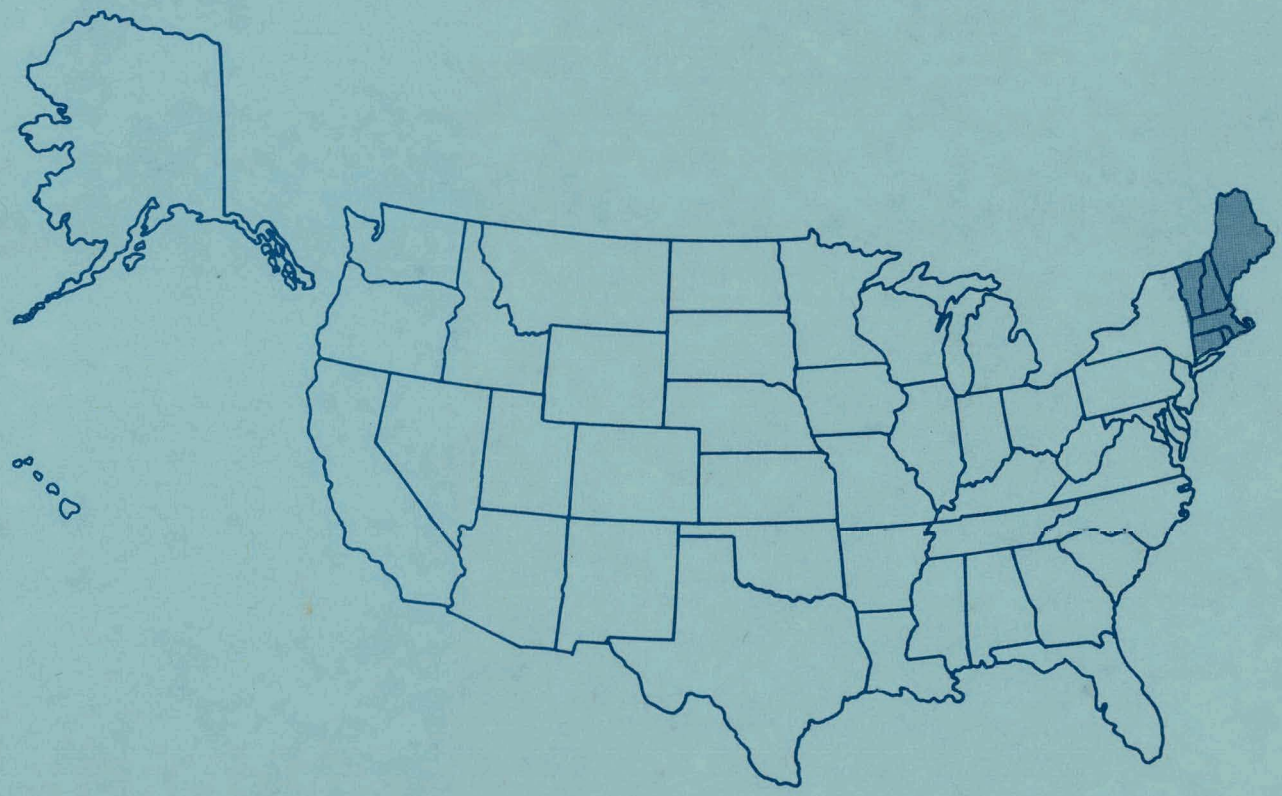
BNL 51135

DEPARTMENT OF ENERGY

REGIONAL ISSUE IDENTIFICATION AND ASSESSMENT PROGRAM (RIIA)

ENVIRONMENTAL IMPACTS AND ISSUES OF THE EIA MID-MID SCENARIO: FEDERAL REGION I (NEW ENGLAND)



BROOKHAVEN NATIONAL LABORATORY

PREPARED FOR THE DEPARTMENT OF ENERGY UNDER CONTRACT NO. DE-AC02-76CH00016

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BNL 51135
UC-13
[General, Miscellaneous, and Progress
Reports (Nonnuclear) - TID-4500]

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ENVIRONMENTAL IMPACTS AND ISSUES OF THE EIA MID-MID SCENARIO: FEDERAL REGION I (NEW ENGLAND)

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April 15, 1979

DIVISION OF REGIONAL STUDIES
NATIONAL CENTER FOR THE ANALYSIS OF ENERGY SYSTEMS
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK

PREPARED FOR THE
REGIONAL ASSESSMENT DIVISION
OFFICE OF TECHNOLOGY IMPACTS
U.S. DEPARTMENT OF ENERGY

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Printed in the United States of America
Available from
National Technical Information Service
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
Price: Printed Copy ~~$5.25~~; Microfiche ~~$3.00~~

A04 A01

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ACKNOWLEDGMENTS

The authors acknowledge the many contributions of their colleagues at Brookhaven who have contributed to the preparation of this report, especially F. Lipfert, L. Kleinman, R. Cederwall and R. Meyers for contributions to air quality analysis; E. Kaplan for water quality analysis; T. Le for solid waste analysis; S. Morris and K. Novak for health effects; C. Bryant for institutional analysis, and W. Metz for socioeconomic impact analysis. J. Carroll of the University of New Hampshire, M. Lapping of the University of Vermont, and J. Edinger of J. Edinger Associates also made significant contributions. We are indebted, as usual, to R. Stern for his assistance with graphics and report production, and to M. Bruck and B. Franz for typing.

A. Katz, of the Regional Assessments Division, U.S. Department of Energy, served as the sponsor's project officer; his guidance and support is gratefully appreciated.

As usual, however, the responsibility for the accuracy and content of the report is solely that of the authors.

