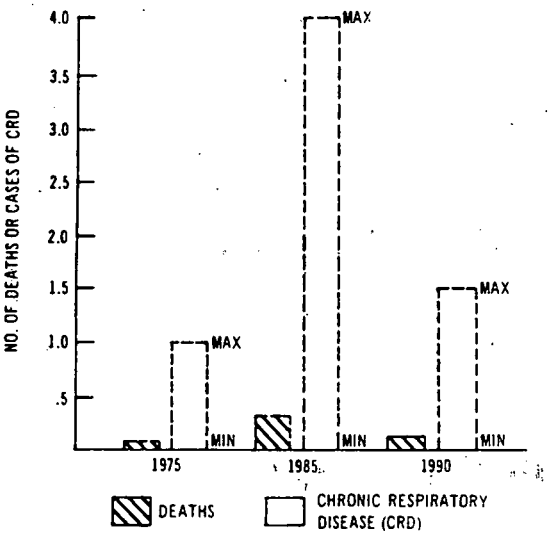

Fig. 6.15. Range of Potential Deaths and Cases of Chronic Respiratory Disease (CRD) in Indiana due to Coal Mining Occupational Exposure under the Mid-Mid Scenario

- Public health impacts from SO_4 exposure in Indiana are projected to decrease by 35-40% during the scenario time frame (Fig. 6.16). However, due to interstate transport of sulfate and easterly dispersion patterns, impact per unit of energy use may be higher in Indiana than in the western states of Region V.

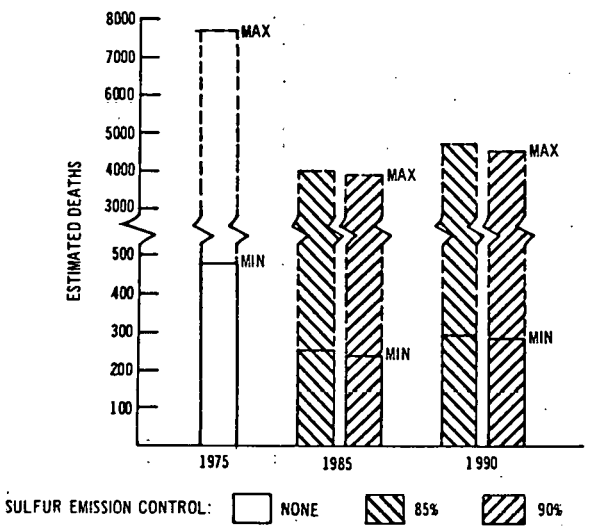

Fig. 6.16. Estimated Range in Deaths in Indiana from SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use under the Mid-Mid Scenario

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7 MICHIGAN

The scenario projects an additional 6,835 MW of electical generating capacity in Michigan by 1985 and 14,169 MW by 1990 (Table 7.1). No coal mining is projected to occur in the state.

Although Michigan has an abundant energy resource base to fuel its industries, it produced only 4% of its total energy needs. In 1975, Michigan produced 8% of its oil needs, 10% of its natural gas needs, and imported the majority of its coal supply. The impacts discussed in the following sections are summarized in Table A.3.

Table 7.1. Projected Increases in Electrical Generating Capacity (MW) - Michigan Mid-Mid Scenario[a]

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	1943	1246	444	3169	0	33	6835
1975-1990	4933	2139	79	4837	108	2073	14169

[a]Base year: 1975.

[b]Includes conventional hydro and pumped storage.

[c]Includes solar, combined cycle, and "other".

7.1 AIR QUALITY/VISIBILITY IMPACTS

- 1990 TSP violations are projected for the southeastern and northeastern sections and SO_2 NAAQS violations in a localized area in the western portion of Michigan (Fig. 7.1).
- Fifty-seven percent of the projected 1990 industrial growth and one-fourth of the combined-cycle increases sited by the scenario in these areas are subject to review.
- Coal, oil, and combined cycle utilities sited in the Upper Peninsula and in northern lower Michigan could be subject to visibility protection statutes.

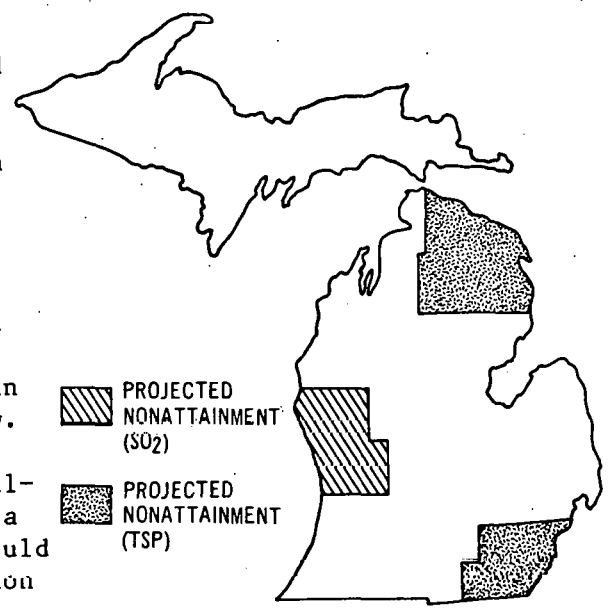

Fig. 7.1. Michigan - Potential Air Quality Impact Areas

7.1.1 Description

Coal (from Ohio, Kentucky, Pennsylvania, and Wyoming) and oil are the primary energy sources for electrical generation in Michigan.[12] Heavy industrial activity in southern portions of the state contribute to air quality problems in that area. The air is relatively clean in the northern parts of the state, where wilderness uses predominate.

There are two PSD Class I areas in Michigan: Semey National Wilderness, which includes about 25,000 acres in the northern part of lower Michigan, and Isle Royale National Park, a 540,000 acre island in Lake Superior.

7.1.2 Background Issues

- Two counties in the state are in violation of primary SO_2 standards and four counties are in violation of primary particulate standards.
- Southeastern Michigan is only marginally in violation of TSP standards even though the area is high in industrial activity.

7 1.3 Scenario-Induced Changes

- Large coal capacity increases projected for western Michigan could cause violations of federal primary SO_2 standards. SO_2 levels would increase substantially between 1985 and 1990.
- NAAQS TSP violations are projected for the southeastern and northeastern portions of the state due, in part, to proposed increases in fossil fuel combustion.
- 57% of industrial growth is projected for nonattainment areas. Emission offsets and appropriate control technologies will be required.
- One-quarter of the proposed combined-cycle power facilities could be restricted with regard to fuel use and emission control technology since they are sited in areas with marginal to poor air quality.
- Small capacity increases in coal, oil, and combined-cycle plants in the northern part of the state may be subject to visibility protection regulations.

7.2 WATER QUALITY/AVAILABILITY ISSUES

- An increase in phosphorus and total dissolved solids loadings to Lake Huron resulting from the increased utility activity in the Saginaw river (Lake Huron Basin) may lead to an increase in eutrophication in Saginaw Bay (Fig. 7.2).

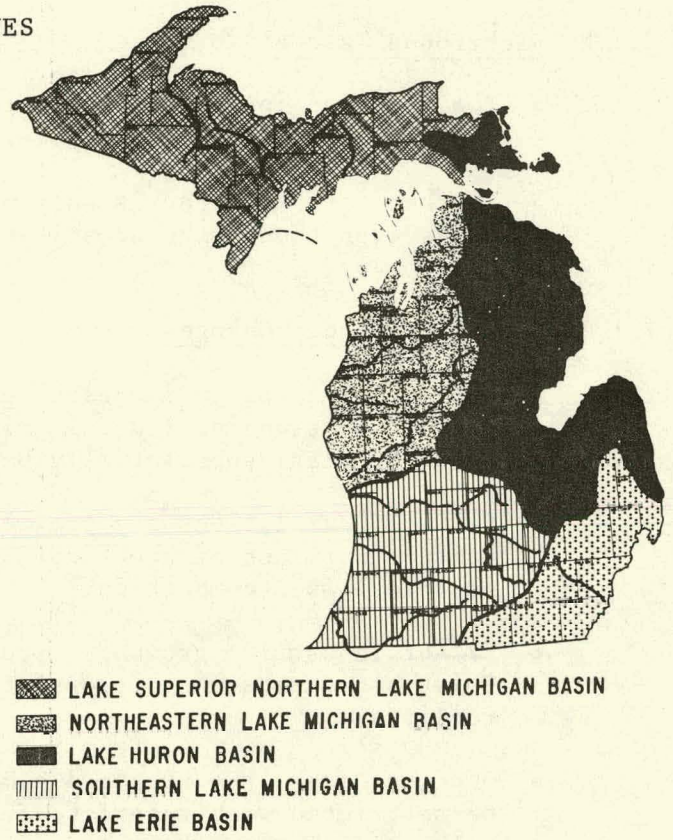

Fig. 7.2. Michigan River Basins

7.2.1 Description

Water quality in Michigan ranges from pristine to severely degraded. Rivers exhibiting the lowest water quality are generally in the southern half of the Lower Peninsula. Practically every stream in the state drains into one of the Great Lakes. Thus, water quality within the state has a direct effect on Great Lakes water quality. Overall, water quality is slowly improving; however, many shoreline areas remain contaminated by fecal coliform, mercury, and biocides.

7.2.2 Background Issues[25-27]

- Several Great Lakes areas are highly eutrophic, particularly Saginaw Bay, Thunder Bay, western Lake Erie, and western Lake St. Clair. Of even greater concern is the mesotrophic status of the southern deep water areas of Lake Michigan.

- Michigan has experienced high levels of mercury and biocide contamination both in rivers and the Great Lakes. Public use warnings and fish consumption limitations are in effect in many areas.

- The water quality of the Great Lakes is an international issue involving the national and local governments of the United States and Canada. Requirements that phosphorus loadings be substantially reduced are in effect but have not yet been made.

7.2.3 Scenario-Induced Changes

- A projected increase in phosphorus concentration in the Grand River (Southern Lake Michigan Basin) in 1985 due to significantly increased utility activity could accelerate the deterioration along the shoreline unless advanced phosphorus removal techniques are implemented (Fig. 7.3).

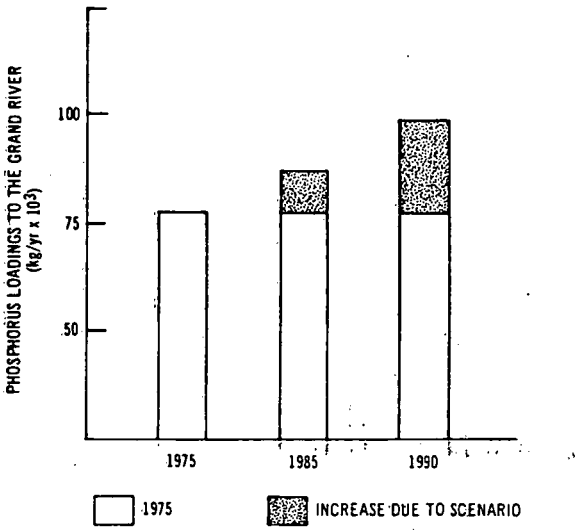

Fig. 7.3. Scenario Increases in Phosphorus Loadings to the Grand River

- According to the analysis, phosphorus levels are also projected to increase because of industrial and utility activity in the Saginaw River basin (Fig. 7.4). Violations of total dissolved solids criteria may also occur in 1985 to 1990 (Fig. 7.5).

