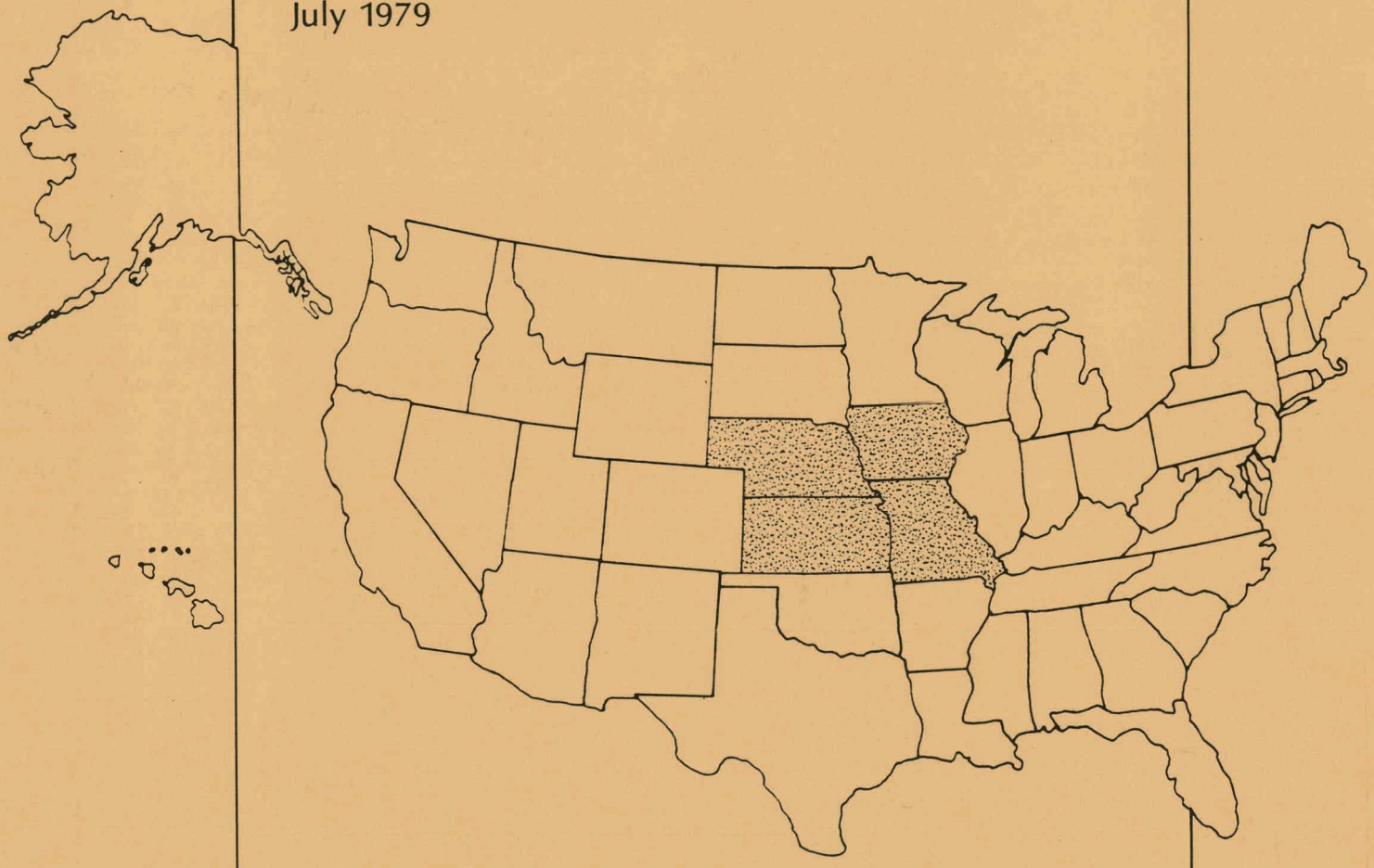
ANL/EES-TM-56

Regional Issue Identification and Assessment Program

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

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 VII

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 VII 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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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

LIST OF FIGURES

LIST OF FIGURES (Cont'd)

LIST OF TABLES

SUMMARY, REGION VII

KEY FINDINGS

The key findings of this DOE-sponsored environmental impact evaluation of the PIES TRENDLONG MID-MID Scenario for Federal Region VII (Iowa, Kansas, Nebraska, and Missouri) are as follows:

- Projected coal-fired utility expansion could be constrained in several areas because of projected TSP and SO_2 National Ambient Air Quality Standards (NAAQS) violations. Problems will be most pronounced in Iowa and Kansas, but could be incurred in any state in the region.

- Large coal and nuclear facilities projected for parts of Region VII may experience water availability problems. The Smokey Hill River in Kansas, the Skunk River in Iowa, and the Platte River in Nebraska may have limited water supplies for operating the projected increases in fossil fuel and nuclear generating facilities.

- Coal surface mining in Missouri (21,000 acres may be disturbed from 1975-1990) may create land-use conflicts.

- Region VII may not have the facilities or legal framework for mitigating the negative socioeconomic impacts that are projected to occur from the proposed energy development. Therefore, the potential for severe and pervasive socioeconomic impacts is great.

The results 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 VII (Iowa, Kansas, Nebraska, and Missouri)

Federal Region VII	Regional Dimensions* Local	Subregional	Regional	Comment or Cause of Constraint or Impact
The Likelihood of Projected Regional Energy Use or Development Producing Significant Environmental Impacts	H[1]	M[2]	H[9]	1) Widespread air quality violations (NAAQS) are projected for Iowa and Kansas, which may pose major constraints on the proposed siting.
**The Likelihood of not Attaining Projected Regional Energy Mix because of Adverse Environmental Impacts	H[1]	M[2]	H[9]	2) Flow augmentation problems in Iowa, Kansas, and Nebraska.
**The Likelihood Specific Technologies or Resources will not Attain Projected Level of Use	H[10]			3) Large coal and nuclear facilities along Smoky Hill River in Kansas and a coal facility on the Platte River in Nebraska may require flow augmentation.
Utility:				4) 70% of industrial growth projection for non-attainment areas.
- Coal	H[1]	H[9],M[3]	H[9]	5) 38 to 62% of projected utility oil capacity increases sited for areas unable to attain air quality standards. Some mitigation possible through restrictive fuel purchasing policies.
- Oil	M[5]	M[5]	L	
- Gas	L	L	L	
- Nuclear	M[3]	M[3]	L	6) Siting of 31% of projected regional utility capacity increases could be influenced by air quality violations and non-attainment provisions.
- Solar				
General:				7) 21,000 acres projected to be disturbed by surface mining in Missouri between 1975 and 1990.
- Utility	E[6]	M[3]	M[6]	8) Potential air quality conflicts with TSP NAAQS in all 4 states of the region depending on fuel selection.
- Industry	E[8]		H[4]	
- Mining		M[7]	L	9) Over 52% of projected utility coal increases sited for areas not able to attain minimal air quality standards.
				10) This region may not have the facilities or legal framework for mitigating the negative socio-economic impacts from the projected energy development

*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 few facilities, but potential cost effective mitigation strategies available.
Low - Conflicts unlikely to occur.

GENERAL CONCLUSIONS

Air

High ambient levels of particulates remain the most persistent air quality problem in Region VII. Industrial emissions from urban industrial centers contribute to the particulate nonattainment problem in Nebraska, Missouri and Iowa. The introduction of over 11,600 MW of coal capacity in this region could present potential siting impediments for slightly over 52 percent of the proposed coal scenario.

Kansas has the greatest concentration of proposed growth in coal use in areas with questionable air quality. Eighty-four percent of the increase in coal use in Kansas occurs in areas that may have difficulty maintaining federal SO_2 and TSP air quality standards. Almost 39 percent of the proposed oil growth is sited in SO_2 nonattainment areas. Although these areas should be in compliance by 1990, nonattainment provisions will be enforced. The Kansas City/Topeka area has the worst air quality problem in the state.

Kansas and Missouri are the two states with over 4,000 MW of new proposed coal capacity and may also experience problems with attainment of federal SO_2 air quality standards. In Missouri, approximately 27 percent of the proposed coal capacity and only 5-1/2 percent of the oil capacity is likely to interfere with maintenance of air quality standards. Approximately 65 percent of the proposed coal capacity in Iowa may be subject to nonattainment regulations. This capacity is spread throughout the eastern central portion of the state.

Projected growth in industrial capacity throughout Region VII will continue to impede attainment and maintenance of federal air quality standards. Regionwide, over 72 percent of industrial growth will occur in nonattainment areas. Major sources in these areas will be required to obtain "emission offsets," install the "lowest achievable emission rate control equipment (LAER)," and demonstrate "net air quality improvement."

Missouri has two national parks totaling over 20,000 acres that will receive visibility protection from major combustion sources. Development of coal facilities in these areas on the southern border of the state may be restricted.

Water

Many tributaries of the Missouri and Mississippi Rivers are characterized by the occurrence of extreme low flow periods with concomitant low water quality. In these rivers, construction of additional utility capacity will be difficult without securing more water storage capacity for the low flow periods. The additional storage may originate from surface water during high flow and/or from groundwater. In extreme cases, the evaporative cooling water system could be replaced by dry cooling, which would have the effect of reducing water consumption from the basin while increasing the cost of energy

production. The majority of projected utility increases are located in areas along the Missouri and Mississippi Rivers, however, and water resources issues were not identified for these sites. Indian, federal, and state water policy issues in upstream states could significantly affect the eventual availability of water in these rivers. Thus, the institutional aspects of water resources are as important to energy development as the physical availability of water.

Solid Waste

The disposal of all kinds of waste, including ash and sludge from industrial and utility coal combustion, will be more difficult in the future. Region VII does not generate a large quantity of industrial ash and sludge. Total land requirements for disposal are estimated at only 26 acres/year in 1990. However, local opposition and institutional constraints can still make finding a suitable site a problem.

The effect of regulations proposed under the Resource Conservation and Recovery Act (RCRA) will be significant. Historically, regulations governing waste disposal have been limited or nonexistent. RCRA will make finding and maintaining sites more difficult and expensive; however, the smaller quantities of waste and the greater degree of open space should make disposal less of a problem than in more urbanized and industrialized regions.

Utilities in the region should not be constrained by solid waste disposal problems. Older plants that are forced to find off-site disposal can usually do so within a reasonable distance. New plants should be able to plan for on-site disposal. Increasing difficulty and expense of disposal may promote utilization or resource recovery of these materials.

Ecology/Land Use

The major land use impacts in Region VII are likely to be related to coal mining activities. There is a high probability that farmland will be affected by mining activities, since crops cover 45% - 65% of the land area in counties where extraction is projected to occur. The destruction of croplands by mining will cause at least a short-term loss of agricultural productivity, a value replaced by the value of the coal being extracted. Reclamation costs in Region VII may be high, since the restoration of croplands to their original productivity, as required by the Office of Surface Mining regulations, requires extensive soil manipulations and amendments.

Construction of the projected power plants is not likely to cause major land use impacts in the region, since proposed increases in electrical generating capacity are generally small. Rarely would more than 500 acres be required in any one area.

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. Coal combustion is

projected to increase in Region VII (see Table 3.2), and many of the region's major crops, including soybeans, wheat, and hay, are SO_2-sensitive. The analysis used in this evaluation flagged nine counties in the region where the potential for local effects on SO_2-sensitive vegetation may be high in 1990. SO_2 concentrations were projected to increase from 1975 levels in six of these counties. Sensitive crops cover as much as 35% of the land area in the counties affected; sensitive communities of natural vegetation cover as much as 50% of the area in at least one of the nine counties.

Socioeconomic Impacts

The states of Iowa, Missouri, Nebraska and Kansas are the potential sites of more than 25,000 MW of new energy developments. These developments are principally energy-generating facilities and are sited in several of the low and extra-low assimilative capacity counties that are predominant within the region. Because of their characteristics, these counties are associated with a high potential for adverse socioeconomic impacts.

There are seven counties within Region VII assessed to suffer adverse socioeconomic impact from the present scenario siting pattern. For example, the existing societal and social infrastructures established within these counties are expected to be incapable of serving the more than 26,000 people projected to temporarily inhabit the region during the period 1975-1990. The result of the divergent social and economic characteristics of the indigenous and in-migrant populations is expected to cause severe negative effects within the counties encountering them.

Health and Safety

Coal extraction will be the primary source of energy-related occupational health impacts in Region VII, despite the facts that only moderate amounts of coal reserves are found in Missouri, Iowa, and Kansas, and that 90% of the coal extracted will be via relatively low-risk surface mining techniques. Other energy cycle activities such as oil production and refining, natural gas extraction, and electricity generation will be on too small a scale to result in the same magnitude of occupational health impacts as those from coal extraction.

The primary energy-related public health impacts in Region VII that are currently quantifiable will result from sulfur oxides emitted during fossil fuel combustion for electricity generation and for industrial heating and process use. Impacts from other energy technologies are either of minimal impact compared to sultur oxides or are not quantitied because of a deficiency in dose-response and/or emission data.

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1 INTRODUCTION

1.1 RIIA STUDY DESCRIPTION

This study, the 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), which 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 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 VII. 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.

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

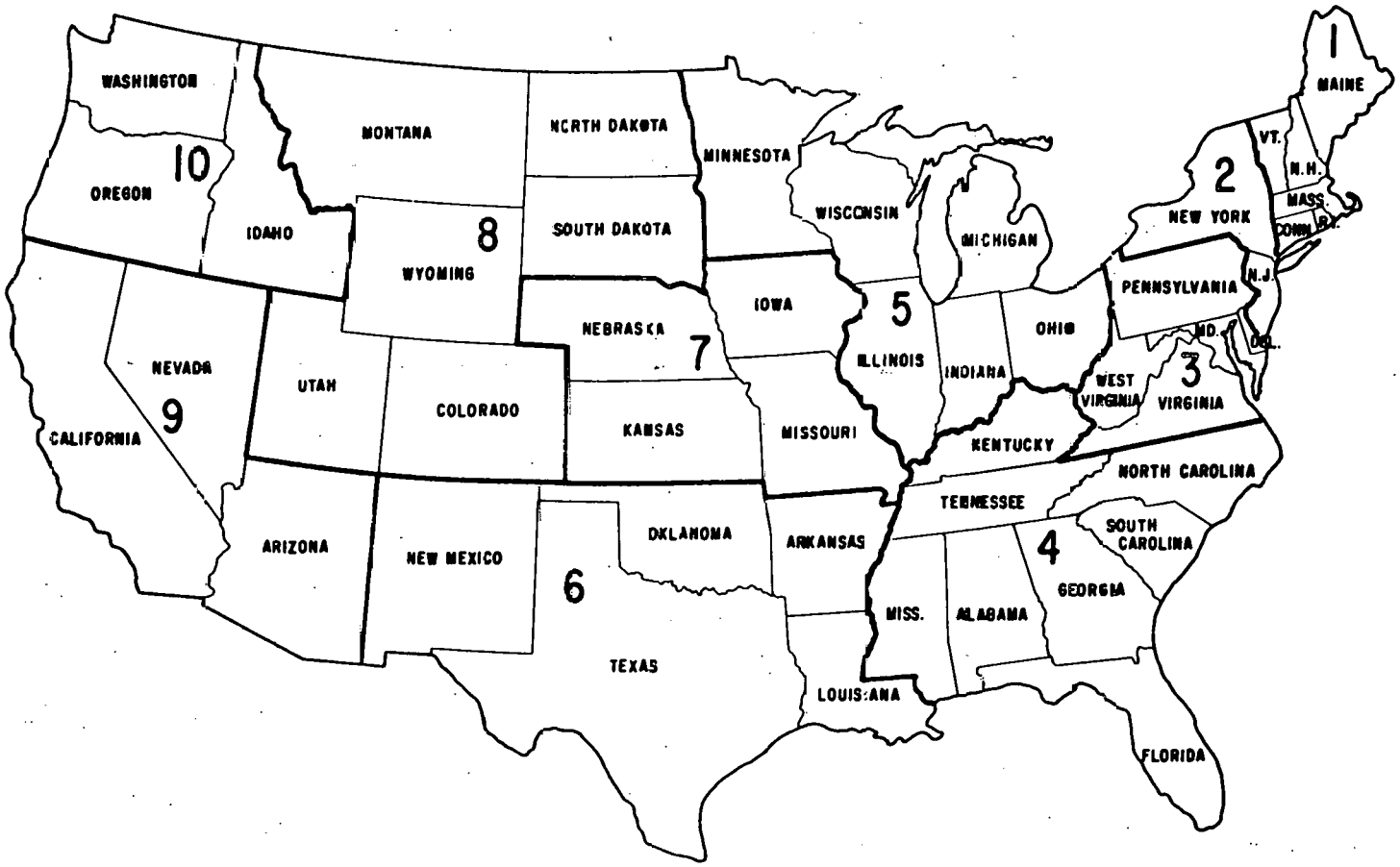

Fig. 1.1. Federal Regions

Six of the national laboratories, Argonne (ANL), Brookhaven, (BNL), Lawrence Berkeley (LBL), Los Alamos (LASL), Oak Ridge (ORNL), and Pacific Northwest (PNL), undertook various lead assignments to analyze the impact of these county level patterns 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 lab analyses from the particular perspective of the states and regions for which they are responsible.

1.2.2 Assumptions

The major technology assumptions used in the lead analyses of technologies addressed in the scenario concerned control techniques. These 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. Only conventional technologies were sited for Region VII (i.e., oil turbine, gas turbine, nuclear, coal, oil steam, gas steam and combined-cycle), except for 1300 MW of increased generating capacity from pumped storage facilities that are most likely to use existing reservoirs in this region.

1.2.3 Criteria for Ranking of Impacts

The discussion of each region and of each state within the region includes a summary matrix displaying the severity of specific environmental, health, social, and economic impacts of energy and energy 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/ELEVATED 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	NEW 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 = 55%	EPCT, EFFECTIVE JULY 1977 EACTEA, 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 X 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); CONSUMPTION (MGD); FOSSIL (1000 MW): WITHDRAWAL (MGD); CONSUMPTION (MGD) ONCE THROUGH: 1400; 4; 830; 3 POND OR CANAL: 42; 25; 25; 15 WET COOLING TOWER: 28; 17; 17; 10 DRY COOLING TOWER: 0.3; 0; 0.2; 0	DATABASE • 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 • POST 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
MFB	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. ANTI*-CIPATED LEGISLATIVE PROHIBITION. ABSENCE OF EFFECTIVE ORGANIZATIONAL RESPONSIBILITIES, STATUTES, ETC.	DELAY POSSIBLE DUE TO LEGAL OR POLITICAL CON-*STRAINTS. LOW TO MODERATE* PUBLIC OR PRIVATE INTEREST IN ENFORCEMENT.	NO SIGNIFICANT OPPOSITION, LEGAL CONSTRAINTS, OR ORGANIZATIONAL PROBLEMS.