MAJOR FINDINGS

The EIA MID-MID scenario generally reinforces existing environmental concerns in the region. This results in part from the emphasis on existing rather than new energy technologies.

- The widespread public opposition to nuclear power in the region is likely to constrain realization of the nuclear goals of the scenario (51% of regional capacity by 1990 versus 25% nationwide). The need for federal action to solve the radioactive waste disposal problem cannot be overemphasized.
- Half of the coal conversions in the scenario, under the Energy Supply and Environmental Coordination Act, will be constrained by local air quality and solid waste concerns.
- About a 30% improvement in sulfur oxides air quality is projected for the region based on emissions reductions both within the region and in upwind states. These reductions are premised on the assumptions that current State Implementation Plans will be met by 1985 in all areas of the country and that, for new facilities, the proposed New Source Performance Standards will be implemented. Nitrogen oxides air quality, however, will not show comparable improvements.
- Maine is the only state showing a significant increase in SO_2 concentrations, due primarily to the 1100 MW of coal capacity shown for Waldo County. Acadia National Park (one of four mandatory Class I PSD areas in the region) is close enough to this plant to warrant a detailed analysis of compliance with Class I PSD increments for SO_2.
- Several important institutional issues will affect realization of scenario goals, including construction work in progress, conflicts over consumptive water use and the riparian water rights doctrine, and the issue of federal preemption in regulating the transport of radioactive materials.
- With the improvement in sulfur oxides air quality, health effects related to sulfate exposure are also expected to decrease by some 40%, although impacts due to other pollutants

were not quantified. Radiation-induced cancers due to nuclear power plant operation are projected to increase, but, because their absolute levels are small, they are likely to constrain the scenario only as a result of public perception of risk rather than actual risk.

These impacts are discussed further in the sections that follow:

Nuclear: The scenario postulates five major new nuclear facilities in the region, corresponding to the utility-planned Montague 1, Millstone 3, Pilgrim 1, Seabrook 1, and NEP 1 units. This would result in some 51% of electric energy generated by nuclear power in the region by 1990, versus 25% nationwide. Every one of these facilities must be expected to encounter significant licensing delays as a result of widespread opposition present even before the Three Mile Island accident. The most tangible issue, one seized upon by many public figures and environmental agencies, is the radioactive waste disposal problem, which is perceived as being a federal responsibility. Already a flood of municipal ordinances preclude shipment of radioactive wastes through the areas of their jurisdiction--some 50% of all Vermont towns have such regulations--and, even if they do not stand the test of the federal preemption doctrine in nuclear regulation matters, they remain a good indicator of widespread public concern. The urgency of federal action to resolve the radioactive waste management problem cannot be overemphasized.

Coal: Only one major new coal plant is postulated by the scenario for the region, an 1100 MW plant in Waldo County, ME, corresponding to the utility-planned Sears Island unit.* Its location happens to be close to one of four Mandatory Class I areas in the region (Acadia National Park) and our analysis indicates that this area may be expected to incur a Class I PSD SO_2 increment exceedance by 1990.

The level of coal conversions under the Energy Supply and Environmental Coordination Act is also highly problematic. Of the 2.49 GW of such conversions postulated in the scenario, only 1.11 GW at Brayton Point in Bristol County, MA, is likely to occur. The others are likely to be constrained on a variety of grounds, especially those in Middletown and Norwalk Harbor, in southeastern Connecticut, that are located in TSP non-attainment areas, and the Mt. Tom facility in Hamden County, MA, where land use encroachments during the years that the plant has burned oil has foreclosed likely solid-waste

*Although currently utility plans call for only a 600 MW coal plant.

disposal areas. Note, however, that the parties in the Brayton Point conversion agreement have displayed considerable innovation in resolving trade-off issues: the plant will be allowed to burn coal without sulfur controls in exchange for installing new particulate control equipment, and the Massachusetts Department of Environmental Quality Engineering has guaranteed at least a 15-year period of unchanged emissions requirements.

Air Quality: Sulfur oxides air quality in all states of the region except Maine is expected to show considerable improvement as a result of improved emissions controls both in the region and in the major industrial areas upwind. The regionwide average concentration of sulfur dioxide is expected to fall from 5.8 ug/m^3 in 1975 to 5.3 ug/m^3 in 1990, and that of suspended sulfate to drop from 6.1 ug/m^3 to 3.7 ug/m^3. These improvements are particularly dependent on improved emissions controls on existing coal-burning facilities in the Ohio Valley and TVA areas to the west since 85% of the 1990 sulfate concentration in the region is due to emissions from upwind regions. The increase in SO_2 levels in Maine is attributable in large part to the emissions from the coal units postulated for Waldo County, the current SO_2 emissions interstate being very low.

It should be noted, however, that emissions of nitrogen oxides are not likely to be as well controlled as those of sulfur oxides, and thus the impact of these species and of photochemical oxidants may actually worsen for both 1985 and 1990 depending on the efficacy of the EPA control strategies. In light of much of the southern part of the region being in non-attainment for these pollutants, these represent important concerns even if the postulated sulfur oxides emissions are achieved.