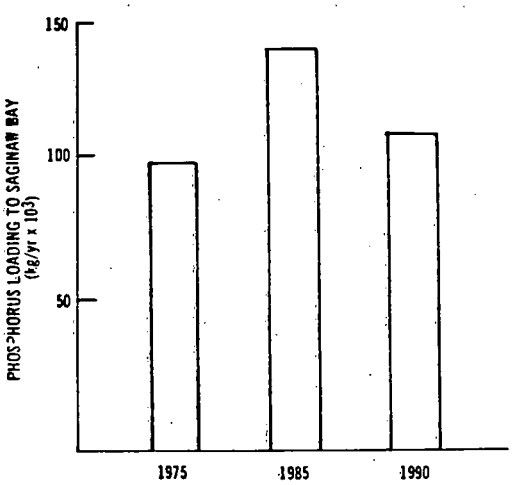

Fig. 7.4. Scenario Changes in Phosphorus Loading to Saginaw Bay

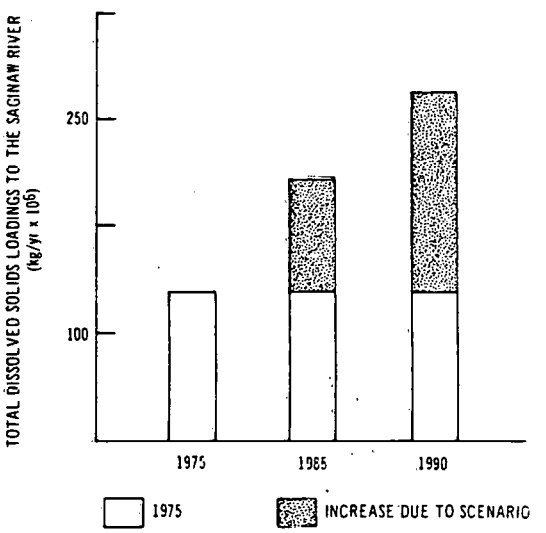

Fig. 7.5. Scenario Increases of TDS Loadings to Saginaw River

7.3 SOLID WASTE IMPACTS

- 1990 industrial solid waste residuals are projected to increase by 500%. Indicators show fifteen counties that may have difficulty disposing of the wastes (Fig. 7.6).

- Installed coal-fired utility capacity is projected to increase by 70% compared to 1975. Solid waste disposal problems should not constrain development; however, disposal at some plants may be more expensive due to transportation costs.

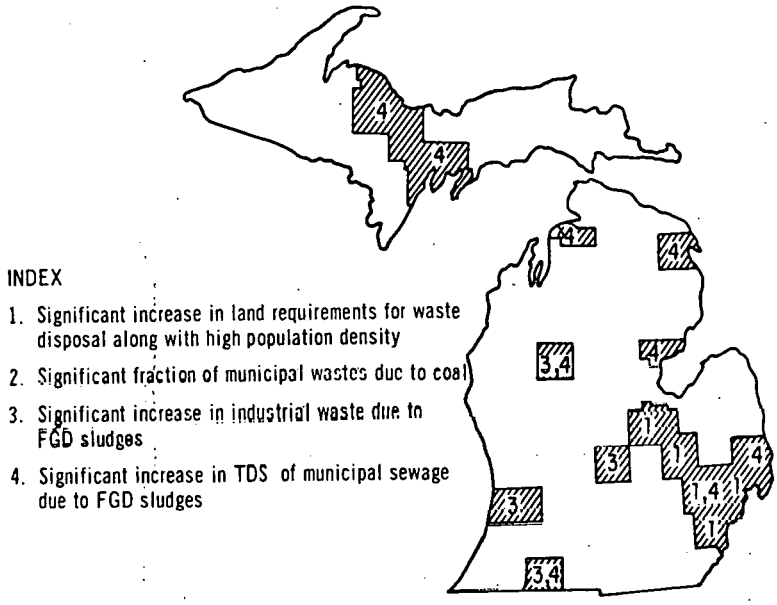

Fig. 7.6. Michigan Counties Potentially Subject to Solid Waste Impacts

7.3.1 Background Issues

- A shallow overburden underlaid by bedrock and a high groundwater table characterize much of the Upper Peninsula, making it difficult to find suitable waste disposal sites.

- A liner will have to be used for an ash disposal pond at a proposed utility site in the upper Peninsula.

- There has been concern in the Detroit area about contaminating groundwater by disposing of ash in an abandoned stone quarry.

7.3.2 Scenario-Induced Changes

- Industrial coal use, 7.9 million tons per year in 1975, is expected to increase by 90% in 1990. Solid waste generation for this same period is projected to increase by over 500% due to the application of FGD systems (Fig. 7.7).

- Land requirements for industrial disposal are projected at 71 acres per year by 1990 (Fig. 7.8).

- Based on criteria relating to the availability of municipal landfills and the potential impact of solid waste on sewer systems, fifteen counties may experience difficulty disposing of industrial wastes. Disposal will be most difficult in areas constrained by both lack of landfill sites and inadequate sewer systems.

- Land requirements for utility waste disposal are estimated at 4,000 acres for the lifetime of the plants.

- Existing utilities located in or near high population density areas may eventually have to transport wastes to off-site disposal sites at additional cost. Most new plants should be able to plan for on-site disposal.

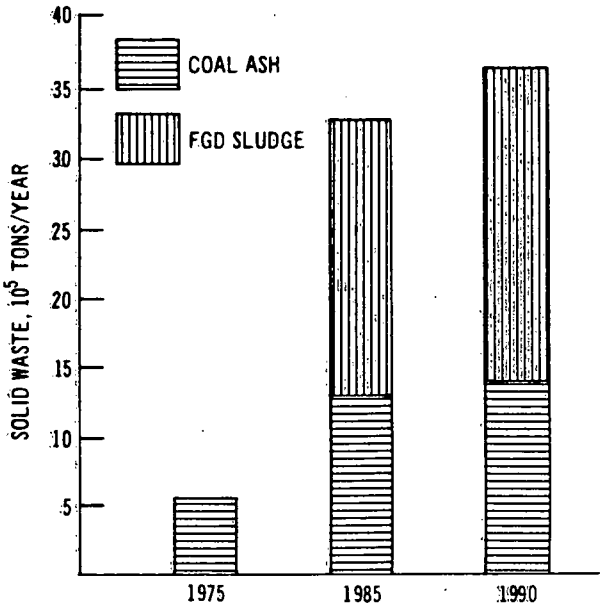

Fig. 7.7. Michigan - Solid Waste Generation from Industrial Coal Use

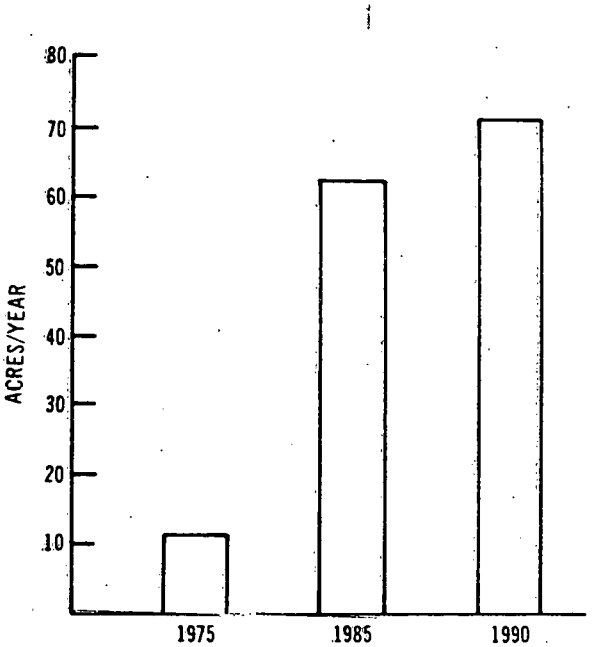

Fig. 7.8. Michigan - Total Area Used for Industrial Ash and Sludge Disposal

7.4 ECOLOGICAL AND LAND USE IMPACTS

- Relatively small acreages are likely to be required throughout the state for the projected new generating facilities, with the largest impacts in the Detroit and Grand Rapids area.
- Projected 1990 SO_2 concentrations in the Grand Rapids area are high enough to adversely affect exposed crops and sensitive natural vegetation.

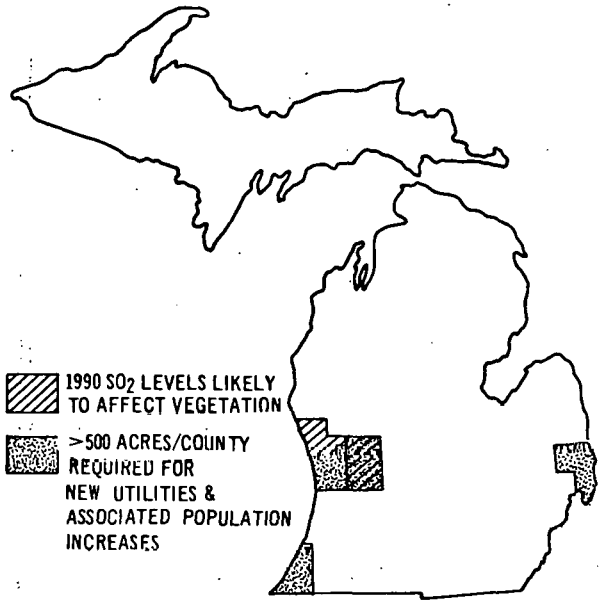

Fig. 7.9. Areas in Michigan with the Greatest Potential for Ecological Impacts

7.4.1 Description

Recreation is an important land use in Michigan, which remains 52% forested. There are 7.3 million acres of public recreation land in the state, 40% of which are in National Forests, Parks, and Wildlife Refuges. Much of this land is in the northern part of the state and in the Upper Peninsula. Michigan is bordered by four of the Great Lakes, and this large amount of shoreline is another important recreational source. Twenty-three percent of the state is in croplands, including more than ten times as many acres in orchards as any other state in the region. Berries are another special agricultural product in Michigan.

7.4.2 Background Issues

- The state has passed a "Shorelands Management Act" in order to preserve the environmental amenities of its shorelines by limiting development and fostering public acquisition of significant areas.
- The "Farmland and Open Space Preservation Act" protects the land of participating owners from forced sales due to property tax increases. This could affect the siting of new power plants, especially at the edges of metropolitan areas.

- The state's natural and agrarian ecosystems are particularly sensitive to high SO_2 levels, especially the fruit and berry crops and the coniferous forests of the northern part of the state.

7.4.3 Scenario-Induced Changes

- The projected energy development in Michigan is not likely to require large amounts of land except in the Detroit and Grand Rapids areas, where approximately 4000 acres (total) may be disturbed for new utilities. Participation in the farmland preservation program is not yet high, thus the conversion of croplands in these areas may not be limited significantly.

- Projected SO_2 levels in the Grand Rapids area may be high enough to cause damage to natural vegetation (some in National Forest and other preserves) and fruit, berry, and vegetable crops being grown in the area. Forty to forty-five percent of the area of the affected counties is covered by vegetation sensitive to the projected SO_2 levels.

- The siting of new facilities may become a controversial issue at the local level because of the Shorelands Management Act and the concern for the preservation of open space and fragile wetland areas.

7.5 SOCIOECONOMIC IMPACTS

- No adverse socioeconomic impacts are expected in Michigan since all projected electric utility increases are sited in high assimilative capacity counties able to absorb the population growth and associated public service demands resulting from energy development.

7.6 HEALTH AND SAFETY IMPACTS

- Occupational health impacts of energy related activities will be minimal.

- Deaths from SO_4 exposure due to industrial and electricity generation fuel use will decrease by 34% to 38% as a result of Clean Air Act initiatives, despite a 40% increase in fossil-fueled electricity generation.

7.6.1 Background Issues

- Michigan has experienced several episodes of environmentally released toxins such as PCB, PBB, and DDT that have threatened human life through direct exposure and biomagnification. The impact has been severe enough to force public health authorities to confiscate contaminated livestock and food stuffs.[28]

- Water concentrations of contaminants such as heavy metals and phenols along portions of heavily industrialized areas of the Detroit River, Saginaw River, Lake Erie, and Lake St. Clair violate levels acceptable for human use.[29]

7.6.2 Scenario-Induced Changes

- A minimal amount of occupational health and safety impacts will occur in Michigan due to electricity generation, oil production and refining, and gas production (Fig. 7.10).

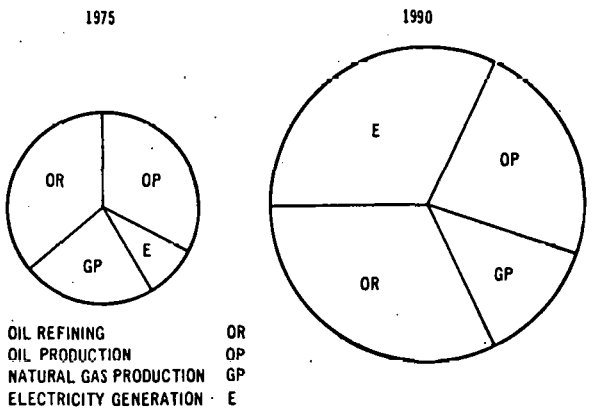

Fig. 7.10. Relative Contribution of Major Energy Activities to Energy-Related Occupational Deaths in Michigan under the Mid-Mid Scenario

- Despite a 49% increase in coal-fired electricity generation during the scenario time frame, public health impacts from sulfates are projected to decrease in Michigan by 34-38% because of implementation of sulfur emission controls.