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2 REGIONAL OVERVIEW*

The population of Region VII was 11.5 million in 1977. The average population density in the region is 41.3 people per square mile. The states of Iowa and Missouri are somewhat more populated with densities of 50.5 and 67.8 while Nebraska and Kansas are sparsely settled and have density factors of 19.4 and 27.5.

The population in this region is principally involved in farming or farm-related industries with a range of between 20,000 and 37,000 employed in each state. The other primary employers include wholesale and retail trade, and agri-business is becoming increasingly dominant. The exception to these employment characteristics is the stae of Missouri, which has increased its manufacturing and industrial production activities since the 1960s. The industries within these states generated a median income of $8,794 with a mean per capita income in 1976 of $6,295, which corresponds to 97.7% of the average for the United States. The average per capita income did not vary greatly throughout the region.

The predominant land use in Region VII is cropland. The region is the major producer of wheat and corn in the nation: approximately 15 million acres are planned in wheat, and 24 million in corn. Soybeans are an important crop in the eastern states. The original vegetation in most of this area consisted of prairie grasses, but these grasslands were easily converted to agricultural use, although the extreme western parts of Kansas and Nebraska are more arid, and the grasslands here are used for open range. Forested areas are largely confined to the Ozarks in southeastern Missouri, and to areas along streams and rivers.

Water is relatively scarce in Region VII, except in areas directly bordering major rivers, and water availability is likely to be the major issue affecting inland siting of new energy facilities. Competing water demands from the agricultural sector for irrigation needs compound the problem. Irrigation shortages already exist along the Platte River in Nebraska, and there is concern among farmers and state officials that upstream developments associated with coal and power production could deplete flows even further. Localized water supply shortages have also occurred in the Des Moines and Cedar Rivers in Iowa. Groundwater is extensively used in some parts of the region to supplement the surface water supply, and in areas of Kansas and Nebraska groundwater mining has been a cause of great concern. A recent study by the Kansas Geological Survey indicated that if current trends continue, groundwater resources in the West Central water planning district will be exhausted in six years. This problem has already prevented construction of one coal-fired power plant that would have relied solely on groundwater for make-up and cooling.

The low and variable streamflows of the region also affect water quality. It is difficult, for instance, for many streams to assimilate adequately treated municipal wastes from even relatively small population

*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).

centers during low flow periods. The quality of both surface and groundwater is also affected by the natural leaching of salts and minerals from the soils and rocks of the region, which has led to high concentrations of total dissolved solids (TDS) in the Missouri and Arkansas drainage basins (primarily Kansas and Nebraska). The problem is aggravated by municipal and industrial effluents that are high in TDS. Energy facilities can increase already high TDS concentrations by reducing the dilution capacity of streams through their consumptive water use and by discharging effluents high in TDS. Regional water quality planning is further complicated by extensive nonpoint sources of nutrients and metals. Waste load allocation plans in Region VII must be designed to respond to extensive nonpoint source pollution during high flows and to effluent dominated streams during low flows.

Air quality in the region is good with localized problems in urban areas such as Omaha, St. Louis, and Kansas City. In each of these areas attainment of particulate national ambient air quality standards is questionable if combustion activity increases dramatically. There are difficulties in the St. Louis area in attaining both national particulate standards and sulfur dioxide standards.

The counties in this region can be categorized by socioeconomic assimilative capacity. This classification methodology refers to the adequacy of public services, facilities and infrastructure 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. The counties in Region VII are primarily of extra-low and low assimilative capacities. This is characteristic of small, sparsely distributed populations that are located at some distance from major trade centers. This classification is reinforced by the small average annual net change in population (0.5%) in this region between 1960-1976 and the fact that only 64% of the population could be classified as urban.

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

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 policies prior to the implementation of the National Energy Act (NEA). These are the basic assumptions for the scenario:

- A slight increase of 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 96.9 Quads in 1990. The total electricity distribution in 1975 was 2,036 billion kilowatt hours. 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 population, 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 VII is summarized in Table 3.2 and Fig. 3.4. These projections were the basis for the county-level utility (shown in Figures 3.5-3.7), industrial, and mine siting patterns developed by ORNL, BNL and MITRE, which, in turn, provide the baseline 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 Geothermal	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	110.0
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	0.2	0.4	0.3
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

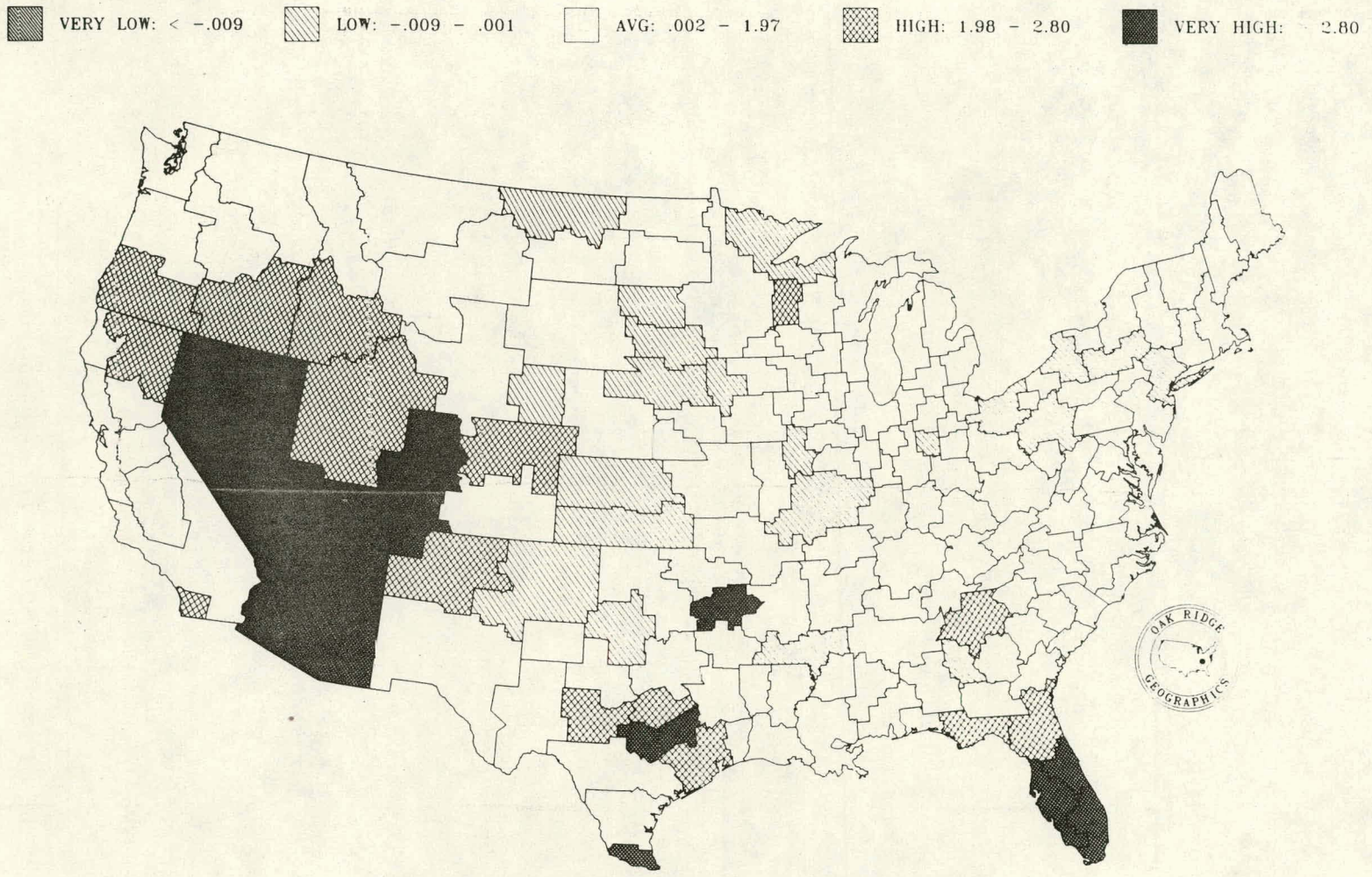

Fig. 3.1. Population Growth 1975 to 1985, PIES Mid-Mid Scenario, Average Annual Percentage Growth Rates

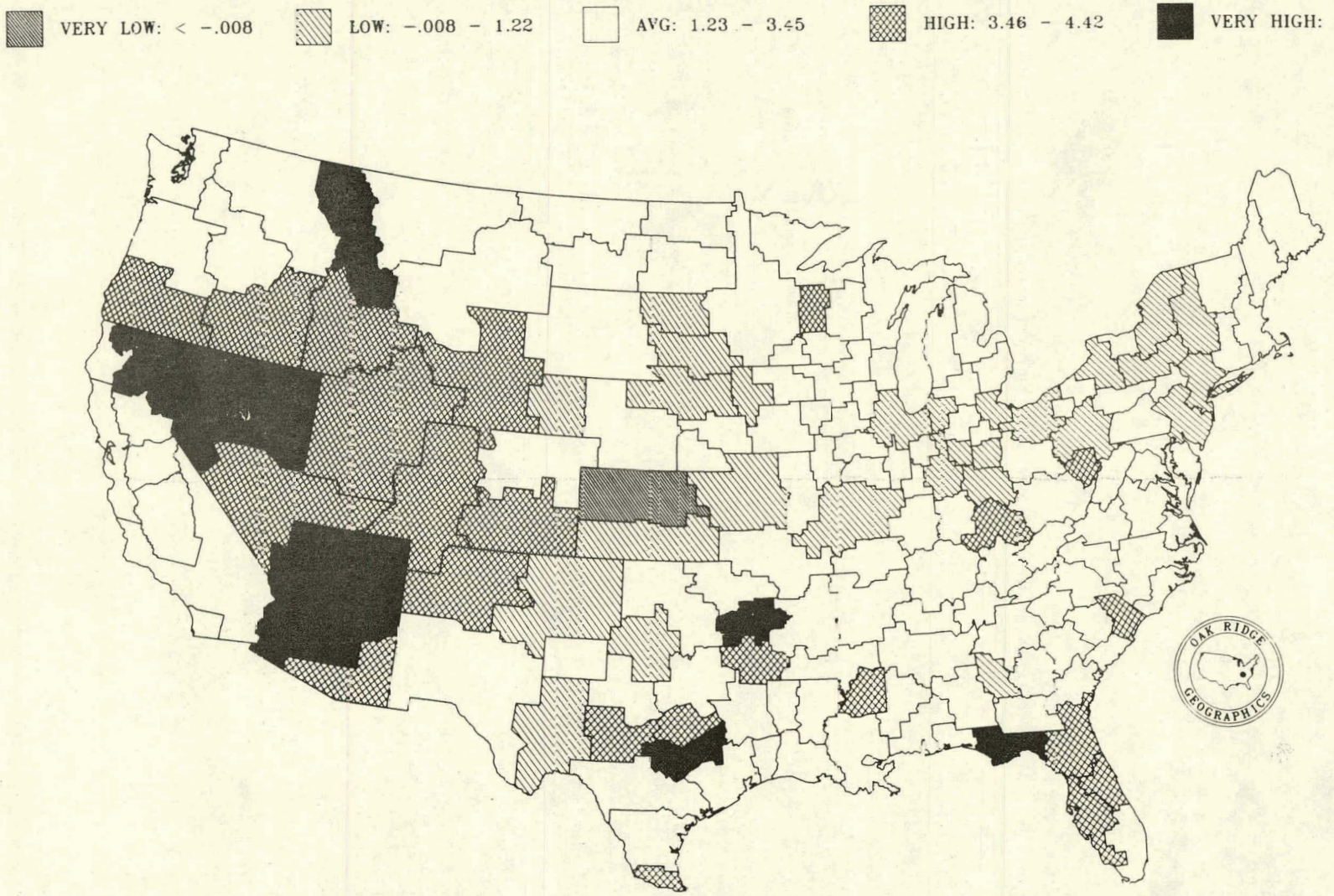

Fig. 3.2. Employment Growth 1975 to 1985, PIES Mid-Mid Scenario, Average Annual Percentage Growth Rates

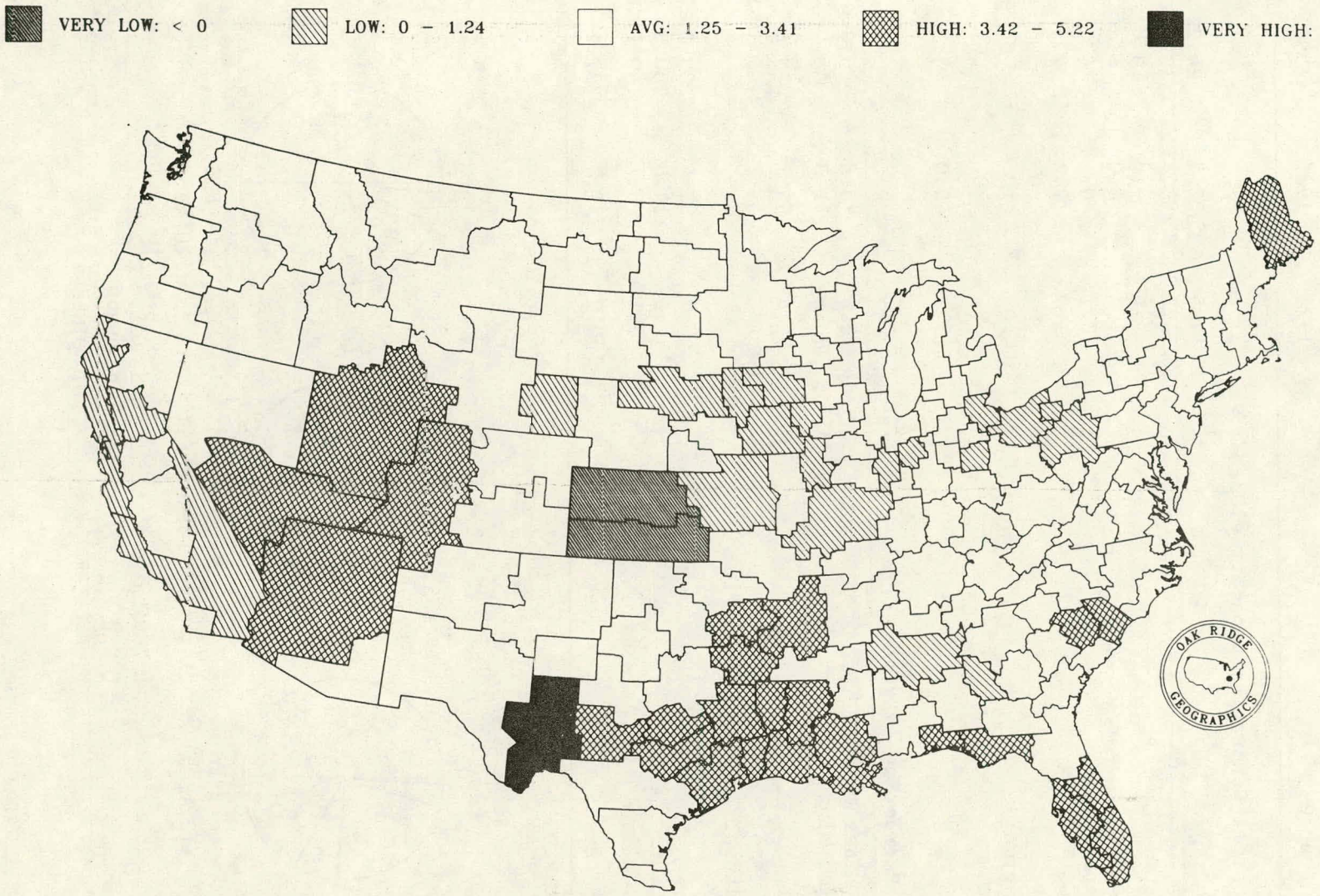

Fig. 3.3. Energy Growth 1975 to 1985, PIES Mid-Mid Scenario, Average Annual Percentage Growth Rates

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

Fuel Source	1975	1985	1990
Electrical Generating Capacity (103 MW)			
Coal	12.5	22.5	24.2
Oil	4.2	6.4	10.7
Gas	5.6	4.8	4.8
Nuclear	1.7	4.0	6.4
Combined Cycle	0.1	0.1	0.1
Hydro	1.0	2.2	2.3
Solar	0	0	0
Geothermal	0	0	0
Other	0	0	0
Total	25.1	40.0	48.5
Coal Extraction (10^6 tons)			
Deep Mines	3.6	3.8	3.7
Surface Mines	63.8	51.3	48.7
Total	67.4	55.1	52.4
Industrial Fuel Use (10^{12} Btu)			
Coal	3.2	32.4	36.2
Oil	157.6	124.8	200.9
Gas	0.1	0.1	0.1
Total	160.9	157.3	237.2