Water Quality and Availability: No major water-related issue should significantly constrain the technology mix postulated in the scenario. Most of the water problems (e.g., release of PCBs from harbor dredging operations need to support OCS development activity; concentration effects in cooling tower blowdown at the Montague plant), are highly local in scope and should be amenable to site-specific solutions and safeguards. Thermal discharge issues, especially in relation to section 316 of the Water Pollution Control Act, may, however, be raised at most new plants. The most serious water problems are likely to be institutional, related primarily to the emerging conflict between increasing levels of consumptive use and the riparian rights doctrine. The combination of planned diversions of Connecticut River water in Massachusetts

to supply Boston's drinking water need and the consumptive use at the Montague plants in Franklin County, Massachusetts, is likely to rekindle Connecticut's riparian rights concerns that reached the Supreme Court in the 1930's.*

Socioeconomic Impacts

The proximity of postulated utility construction projects to the major metropolitan area and the historical willingness of New England construction laborers to commute long distances results in very few construction and operation phase personnel relocations: from a high of 300 and 100 workers, respectively, for Sears Island in Waldo County, ME, to 75 and 30, respectively, for Millstone 3 in southern Connecticut. These levels are generally well within the infrastructure capacity of the affected counties. Because in New England the property tax revenues on utility plants accrue to the town level of government, however, the benefits of the considerable tax revenues involved will accrue to only a small percentage of those who may feel they bear the environmental impact of the plant's operation.

Institutional Issues: The unique powers of town government in the region and the strong traditions of public involvement make energy facility proposals of all kinds subject to extremely parochial pressures that are difficult to balance against state, regional, and even federal priorities. Proposals for refineries are much more likely to be defeated by town level votes on zoning ordinance variances than by an analysis of costs and benefits to the region as a whole by a state agency. The proliferation of ordinances regulating radioactive materials transport, in the face of clear legal precedents that give the federal government preemptive powers over nuclear materials regulation, similarly miror local attitudes and concerns. Indeed, the difficulties of siting have resulted in the situation that Public Service Company of New Hampshire, in financial trouble over Seabrook but now with an approved site, has had no difficulty in finding buyers for the bulk of its interest in the plant--this despite the continuing problems over financing and the Construction Work in Progress issues. It must be expected, therefore, that federal energy objectives for the region, however well-intentioned in terms of alternatives that will lessen the region's dependence on imported oil, will continue to be complicated by conflicting regional interests.

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*The Riparian doctrine is based on the concept that water cannot be taken from a riparian owner-without compensation, riparian ownership being a package of rights accruing to an owner of real property adjacent to a river or stream.

Health and Safety: Regarding several issues there is considerable divergence between the current public perception of their importance and the computed levels of impact of the scenario as derived in this analysis. For example, there is widespread concern over the effects of low-level radiation at nuclear power plants in the region, yet our analysis indicates that the expected total number of cancers due to radiation from nuclear power plant operation in the region, including not only occupational and general public exposure, but also the annualized effect of catastrophic accidents, will increase from 1 per year in 1975 to only 2.5 per year by 1990.

The health effects of fossil fuel combustion in terms of excess mortality due to population exposure to sulfates are projected to decline parallel to overall regional decreases in ambient SO_4 concentrations. Thus anticipated deaths related to sulfate exposure will decrease from a range of up to 5% of all deaths in 1975 (5900 deaths) to up to 3% of all deaths in 1990 (4000 deaths). Since these effects are postulated to be chronic, the improvements may not actually be realized until some future year.

It should also be recognized that the calculations for excess mortality involve large uncertainties, including whether or not the sulfur oxides are actually the damaging agent, whether the damage is linear or whether a "no-effect" threshold exists, whether present-day or historical concentration levels are the most important, and whether smoking habits or occupational exposures play an important role.

I. INTRODUCTION

1.1 RIIA Study Description

This study, the Regional Issue Identification and Assessment (RIIA), is an evaluation of the regional environmental impacts of future energy development. The study was produced for the 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 National Energy Act (NEA). This scenario, referred to as the Projection Series C or the TRENDLONG MID-MID scenario, is one of six possible energy futures developed by the Energy Information Administration (EIA) of the Department of Energy for the Department's 1977 Annual Report to Congress. It 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 increases 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 I (Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, and Connecticut). However, there are nine companion volumes, one for each of the other Federal Regions in the Nation (shown in Figure 1). This set of studies represents a comprehensive consistent portrayal of the regional environmental impacts and implications of future national energy development.[1]

1.2 RIIA Methodology and Assumptions

1.2.1 Overall 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 studies used the

[1]The three volumes on the Northeast are augmented by a series of RIIA issues papers containing detailed technical material and supporting analyses; these are referred to below, where relevant.