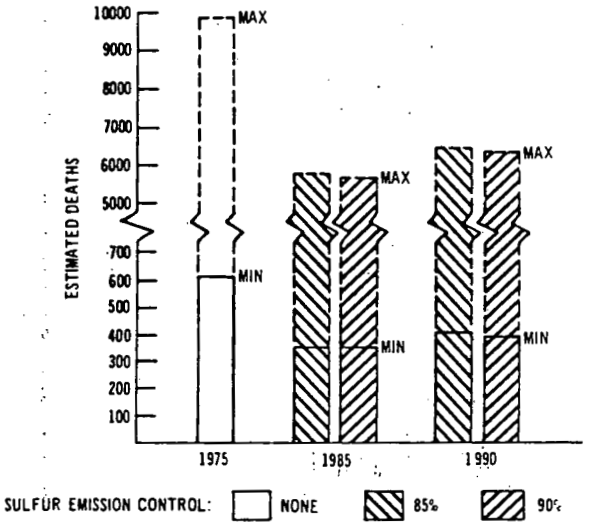

Fig. 7.11. Estimated Range in Deaths in Michigan from SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use under the Mid-Mid Scenario

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8 MINNESOTA

The scenario projects an additional 2,964 MW of electrical generating capacity in Minnesota by 1985 and 4,190 MW by 1990 (Table 8.1). No coal mining is projected to occur in the state.

Minnesota has no conventional fossil energy resources and imports the majority of its supplies. Presently, electric power plants are converting from oil to coal, and industries from natural gas to fuel oil. Canada supplies 88% of the fuel oil imported into the state, but that country is currently reducing its oil exports, which has led Minnesota to evaluate other fuel options such as low-Btu coal gasification, nuclear power, and peat gasification. The impacts discussed in the following sections are summarized in Table A-4.

Table 8.1. Projected Increases in Electrical Generating Capacity (MW) - Minnesota Mid-Mid Scenario[a]

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	2350	160	429	0	0	25	2964
1975-1990	3150	460	426	0	0	154	4190

[a]Base Year: 1975.

[b]Includes conventional hydro and pumped storage.

[c]Includes solar, combined cycle, and "other".

8.1 AIR QUALITY/VISIBILITY IMPACTS

- Minnesota contains eight counties which, in part, have not achieved primary SO_2 standards and nine counties where TSP NAAQS violations are occurring. The entire northeastern portion of Minnesota, totaling over 860,000 acres, is protected under PSD Class I air quality regulations. Projected developments are not expected to cause significant deterioration of air quality, but potential visibility impacts resulting from scenario-projected coal-burning powerplants sited near a visibility protected area in the northeastern part of the state could restrict such development.

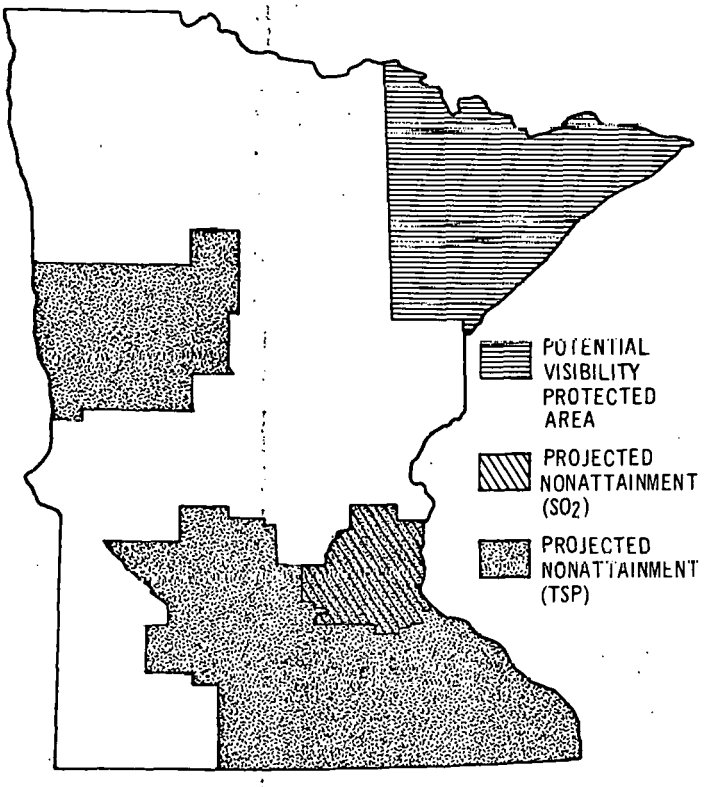

Fig. 8.1. Minnesota - Potential Air Quality Impact Areas

8.2 WATER QUALITY/AVAILABILITY ISSUES[27,30]

- Minnesota generally has good water quality: state environmental officials estimate that 78% of the state's rivers already meet 1983 water quality goals. No significant scenario-induced changes in water quality were identified for Minnesota.

- Several streams in the extreme southern part of the state are subject to extremely low flows seasonally; however, no increases in energy-related activities were sited in these basins.

8.3 SOLID WASTE IMPACTS

- 1990 solid waste residuals from industrial coal use are projected to increase by 110%. Indicators show only three counties that may have problems disposing of these wastes (Fig. 8.2).

- Solid waste disposal problems should not constrain utility development; however, additional costs may be incurred when the material has to be transported to an off-site disposal area.

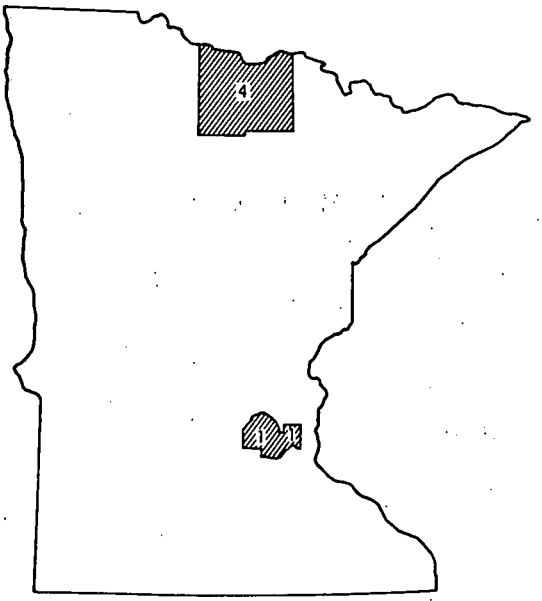

Fig. 8.2. Areas in Minnesota Potentially Subject to Solid Waste Impacts

8.3.1 Background Issues

- Present industrial coal use is less than 2 million tons per year. One-fourth of this is concentrated in one county, the remainder is scattered throughout 16 counties.

- The fractured limestone topography in the southeastern portion of the state makes it more difficult to find an environmentally acceptable disposal site.

- There is a continuing effort toward ash utilization, either in filling projects or concrete production.

8.3.2 Scenario-Induced Changes

- Industrial coal use is projected to increase by 80% in 1990 relative to 1975. Solid waste generation is projected to increase by about 10% (Fig. 8.3).

- Land requirements for disposal area projected to be six acres per year in 1990 (Fig. 8.4).

- Three counties may experience problems disposing of industrial wastes, based on criteria relating to availability of landfills and potential solid waste impact on municipal sewer systems; however, solid waste disposal associated with industrial coal use is not expected to pose a significant problem in Minnesota.

- Installed coal-fired utility capacity will more than double by 1990, reaching 6,000 MW. New plants should be able to plan for on-site disposal. Some existing plants may have to transport wastes off-site, but no significant problems are foreseen.

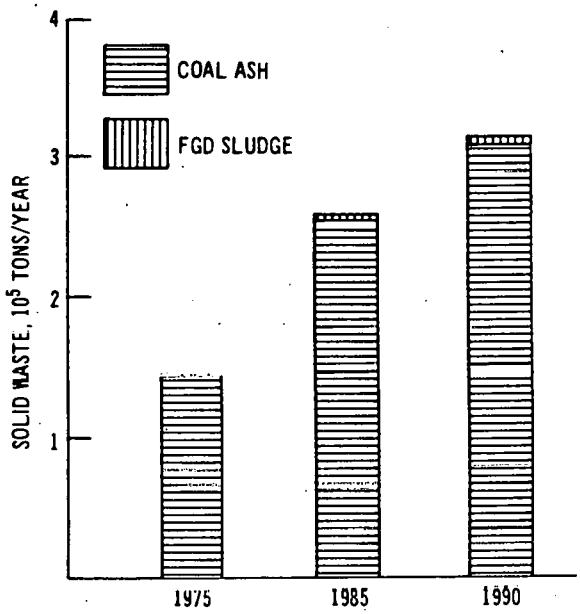

Fig. 8.3. Minnesota - Solid Waste Generation From Industrial Coal Use

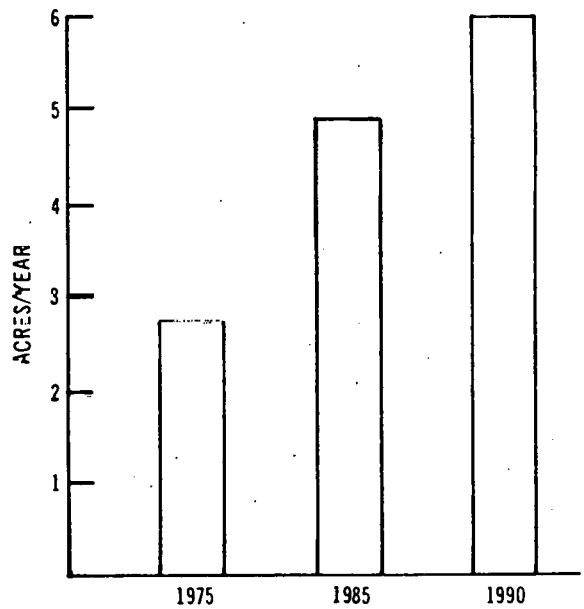

Fig. 8.4. Minnesota - Total Area Used for Industrial Ash and Sludge Disposal

8.4 ECOLOGICAL AND LAND USE IMPACTS

- Although the potential for adverse ecological and land use impacts is high in Minnesota because of large amounts of natural habitat and shoreline acreage in the northern part of the state and the intense agricultural activity in the southern half of the state, impacts are expected to be minimal since only small acreages are projected to be disturbed for new energy facilities. State environmental legislation* and a power siting law[31] may limit the number of sites available for these facilities and will influence the siting process at the local level.

8.5 SOCIOECONOMIC ISSUES

- No adverse socioeconomic impacts are expected in Minnesota since all projected electric utility increases are sited in counties that are able to absorb the population growth and associated public service demands resulting from energy development.

8.6 HEALTH AND SAFETY IMPACTS

- Public and occupational health impacts of the scenario will be minimal in Minnesota. No fossil fuel reserves are currently economically recoverable there. Although electricity generation is projected to increase by 61% and oil refining by 40%, the relatively low risk of these occupations will keep impacts small.

- Public health impacts from sulfate exposure due to fossil fuel use will also be low despite a 90% increase in utility fossil fuel use. Increased control of sulfur emissions and low potential for exposure will keep impacts minimal.

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* Relevant legislation includes the Critical Areas Act of 1973 (authorizes state to identify areas that would be damaged by uncontrolled development); The Shoreland Management Act of 1969, amended 1973 (directs coastal counties to develop zoning ordinances for shorelands); and the Green Acres Law of 1967, amended 1969 and 1973 (allows deferred taxation for agricultural land and private recreational, open space, and park land).

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9 OHIO

The scenario projects an additional 4,788 MW of electrical generating capacity in Ohio by 1985, and 11,400 MW by 1990 (Table 9.1). Coal production in the state is projected to increase from 46.3 million tons per year in 1975 to 52 million tons per year in 1985 and then decrease to 48 million tons per year in 1990. More than half of this coal comes from surface mines.

Ohio is one of the largest users and producers of coal in the nation. Ohio coal has a high sulfur content, and low sulfur coal is presently being imported for blending with the Ohio coal. Little petroleum is used by Ohio industry, but there is a high degree of industrial dependence on natural gas. The impacts discussed in the following sections are summarized in Table A-5.