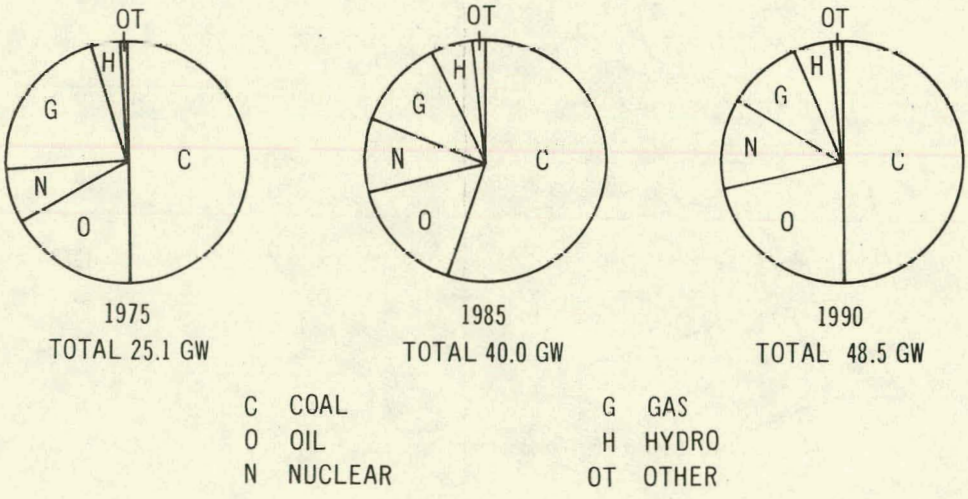

Fig. 3.4. Projected Electrical Generating Capacity by Technology, Region VII

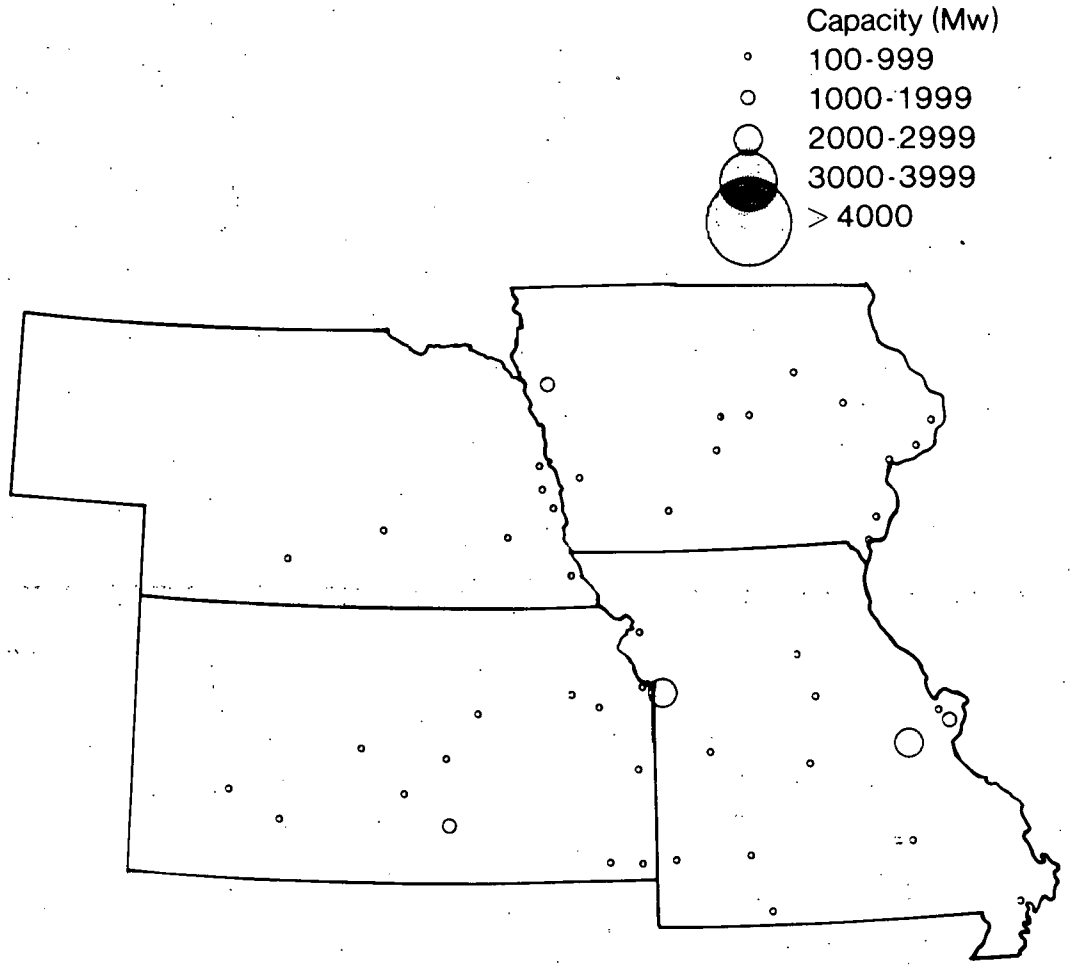

Fig. 3.5. 1975 Electrical Generating Capacity - Region VII, PIES Mid-Mid Scenario

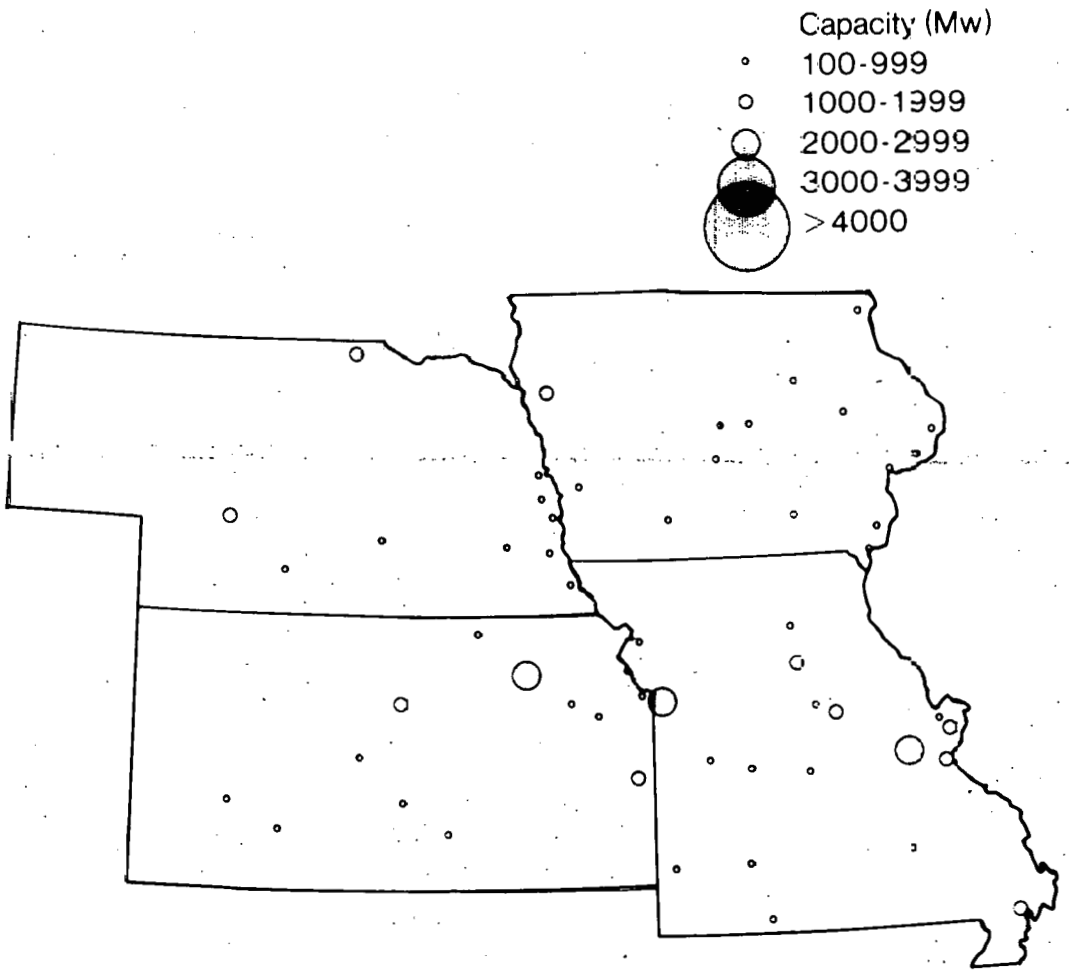

Fig. 3.6. 1985 Electrical Generating Capacity - Region VII, PIES Mid-Mid Scenario

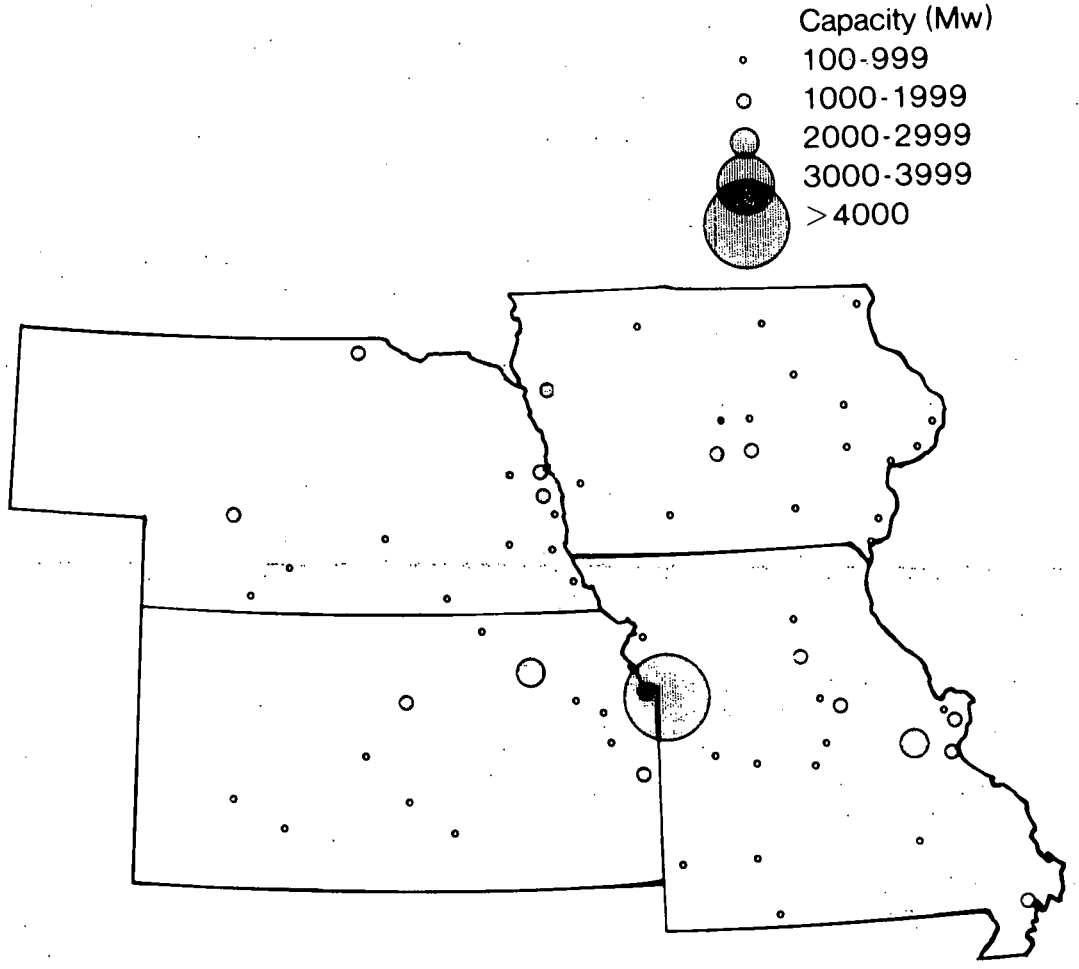

Fig. 3.7. 1990 Electrical Generating Capacity - Region VII, PIES Mid-Mid Scenario

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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. They are effectively the product of national or multiregional 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. Impacts from these broad range issues are disaggregated to the regional level in Table 4.1.

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

	Air Quality			
Fuel Source	Visibility	Long Range Transport	National Socioeconomics	Water Resources
Coal	L	L[a]	L	L
Oil	L	L	L	L
Gas	L	L	L	L
Nuclear	L	L	L	L
Solar	L	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 are unlikely to occur.

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

4.1.1 Long-Range Transport, Visibility

As in the case of other midwestern regions, long range SO_2 transport may contribute to deteriorated air quality in nonattainment and marginal attainment areas. By itself, long range SO_2 transport is not expected to present severe impediments to energy development in Region VII.

4.1.2 National Socioeconomic Impacts

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 capital expenditure increases are calculated to be in the construction of low-Btu coal-fired power plants, oil refineries, gas distribution facilities, light water nuclear reactors and electrical distribution facilities. The largest capital expenditures are associated with nuclear reactor construction where 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 of energy facilities are expected to exceed 1.2 million person-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 be primarily composed of demand from the gas distribution facility, light water reactor, and electrical 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 $4.3 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 electrical distribution facilities. These sectors correspond to 63% of the total annual operating costs attributable to the energy facilities.

Manpower requirements increase in the operating phase from 1.2 to 1.8 million person-years. The greatest manpower demands are concentrated in the sectors where the most significant operation costs are identified. These sectors correspond to 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 for equipment, goods, and services throughout the states from both development inside and outside the region may slow the subsidence of businesses from this region. Any problematic effects of the subsequent impacts can be mitigated through interstate cooperation and effective regional planning.

4.1.3 Inland and Coastal Water Resources

Interregional water-use conflicts have led to court decrees and interstate compacts regarding the use of water from the South Platte and North Platte Rivers. The South Platte Compact signed in 1923 by Nebraska and Colorado provides for minimum flow from Colorado to Nebraska, and a 1945 Supreme Court decree apportioned water from the North Platte River, limiting diversions by Colorado and Wyoming users and allocating natural flow. These agreements may become issues in neighboring regions but are unlikely to affect siting in Region VII.

4.2 REGIONAL ISSUES

The issues described below are summarized in Table 4.2.

4.2.1 Local Air Quality, Visibility

All of the states in Region VII are likely to experience regulatory impediments on coal growth during implementation of the Mid-Mid Scenario (Fig. 4.1). Iowa has almost two-thirds of its proposed coal growth located in nonattainment areas in the southeastern and southwestern portions of the state. Kansas has a single area in the northwestern portion of the state around the Pottawatomie Indian Reservation where most of the state's proposed coal growth is sited to occur. Offsets or improved control technology in this area are not expected to significantly mitigate air quality problems. Other high impact areas for coal development in Region VII are the St. Louis area and portions of southeastern Nebraska.

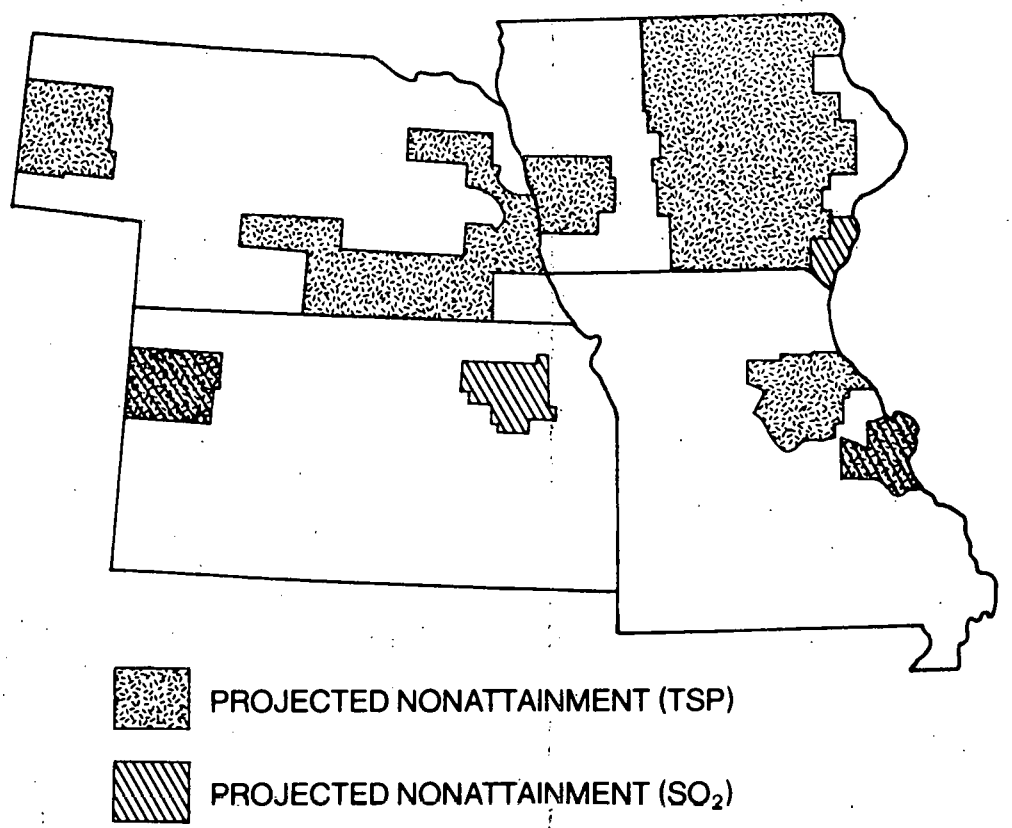

Fig. 4.1. Region VII Areas with Potential Air Quality Constraints

Table 4.2. Environmental Impacts of the EIA Trendlong Mid-Mid Scenario at the Regional Level - Region VII[a]

		Water	Land			Health and Safety	
Energy Source	Air Quality	Quality/Availability[b]	Ecology	Land Use	Solid Waste	Occupational Safety	Public Health
Utility:		Regional water quality/availability impacts were not identified with certainty for the regions. However, because of upstream consumption and pollutant loading from all future economic activities, the impact on downstream basins could become an issue, based on best basin management practices.					
-Coal	H					L	L
-Oil	M					L	L
-Gas	L					L	
-Nuclear	L					L	L
-Combined Cycle	L						
-Solar							
-Hydro							
General:							
-Utility	M		M	L	L	L	L
-Industry	H		M		L		L
-Mining	L		M	M		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. Criteria are not provided for socioeconomic issues because their extreme localized nature cannot be reflected in the aggregated analysis.

[b]Includes ground water.

Utility oil development may be restricted in industrialized areas including St. Louis, Lincoln, Omaha, and Kansas City. Fuel purchasing policies will aid in mitigating air quality problems in these areas, but nonattainment/offset issues must be satisfied.

Industrial development in Region VII, as projected by the Mid-Mid scenario, will be greatly influenced by regulatory constraints in nonattainment areas. All of Missouri's new major industrial sources are projected for nonattainment areas.

Seventy-three percent of Iowa's, and 84% of Nebraska's proposed industrial sources are located in areas with poor or marginal quality. Most of these sites will require satisfaction of nonattainment provisions and offsets.

4.2.2 Water Quality/Availability

The utility activities analyzed for water-related impacts were the coal, gas, oil, combined cycle (assuming coal type), and nuclear technologies. Of these categories, nearly 30% of the projected increase in generating capacity to 1990 was identified as having a potential impact on water quality or availability (assuming that effluent treatment beyond statutory point source requirements is implemented and/or that the 7 day-10 year low flow is maintained). This represents 10% of the total utility activity projected by 1990 for Region VII.

Projected increases having large water demands may be restricted in areas where seasonal low flows and agricultural water consumption create water use conflicts. In these areas, energy activities must compete with agricultural uses for water. Impact mitigation may require construction of reservoirs for water storage and for flow augmentation to maintain adequate dilution ratios.