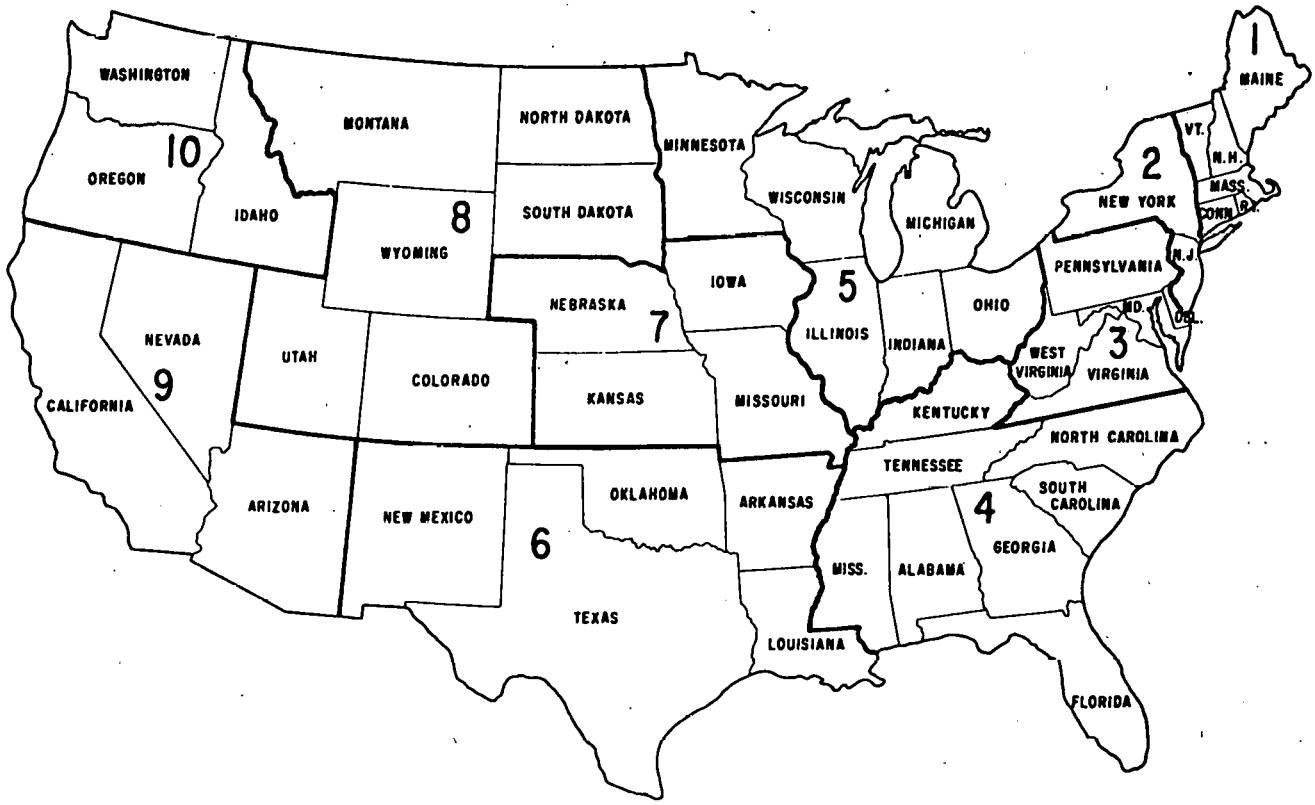

Figure 1. Federal Regions

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. Thus, the utility siting patterns may show deviations from current utility plans. Energy sources addressed were coal, nuclear, oil, oil shale, gas, geothermal, hydroelectric and solar.

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

1.2.2 Assumptions: Many of the issues identified in this report are premised on clearly identifiable assumptions, variations of which would significantly change the impact and location of the specific issues associated with the MID-MID scenario. Clearly the most important assumption for the region is the electric sector generation mix (as determined by the MEFS* model), and the subsequent allocation of this capacity at the county level. In the industrial sector, an important assumption is that the spatial pattern of fuel use within each BEA area** remains unchanged in the future, although interregional shifts of economic activity are considered in the scenario specification.

In terms of the identification of environmental issues, the critical assumptions are those relating to environmental regulation, in particular to implementation of the provisions of the Clean Air Act and its amendments and of the Water Pollution Control Act. For example, it is assumed that by 1985

*Midterm Energy Forecasting System (MEFS) is the model currently in use by EIA for projections through 1990. This model was previously known as PIES (Project Independence Energy System).
**Bureau of Economic Analysis Areas, see Figures 3,4 and 5.

all air emissions from existing facilities will meet current SIP requirements,*** and all thermal electric generating plants located in freshwater basins will be required to have evaporative cooling towers. Fossil plant additions beyond 1982 are also assumed to be subject to the current EPA New Source Performance Standards (NSPS) proposals (e.g., requiring flue gas desulfurization (FGD) systems on coal plants). Table 1 summarizes the specific assumptions for the control technologies considered in the analysis.

1.2.3 Criteria for Ranking Impacts: This discussion of the 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 use and energy technologies imposed by the scenario. The severity is rated as high, medium or low according to the criteria described in Table 2.

***As of summer 1978; the assumptions do not reflect changes contemplated in the more recent 1979 SIP revisions submitted to EPA under the provisions of the 1977 Clean Air Act amendments.