Table 9.1. Projected Increases in Electrical Generating Capacity (MW) - Ohio Mid-Mid Scenario[a]

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	2061	136	-352	2893	40	10	4788
1975-1990	2951	971	-412	7090	40	760	11400

[a]Base Year: 1975.

[b]Includes conventional hydro and pumped storage.

[c]Includes solar, combined cycle, and "other".

9.1 AIR QUALITY/VISIBILITY IMPACTS

- Although ambient TSP levels are projected to decline by 1990, many areas within the state may continue to be in violation of standards. Additional coal generating capacity is projected in southeastern Ohio where current TSP violations occur (Fig. 9.1).
- Over 33% of the scenario-projected utility oil growth, 56% of the proposed utility combined-cycle, and 66% of the industrial growth are expected in nonattainment areas.

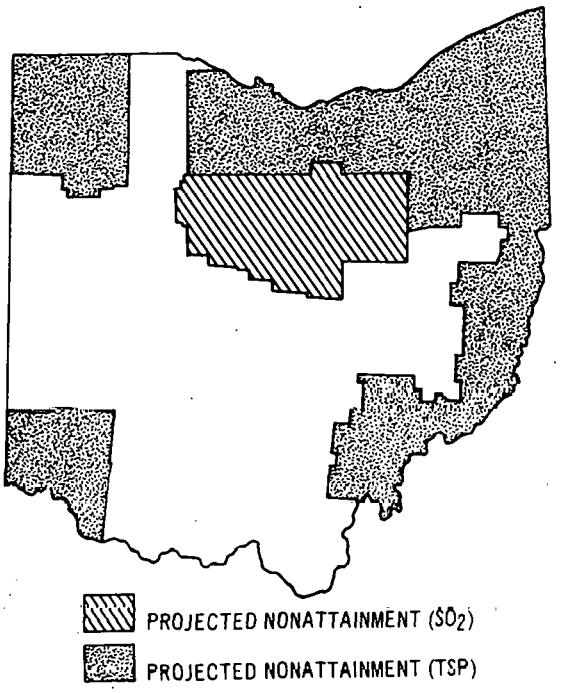

Fig. 9.1. Ohio - Potential Air Quality Impact Areas

9.1.1 Description

Nearly all the eastern counties in Ohio have been designated as AQMAs, and the state has 23 counties in violation of primary SO_2 standards and 31 counties with violations of primary particulate standards. Southeastern Ohio in particular must decrease SO_2 emissions in order to comply with Clean Air Act requirements, and this has led to a major controversy in the state. A large part of Ohio's economy has been dependent on local coal mining, which is the principal employer in 25 of the 88 counties in the state. Requirements of the Clean Air Act have resulted in the steady decline in demand for high sulfur Ohio coal, and the EPA is presently considering comments on its proposed determination that significant economic disruption would result from utility compliance with environmental rules by switching to low-sulfur out-of-state coal. If the EPA decides that "significant local or regional economic disruption and unemployment" would result from the plan by Ohio utilities to burn out-of-state coal, the utilities could be compelled, under Section 125 of the Clean Air Act, to use locally or regionally available coal. This could involve the installation of pollution controls that would not be needed for low-sulfur coal.[32] Ohio has no visibility-protected areas.

9.1.2 Background Issues

- Particulate violations are most pronounced in counties along Lake Erie and the Ohio River, and TSP levels in general are significantly above federal primary standards.

- SO_2 levels are above primary standards in some parts of the state but are expected to improve with enforcement of the SIP. The controversy over the importation of low-sulfur coal in order to attain these goals remains to be resolved.

9.1.3 Scenario-Induced Changes

- The scenario projects additional coal generating capacity in areas in the Cincinnati Inter-state AQCR, which is currently in violation of primary TSP standards.

- Significant increases in TSP from powerplants could offset air quality improvement from SIP enforcement in southwestern and eastern Ohio.

- Over one-third of the scenario-projected oil growth occurs in nonattainment areas (Parkensling-Marietta Inter-state AQCR).

- Over 56% of the proposed combined-cycle powerplants may have restricted fuel use. Most of these increases are projected to occur in the Greater Metropolitan Cleveland and the Steubenville Wenton-Wheeling Interstate AQCRs.

- Two-thirds of the industrial growth is proposed for areas with poor air quality.

9.2 WATER QUALITY/AVAILABILITY ISSUES

- Major increases in utility activity projected to occur along the Lake Erie shoreline and Lake Erie tributaries may be constrained by state and federal efforts to improve water quality in the lake.

- Increases in surface mining activity in the Hocking River Basin (Fig. 9.2) may exacerbate mine-related pollution issues in that area. Projected decreases in surface mining in other Ohio river basins will probably not improve water quality because of the expected impact of reclamation activity and continuing drainage from abandoned mines.

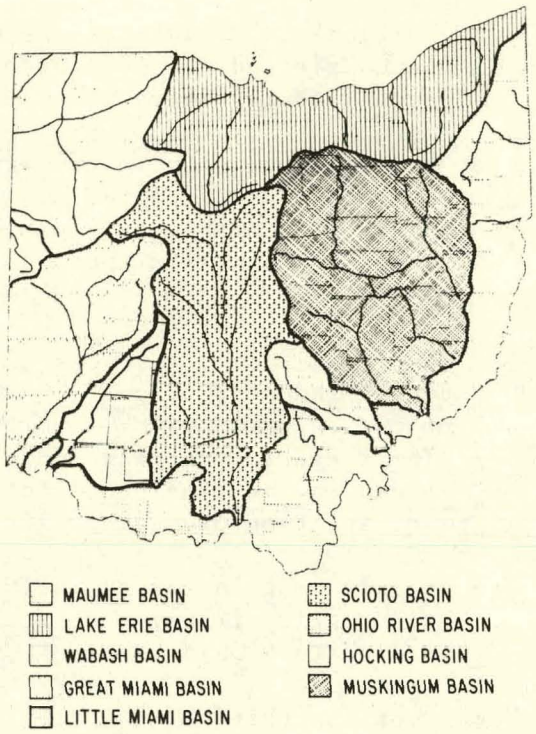

Fig. 9.2. Ohio River Basins

9.2.1 Description

Northern Ohio streams are tributary to Lake Erie and drain densely populated, heavily industrialized areas.[33] Central and southern Ohio are part of the Ohio River basin. The area is characterized by large urban areas surrounded primarily by agricultural activity.

Extensive coal deposits occur in the Muskingum, Hocking, and Raccoon basins. Drainage from abandoned strip mines and current mining activities have had major impacts on the quality of water in those basins and on the Ohio River mainstem.

9.2.2 Background Issues

- Ohio water-quality criteria are stricter in many respects than those of other Great Lakes states.

- In general, the quality of Ohio rivers, is very low particularly near the industrialized cities in the north.

- Many Ohio streams are subject to seasonal low flows when a large percentage of the total flow consists of effluents.
- The Portage, Huron, and Grand Rivers in the Lake Erie Basin experience frequent water quality violations of limits on toxic substances, trace metals, and phenols. Major increases in utility activity are projected in these basins.
- The Grand River is subject to salt leaching from industrial disposal sites.

9.2.3 Scenario-Induced Changes

- Violations of water quality criteria for sulfate and total dissolved solids may occur in the Grand River basin (Figs. 9.3 and 9.4).
- Although there is a projected net decrease in surface coal mining in Ohio, drainage from abandoned mines and reclamation of active mines will likely continue to degrade the water quality.

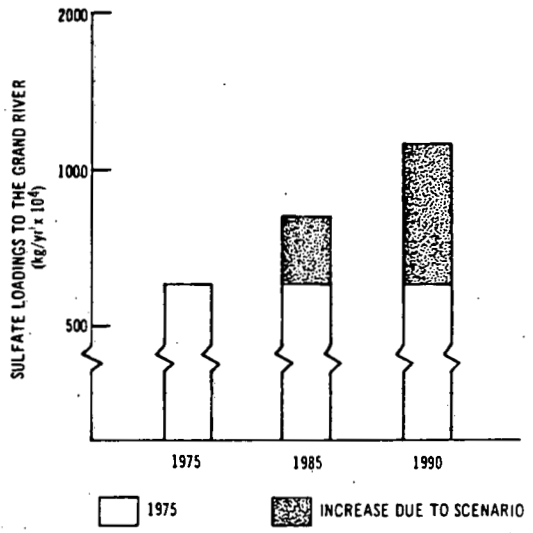

Fig. 9.3. Scenario Increases in Sulfate Loadings to the Grand River.

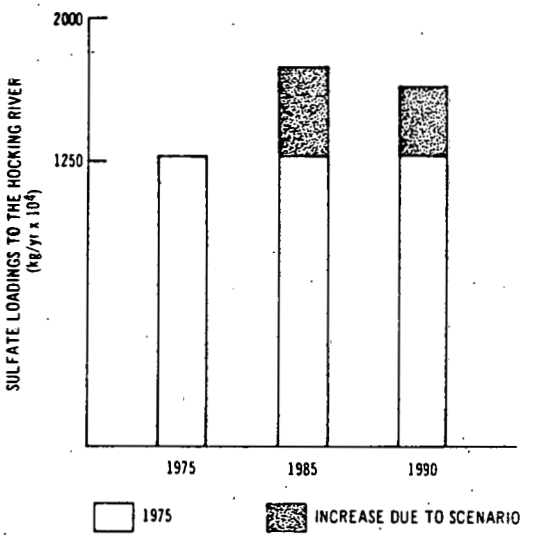

Fig. 9.4. Scenario Changes in the Sulfate Loadings to the Hocking River

9.3 SOLID WASTE IMPACTS

- Industrial coal use is projected to increase by 25%. Indicators show 27 counties that may experience difficulty disposing of these wastes.

- Solid waste disposal problems should not constrain new utility development; however, several utilities may have to transport wastes to off-site disposal areas.

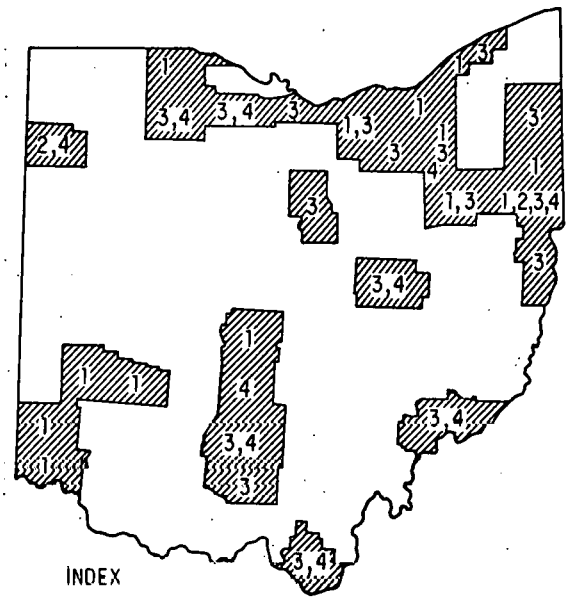

Fig. 9.5. Ohio Counties Potentially Subject to Solid Waste Impacts

9.3.1 Background Issues

- Present industrial coal use is 17 million tons per year, the highest of any state in the nation. The state, with several large urban areas, also generates large quantities of municipal solid waste.

- Licensing a new disposal site is an extremely time-consuming process. Industries are advised to start looking at least three years before they actually need a new site.

- Many utilities already have to haul ash off-the-site for disposal. Hauling distances tend to be greater in some of the highly urbanized and industrialized areas, significantly increasing disposal costs.

9.3.2 Scenario-Induced Changes

- Industrial coal use is projected to increase by 20%; however, the amount of waste generated is projected to increase by 370% because of the application of FGD systems (Fig. 9.6).

- Land requirements for industrial waste disposal are projected to be 160 acres per year (Fig. 9.7).

- Based on criteria relating to the availability of landfills and the solid waste impact on municipal sewer systems, 27 counties may experience difficulty disposing of industrial wastes. Disposal will be most difficult in areas constrained by both lack of landfill sites and inadequate sewer systems.

- Installed coal-fired utility capacity is projected to increase to 30,000 MW by 1990 (or by 13% compared to 1975). The lifetime land requirement for disposal of utility wastes is projected at 7,300 acres.