4.2.3 Solid Waste

Disposal of all kinds of solid waste has become an important issue in all parts of the country. Historically, solid waste disposal has not been a constraint to new development; however, inexpensive dumping at nearby locations is no longer possible in many areas.

All regions face the challenge of disposing of ash, sludge, and other wastes in an environmentally acceptable manner. Although Region VII does not generate as large a quantity of ash and sludge as some other regions, local problems still exist.

Industrial disposal requires a large number of small sites, compared to utilities, which require fewer but larger sites. Some industries have their own disposal sites and others use municipal facilities. Although the amount of solid waste is much less than in Region V and the amount of open space near urban areas is much greater, institutional constraints can still make siting a disposal facility difficult.

Industrial ash and sludge disposal problems are part of the general solid waste disposal problem, especially in the urban areas. For the nation as a whole, the quantity of municipal solid waste is expected to increase 30% from 1977 to 1990; however, the 150 largest metropolitan areas will account for two-thirds of the increase.[1]

Although the quantity of ash and sludge from a utility is greater, disposal is often easier than it is for an industry. Utilities have more on-site land available for disposal. Some existing utilities will have to transport wastes off-site, but the distance should not be prohibitive. New plants should be able to plan for on-site disposal for the lifetime of the plant.

Region VII is not a highly urbanized or industrialized area. Industrial coal use in 1975 was less than 3 million tons, and land requirements for disposal amounted to only 5 acres. Even with the 185% increase projected by the scenario, industrial coal use is low resulting in the production of relatively small amounts of ash and flue gas desulfurization (FGD) wastes.

Installed coal-fired utility capacity, 11,597 MW in 1975, is projected to increase to 17,257 MW by 1990. Application of FGD systems will increase the amount of solid 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 a "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 would 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 Environmental Protection Agency's solid waste program has been small with no regulatory respon-

sibilities, and many states have limited solid waste management programs. When the 1970 Clear 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.[2] The implementation of this ambitious new regulatory program will be an important issue in the region.

4.2.4 Ecology/Land Use

Relatively small acreages (rarely over 500 acres in any one area) may be disturbed by projected energy development in Region VII, mostly in counties near the urban centers. The preemption of croplands for new power facilities is likely, but the total production of the area is not likely to be grossly diminished by these activities.

The coal resources in the region are not projected to be greatly exploited except in Missouri. Agriculture is the major land use in areas with projected mining activities, and the croplands are primarily devoted to wheat, corn, soybeans, sorghums, and hay crops. Office of Surface Mining regulations require that prime agricultural lands be returned to their original crop productivity.[3] The cost of reclamation in Region VII may be high if such lands are mined.

Continuing high sulfur dioxide levels near urban areas are of concern in the region, since many of the major crops are sensitive to SO_2-induced damage, which can cause decreases in productivity and yield (Fig. 4.2). The sensitivity of the natural prairie-grassland vegetation to SO_2 is not yet known.

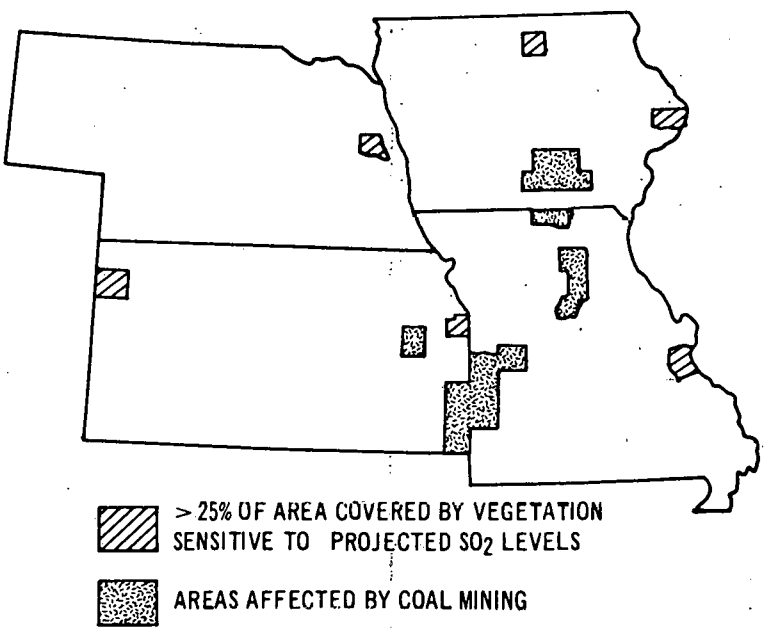

Fig. 4.2. Coal Mining Areas & Potential SO_2-Induced Vegetation Damage

4.2.5 Socioeconomic Impacts

Region VII is projected to receive more than 25,000 MW of new energy generating facilities. Since these four states contain primarily low and extra-low assimilative capacity counties (see Section 2), there is a high potential for adverse socioeconomic impacts from the construction of new, large-scale energy facilities. However, the present siting pattern restricts the severe impacts to three counties in Nebraska, three in Kansas, and one in Missouri (Fig. 4.3). The identification of these socioeconomic impact subregions is based on the operation dates and the size and type of facilities to be sited within these particularly susceptible areas.

Besides the seven counties assessed to receive severe socioeconomic impact, there are 18 other counties in this region that are expected to experience new growth as a result of energy activities. However, the growth in these areas is not expected to exceed 10% of the baseline population. These subregions will incur some negative impacts from the development, but these could be easily mitigated with proper planning.

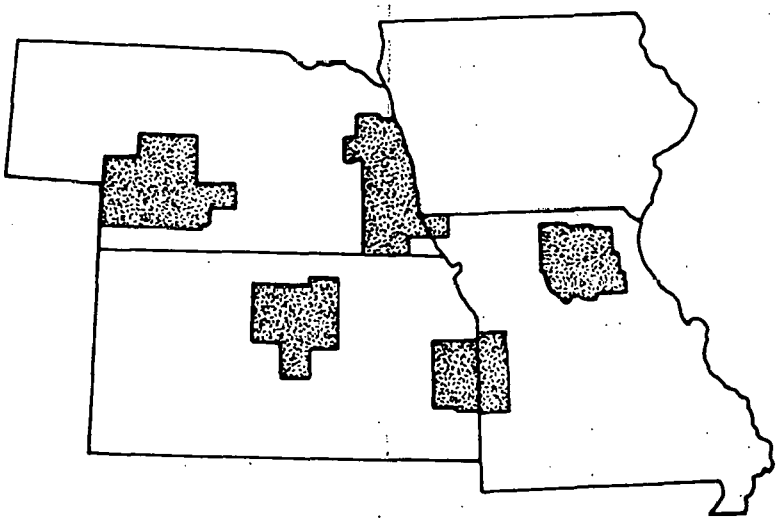

Fig. 4.3. Areas in Region VII Potentially Subject to Adverse Socioeconomic Impacts

Since the existing workforces and rural infrastructures within the seven affected counties are not sufficient to satisfy the demands of the energy development(s), an in-migrant labor force in excess of 12,000 basic workers could be required. These workers would cause a temporary population increase of more than 26,000 people during the period 1975-1990. However, only approximately 2,500 are projected to remain during the long-term operation phase of the developments. Because of the divergent social and economic characteristics of the indigenous and in-migrant populations, the sociocultural problems encountered are expected to be severe.[4,5]

4.2.6 Health and Safety

Region VII is not as intensively developed in terms of energy-related activity as other more densely populated regions. As a result, the impact of health risks associated with the energy cycle, from extraction to end use, on occupational and public populations in the region is less significant than in other highly industrialized regions. The highest risk energy-related occupation is deep coal mining. Of the small to moderate amounts of coal mined in Iowa, Kansas, and Missouri, 90% is extracted by surface mining techniques. The number of accidental deaths and injuries and deaths and cases of chronic respiratory disease from coal mining are projected to be minimal in Region VII because of relatively low levels of extraction and the use of lower risk surface mining techniques (Fig. 4.4-4.5). Despite these minimal impacts, coal extraction will be the primary source of energy-related ocupational health impacts in Region VII during the scenario time frame. Other energy cycle activities, such as oil production and refining, natural gas production, and

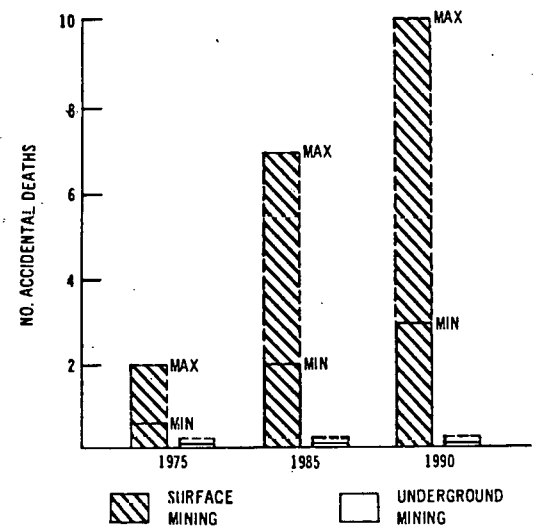

Fig. 4.4. Range of Potential Accidental Deaths in Region VII Coal Mines Due to Implementation of the Mid-Mid Scenario

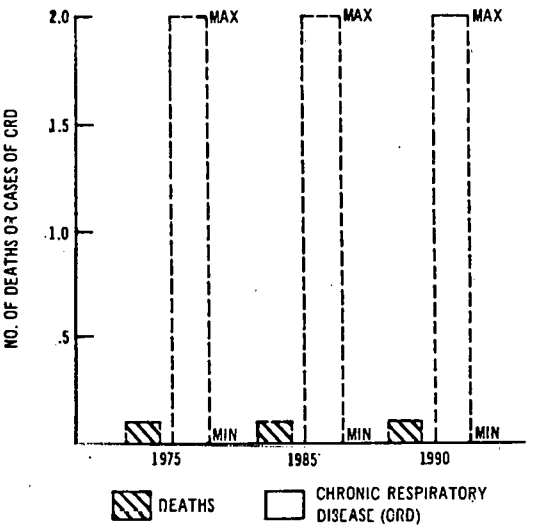

Fig. 4.5. Range of Potential Deaths and Cases of Chronic Respiratory Disease (CRD) in Region VII Due to Coal Mining Occupational Exposure Under the Mid-Mid Scenario

electricity generation (fossil and nuclear fueled), are of insufficient magnitude to result in substantial occupational health impacts (Fig. 4.6).

In Region VII, public health impacts of sulfates released from fossil fuel use under the Mid-Mid Scenario are projected to decline by 14% to 20% (Fig. 4.7). The decline is primarily due to Clean Air Act requirements for sulfur emission control and a doubling in the amount of nuclear electricity generation in that region. Impacts that do occur are likely to be greatest at the eastern edge of the region -- in Missouri -- because of both interstate transfer of sulfates and the projected amount of fossil fuel use in Missouri.

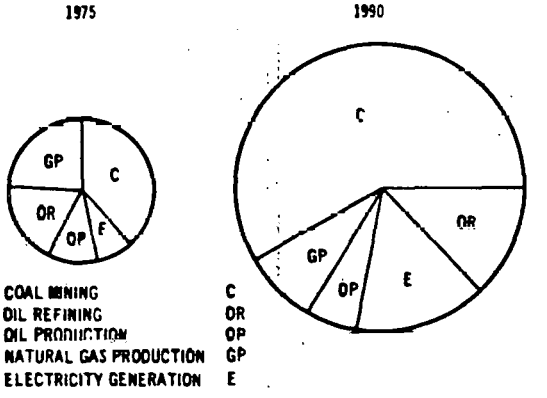

Fig. 4.6. Relative Contributions of Major Energy Activities to Energy- Related Occupational Deaths in Region VII under the Mid-Mid Scenario

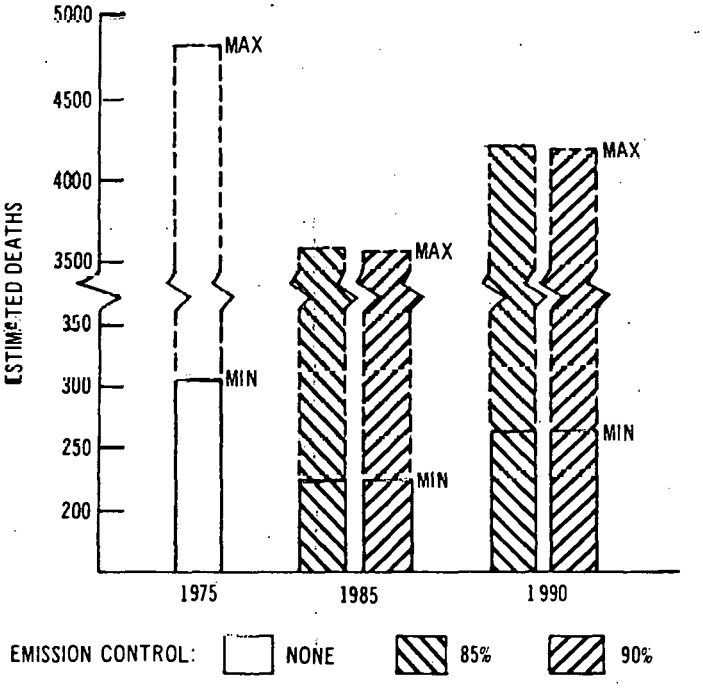

Fig. 4.7. Estimated Range in Deaths in Region VII from SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use Under the Mid-Mid Scenario

5 IOWA

The scenario projects an additional 2,250 MW of electrical generating capacity in Iowa by 1985 and 4,770 MW by 1990 (Table 5.1). There is a relatively small amount of coal extraction in the state: production is projected to decrease from 620,000 tons per year in 1975 to 580,000 tons per year in 1985 and 560,000 tons per year in 1990. More than half of this coal will be mined underground. The impacts discussed in the following sections are summarized in Table A-1 (Appendix).

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

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	1680	679	-109	0	0	0	2250
1975-1990	1680	1949	-59	1200	0	0	4770

[a]Base year: 1975

[b]Includes conventional hydro and pumped storage.

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

5.1 AIR QUALITY/VISIBILITY IMPACTS

- 1990 TSP levels are expected to be lower than 1975 levels, assuming attainment of existing sources due to the enforcement of SIPs and improved control technologies (Fig. 5.1).

- Continued TSP and SO_2 NAAQS violations are projected for several areas in Iowa where scenario-determined industrial and utility increases are proposed (Fig. 5.1).

- Over 65% of the projected utility coal growth, nearly 25% of the utility oil growth, and almost 75% of the industrial growth projected for Iowa is sited in nonattainment areas.

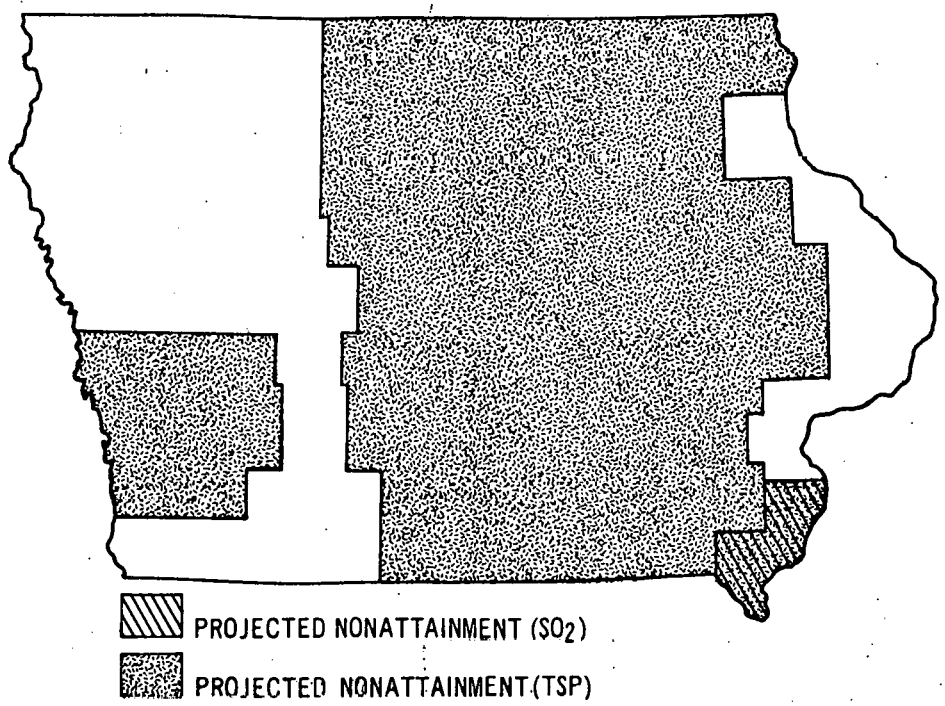

Fig. 5.1. Iowa - Potential Air Quality Impact Areas

5.1.1 Description

Over 50% of the state's electrical power came from coal burning plants in 1975; most of the coal burned in Iowa comes from Montana and Wyoming with smaller amounts from the Midwest.[6] Iowa contains no PSD Class I protected areas.

5.1.2 Background Issues

- Iowa has eight counties in nonattainment for SO_2 and six for TSP. These areas are not concentrated in any part of the state.
- Particulate violations are spread throughout the state with high TSP readings in the vicinities of Des Moines, Davenport, Waterloo, and Dubuque. Coal burning places a significant burden on the particulate loading in these areas.
- Since violations are not extreme, careful siting of new sources could prevent significant additional impacts and the continuation of noncompliance.
- The high sulfur content of Iowa coal may lead to problems in meeting NSPS without emission controls; new plants in the state are likely to depend on western coal and scrubbers.

5.1.3 Scenario-Induced Changes

- TSP levels are projected to increase in various locations throughout Iowa between 1975 and 1985, but substantial reductions are expected between 1985 and 1990 assuming successful enforcement of the SIP and improved control efficiencies.
- Continued TSP violations are projected for portions of the North Central, Northeast, Southcentral, Southeast, and Omaha-Council Bluffs Inter-state AQCRs. SO_2 violations are projected for the Burlington-Keokuk Inter-state AQCR. Sixty-five percent of the projected 1990 coal-fired utility generating capacity increases are sited in TSP nonattainment areas. Most of these coal-fired increases are projected in the Metropolitan Omaha-Council Bluffs Inter-state AQCR; oil fired increases are projected in the Northeast and Southcentral Inter-state AQCRs.
- Nearly 3/4 of the industrial growth is projected for nonattainment areas; offsets and stringent emission controls will likely be required.