TABLE 1

CONTROL TECHNOLOGY ASSUMPTIONS

	UTILITY	INDUSTRY	MINING
AIR	EMISSIONS AND LOCAL AIR QUALITY: COAL • EXISTING PLANTS – UNCONTROLLED EMISSIONS BASED ON FPC COAL CHARACTERISTICS FOR ASH, HEAT AND SULFUR (1976) • PLANTS WITH STARTUP DATES PRIOR TO 1983 – SIPS OR NSPS REQUIREMENTS • PLANTS WITH STARTUP DATES AFTER 1983 – BACT, 85% AND 90% CONTROL OR REMOVAL OF SO_2 CONSIDERED OIL • SIPS REQUIREMENTS GAS AND METALLURGICAL COAL • UNCONTROLLED	EMISSIONS AND LOCAL AIR QUALITY: COAL • NEW LARGE SOURCES (250 X 10^6 BTU/HR) – SO_2: BACT, 80% REMOVAL; PARTICULATES: BACT, 99% REMOVAL • NEW SMALL SOURCES (100–250 X 10^6 BTU/HR) – SO_2: 1.5 LB/10^6 BTU; PARTICULATES: 0.05 LB/10^6 BTU • NEW NON-MFBI PLANTS (100 X 10^6 BTU/HR) – SO_2: SIPs WITH PHYSICAL CLEANING; PARTICULATES: SIPs, CYCLONES • EXISTING LARGE SOURCES (250 X 10^6 BTU) – SO_2: SIPs FOR MFBIs; PARTICULATES: SIPs FOR MFBIs • EXISTING SMALL SOURCES (100–250 X 10^6 BTU/HR) – SO_2: SIPs FOR MFBIs; PARTICULATES: SIPs FOR MFBIs • EXISTING NON-MFBI PLANTS (100 X 10^6 BTU/HR) – SO_2: SIPs USING LOCALLY AVAILABLE COAL; PARTICULATES: SIPs USING SETTLING CHAMBER/EXPANDED CHIMNEY & CYCLONES OIL AND GAS • SIPs LIMITATIONS ON SULFUR CONTENT OF FUEL, AS A WEIGHT FRACTION. • EMISSIONS FACTORS IN USEPA "COMPILATION OF AIR POLLUTANT FACTORS".	NO ASSUMPTIONS MADE. AIR POLLUTANTS FROM MINING ACTIVITIES NOT CONSIDERED.
WATER QUALITY	BPCT, EFFECTIVE JULY 1977 BACTEA, EFFECTIVE JULY 1984 NSPS, EFFECTIVE JULY 1977 UTILITY GENERATING LOAD FACTOR – 55%	BPCT, EFFECTIVE JULY 1977 BACTEA, EFFECTIVE JULY 1984 NSPS, EFFECTIVE JULY 1977	MINE DRAINAGE: "COAL SUPPLY REGION" (CSR) DRAINAGE DATABASE – COMPLIANCE WITH EFFLUENT LIMITATIONS ASSUMED. COAL WASHING: ASSUME 50% OF COAL IS CLEANED, 95% 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); NUCLEAR (1000 MW) CONSUMPTION (MGD); FOSSIL (1000 MW) WITHDRAWAL (MGD); FOSSIL (1000 MW) CONSUMPTION (MGD) ONCE THROUGH: 1400; 4; 830; 3 POND OR CANAL: 42; 26; 25; 15 WET COOLING TOWER: 28; 17; 17; 10 DRY COOLING TOWER: 0.3; 0; 0.2; 0	DATA BASE: • WATER CONSUMPTION DATA DEVELOPED FOR THE WATER RESOURCES COUNCIL.	WATER REQUIREMENTS FOR COAL EXTRACTION AND WASHING, DUST CONTROL AND REVEGETATION ARE ASSUMED TO BE NEGLIGIBLE.
SOLID WASTE	• COAL CHARACTERISTICS IN 1985 AND 1990 ARE THE SAME AS IN 1976. DATA FROM FPC TAPES. • USE OF ELECTROSTATIC PRECIPITATORS AND FLUE GAS DESULFURIZATION WITH LIME/LIMESTONE SLURRIES ASSUMED FOR 1985 AND 1990.	• NSPS AND SIPs REQUIREMENTS USED TO DETERMINE ASH AND FGD SLUDGE PRODUCTION AND LAND REQUIREMENTS.	• CONVERSION FACTORS FOR COAL MINING RANGED FROM 0.0818 ACRES/1000 TONS (COAL MINED) IN DEEP MINING IN EASTERN KENTUCKY TO 0.235 ACRES/1000 TONS IN STRIP MINING IN ARKANSAS • PAST BUREAU OF MINES DATA AND MINRES PROGRAM WERE USED TO DETERMINE MINING RESIDUALS.

ABBREVIATIONS:

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

TABLE 2

DEFINITION OF CRITERIA FOR RATING OF IMPACTS

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

II. REGIONAL OVERVIEW

Analysis of the energy problems of New England and their solutions is complicated by the varied nature of the basic characteristics that directly or indirectly affect energy use in the region.* The coastal area from Southwestern Connecticut to Boston marks the northern extension of the mid-Atlantic megalopolis characterized by high population density, extensive development, concentrated commerce and industry, and intensive environmental demands. Moving north and inland, population becomes dispersed, population density decreases, business and industry become less concentrated, and the demands on the environment change. Average state population density in Rhode Island is some 26 times as large as in Maine. More than 85% of the total population is in metropolitan areas in each of the three southern states, versus less than 35% in each of the northern states. Less than 5% of the total land area in each of the norther tier states is in special uses (including urban and transportation areas), versus more than 20% in each of the southern ones.

Average per capita income (1975) in New England ranged from 82 to 117.5% of the U.S. average, being above it in the southern states and below it in the northern states. Two states, Massachusetts and Connecticut, accounted for more than 76% of the regional value added in manufacturing in 1975 (the three northern tier states contributed only 15%), and industry is concentrated in two small bands of counties in Eastern Massachusetts and Southern Connecticut (Figure 2). All of New England except New Hampshire had unemployment rates higher than the national average in 1976. Between 1970 and 1976 a net outmigration of the work force occurred, but, except in Massachusetts, no clear-cut trend towards loss of the work force is apparent.

The environmental characteristics and quality in New England, like the population, industry, and income, are variable. The region has 3.8% of the U.S. general coastline and 6.9% of its tidal shoreline. Glacial features are characteristic, and poor drainage, drumlins, eskers, and outwash plains mark both the coastal and interior topography. New England has two major ecoregions. The Laurentian Mixed Forest Province includes most of the northern

*For a detailed review of the region, see, e.g., J. Brainard et al., The Energy Situation in New England, BNL 50580, Nov. 1976.