- Although many existing uilities have waste disposal problems, new plants, with proper planning, should be able to provide for on-site disposal.

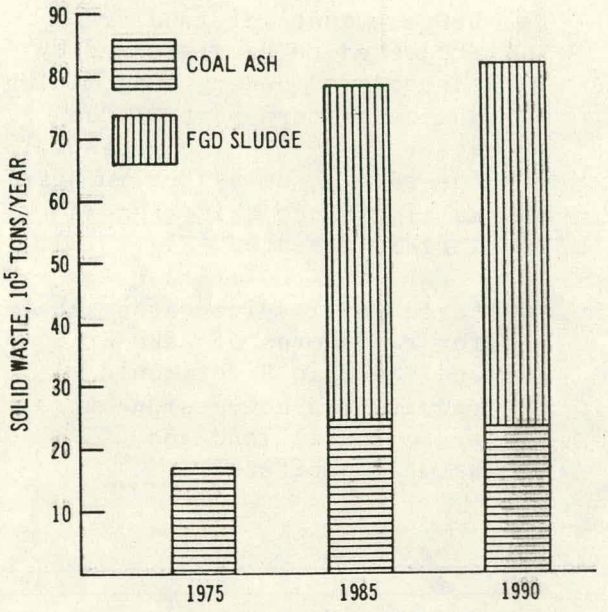

Fig. 9.6. Ohio - Solid Waste Generation From Industrial Coal Use

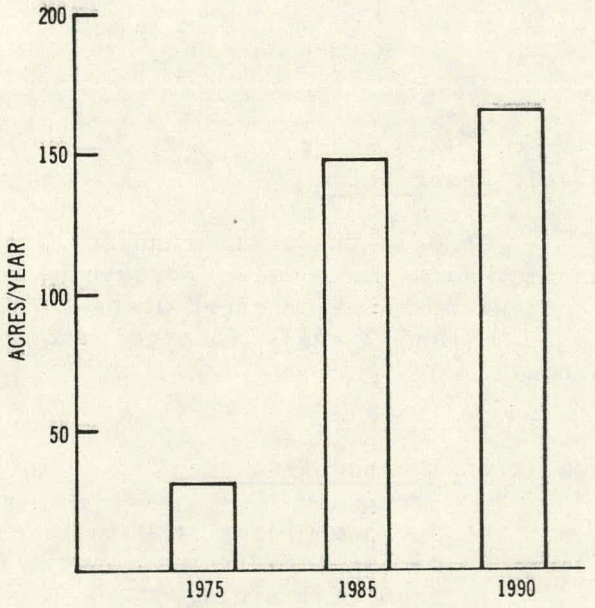

Fig. 9.7. Ohio - Total Area Used for Industrial Ash and Sludge Disposal

9.4 ECOLOGICAL AND LAND USE IMPACTS

- Large amounts of land are projected to be disturbed by surface and underground mining in the eastern part of the state in 1990. The potential for adverse ecosystem impacts is high since this area is largely forested (Fig. 9.8).

- Large utility increases sited for the shores of Lake Erie and the Ohio River could require the conversion of agricultural land and natural habitats.

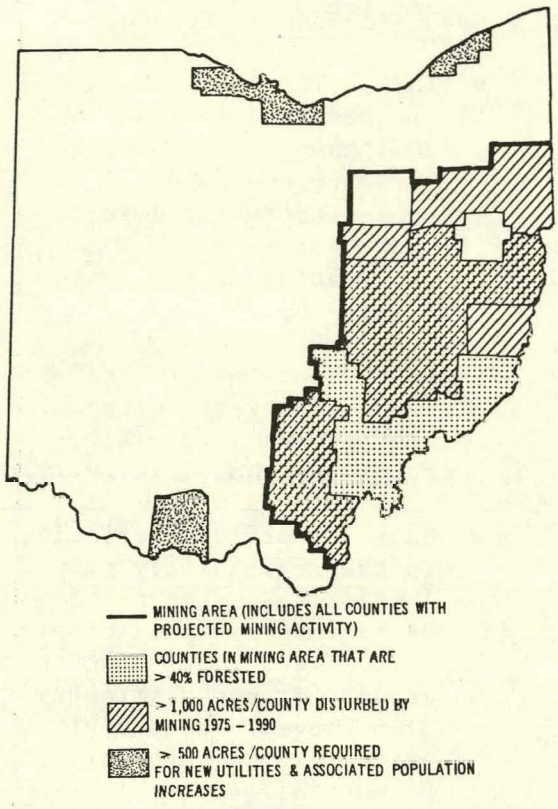

Fig. 9.8. Areas with Greatest Potential for Ecological Impacts - Ohio

9.4.1 Description

Ohio is the most urbanized state in Region V, although farming remains an important land use. Forty-nine percent of the state is covered by croplands with the major crops being corn, soybeans, and wheat. Southeastern Ohio is hilly and largely forested and contains 69,000 acres of National Forest lands.

9.4.2 Background Issues

- Surface mining in Ohio is a major land-use concern. Ohio strip mining legislation conveys the authority to delete certain lands from coal mining.[34]

- Ohio's National Forest lands are located in the southern part of the coal mining area.

9.4.3 Scenario-Induced Changes

- Coal mining projected by the scenario is potentially the most important energy-related ecological issue in Ohio. Surface mining is projected to disturb about 5,600 acres per year in 1985 and 5,100 acres per year in 1990 (Fig. 9.9). A total of 58,000 acres are thus projected to be surface mined in the eastern part of the state in the period 1975-1985, and 85,000 acres by 1990. An additional 3,800 acres of undermined land may be affected by subsidence by 1990(2,400 acres by 1985). Forest and pastureland are the major land uses in the mining area. The greatest ecological impacts would occur if forested areas were mined, since restoration of the original forest ecosystem is unlikely.

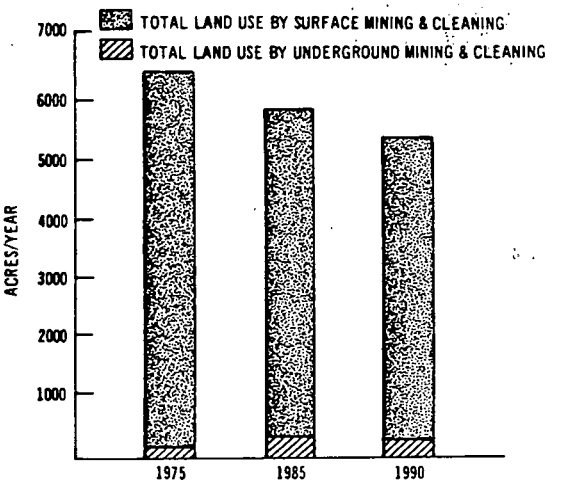

Fig. 9.9. Ohio - Land Use For Coal Production

- Although the state's National Forests are located in the coal mining area, little conflict may occur since only a small amount of mining activity is projected for the counties with federal lands.

- Approximately 2,500 acres of land in the Cleveland and Toledo areas and about 1,500 acres in the southern part of the state may be required for large (1000 MW or more) power plants projected by the scenario. The construction of these facilities and their attendant transmission lines would remove land from its present use (most likely cropland in the north and natural habitat in the south) and may adversely affect shoreline ecosystems on Lake Erie.

- Although short-term SO_2 concentrations are high enough to damage crops in the northeastern part of the state in 1975, by 1985 these levels will have decreased below the damage threshold except in the Mansfield area, where 40% of the land is covered by SO_2-sensitive vegetation.

9.5 SOCIOECONOMIC ISSUES

- Severe socioeconomic impacts are projected for one scenario-defined site for energy development in Ohio. The number of available workers in this county and those adjacent to it may not be sufficient to fill all the newly created jobs. These areas may experience shortages of local public services as well as price effects on private sector goods.

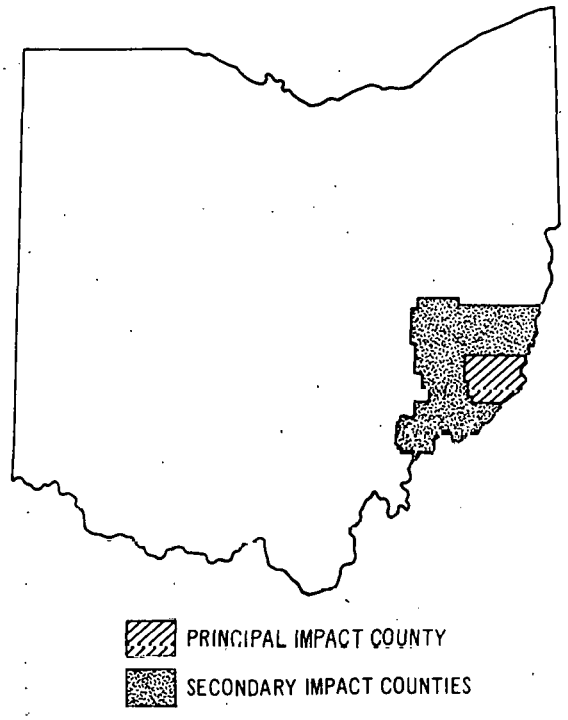

Fig. 9.10. Ohio Counties Potentially Subject to Socioeconomic Impact

9.5.1 Description

The Ohio population (10.8 million) resides principally in the northern half of the state and in the southwestern corner. This population is distributed over 41,000 square miles for a density of 263 people per square mile. This factor is heavily influenced by the more urbanized centers of Cleveland, Columbus, Akron, and Cincinnati.

The state produces many heavy industrial goods including machinery, primary metals, fabricated steel products, and motor vehicles and equipment. The farming sector of the Ohio economy has been slowly declining, although it still produces substantial income from dairy products and from corn, oats, and hay crops. Overall the durable goods sector is generally mature or aging, and because of this as well as the uncertainties in the primary metals industry (strongly dependent on the state of the economy), Ohio has an unemployment rate equivalent to the national level.[17]

9.5.2 Background Issues

- Ohio has 53 high assimilative capacity counties, 29 moderate, 5 low and 1 extra-low. These correspond to 28% of the high assimilative capacity counties in the region, 17% of the moderate, 5% of the low and 2% of the extra-low, respectively.

- The Ohio counties identified as potential sites for future energy developments range from extra-low to high assimilative capacity.

9.5.3 Scenario-Induced Changes

- All scenario-projected energy developments except mining are sited in higher assimilative capacity counties, which can absorb the calculated in-migrant population.

- It is estimated that 38% of the projected total of 5,025 new miners will be employed in Monroe County in the southeastern section of the state, which currently does not contain a major industrial plant or transportation route (Fig. 9.11). Monroe has only one community with a population greater than 1,000 people and has experienced an out-migration for the past decade. This is primarily attributed to the marginally productive farmland and the prospect of employment in adjacent counties.[24]

- 883 basic workers could be required in excess of the present and projected available workforce in this county. These workers and their families would increase the permanent population by 1,678 people or 11%.

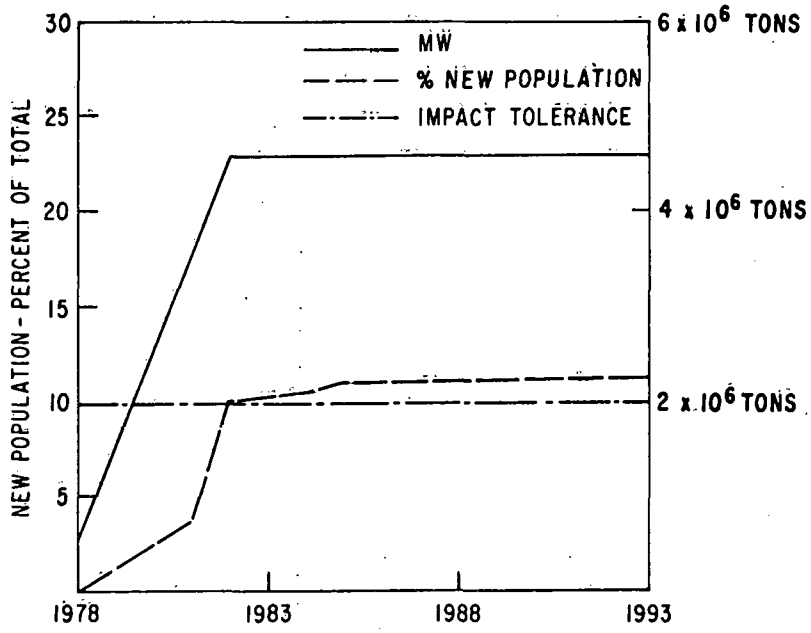

Fig. 9.11. Potential In-Migration into Monroe Co., Ohio (Low Assimilative Capacity)

- When the average regional public costs for the particular size and type of county are calculated, the new residents (1678) may incur additional public costs in excess of $900,000 annually. The public costs of expanding services in the affected county would be greatest for sewage disposal and water treatment since these two services require the largest capital expenditures.