5.2 WATER QUALITY/AVAILABILITY ISSUES

- An increase in nuclear utility activity in the upper Skunk River Basin may require reservoir storage to supplement the natural flow during low flow periods (Fig. 5.2).

- No water quality problems related to the scenario are expected.

5.2.1 Description

Generally, Iowa water quality is affected most severely by non-point source runoff from agricultural activities.[7] Seasonal low flows and high sediment loads during high flow periods characterize most of the state's streams. Increases in energy related activity will be relatively small, and the additional loadings from energy activity will not be constraints on development because of already high loads contributed by non-point sources.

5.2.2 Background Issues

- In addition to non-point source pollution, Iowa streams frequently exhibit violations of water quality criteria as a result of apparently natural weathering. Violations of barium, lead, zinc, and copper criteria apparently result from natural background.

- Increasing temperatures in the Iowa River are of concern because of several industrial cooling water discharges to the river.

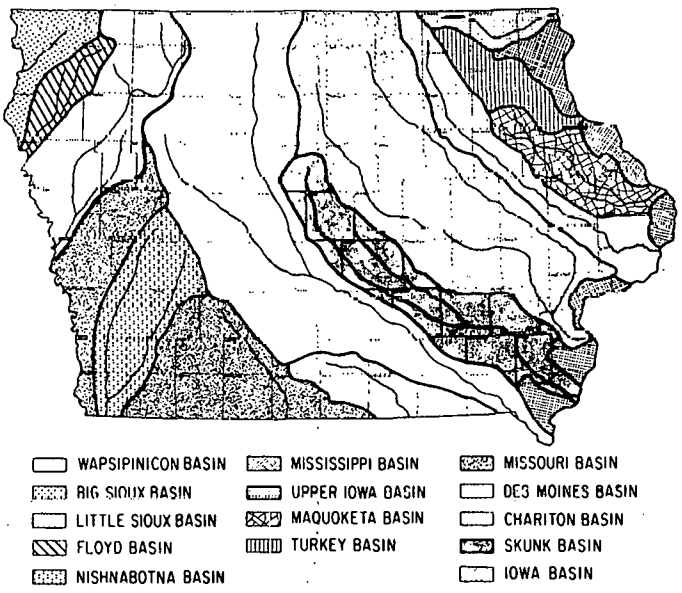

Fig. 5.2. Iowa River Basins

5.2.3 Scenario-Induced Changes

- No significant scenario-induced changes were identified in the analysis, although a need for flow augmentation was cited for the Skunk River basin.

5.3 SOLID WASTE IMPACTS

- Iowa should not have any serious problems disposing of the relatively small amounts of industrial waste.
- Solid waste disposal problems should not constrain utility development; however, disposal costs will increase.

5.3.1 Background Issues

- Industrial coal use was only 520,000 tons in 1975 (compared to 17 million tons for Ohio), and land requirements for disposal were less than one acre.
- Suitable landfill sites are difficult to find in some of the loess hill areas of the western part of the state.

5.3.2 Scenario-Induced Changes

- Industrial coal use is projected to triple by 1990; however, solid waste generation is estimated at less than 200,000 tons per year and land use required for disposal is estimated at less than 4 acres per year (Figs. 5.3-5.4).

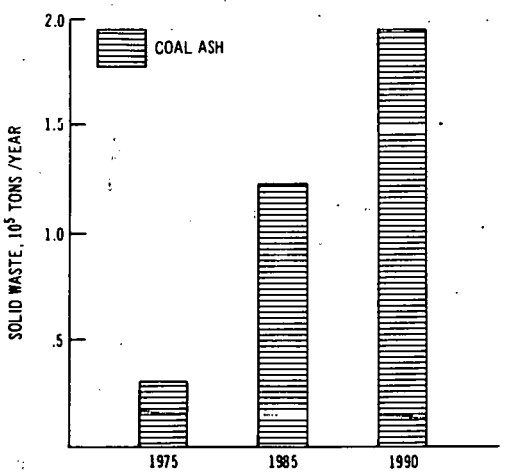

Fig. 5.3. Iowa - Solid Waste Generation from Industrial Coal Use

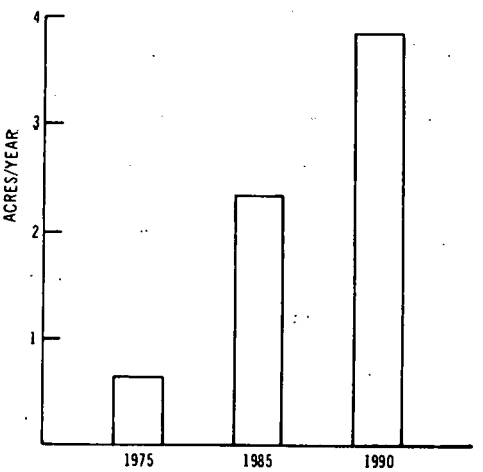

Fig. 5.4. Iowa - Total Area Used for Industrial Ash Disposal

- Indicators do not show any areas where disposal is likely to be a serious problem.

- Installed coal-fired utility capacity is projected to increase by 75%, but no waste disposal problems are foreseen. Total lifetime area requirements for solid waste disposal are projected to be 1,300 acres.

5.4 ECOLOGICAL AND LAND USE IMPACTS

- Sulfur dioxide concentrations in the Mason City and Clinton areas of Iowa are projected to increase steadily through 1990; 1975 levels are already high enough to cause damage to exposed soybean, hay, and grain crops in these areas. Crop damage could become a major issue in Iowa, where over 75% of the land area is in cropland. Generating capacity increases are relatively small, and surface mining is projected to disturb 1000 acres in the state from 1975 to 1990.

5.5 SOCIOECONOMIC IMPACTS

- No adverse socioeconomic impacts are expected in Iowa since the scenario-defined energy developments are sited in counties able to absorb the population growth and public service demands likely to result from these developments.

5.6 HEALTH AND SAFETY IMPACTS

- Electricity generation - a low risk activity - will be the primary source of energy-related occupational health impacts in Iowa. Only small amounts of fuel extraction or refining are projected to occur in Iowa. Despite a 65% increase in electricity generation, occupational health impacts of energy related activities in Iowa will be negligible.

- Sulfur emissions from fossil fuel use will not have a significant impact on exposed populations in Iowa because of dispersed location of sources and implementation of sulfur controls.

6 KANSAS

The scenario projects an additional 3,609 MW of electrical generating capacity in Kansas by 1985, and 5,224 MW by 1990 (Table 6.1). A relatively small amount of coal is mined in Kansas: production is projected to increase from 480,000 tons per year in 1975 to 520,000 tons per year in 1985 and 1990. All of this coal is surface-mined. The impacts discussed in the following sections are summarized in Table A-2.

Table 6.1. Projected Increases in Electrical Generating Capacity (MW) - Kansas Mid-Mid Scenario[a]

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	2858	132	-531	1150	0	0	3609
1975-1990	4038	604	-568	1150	0	0	5224

[a]Base year: 1975.

[b]Includes conventional hydro and pumped storage.

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

6.1 AIR QUALITY/VISIBILITY IMPACTS

- 85% of the proposed 1990 utility coal growth occurs in one county in the northeastern portion of the state. This area is projected to be in violation of short-term SO_2 National Ambient Air Quality standards in 1985 and 1990 (Fig. 6.1)

- Nearly 40% of the scenario-sited utility oil increases are in areas projected to exceed SO_2 standards in 1985; these areas are expected to be in compliance by 1990.

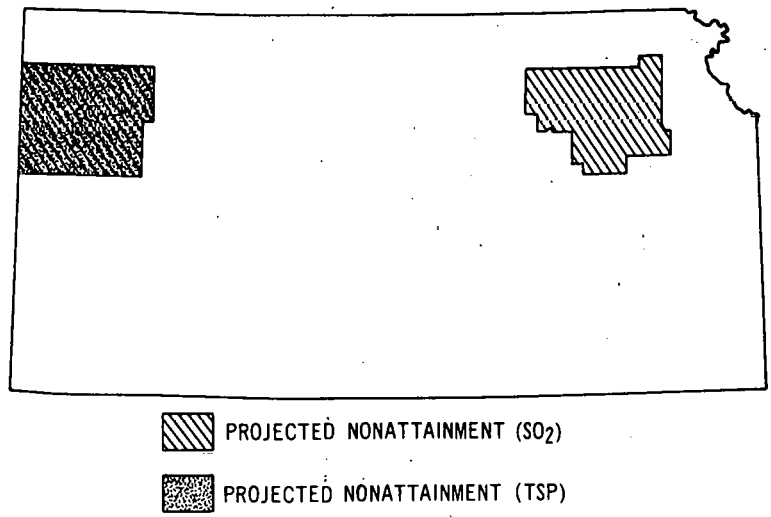

Fig. 6.1. Kansas - Potential Air Quality Impact Areas

6.1.1 Description

Though coal use is increasing in Kansas, almost two-thirds of the state's electrical power was generated in gas-fired plants in 1975. Representatives from state offices feel that the state's important future energy sources are Kansas and Wyoming coals.[8]

Sulfur dioxide emissions do not present significant air quality problems in Kansas. Primary particulate violations occur in two counties.

6.1.2 Background Issues

- Air quality in Kansas is most serious in the Kansas City/ Topeka area where particulate violations occur. Most of the state's industrial activity centers in this northeastern portion of the state.

- Particulate levels in the state are naturally high; high winds and a lack of rainfall contribute to high levels of fugitive dust in the air.

6.1.3 Scenario-Induced Changes

- Sulfur dioxide levels could rise significantly in northeastern Kansas if a large scenario-induced projected coal-fired plant is built. Primary standards for SO_2 may be violated by 1985. This plant accounts for over 85% of the new coal utility capacity projected for the state.

- Over 60% of the state's projected total utility increases (coal and oil) are sited in nonattainment areas.

- Almost 40% of the projected oil capacity increases are sited in SO_2 nonattainment areas in the northeastern part of the state. This area is expected to be in compliance by 1990.

- About 55% of the projected industrial growth is sited for areas with poor air quality.

6.2 WATER QUALITY/AVAILABILITY ISSUES

- Flow augmentation may be required because of projected increases in utility activity in the Smoky Hill River basin in central Kansas. Seasonal low flows provide insufficient dilution capacity for energy effluents (Fig. 6.2).

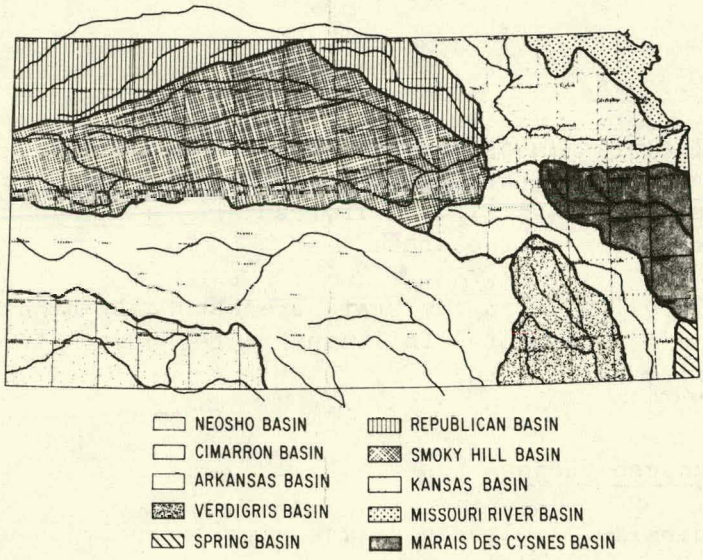

Fig. 6.2. Kansas River Basins

6.2.1 Description

Kansas water quality is determined by flow regime.[9] Scenario-defined energy increases occur in eastern Kansas where the impact of flow is less severe.

6.2.2 Background Issues

- The impact of natural minerals and non-point source runoff is greater than that from point sources in most of Kansas.
- Kansas has been historically successful in limiting point-source discharges. More than 50% of Kansas municipal discharges were meeting 1983 requirements in 1976.

6.2.3 Scenario-Induced Changes

- Flow augmentation may be required in the Smoky Hill Basin to meet energy needs.

6.3 SOLID WASTE IMPACTS

- Industrial coal use is projected to double, but no significant solid waste problems are foreseen. Indicators show only three counties that may experience problems (Fig. 6.3).

- Solid waste disposal problems should not constrain utility development.

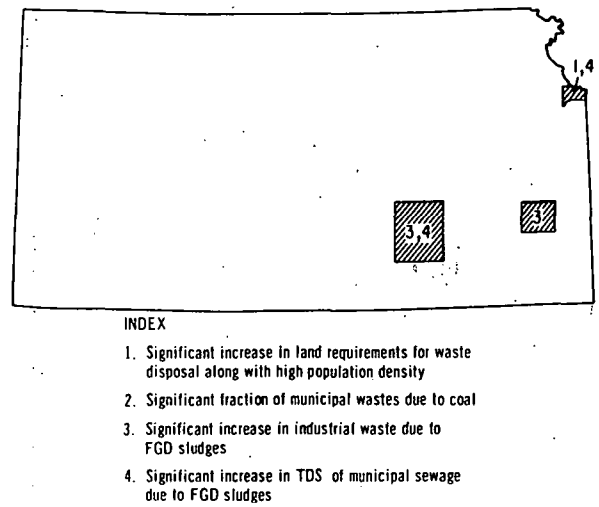

Fig. 6.3. Kansas Counties Potentially Subject to Solid Waste Impacts

6.3.1 Background Issues

- Ash disposal has not been an issue in the past because a majority of the facilities have used natural gas rather than coal.

- Most facilities using natural gas are, or will be, converting to coal.

- Older disposal sites in the metropolitan areas of Lawrence and Topeka are nearly filled; however, it appears that suitable alternative ash disposal sites are available within one mile of the utility plants.

- In general, the small quantities of solid waste and the relatively large amount of open space in Kansas, even near metropolitan areas, make disposal of solid waste less of a problem than in more industrialized states.

6.3.2 Scenario-Induced Changes

- Industrial coal use is projected to double by 1990, and resulting solid waste generation is projected to triple because of the application of FGD systems (Fig. 6.4).

- Land use requirements for industrial disposal are estimated at only 11 acres per year in 1990 (Fig. 6.5).

- On the basis of criteria relating to land availability and adequacy of sewer systems, three counties may experience difficulty in disposing of industrial waste; however, determination of the extent of the solid-waste disposal problem requires a county-specific or case study analysis.

- Land requirements for utility solid waste disposal are projected to be 130 acres per year in 1990 with a total lifetime area requirement of nearly 4,000 acres. Nearly 90% of this area is located in two counties; however, this should not present a problem because land has already been committed to this purpose.

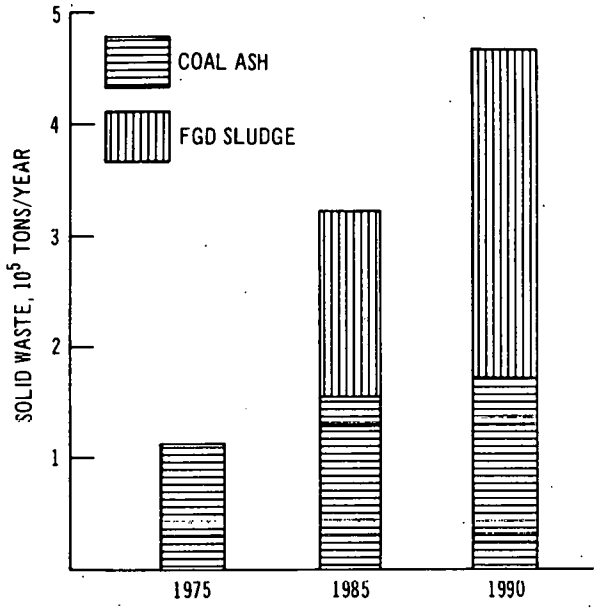

Fig. 6.4. Kansas - Solid Waste Generation from Industrial Coal Use

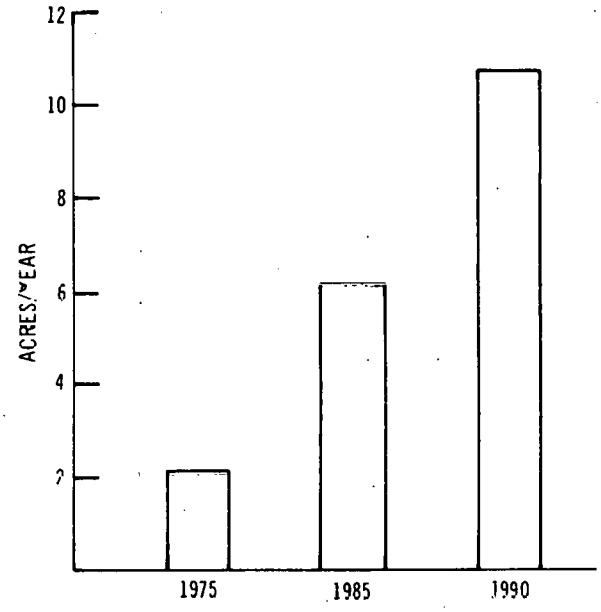

Fig. 6.5. Kansas - Total Area Used for Industrial Ash and Sludge Disposal

6.4 ECOLOGICAL AND LAND USE IMPACTS

- Increasing or continuing SO_2 emissions may affect the wheat crop in three areas in Kansas. Relatively small acreages are projected to be disturbed throughout the eastern half of the state for utilities and surface mining. The preservation of endangered species habitats may be a site specific issue for projected energy development (Fig. 6.6).