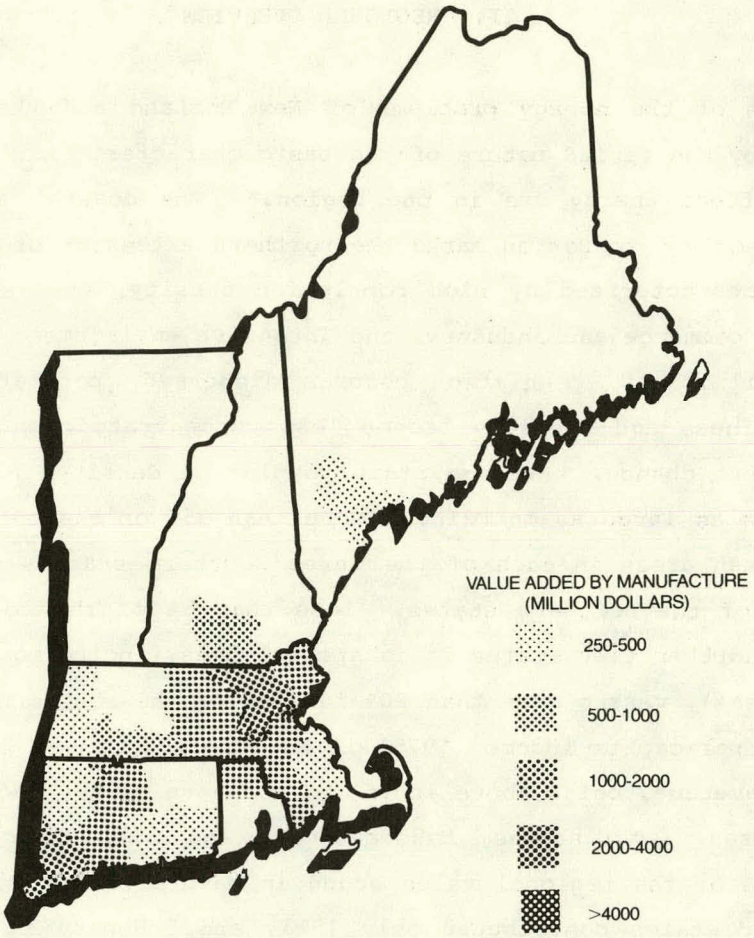

Figure 2. Geographical Distribution of Industry (as measured by Value Added in Manufacturing).

tier states and parts of Massachusetts and Connecticut. Its winters are moderately long and severe, with snow staying on the ground most of the season. Average annual temperatures range from 35° to 50° F, and precipitation averages from 24 to 45 in. per year and is greatest during the summer. Vegetation is of the Northern Hardwoods - Spruce Forest types: either mixed coniferous/deciduous stands or a mosaic-like arrangement with pure deciduous stands in favorable habitats and pure coniferous forests in less favorable habitats. Eastern Massachusetts, Rhode Island, and Connecticut are part of the Eastern Deciduous Forest Province. Winters are cold and summers warm, and the average annual temperature is from 40 to 60° F. Precipitation averages 35"

per year and is greatest during the summer. Temperate deciduous forest dominated by tall broadleaf trees is characterisic.

In the judgement of the EPA, progress in environmental protection and improvement has been slow but steady over the past year.* Air and water quality and solid and hazardous waste management are the most important environmental issues in the region. Regarding air quality, the following points merit emphasis:

- o The entire region is in non-attainment for photochemical oxidants (except for a few unclassified areas in Northern Maine).
- o The entire region is in attainment for SO_2, except for some localized areas near pulp mills.**
- o Attainment status for TSP shows wide variations in the region.

Controversies have erupted over every major energy facility or resource development proposal despite the range of sites from rural to urban and from inland to coastal. Neither the importance of the conflicting economic, environmental, and energy objectives nor that of the primary actors in decision making or influence bearing positions should be underestimated. New England's traditional citizen participation in government seems as strong today as ever.+

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*Regional Administrator's Annual Report, Environmental Quality in New England, U.S. Environmental Protection Agency, Region I, Boston, Dec. 1978.

**In light of this, several states are now contemplating a relaxation in sulfur-in-fuel regulations as part of their revisions to state implementation plans required by the 1977 Clean Air Act Ammendments.

+The generally favorable public climate in New England toward biomass, low-head hydro, and other small-scale technologies is a manifestation of the traditional values of Yankee independence--any measure that makes the citizen independent of large institutions, be they central governments or electric utilities, is well received; this is more generally reflected in very strong home rule traditions giving extensive powers to local governments. This has some unfortunate manifestations as well, as many decisions affecting the region's energy supply may be made on quite parochial grounds. A good example is the rejection of the refinery site in Durham, NH, by a vote of the citizens of that town not to grant the necessary variance of a zoning ordinance.

III. THE EIA TRENDLONG MID-MID SCENARIO

3.1 National Scenario

The MID-MID Scenario* represents a mid-range projection of energy development based on assumptions of median supply, median demand, and constant world oil prices. It projects the future on the basis of the continuation of policies existing prior to the implementation of the National Energy Act (NEA). Basic assumptions for the scenario on the national level include the following:

- Slight increase in domestic oil production due to Alaskan oil field and outer continental shelf (OCS) development.
- Continued decline of natural gas production in the lower 48 states.
- Dramatic increase in coal production, particularly in the western states, due to increasing demand coupled with rising oil and gas prices.
- Decrease in the growth rate of electricity sales from the historic 7% to 4.5% per year, representing saturation of the market for air conditioning and other major appliances that appeared during the 1960s. The projected growth is consistent with 5% growth from 1970 to 1976 and 4.2% from 1976 to 1977.
- Shift in the industrial sector from gas to oil and to a lesser extent to electricity, indicated by fuel shares in the industrial sector.
- Constant oil price of $15.32 a barrel in 1978 dollars.

Table 3 shows the national MID-MID scenario projections for energy supply and demand for 1985 and 1990, and the status in 1975. Total energy flow is projected to increase from 72.6 quadrillion Btus (quads) in 1975 to 96.9 quads in 1985 and 110.9 quads in 1990. Total electricity generation in 1975 was 2036 billion kilowatt hours; the scenario projects increases to 3045 in 1985 and 3692 in 1990.