- No infrastructures currently exist to mitigate the socioeconomic impacts. Since the adjacent counties may experience similar mining expansion impacts, proper management, control, and planning are required to reduce the possibility for adverse impacts in these counties.

9.6 HEALTH AND SAFETY IMPACTS

- A shift from surface to deep mining techniques is projected to result in a 7-18% increase in mining accidents and a 35-40% increase in the incidence of chronic respiratory disease during the scenario time frame. Coal extraction may account for more than 75% of energy related occupational health impacts in Ohio.

- Though public health impacts from exposure to sulfates are projected to decrease significantly from 1975 levels because of implementation of Clean Air Act regulations, impacts per unit of fuel use will be higher than in other states due to interstate transport of sulfate.

9.6.1 Background Issues

- Water in portions of several Ohio rivers (e.g., Mahoney, Cuyahoga) violate suggested EPA standards for domestic water supplies.[29]

- Many counties throughout Ohio have been designated as nonattainment areas for primary standards, and many others have been so designated for photochemical oxidants.[35]

- Acid drainage from abandoned coal mines in several counties of southeastern Ohio has contaminated ground water.[29]

- Cardiovascular and respiratory diseases, both of which are aggravated by exposure to sulfur oxides and particulates, accounted for over sixty percent of total deaths in Ohio in 1973.[20]

9.6.2 Scenario-Induced Changes

- Accidental occupational deaths and injuries due to surface coal mining may decline slightly, whereas deaths and injuries attributable to deep mining are projected to increase from 36% to 66% under the scenario (Fig. 9.12).

- As a result of a 43% increase in coal production using underground techniques, the number of deaths and cases of chronic respiratory disease attributable to coal extraction is expected to increase by approximately 37% to 44% (Fig. 9.13).

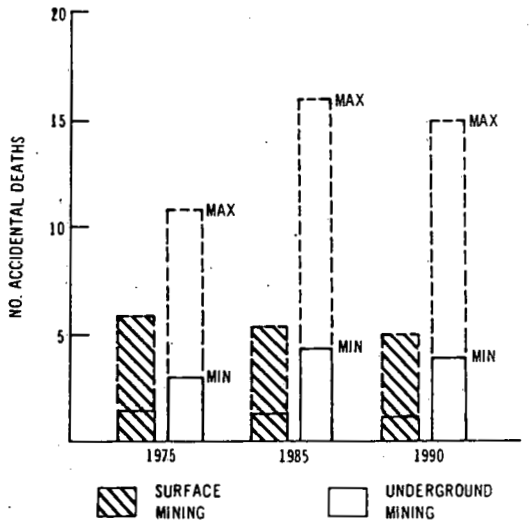

Fig. 9.12. Range of Potential Accidental Deaths in Ohio Coal Mines Due to Implementation of the Mid-Mid Scenario

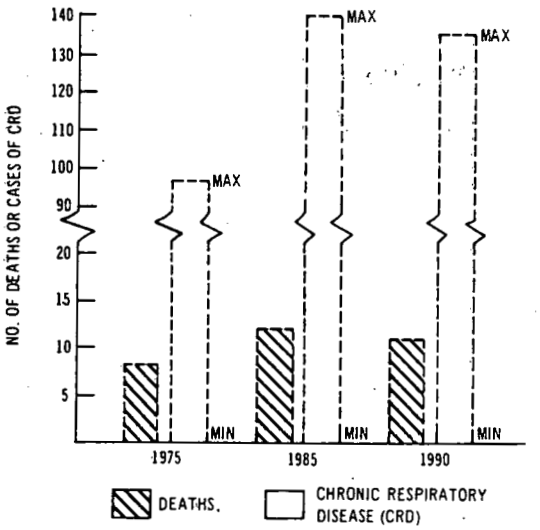

Fig. 9.13. Range of Potential Deaths and Cases of Chronic Respiratory Disease (CRD) in Ohio Due to Coal Mining Occupational Exposure Under the Mid-Mid Scenario

- The relative contribution of coal extraction to overall energy-related occupational health impacts in Ohio will decrease because of significant projected increases in oil refining and electricity generation impacts. Coal extraction will still account for over 75% of total energy-related impacts. Extraction impacts will be centralized in the southeastern portion of the state (Fig. 9.14).

- Deaths from exposure to sulfate concentrations resulting from industrial and utility fossil fuel use are projected to decrease by approximately 45% because of increased control of sulfur emissions during the scenario time frame. However, impacts per unit of fuel use will be higher in Ohio than in other states in Region V because of interstate transport of sulfates (Fig. 9.15).

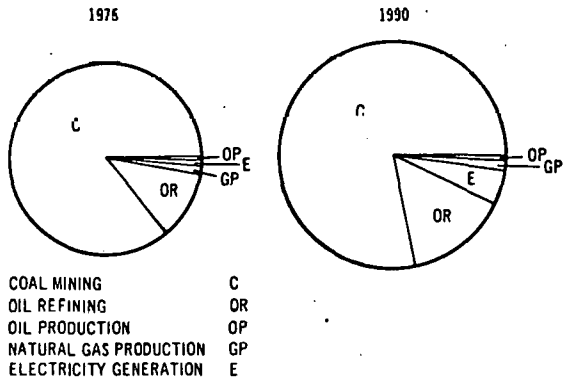

Fig. 9.14. Relative Contribution of Major Energy Activities to Energy-Related Occupational Deaths in Ohio Under the Mid-Mid Scenario

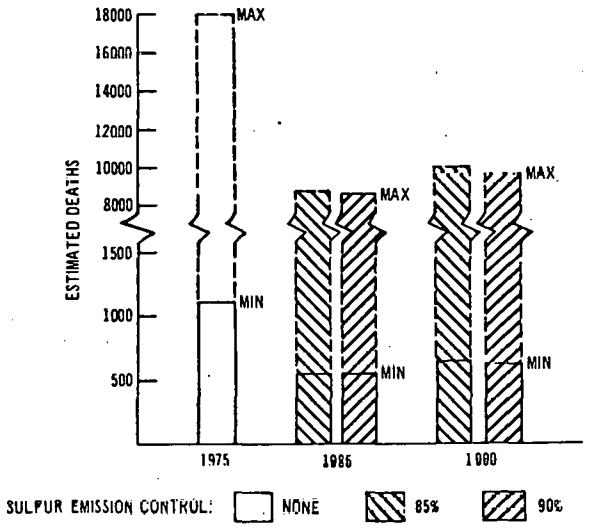

Fig. 9.15. Estimated Range in Deaths in Ohio from SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use Under the Mid-Mid Scenario

10 WISCONSIN

The scenario projects an additional 6,283 MW of electrical generating capacity in Wisconsin by 1985, and 7,651 MW by 1990 (Table 10.1). No coal mining is projected to occur in the state.

Wisconsin imported 98% of its energy needs in 1977, principally in the form of fossil fuels. In 1976 more than 85% of the imports came from Canada. Wisconsin also imports sizeable amounts of electricity from Illinois. The state's energy dependence is expected to decline with the implementation of conservation measures and more widespread use of emerging technologies. Wisconsin has initiated a plan to reduce energy growth to 1.2% annually by 1985. This is expected to be accomplished through rate reform to encourage conservation, rather than flat block rates or the construction of new generating stations. The impacts discussed in the following sections are summarized in Table A-6.

Table 10.1. Projected Increases in Electrical Generating Capacity (NW) - Wisconsin Mid-Mid Scenario[a]

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	2715	591	750	0	28	2199	6283
1975-1990	2603	879	662	1150	28	2329	7651

[a]Base year: 1975.

[b]Includes conventional hydro and pumped storage.

[c]Includes solar, combined cycle, and "other".

10.1 AIR QUALITY/VISIBILITY IMPACTS

- Overall air quality in 1990 is projected to improve over existing 1975 and projected 1985 levels, assuming compliance of existing sources due to enforcement of SIP regulations and improved control technologies

- NAAQS SO_2 violations in 1990 may occur in the northcentral AQCR, and TSP violations in the southeastern AQCR of Wisconsin. These violations represent over 53% of projected utility coal growth, 18% of projected utility oil growth, and 100% of proposed combined cycle expansion (Fig. 10.1).

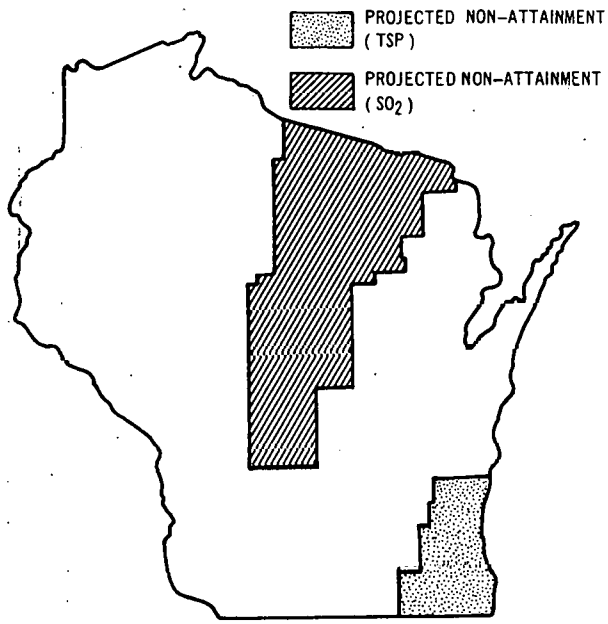

Fig. 10.1. Wisconsin - Potential Air Quality Impact Areas

10.1.1 Description

Of the states in Region V, Wisconsin burns the smallest quantity of fossil fuel. 1977 coal deliveries to steam plants were one-fifth of those to Ohio plants.[12] Oil and gas use is more prevalent in comparison to other states in the region. Wisconsin's overall density of emission-producing sources is significantly less than other midwestern states. Although Illinois has over 540 major installations capable of emitting 100 tons per year of criteria pollutants, Wisconsin has only 143 sources in the same category. Steel processes, a major source of particulate emissions, number over 72 in Illinois but only four in Wisconsin. Coal transported to Wisconsin comes primarily by train from the Montana/Wyoming region, and the sulfur content of that coal is less than 1% and the ash content is low as well. Expansion of fossil fuel use is not likely to create air quality problems except in those counties where attainment problems already exist. Wisconsin has no PSD Class I areas.[35]

10.1.2 Background Issues

- Air quality problems exist in Wisconsin near industrial centers in the southeastern and central portions of the state.
- Total suspended particulates have been a persistent problem in the southeast; however, total levels have decreased over the past decade in Milwaukee, the most industrialized area of the state.
- High SO_2 levels are a problem in parts of the northcentral AQCR.
- Visibility protected areas in the northern part of Wisconsin have the potential for influencing development in this area.

10.1.3 Scenario-Induced Changes

- SO_2 violations may continue in the northcentral AQCR; however, levels will be lower in 1985 and 1990 than in 1975.
- TSP violations will continue in the southeastern AQCR; however, substantial TSP improvements by 1990 will bring several localities into attainment of standards.
- Over 53% of the proposed utility coal growth sited in this study will occur in nonattainment areas. Over one-third of Wisconsin's coal growth is projected in the southeast corner of the state where persistent particulate violations occur. Continued violations of short-term SO_2 and particulate air quality standards are expected in central Wisconsin where coal utility expansion is projected.
- Only 18% of the proposed utility oil growth is likely to conflict with nonattainment provisions. The impact of utility oil development in Wisconsin could be mitigated by selective fuel purchasing policies.
- 100% of Wisconsin's combined-cycle capacity is proposed in nonattainment areas. Regulatory impediments will depend on facility design and fuel selection. Use of coal as a primary fuel could have significant adverse impacts on particulate air quality levels.
- About one-quarter of Wisconsin's industrial growth is projected in areas with poor air quality. Fuel selection and sufficient offsets could mitigate air quality issues.