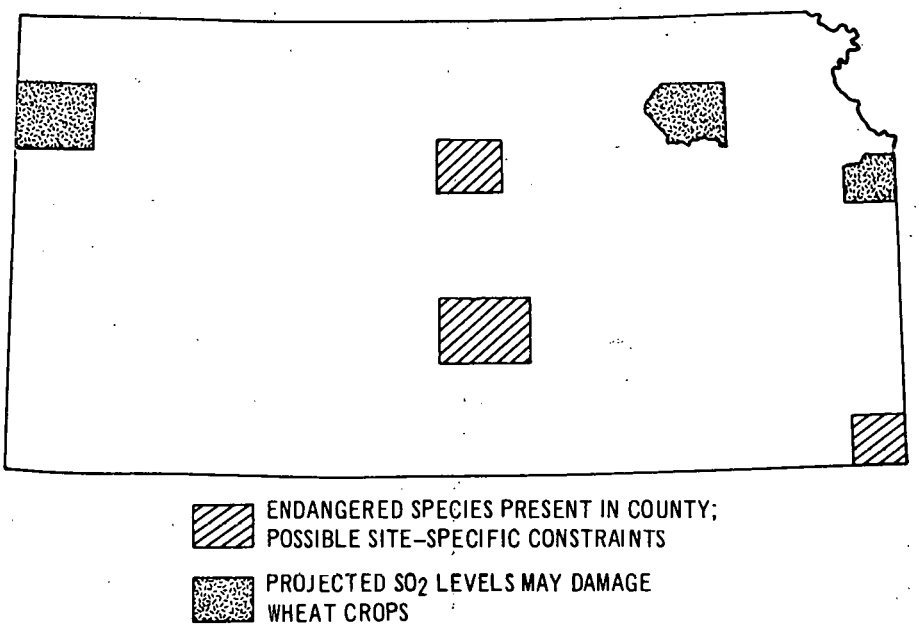

Fig. 6.6. Potential Siting Constraints Due to Land Use or Ecological Issues - Kansas

6.4.1 Description

Sixty-one percent of Kansas land is covered with crops, and most of this land is planted in wheat. Kansas is the major producer of wheat in the region (two-thirds of the regional acreage of wheat) and in the nation. Sorghums, corn, and soybeans are locally important crops. The western part of the state is arid, with a natural grassland cover primarily used for open range.

6.4.2 Background Issues

- Wheat, the major crop in Kansas, is extremely sensitive to SO_2.
- The whooping crane (endangered) is known to occur in the state, and some parts of the state contain critical habitats for this species.

6.4.3 Scenario-Induced Changes

- Emissions of SO_2 from the projected siting of a large amount of coal-fired capacity in the northeastern part of the state may result in local SO_2 concentrations high enough to cause damage to wheat crops grown in that area. Levels of SO_2 in the Kansas City area and on the Colorado border will remain high enough through 1990 to affect wheat crops in those areas.

- Surface mining is projected to disturb about 2000 acres in the southeast corner of the state by 1990. Soybeans are the major crop in that area, although 20% of the land remains in natural grassland cover. Reclamation costs may be high if croplands are disturbed.

- The whooping crane is known to be present in two counties in the central part of the state where new facilities are projected, and the Neosho madtom, a fish on the endangered species list, is known to occur in the surface mining area.

6.5 SOCIOECONOMIC IMPACTS

- Severe socioeconomic impacts are projected for three scenario-defined sites for energy development in Kansas (Fig. 6.7). 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.

6.5.1 Description

The total current employment in Kansas is 1.1 million from a population base of 2.3 million, concentrated in small metropolitan areas throughout the state's 82,000 square miles. The state density of 28 people per square mile represents an average of the more populated northeastern counties and the farm-occupied central and western counties.

Kansas has a diversified economy; 38 of the 51 production sectors have businesses within the state. The agricultural sector contributes raw materials to the manufacturing sector and supports the growth of agri-business industries.[10]

The energy and mineral extraction industries have become important employment and economic resources for the state. With the exception of two, each of the 105 Kansas counties has an active mineral extraction industry. This industry includes the mineral commodities used by the construction industry such as sand, gravel, clay, shale, stone, and cement.[11]

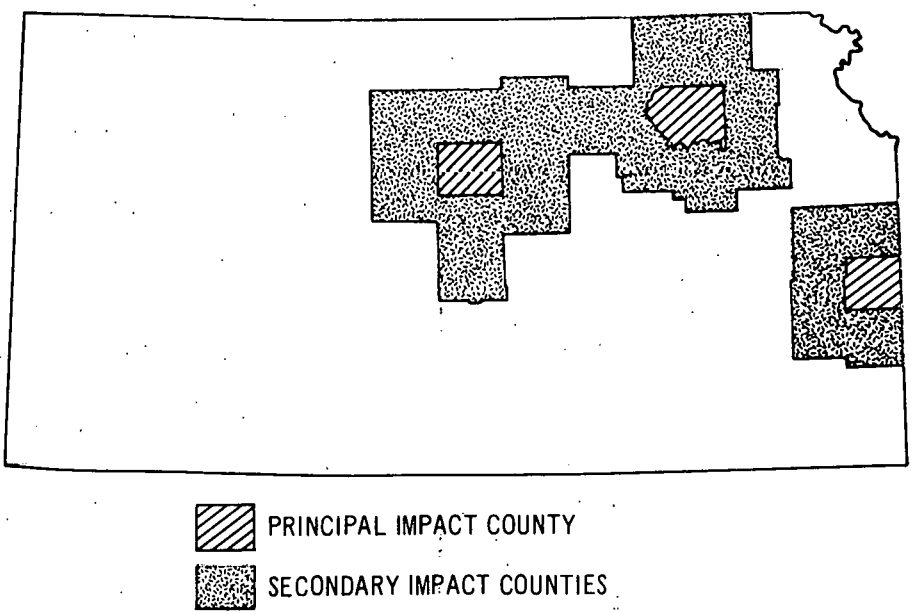

Fig. 6.7. Kansas Counties Potentially Subject to Socioeconomic Impact

6.5.2 Background Issues

- Local socioeconomic impacts are defined by the demographic, economic, and social changes expected with siting, construction and operation of energy generating facilities. The interdependence 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:[12,13]
  - 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 expand 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 fighters, 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, less 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% range of increase, the 10% figure used in this analysis is based on Gilmore's study, which indicates that such a change is sufficient to result in social problems such as increased crime, divorce, out-migration, and labor turnover.

- The capacity for 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 capacity can absorb, without adverse population 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 Kansas counties identified for future energy developments have either a low or extra-low assimilative capacity.

- Kansas contains a 10 high assimilative capacity counties, 15 moderate, 17 low and 63 extra-low. These correspond to 22% of the high assimilative capacity counties in the region, 23% of the moderate, 15% of the low and 34% of the extra-low assimilative capacity counties.

6.5.3 Scenario-Induced Changes

- Three counties in the northeast and central parts of the state are likely to experience adverse socioeconomic impacts as a result of projected energy development. Lincoln, Linn, and Pottawatomie Counties are projected to absorb 5,200 new temporary workers, of which 540 are expected to be retained for employment in the operations phase. This permanent work force corresponds to 1,020 new individuals or 445 households (Figs. 6.8-6.10).

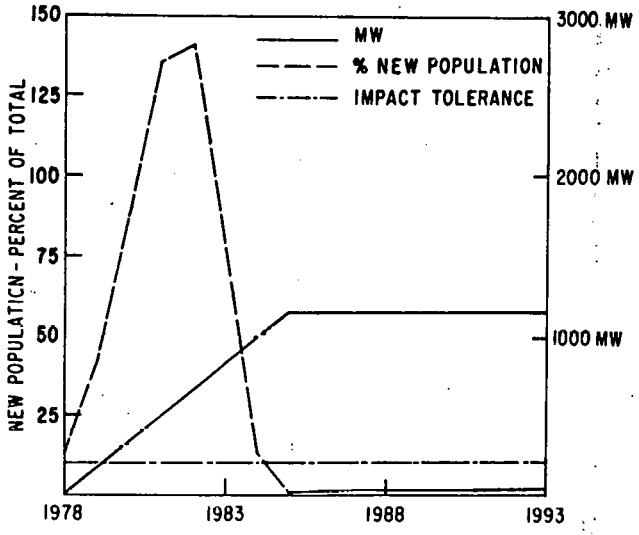

Fig. 6.8. Potential In-Migration into Lincoln Co., Kansas (Extra-Low Assimilative Capacity)

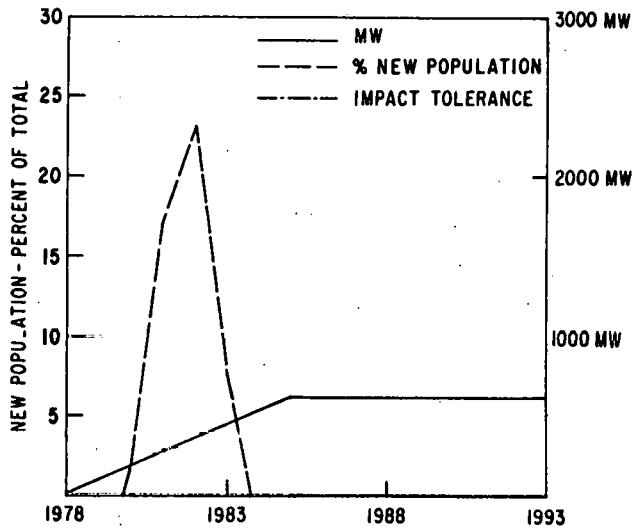

Fig. 6.9 Potential In-Migration into Linn Co., Kansas (Extra-Low Assimilative Capacity)

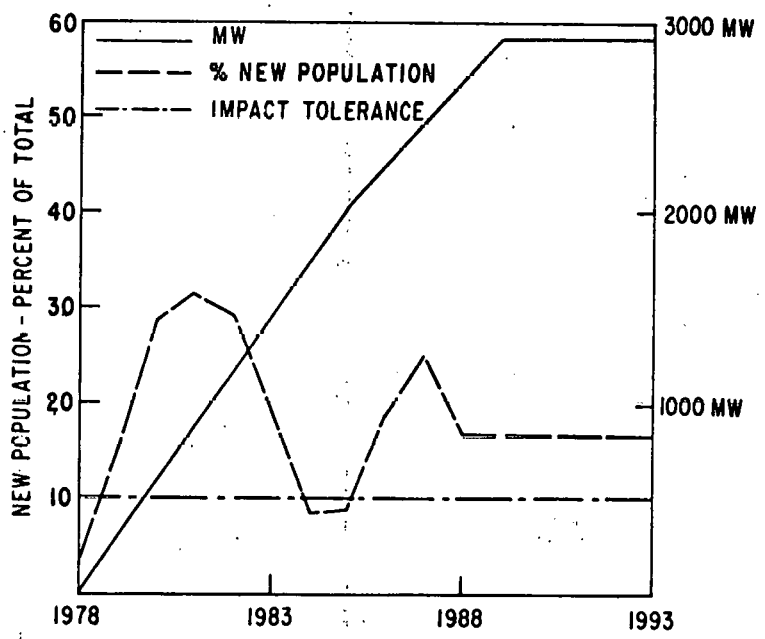

Fig. 6.10. Potential In-Migration into Pottawatomie Co., Kansas (Extra-Low Assimilative Capacity)

- Linn and Pottawatomie Counties could incur 23% and 32% increases in their baseline population as a result of the new facilities. The ability to absorb the new population and the public and private service demands may be greater than projected since the counties are adjacent to a large standard metropolitan statistical area.

- Lincoln County is expected to be most severely affected since it could experience a 140% increase in population during the construction phase of the proposed nuclear development. However, since manpower requirements during the operations phase are drastically smaller, the long-term population increase should only be approximately 1%.

- When the average regional public costs for the particular size and type counties are calculated, the new permanent residents (540) may incur additional public costs in excess of $575,000 annually.

- There is presently no state infrastructure for the mitigation of these impacts.

- According to the scenario, the three identified counties will be the construction sites for 87% of the coal and 100% of the nuclear generating capacity increases projected for Kansas by 1990. Thus, 79% of the total projected energy growth may cause adverse socioeconomic impacts.

6.6 HEALTH AND SAFETY IMPACTS

- The low levels of coal extraction, oil production and refining, and decreasing amounts of natural gas production are not likely to create a significant number of occupational health impacts in Kansas. The low risk nature of electricity generation will keep all energy-related occupational health impacts negligible in Kansas.

- As a result of sulfur controls, public health impacts from sulfates resulting from fossil fuel use will be minimal in Kansas despite a 70% increase in fossil fueled electricity generation.

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The scenario projected an additional 6216 MW of electrical generating capacity in Missouri by 1985 and 8474 MW by 1990 (Table 7.1). Coal production (all from surface mines) is projected to decrease from 5.7 million tons/year in 1975 to 4.4 million tons/year in 1985 and 4.2 million tons/year in 1990. The impacts discussed in the following sections are summarized in Table A-3.

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

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	3723	1277	-154	1150	220	0	6216
1975-1990	4023	3230	-176	1150	247	0	8474

[a]Base year: 1975

[b]Includes conventional hydro and pumped storage.

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

7.1 AIR QUALITY/VISIBLITY IMPACTS

- Despite enforcement of the SIP, TSP levels could remain in violation of primary standards or even deteriorate with the scenario-projected increases. These violations may occur in the St. Louis AQCR and in a portion of the northern AQCR (Fig. 7.1).
- All of the state's industrial growth is projected for nonattainment areas.
- Projected utility increases in southern counties could be subject to visiblity protection statutes.

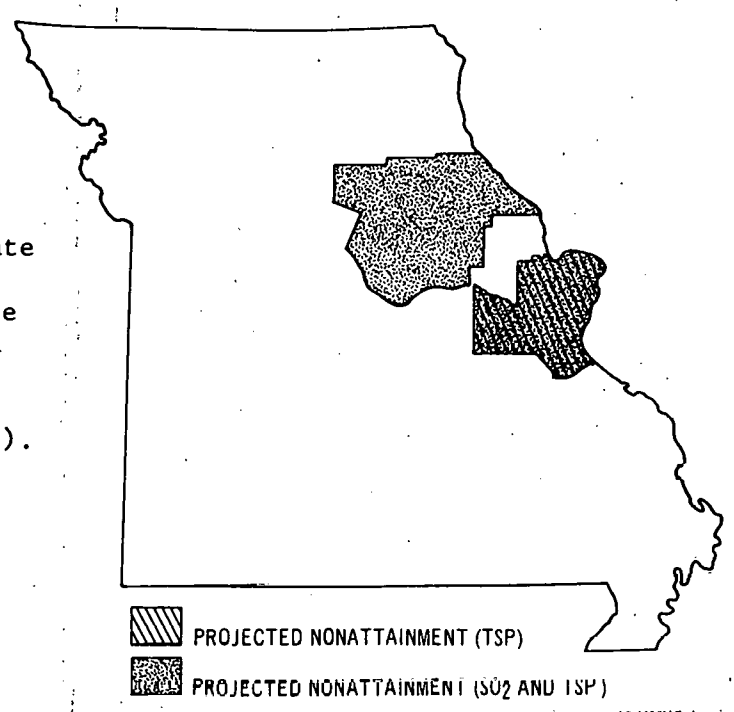

Fig. 7.1. Missouri - Potential Air Quality Impact Areas

7.1.1 Description

Ninety percent of the state's electrical output is generated from coal. Most of Missouri's coal is used for mine-mouth steam electric power generation; the rest of the coal burned in the state is imported from the Midwest, Wyoming, and Oklahoma.[14]

Missouri has two counties that have not achieved primary sulfur dioxide standards and seven counties that have at least partial nonattainment designations for TSP. Air quality problems are most pronounced in the metropolitan St. Louis area and in surrounding counties.

There are two national parks in Missouri, totaling over 20,000 acres, which are subject to PSD Class I air quality limitations. These areas are located on the southern border of the state.

7.1.2 Background Issues

- Violations of primary and secondary SO_2 and TSP standards are presently occurring in the St. Louis area.
- Visibility-protected areas in the southern part of the state have the potential for affecting development in this area.

7.1.3 Scenario-Induced Changes

- Approximately one-fourth of the state's projected coal growth is sited in nonattainment areas and could be restricted by air quality regulations. These areas are located in the metropolitan St. Louis Interstate AQCR.

- All of the projected increases in industrial fuel uses are sited in the metropolitan St. Louis Interstate and the northern Missouri AQCRs.

7.2 WATER QUALITY/AVAILABILITY ISSUES

- Effluents from projected energy-related activities would contribute minimal additions that should not result in additional stream violations or alter waste load allocations. Sufficient water exists in areas projected for energy increases to serve energy and other users, and the impact of additional mining activity in the northwestern counties will be minimal if Best Management Practices[15] and the state's strict mining laws relating to water quality are followed.

7.3 SOLID WASTE IMPACTS

- Industrial solid waste generation will increase by nearly 300%; however, no significant problems are foreseen (Fig. 7.2).

- Solid waste disposal problems should not constrain utility development, although transportation costs may increase.

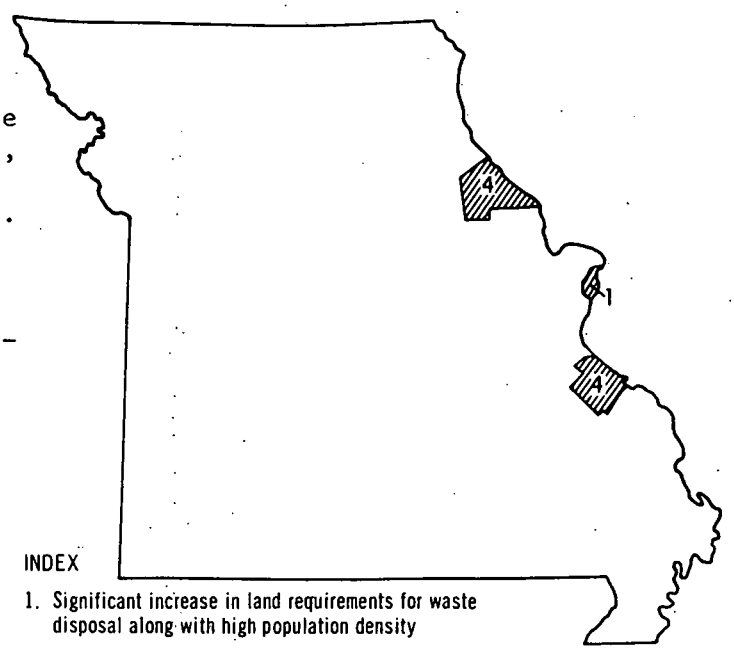

Fig. 7.2. Missouri Counties Potentially Subject to Solid Waste Impacts

7.3.1 Background Issues

- In the southern half of the state, the permeable limestone topography makes it difficult to find environmentally acceptable landfill sites.
- Industrial coal use was slightly greater than 1 million tons in 1975 and less than 2 acres was required for land disposal.

7.3.2 Scenario-Induced Changes

- Industrial coal use will almost double and residuals will increase by almost 300% according to the scenario. No significant solid waste disposal problems are foreseen, however (Fig. 7.3).
- Land requirements for industrial waste disposal are projected at 10 acres per year (Fig. 7.4).
- Indicators show three counties where disposal of industrial wastes might be difficult.
- Solid waste disposal problems should not constrain projected utility development, although additional costs may be incurred for waste transportation or landfill liners in environmentally sensitive areas.