Many of the regional energy system and environmental implications analyzed in this report follow directly from the underlying population and economic trends, the present patterns of which are assumed to extend well into

*For a full description, See Energy Information Administration, Annual Report for Congress, 1977, DOE/EIA-0036/2 (Executive Summary)

TABLE 3: ENERGY SUPPLY/DEMAND BALANCE FOR 1975, 1985, AND 1990
(10^{15} Btu/yr)

	1975	1985	1990
DOMESTIC PRODUCTION			
Crude oil	17.9	19.0	18.0
LNG & butane	2.6	2.0	1.8
Shale oil	0	.1	.3
Natural gas	19.0	17.2	16.7
Coal	14.6	23.1	27.5
Nuclear	1.8	6.2	10.3
Hydro & geothermal	3.2	71.8	79.6
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	12.6
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	10.5
Hydro & 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	70.8	94.6	108.5

the 1980's. Thus, as shown in Figures 3 and 4, New England's share of national population and employment growth are about average. The concommittant share of national energy growth is therefore also at national average, except for high growth in Northern Maine, as shown by Figure 5.

3.2 The Regional Scenario

The regional scenario in terms of sectoral energy consumption is shown in Table 4, with the 1975 and 1990 fuel mix compared on Figure 6. Note that the high dependance on oil continues with only a nominal percentage decline (but with an increase in actual oil use, as indicated on Table 4).

TABLE 4
REGION I ENERGY CONSUMPTION (10^{12} Btu/yr)

SECTOR/FUEL	1975	1985	1990
Residential	629	793	834
Commercial	552	721	775
Industrial	276	484	572
Transportation	799	955	1031
Raw material	20	39	49
TOTAL	2276	2991	3261
Electricity	228	298	342
Oil	1733	2248	2445
Natural gas	309	442	471
Coal	6	3	3
TOTAL	2276	2991	3261

The fuel mix in the electric sector (Figure 7) indicates that the region will continue its very high reliance on nuclear energy (some 51% of 1990 generation vs. a nationwide average of 25.3%) and its high dependance on oil, which even by 1990 will provide some 22.1% of total electric generation (vs. 5.6% nationwide). However, because of the overall lower-than-average growth in population and energy in the region, the scenario requires a relatively small number of new electric generating plants: five major nuclear units, one coal unit, and some 300 MW of combined cycle between 1979 and 1990 (Figure 8). At least in part, the requirement is a function of currently very high reserve margins in the New England Power Pool (estimated at 42.8% at the time of the December 1978 peak*), which the MEFS model assumes will fall to 20% by 1985.

*New England Load & Capacity report, Jan. 1, 1978. Report of the NEPOOL Planning Committee, p. 20. Although the Pool as a whole (and the northern tier) has a winter peak, utilities in Southern New England tend to have summer peaks.