10.2 WATER QUALITY/AVAILABILITY ISSUES

- Projected increases in utility and industrial activity in counties adjacent to Lake Michigan may be constrained by water quality and availability issues.

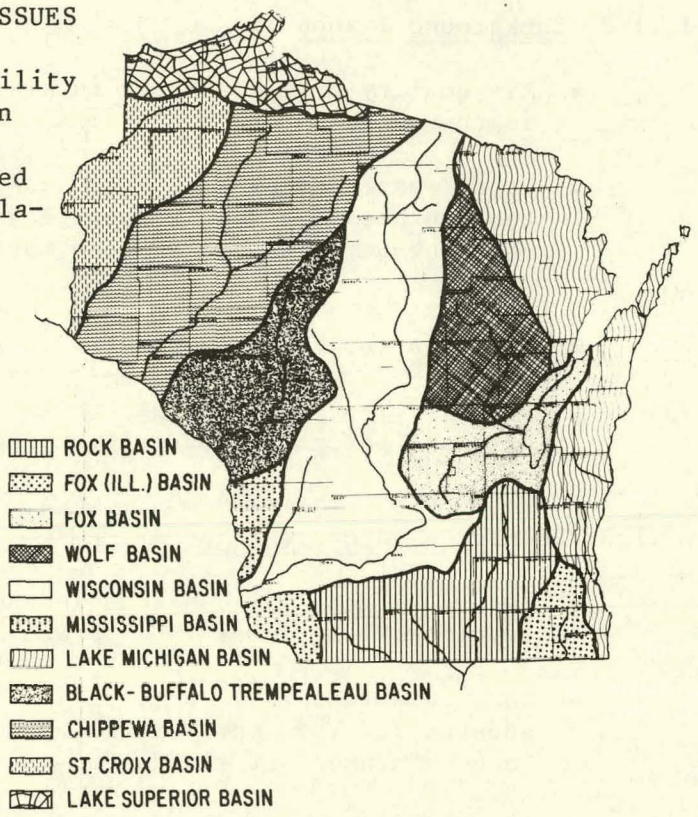

Fig. 10.2. Wisconsin River Basins

10.2.1 Description

The Great Lakes are subject to water quality regulations at the international, federal, and state levels. Ammonia, phosphorus, chlorides, and dissolved solids are of primary concern. Planning management for Lake Michigan requires an 80% reduction of phosphorus in effluents discharged to the lake.

Water demand from utilities may be high along the Lake Michigan shoreline, particularly in the southeast corner of the state if once-through cooling is not permitted.

10.2.2 Background Issues[36]

- Wisconsin has a history of concern for improving and maintaining the quality of the Lake Michigan shoreline.

- Increasing concentrations of heavy metals such as zinc, cadmium, nickel, and mercury in the lake sediments have been observed and attributed partly to energy-related air emissions.

- Discharges from heavy industrial development along the Fox River from Lake Winnebago to Green Bay have produced an accumulation of sludges with a high dissolved oxygen requirement. As a result, Green Bay is in advanced stages of eutrophication. Improved practices of effluent discharge are not expected to reduce the problem in the near future.

- The Milwaukee River commonly discharges into Lake Michigan and violates standards, especially during heavy rainfalls. Eutrophication along the lake's shoreline in the vicinity of the river outfall is not uncommon.

10.2.3 Scenario-Induced Changes

- Because the use of once-through cooling by future utilities will likely be restricted, the projected utility activity along the lake would use wet evaporative cooling, which requires substantially more water than does once-through cooling. Because large utility increases are projected, utilities may be required to develop alternative water supplies, use dry cooling, or locate away from the scenario-defined sites.

10.3 SOLID WASTE IMPACTS

- Industrial solid waste generation is projected to increase by over 500%; the greatest proportion of this increase is due to the application of FGD systems. Indicators show eight counties that may have difficulty disposing of these wastes (Fig. 10.3).

- Coal-fired capacity is projected to increase by 68%. Solid waste problems are not expected to constrain development.

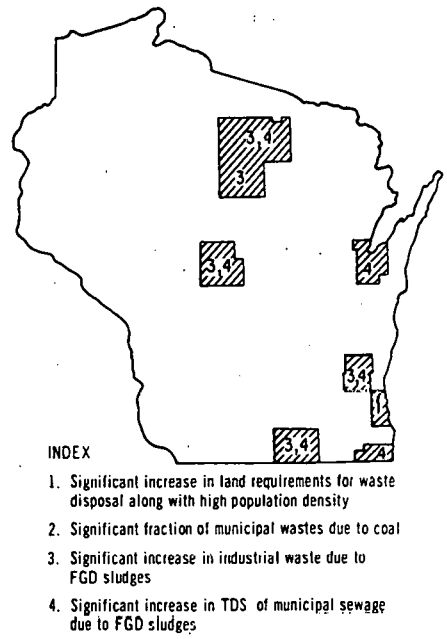

Fig. 10.3. Wisconsin Counties Potentially Subject to Solid Waste Impacts

10.3.1 Background Issues

- State regulations prohibit disposal within any area where a detrimental effect on surface or groundwater will result. This creates a situation where disposal near wetlands, on slopes, or above rock is prohibited; the best sites are then in the most productive farming areas of the state.

- There is strong organized opposition to removing farmland from production. Recent legislation requires an agricultural impact statement for any action that impairs the productivity of five or more acres of land.

- There are currently no FGD scrubbers in Wisconsin. Consequently, the Federal New Source Performance Standards will cause a substantial change in both pollution control technology and solid waste (sludge) production and disposal.

10.3.2 Scenario-Induced Changes

- Industrial coal use is projected to increase by 82% and solid waste generation by over 500% by 1990 (Fig. 10.4).
- Land requirements for disposal are projected to be 24 acres per year in 1990 compared to 3 acres per year in 1975 (Fig. 10.5).
- Indicators show eight counties that may have difficulty disposing of industrial wastes. Those areas constrained by both lack of landfill sites and inadequate sewer systems will have the most problems.
- Some utilities will have to transport wastes to off-site disposal areas at additional cost; however, new plants should be able to plan for on-site disposal. Life-time utility land-use requirements are projected at 1,500 acres.

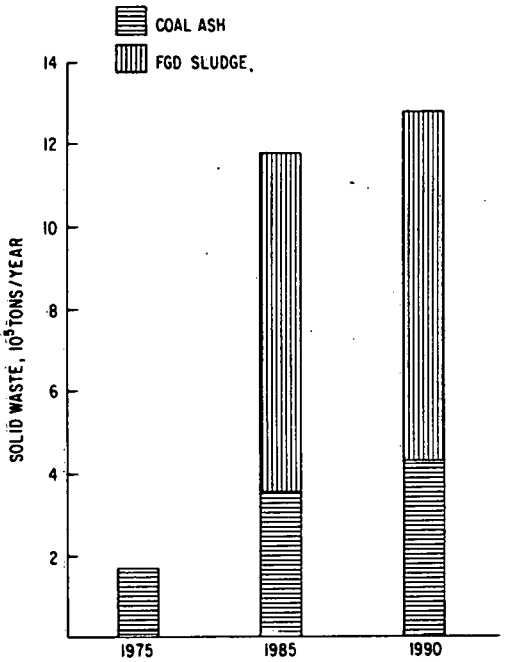

Fig. 10.4. Wisconsin-Solid Waste Generation From Industrial Coal Use

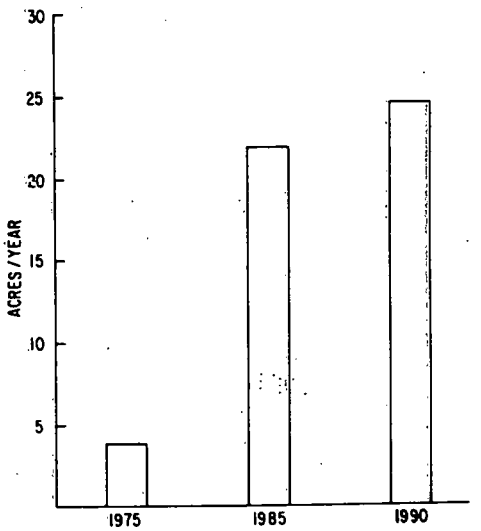

Fig. 10.5. Wisconsin-Total Area Used For Industrial Ash & Sludge Disposal

10.4 ECOLOGICAL AND LAND USE IMPACTS

- Relatively small acreages, primarily of agricultural land, are projected to be disturbed throughout Wisconsin for new power facilities. Wisconsin has zoned its coastal areas along Lakes Michigan and Superior into conservancy, recreational-residential, and general purpose (including industrial use) areas, which limits the number of sites available for facilities projected for the Lake Michigan shoreline. A current moratorium on new nuclear power plants in the state makes it unlikely that a large nuclear facility projected for the western border of the state will be built.

10.5 SOCIOECONOMIC ISSUES

- Severe socioeconomic impacts are projected for one scenario-defined site for energy development in Wisconsin. The number of available workers in this county and those adjacent to it may not be sufficient to fill all the newly created jobs. The affected area may experience shortages of local public services as well as price effects on private sector goods attributable to the immigration of additional workers.

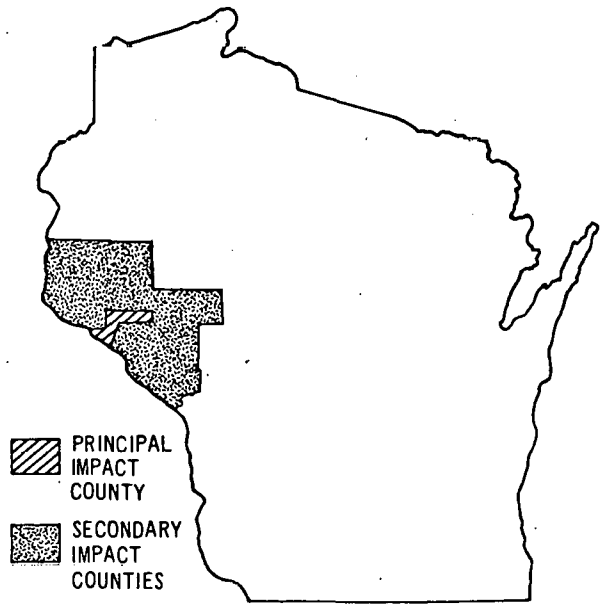

Fig. 10.6. Wisconsin Counties Potentially Subject to Socioeconomic Impact

10.5.1 Description

Wisconsin has a population of 4.6 million people distributed over almost 55,000 square miles. The average density for the state is 85 people per square mile but most of the urbanized areas are located in the southern and east-central sectors. The majority of the state's 1.5 million private and government workers are employed in this section of the state.

Agriculture is the cornerstone of Wisconsin's economy. In 1974 Wisconsin had 105,000 farms and a total acreage of 19,600,000. There are many interrelated industries in the state that complement the agricultural and dairy base. The trucking industry, for instance, assigns 40% of its hauling capacity to the transportation of farm products.

Tourism is a second major contributor to the state's economy. There are presently 30,000 businesses directly associated with serving tourists, representing 26% of the state's total retail service establishments.[17]

10.5.2 Background Issues

- Within Wisconsin there are 25 high assimilative capacity counties, 21 moderate, 14 low, and 11 extra-low. This corresponds to 13% of the high assimilative capacity counties within the region, 13% of the moderate, 14.0% of the low, and 17% of the extra-low.

- The Wisconsin counties identified as potential sites for future energy generating facilities have either an extra-low or high assimilative capacity.

10.5.3 Scenario-Induced Changes

- The construction of a projected nuclear plant on the western border of the state is the only scenario-defined energy development that is likely to create adverse socioeconomic impact since it is sited in a small rural county, Pepin. All of the counties in this area have extra-low to moderate assimilative capacity (Fig. 10.7).