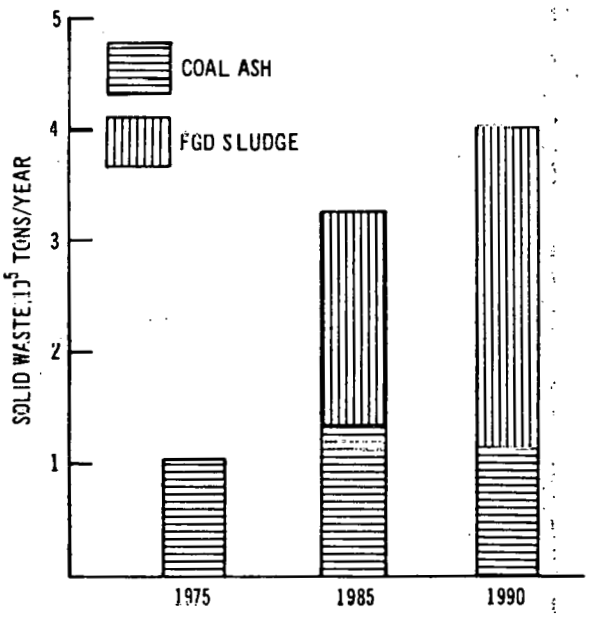

Fig. 7.3. Missouri - Solid Waste Generation from Industrial Coal Use

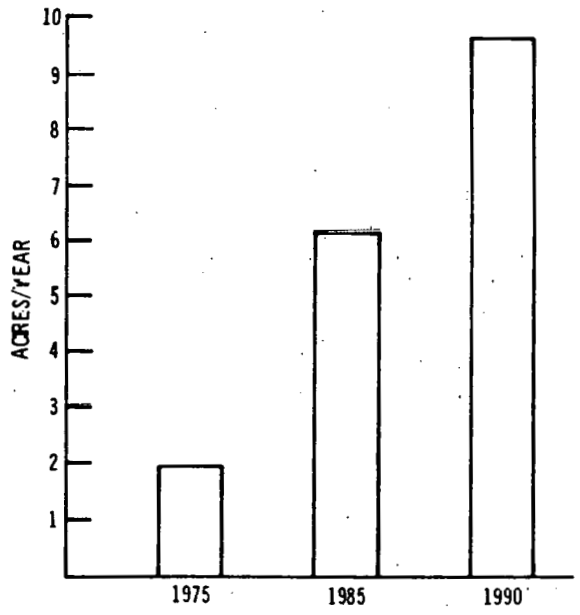

Fig. 7.4. Missouri - Total Area Used for Industrial Ash and Sludge Disposal

7.4 ECOLOGICAL AND LAND USE IMPACTS

- Surface mining activities are projected to disturb 21,000 acres by 1990. Agricultural lands are most likely to be affected.
- New power generating facilities could require the conversion of agricultural land and natural habitats (Fig. 7.5).

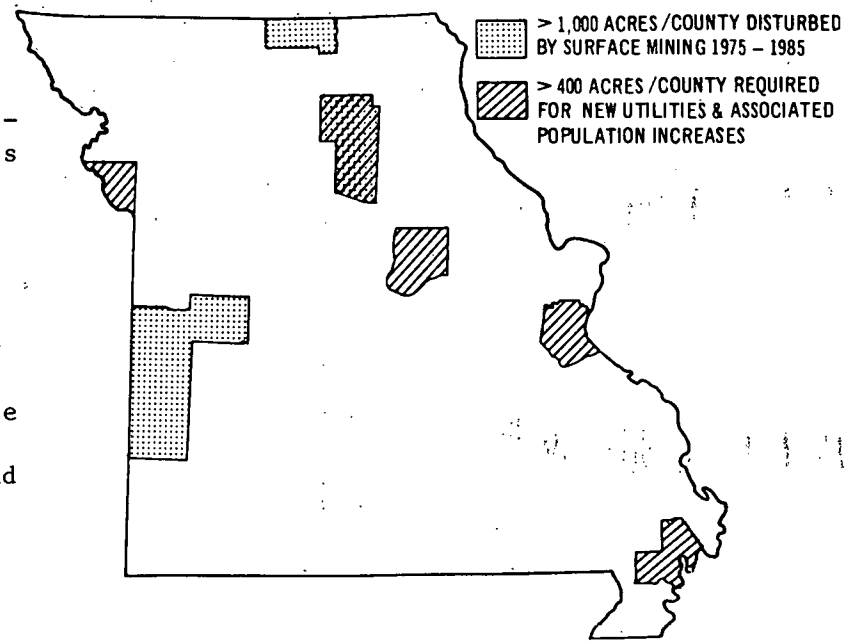

Fig. 7.5. Areas with Greatest Potential for Ecological Impacts - Missouri

7.4.1 Description

Forty-seven percent of Missouri is cropland. The major crops are soybeans and corn, and it is the only state in the region where cotton is grown (300,000 acres). The Ozarks in the southeastern part of the state are largely forested with 1.4 million acres of National Forest. The recreational value of these lands is high.

7.4.2 Background Issues

- Land use control is not favored in Missouri, and the county zoning ordinances that do exist contain many exceptions for strip mining and public utilities. Therefore, siting of new facilities may not be a major issue at the local level.

7.4.3 Scenario-Induced Changes

- Surface mining of coal is projected to occur in the northern and western parts of the state, where croplands dominate land use. It is projected that about 15,000 acres will have been disturbed from 1975 to 1985, and 21,000 acres by 1990 (Fig. 7.6). Land use by surface mining is projected to drop from 1600 acres per year in 1975 to about 1200 acres per year in 1990. Reclamation of agricultural lands to their original row crop productivity will be costly.

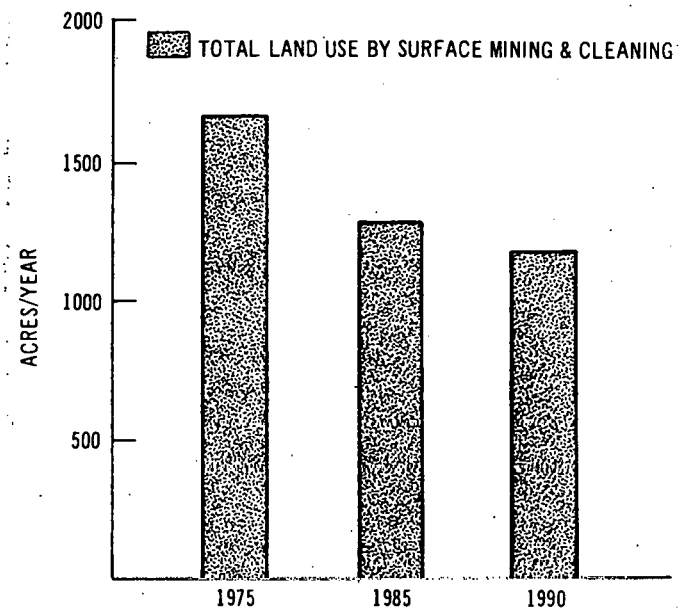

Fig. 7.6. Missouri - Land Use for Coal Production

- New utilities projected by the scenario are likely to disturb both farmlands and natural habitats.

- Projected mine-mouth coal-fired plants could require longer transmission distances to the major urban load centers. Transmission lines may cause long-term disruption of some agricultural activities such as center-pivot irrigation systems, crop dusting, and the use of large farm equipment.

- Sulfur dioxide levels high enough to cause damage to vegetation are projected for the St. Louis and Kansas City areas, but there is little acreage in SO_2-sensitive crops in the affected region.

7.5 SOCIOECONOMIC IMPACTS

- Severe socioeconomic impacts are projected for one scenario-defined site for energy development in Missouri (Fig. 7.7). 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.

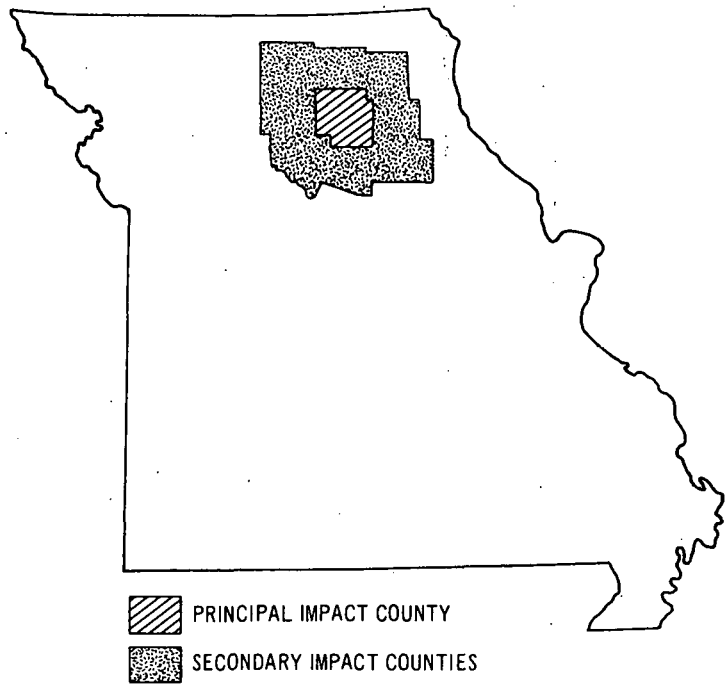

Fig. 7.7. Missouri Counties Potentially Subject to Socioeconomic Impacts

7.5.1 Description

The population of Missouri is 4.7 million with a density of 69 people per square mile. The primary employment sector is trade, followed by manufacturing and the mineral processing industries. The manufacturing industries (largely aircraft and chemical processing) generate the greatest income; they are located primarily in the St. Louis area and thereby utilize the intersecting transportation networks of rail, highway and water.[10]

7.5.2 Background Issues

- Missouri has 14 high assimilative capacity counties, 23 moderate, 35 low, 43 extra-low. This corresponds to 31% of the high assimilative capacity counties within the region, 35% of the moderate, 31% of the low, and 23% of the extra-low.

- The Missouri counties identified as projected sites for future energy developments have either a low, moderate, or high assimilative capacity.

7.5.3 Scenario-Induced Changes

- The majority of the projected developments are expected to generate no adverse socioeconomic impacts since they are sited in counties more capable of absorbing the required population growth and public service demands.

- Severe socioeconomic impacts are likely in one county (Macon) where about 7% of the total energy growth (14% of the projected increase in coal-fired capacity) projected for the state is sited (Fig. 7.8). An in-migration of 1,027 basic workers could be required. This would increase the county population by 1,951, or nearly 12%.

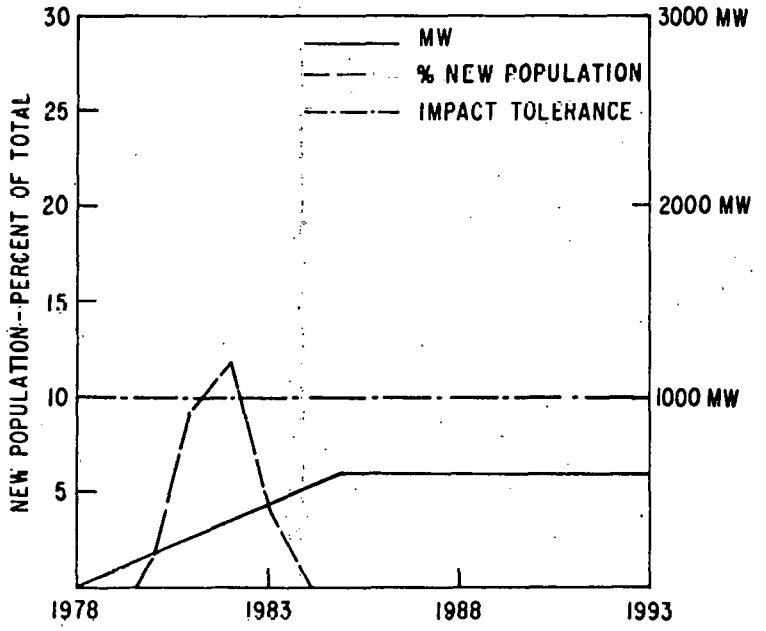

Fig. 7.8. Potential In-migration into Macon Co., Missouri (Low-Assimilative Capacity)

- Since new energy facilities are also projected for adjacent counties, the potential is high for larger and more severe regional imacts than calculated in this analysis. The actual siting pattern and staging of these facilities are crucial factors in determining the extent of impact.

- No infrastructures are currently established to mitigate the potential for socioeconomic impact. Many of the adjacent counties may experience similar effects on a small scale and without proper management, control, and planning these could also suffer adverse impacts.

7.6 HEALTH AND SAFETY IMPACTS

- Energy related occupational health impacts in Missouri are likely to be minimal.

- Despite a 40% increase in fossil fuel electricity generation, deaths from sulfate exposure are expected to decrease 20% because of sulfur emission controls.

7.6.1 Background Issues

- Ground water supplies in heavily industrialized portions of St. Louis and Jefferson County have been contaminated by industrial wastes.[16]

- St. Louis, Jefferson, Franklin, and St. Charles counties in eastern Missouri, all heavily populated areas, have been designated nonattainment areas for primary oxidant standards.[8]

- Cardiovascular and respiratory diseases, both subject to aggravation by fossil fuel atmospheric emissions, accounted for 61% of total deaths in Missouri in 1973.[17]

7.6.2 Scenario-Induced Changes

- Occupational health impacts from fossil fuel extraction and conversion to electricity are expected to be small in Missouri. Low levels of oil, gas, and coal extraction and use of lower-risk surface coal mining techniques will keep impacts minimal.

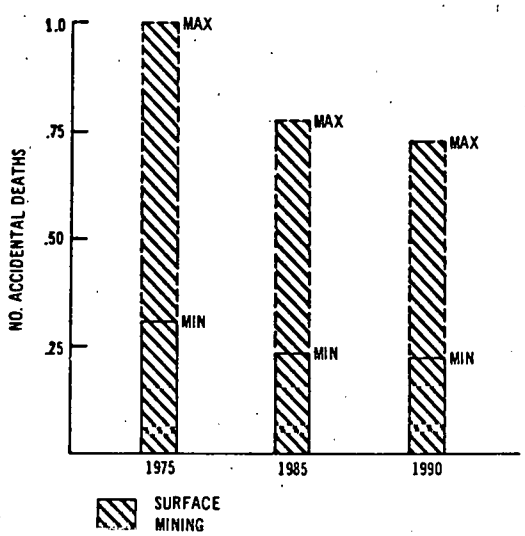

Fig. 7.9. Range of Potential Accidental Deaths in Missouri Coal Mines Due to Implementation of the Mid-Mid Scenario

- Despite a 26% decrease in coal production, coal mining will account for the majority of energy-related occupational health impacts in Missouri (Fig. 7.10).

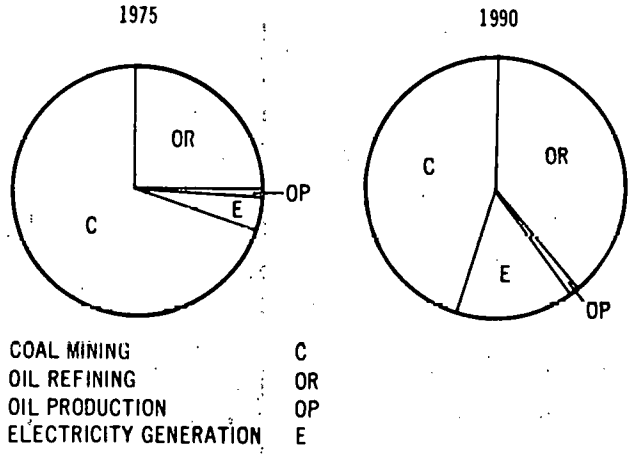

Fig. 7.10. Relative Contributions of Major Energy Activities to Energy-Related Occupational Deaths in Missouri under the Mid-Mid Scenario

- Public deaths from sulfate exposure will decrease by approximately 20% during the scenario time frame because of sulfur emission controls (Fig. 7.11).

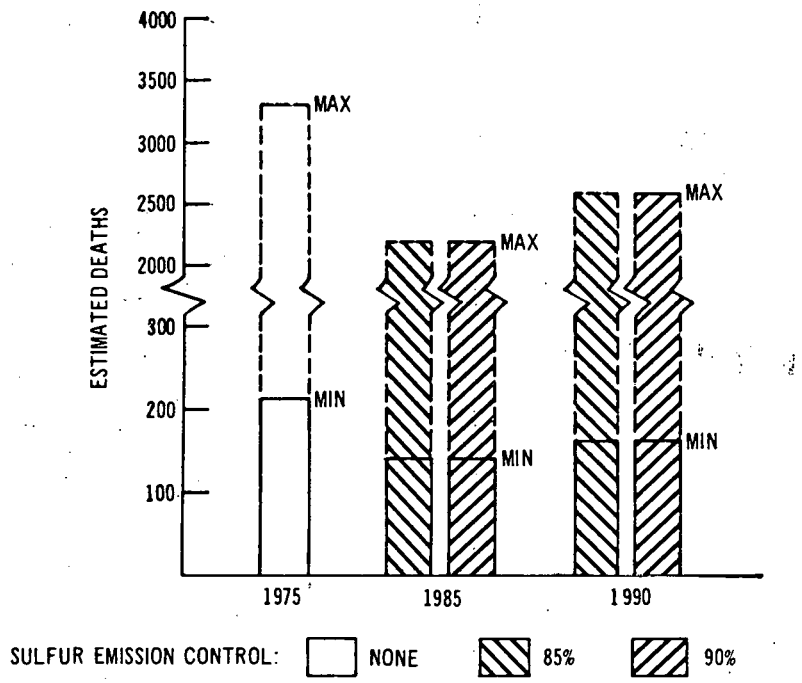

Fig. 7.11. Estimated Range in Deaths in Missouri from SO_4 Exposure Due to Utility and Industrial Fossil Fuel Use Under the Mid-Mid Scenario

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8 NEBRASKA

The scenario projects an additional 2,796 MW of electrical generating capacity in Nebraska by 1985 and 4,734 MW by 1990 (Table 8.1). No coal mining is projected to occur in the state. The impacts discussed in the following sections are summarized in Table A-4.

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

Period	Coal	Oil	Gas	Nuclear	Hydro[b]	Other[c]	Total
1975-1985	1792	70	-68	0	1002	0	2796
1975-1990	1955	634	-68	1150	1063	0	4734

[a]Base year: 1975.

[b]Includes conventional hydro and pumped storage.

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

8.1 AIR QUALITY/VISIBILITY IMPACTS

- Eastern border counties are likely to experience increasing levels of particulates. Ambient TSP concentrations, already over primary standards, could increase despite emission reductions obtained by enforcement of the SIP (Fig. 8.1).

- Continued violations of air quality standards could restrict one-third of proposed coal growth, most of which will occur in the southern part of the state.

8.1.1 Description

Coal burned in Nebraska is typically low in sulfur content (less than 0.8%); the state receives most of its coal from Wyoming, with small amounts imported from Kansas, Utah, and Colorado.[14] There are currently no violations of primary SO_2 standards in the state; three counties on the central eastern border are in violation of primary NAAQS for TSP.

8.1.2 Background Issues

- Nebraska has naturally high levels of particulates due to fugitive dust, wind, and drought.

- Several counties in the eastern part of the state have persistent particulate problems.

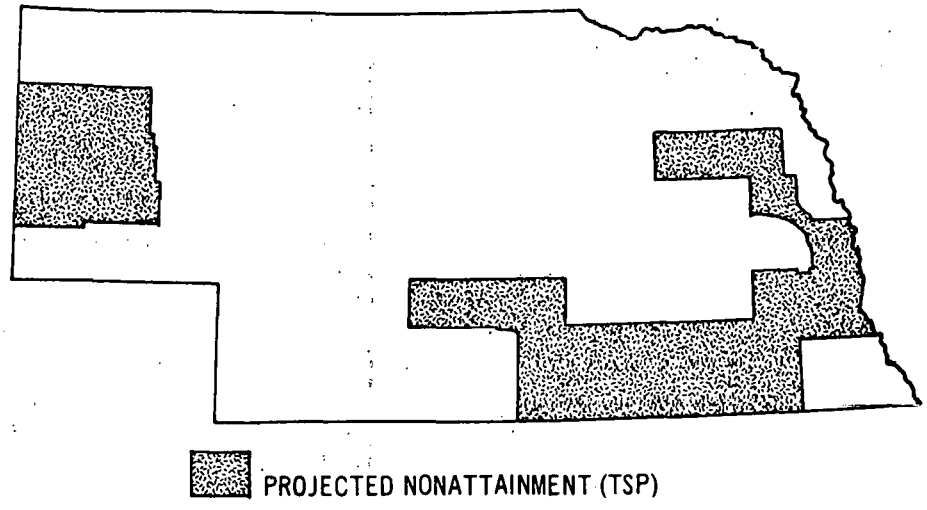

Fig. 8.1. Nebraska - Potential Air Quality Impact Areas

8.1.3 Scenario-Induced Changes

- 1990 TSP violations of NAAQS are projected to continue mostly in the eastern half of Nebraska. One-third of the scenario-projected increases in coal-fired generating capacity and nearly two-thirds of the projected oil capacity is sited in nonattainment areas (Omaha-Council Bluffs Interstate and the Lincoln-Beatrice-Fairburg Interstate AQCDs). Selective fuel purchasing policies will mitigate air quality problems caused by emissions.

- Over 80% of the proposed industrial growth in Nebraska will occur in nonattainment areas. Fuel use, emission limitation, and offset requirements may be necessary for these plants to meet new source review requirements.

8.2 WATER QUALITY/AVAILABILITY ISSUES

- Severe fluctuations in flows along the Platte River and high demand for water by agriculture may require additional storage capacity in the Platte River Basin (Fig. 8.2).

8.2.1 Description

Nebraska's water resources are under heavy demand from agriculture.[18] Irrigation with surface water is extensive throughout the state, and use of ground water is increasing, particularly in the western and central areas where pivot irrigation sytems have become widespread.

Water for energy development may conflict with agricultural demand and could become a site specific issue. Currently, 95% of cooling water for the power industry is provided by surface waters. The prevalent opinion in the state is that the discharges most likely to affect water quality are from power plants.

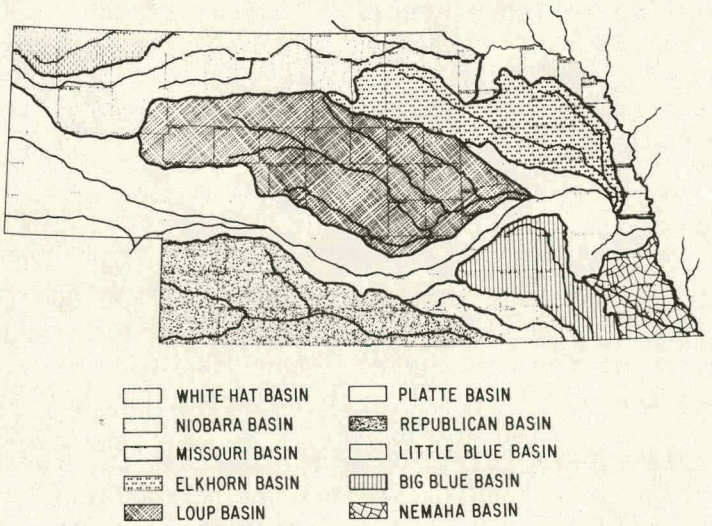

Fig. 8.2. Nebraska River Basins

8.2.2 Background Issues

- During summer low flows, many Nebraska rivers, particularly the Platte, are intermittent. Pooling is common and available flows are due to effluents and irrigation return flows.

- Nebraska water quality agencies are considering waste load allocation plants designed to reduce the impact of effluents during low flows. Advanced waste treatment and extensive holding ponds are under consideration.

- The state has not developed an assessment of the level of trace metals in streams and, therefore, no analysis of this problem is available.

- Effluent limitations for the power industry require off-stream cooling for facilities constructed after 1974.

- Under Nebraska water-rights laws, domestic uses of water have preference over all other uses; agricultural uses have priority over manufacturing and electricity generation.

8.2.3 Scenario-Induced Changes

- Scenario-projected energy development may affect agricultural water use in the Platte River Basin. Existing reservoirs were constructed for irrigation water storage and may be inadequate for the projected energy increase. Sufficient surface supplies exist for the projected increase in the eastern Nebraska area.

8.3 SOLID WASTE IMPACTS

- Industrial coal use, even with large projected increases, will be low relative to other states. Indicators do not show any counties likely to experience problems disposing of the residuals.

- Acreage requirements for utility waste disposal are low and should not pose significant problems

8.3.1 Background Issues

- Present industrial coal use is less than 200,000 tons per year (compared to 17 million tons per year for Ohio and even 2 million tons per year for Minnesota). Land use for waste disposal is less than two-tenths of an acre per year.

- The Platte River Valley, from the western tip to the mouth, is not a desirable location for solid waste disposal. The area is productive agriculturally, and the groundwater level is often only 6-10 feet below the surface.

8.3.2 Scenario-Induced Changes

- Installed coal-fired utility capacity is projected to double to 3,000 MW by 1990. Land use requirements for waste disposal are estimated at 18 acres per year or about 550 acres for the lifetime of the plants. Land use for disposal will not exceed 250 acres in any single county.
- Assembling enough land at new plants for on-site disposal is not a problem. Although solid waste may have to be hauled off-site at older plants, the greater quantity of open space near even metropolitan areas usually allows for disposal relatively close to the plant.
- Industrial coal use is expected to increase by nearly 800% for the period 1975-1990; however, this still only amounts to 1.4 million tons per year (compared to 21 million tons per year for Ohio) (Fig. 8.3).
- Land requirements for industrial disposal are projected at less than 2 acres per year (Fig. 8.4).
- Criteria relating to land availability and adequacy of sewer systems do not indicate any counties likely to experience problems.

8.4 ECOLOGICAL AND LAND USE IMPACTS

- Projected increases in generating capacity in Nebraska are relatively small and would likely require the conversion of cropland or rangeland. The state contains critical habitats for the whooping crane, an endangered species; concern for preservation of this habitat may be a site-specific issue for projected energy development. Sulfur dioxide concentrations high enough to cause damage to soybean, wheat, and hay crops are projected to continue at their 1975 level or increase in the Omaha area.

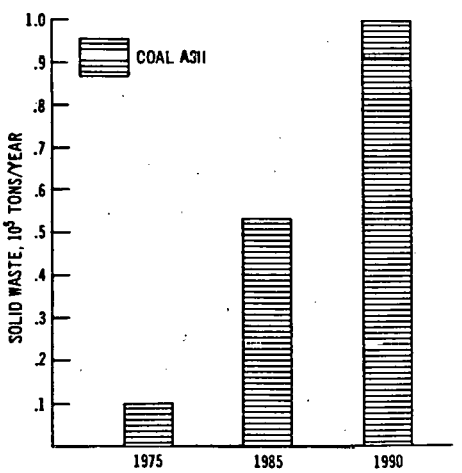

Fig. 8.3. Nebraska - Solid Waste Generation From Industrial Coal Use

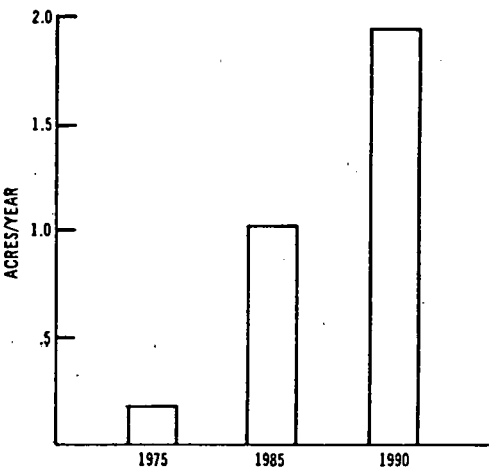

Fig. 8.4. Nebraska - Total Area Used For Industrial Ash And Sludge Disposal

8.5 SOCIOECONOMIC IMPACTS

- Severe socioeconomic impacts are projected for three scenario-defined energy development sites in Nebraska (Fig. 8.5). 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.

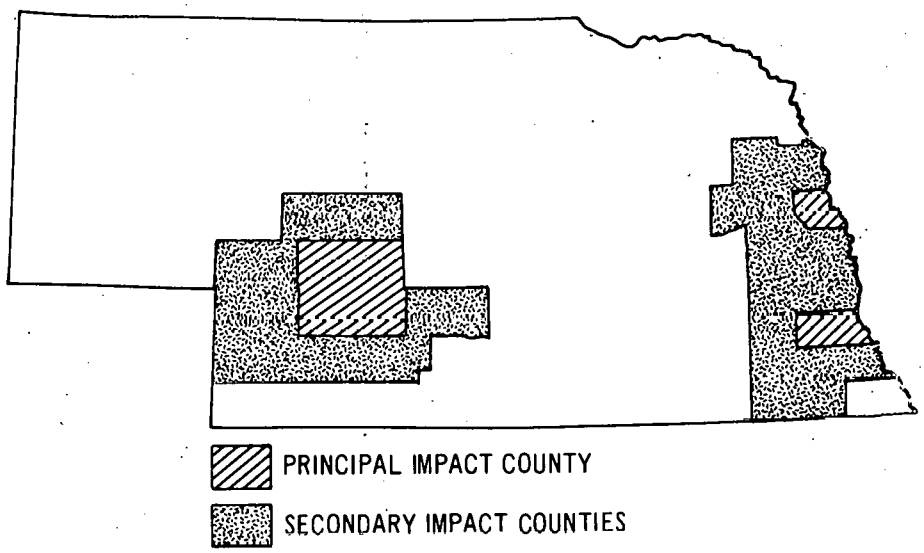

Fig. 8.5. Nebraska Counties Potentially Subject to Socioeconomic Impact

8.5.1 Description

Nebraska ranks among the top ten states in the country in agricultural production. Manufacturing, trade, food, and farm-related industries provide a high percentage of the employment. To supply the energy for these economic sectors and the population, Nebraska relies on two large electric power companies in the southeastern and central portions of the state.

The state population is 751,000 or 10 people per square mile, and per capita income is $6,016, with half of the total labor force employed in small independent industries. Since 1970, the size, employment, and value-added of these establishments has increased by more than 35%.[10]

8.5.2 Background Issues

- Nebraska contains four high assimilative capacity counties, 8 moderate, 15 low and 66 extra-low. This is equivalent to 9% of the high assimilative capacity counties in the region, 12% of the moderate, 13% of the low, and 35% of the extra-low.

- The Nebraska counties identified for future energy developments have either a low or extra-low assimilative capacity.

8.5.3 Scenario-Induced Changes

- Projected energy developments are sited in the eastern and southwestern quadrants of the state, which have principally low and extra-low assimilative capacity counties. Of the affected counties, Lincoln, Otoe, and Washington counties are suffering from a declining basic workforce, which is not expected to supply the required manpower during construction of the projected nuclear and coal facilities (Figs. 8.6 - 8.8). 12,000 new in-migrants are calculated to remain for two or three years, which could cause a severe financial and cultural strain on these small farm communities.

- Lincoln County could require a long-term population increase of 1% during the operation period.

- When the average regional public costs for the particular size and type of counties are calculated, the new permanent residents (365) may incur additional public costs in excess of $210,000 annually.

- There are no infrastructures presently established to mitigate either the construction or long term (operation) increases in population and their coexistent socioeconomic impact.

- The scenario sites 85% of the projected 1990 coal-fired capacity increases and 100% of the nuclear increases for the state within these three counties. This corresponds to 58% of the total generating capacity increases sited in Nebraska by the scenario.

8.6 HEALTH AND SAFETY IMPACTS

- Energy related occupational health impacts are expected to be minimal in Nebraska because of low levels of electricity generation and natural gas production and no coal extraction. The moderate levels of oil production and refining projected in Nebraska present relatively low health risks.

- Public health impacts from sulfur released through fossil fuel use will be minimal because of low levels of utility and industrial fossil fuel use.

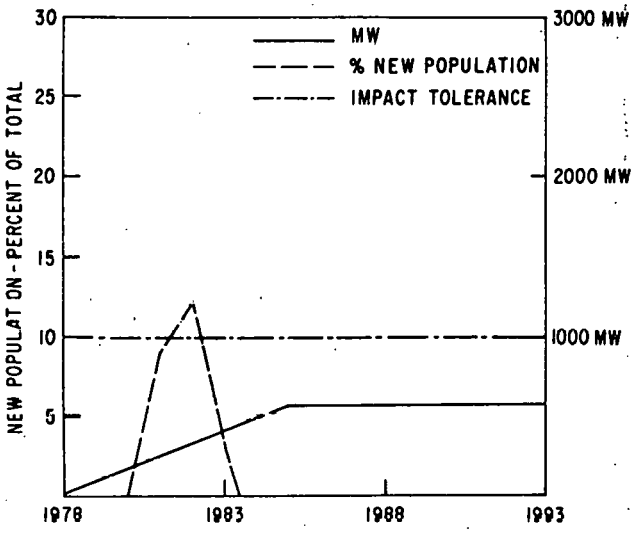

Fig. 8.6. Potential In-Migration into Otoe Co., Nebraska (Low Assimilative Capacity)

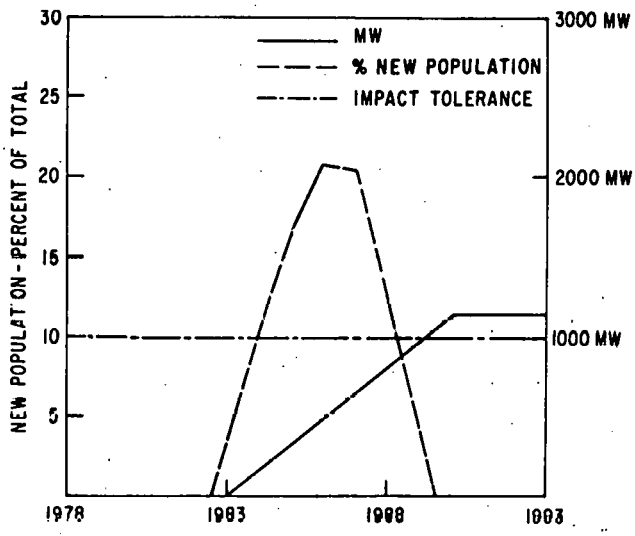

Fig. 8.7. Potential In-Migration into Washington Co., Nebraska (Low Assimilative Capacity)

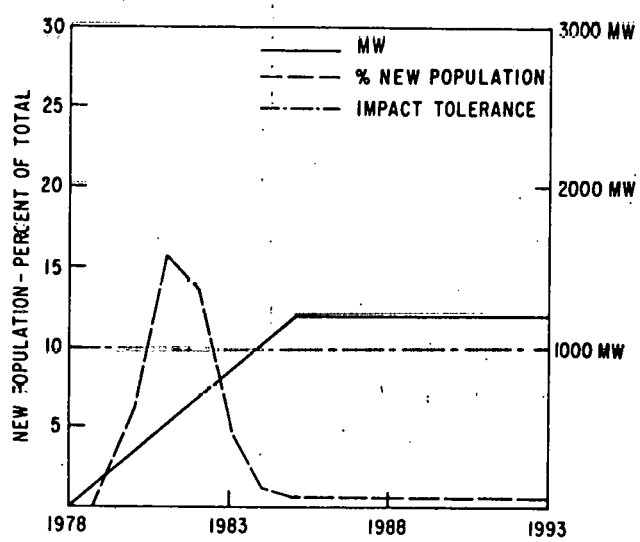

Fig. 8.8. Potential In-Migration into Lincoln Co., Nebraska (Moderate Assimilative Capacity)

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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 - Iowa[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	L		
-Oil	M[d]						L	L		
-Gas	L						L			
-Nuclear	L		H				L	L		
-Combined Cycle										
-Solar										
-Hydro										
General:										
-Utility	M		H	M	L		L	L	L	L
-Industry	H		L	M		L		L		
-Mining	L		L	L	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.

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

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

Table A-3. Environmental Impacts of the EIA Trendlong Mid-Mid Scenario at the State Level - Missouri[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		M
-Oil	L						L	L		
-Gas	L						L			
-Nuclear	L						L	L		
-Combined Cycle	M									
-Solar										
-Hydro										
General:										
-Utility	M	L	L	L	L	L	L	L	M	M
-Industry	H	L	L			L		L		
-Mining	L	L	L	M	M		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 - Nebraska[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	M						L	L	M	
-Oil	M[d]						L	L		
-Gas							L			
-Nuclear	L						L	L	M	
-Combined Cycle										
-Solar										
-Hydro										
General:										
-Utility	M	L	H	M	L	L	L	L	M	M
-Industry	H	L	L	M		L		L		
-Mining	L	L	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.