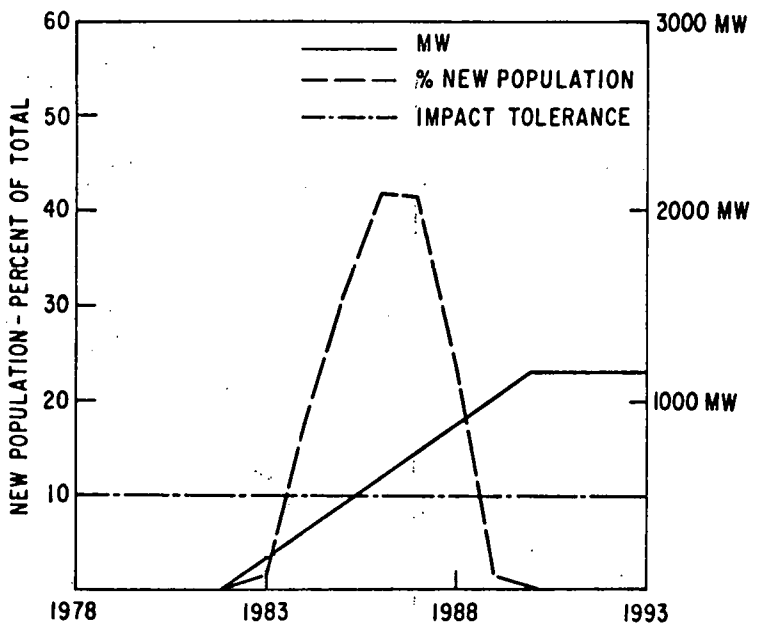

Fig. 10.7. Potential In-Migration into Pepin County, Wisconsin (Extra-Low Assimilative Capacity)

- The nuclear facility could require 1,980 basic construction workers at peak development. An estimated in-migration of 1669 workers and their families would temporarily increase the population by 3,171.

- The in-migration of this number of basic workers could cause temporary shortfalls in the public revenues and inadequacies in the provision of public and private services. The absolute impact is dependent on the spatial distribution of the new in-migrants, and since Pepin is a very small county, the probability of a larger area incurring impact is high.

- The public costs for this six-year increase in population is presently indeterminable. The costs are a function of the utilization rate and capacity of existing services. The public costs of expanding services in the affected county would be the greatest for sewage disposal and water treatment during the construction of the facility.

- No infrastructures are currently established that would mitigate or prepare for the resultant impacts. Furthermore, it is uncertain, because of institutional and legislative constraints, whether this plant could be constructed.

- 100% of the scenario-defined increase in nuclear generating capacity for the state (15% of the total new generating capacity projected for Wisconsin by 1990) is sited in Pepin county.

10.6 HEALTH AND SAFETY IMPACTS

- Health impacts projected from the scenario will affect the general public more severely than they will occupational populations. Pubic health impacts will be most severe in the southeastern portion of the state but will be significantly smaller than 1975 impacts.

10.6.1 Background Issues

- Ambient air concentrations of SO_2 and TSP that exceed proposed guidelines have been recorded in Dane, Columbia, Rock, Waukesha and Milwaukee counties.[35]

- In 1973, 8% of total deaths in Wisconsin were due to respiratory diseases, and 56% were due to cardiovascular disease; both diseases are aggravated by SO_x exposure.[20]

- 43% of the 1975 Wisconsin population lived in counties where 62% of the coal-fired electricity generation occurred.

- No fossil fuel reserves are currently commercially recoverable in Wisconsin.

10.6.2 Scenario-Induced Changes

- Projected energy-related occupational health impacts in Wisconsin will be minimal. Occupational impacts from operation and maintenance activity at electricity generation facilities and from fuel transportation may increase, but by 1990 these activities are projected to account for less than one death and fewer than 40 injuries per year in Wisconsin.

- From 1975 to 1990, estimated deaths from SO_2 exposure due to fossil fuel use in Wisconsin are projected to decrease by 62% despite an increase of 60% in fuel use. This decrease is primarily due to the observance of sulfur-control regulation (Fig. 10.8).

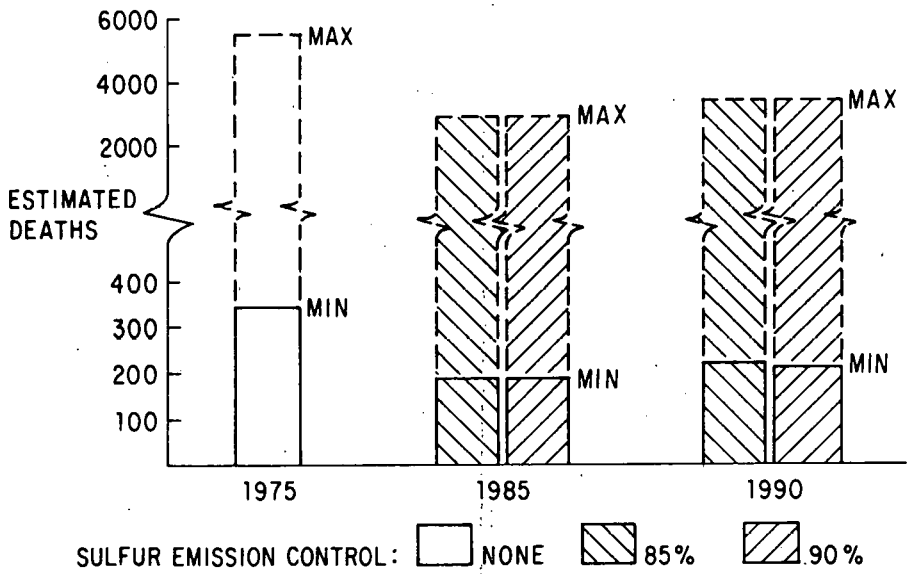

Fig. 10.8. Estimated Range in Deaths in Wisconsin From SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use Under the Mid-Mid Scenario

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APPENDIX: SUMMARY TABLES FOR EIA TRENDLONG MID-MID SCENARIO AT THE STATE LEVEL

Table A-1. Environmental Impacts of the EIA Trendlong MID-MID Scenario at the State Level - Illinois[a]

Energy Source	Air Quality	Water		Land			Health and Safety		Local[c] Socioeconomic	
		Quality	Availability[b]	Ecology	Land Use	Solid Waste	Occupational Safety	Public Health	Economics	Sociological Factors
Utility:										
-Coal	L	L					L	L	M	
-Oil	M[d]						L	L	M	
-Gas	L						L			
-Nuclear	L						L	L	M	
-Combined Cycle	L								M	
-Solar	L									
-Hydro										
General:										
-Utility	M	L	H	L	L	L	L	L	M	M
-Industry	H					L		L		
-Mining	L			M	M		M		L	L

[a]Criteria for ranking impacts found in Table 1.2. Blank entries indicate either no impact or impact not addressed. Refer to the the individual state text.

[b]Includes ground water.

[c]The socioeconomic entries only reflect growth in counties with a projected in-migration (for energy facility developments) in excess of 10% of the baseline population in any one period. Because actual impacts are extremely localized and thus vary significantly by county, the utility of the aggregated state impact index presented in the matrix is limited.

[d]Fuel switching to premium quality fuel may be required.

Table A-2. Environmental Impacts of the EIA Trendlong Mid-Mid Scenario at the State Level - Indiana[a]

		Water		Land			Health and Safety		Local[c] Socioeconomic	
Energy Source	Air Quality	Quality	Availability[b]	Ecology	Land Use	Solid Waste	Occupational Safety	Public Health	Economics	Sociological Factors
Utility:										
-Coal	L	M	M				L	M	H	
-Oil	M[d]						L	M	M	
-Gas							L	L		
-Nuclear	L						L	L	H	
-Combined Cycle										
-Solar										
-Hydro										
General:										
-Utility	L		M	L	L	L	L	M	H	H
-Industry	M					M				
-Mining	L	M		M	M		L		M	H

[a]Criteria for ranking impacts found in Table 1.2. Blank entries indicate either no impact or impact not addressed. Refer to the individual state text.

[b]Includes ground water.

[c]The socioeconomic entries only reflect growth in counties with a projected in-migration (for energy facility developments) in excess of 10% of the baseline population in any one period. Because actual impacts are extremely localized and thus vary significantly by county, the utility of the aggregated state impact index presented in the matrix is limited.

[d]Fuel switching to a premium quality fuel may be required.

Table A-3. Environmental Impacts of the EIA Trendlong Mid-Mid Scenario at the State Level - Michigan[a]

Energy Source	Air Quality	Water		Land			Health and Safety		Local[c] Socioeconomic	
		Quality	Availability[b]	Ecology	Land Use	Solid Waste	Occupational Safety	Public Health	Economics	Sociological Factors
Utility:										
-Coal	H			L			L	L		
-Oil	L			L			L	L		
-Gas	L			L			L			
-Nuclear	L			L			L	L		
-Combined Cycle	M									
-Solar										
-Hydro										
General:										
-Utility	M	M		M	M	L	L	L	L	L
-Industry	H			M		M		L		
-Mining	L									

[a]Criteria for ranking impacts found in Table 1.2. Blank entries indicate either no impact or impact not addressed. Refer to the individual state text.

[b]Includes ground water.

[c]The socioeconomic entries only reflect growth in counties with a projected in-migration (for energy facility developments) in excess of 10% of the baseline population in any one period. Because actual impacts are extremely localized and thus vary significantly by county, the utility of the aggregated state impact index presented in the matrix is limited.

Table A-4. Environmental Impacts of the EIA Trendlong Mid-Mid Scenario at the State Level - Minnesota[a]

Energy Source	Air Quality	Water		Land			Health and Safety		Local[c] Socioeconomic	
		Quality	Availability[b]	Ecology	Land Use	Solid Waste	Occupational Safety	Public Health	Economics	Sociological Factors
Utility:										
-Coal	L						L	L		
-Oil	L						L			
-Gas	L						L	L		
-Nuclear										
-Combined Cycle										
-Solar										
-Hydro										
General:										
-Utility	L			L	M	L	L	L	L	L
-Industry	L					L		L		
-Mining	L						L			

[a]Criteria for ranking impacts found in Table 1.2. Blank entries indicate either no impact or impact not addressed. Refer to the individual state text.

[b]Includes ground water.

[c]The socioeconomic entries only reflect growth in counties with a projected in-migration (for energy facility developments) in excess of 10% of the baseline population in any one period. Because actual impacts are extremely localized and thus vary significantly by county, the utility of the aggregated state impact index presented in the matrix is limited.

Table A-5. Environmental Impacts of the EIA Trendlong Mid-Mid Scenario at the State Level - Ohio[a]

Energy Source	Air Quality	Water		Land			Health and Safety		Local[c] Socioeconomic	
		Quality	Availability[b]	Ecology	Land Use	Solid Waste	Occupational Safety	Public Health	Economics	Sociological Factors
Utility:										
-Coal	M						L	M		
-Oil	M[d]						L	M		
-Gas							L	L		
-Nuclear	L						L	L		
-Combined Cycle	H									
-Solar										
-Hydro										
General:										
-Utility	M	M		L	L	L	L	M	L	L
-Industry	H	M				M		M		
-Mining	L	M		M	M		M		M	

[a]Criteria for ranking impacts found in Table 1.2. Blank entries indicate either no impact or impact not addressed. Refer to the individual state text.

[b]Includes ground water.

[c]The socioeconomic entries only reflect growth in counties with a projected in-migration (for energy facility developments) in excess of 10% of the baseline population in any one period. Because actual impacts are extremely localized and thus vary significantly by county, the utility of the aggregated state impact index presented in the matrix is limited.

[d]Fuel switching to a premium quality fuel may be required.

Table A-6. Environmental Impacts of the EIA Trendlong Mid-Mid Scenario at the State Level - Wisconsin[a]

Energy Source	Air Quality	Water		Land			Health and Safety		Local Socioeconomic[c]	
		Quality	Availability[b]	Ecology	Land Use	Solid Waste	Occupational Safety	Public Health	Economics	Sociological Factors
Utility:										
-Coal	H						L	L		
-Oil	M[d]						L	L		
-Gas	L						L			
-Nuclear	L						L	L	M	
-Combined Cycle	H									
-Solar	L									
-Hydro										
General:										
-Utility	M	M	L	L	M	L	L	L	M	M
-Industry	M					L		L		
-Mining	L						L			

[a]Criteria for ranking impacts found in Table 1.2. Blank entries indicate either no impact or impact not addressed. Refer to the individual state text.

[b]Includes ground water.

[c]The socioeconomic entries only reflect growth in counties with a projected in-migration (for energy facility developments) in excess of 10% of the baseline population in any one period. Because actual impacts are extremely localized and thus vary significantly by county, the utility of the aggregated state impact index presented in the matrix is limited.

[d]Fuel switching to a premium quality fuel may be required.