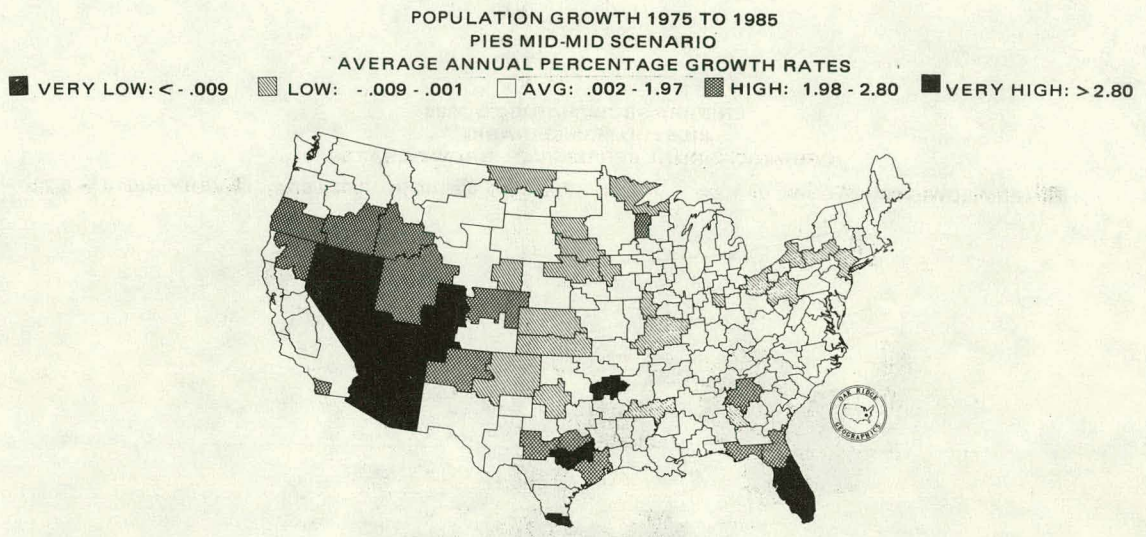


Figure 3. Population Growth in the MID-MID Scenario

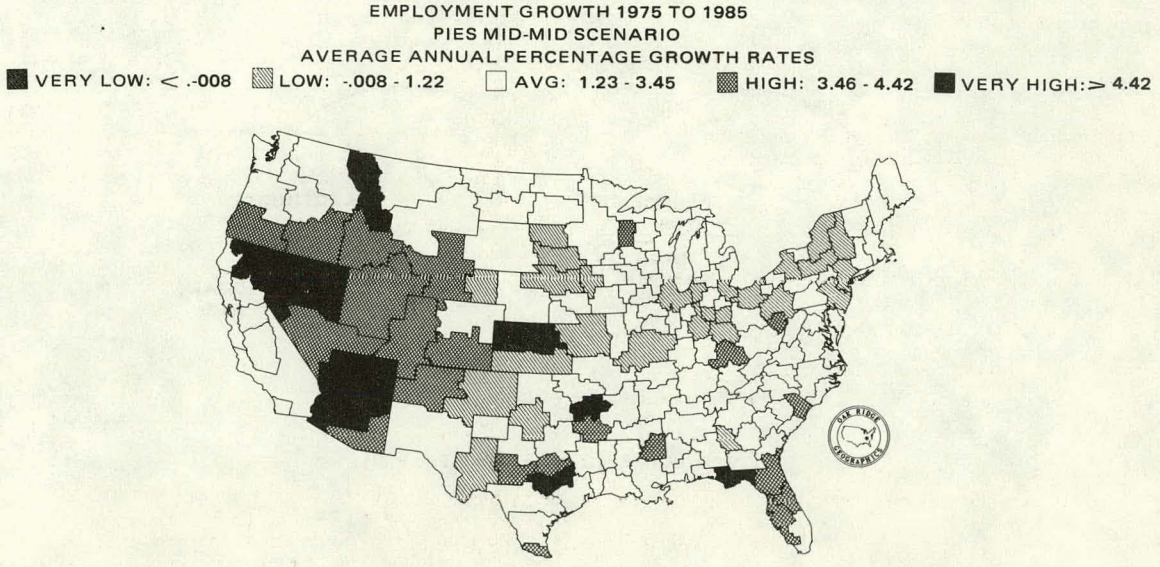


Figure 4. Employment Growth in the MID-MID Scenario

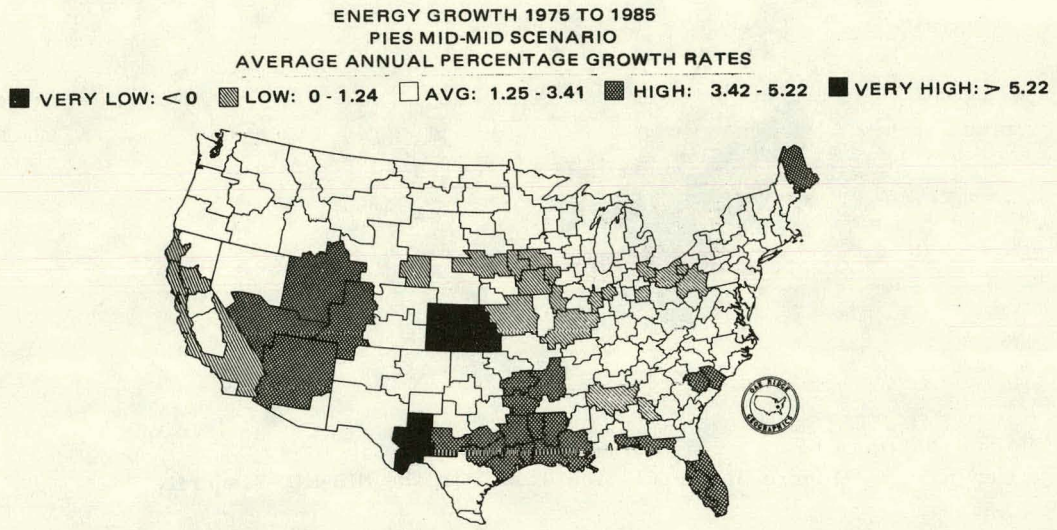


Figure 5. Energy Growth in the MID-MID Scenario

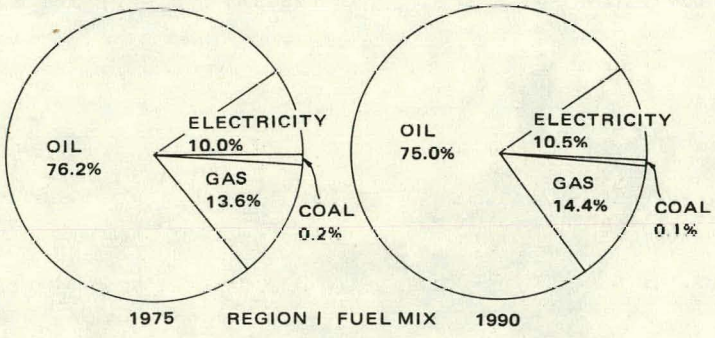


Figure 6. 1975 and 1990 Fuel Mix

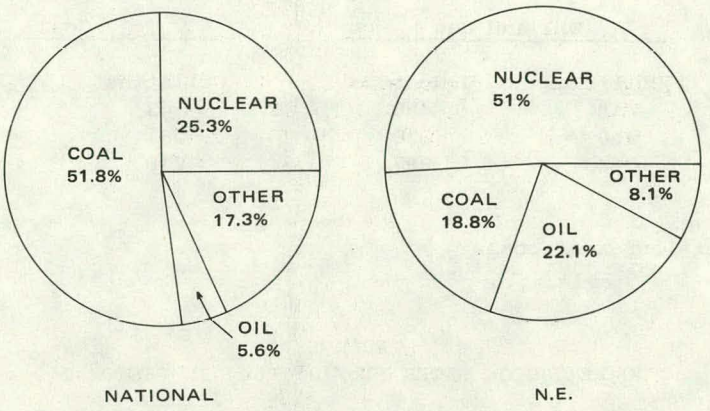


Figure 7. 1990 Electric Sector Fuel Mix

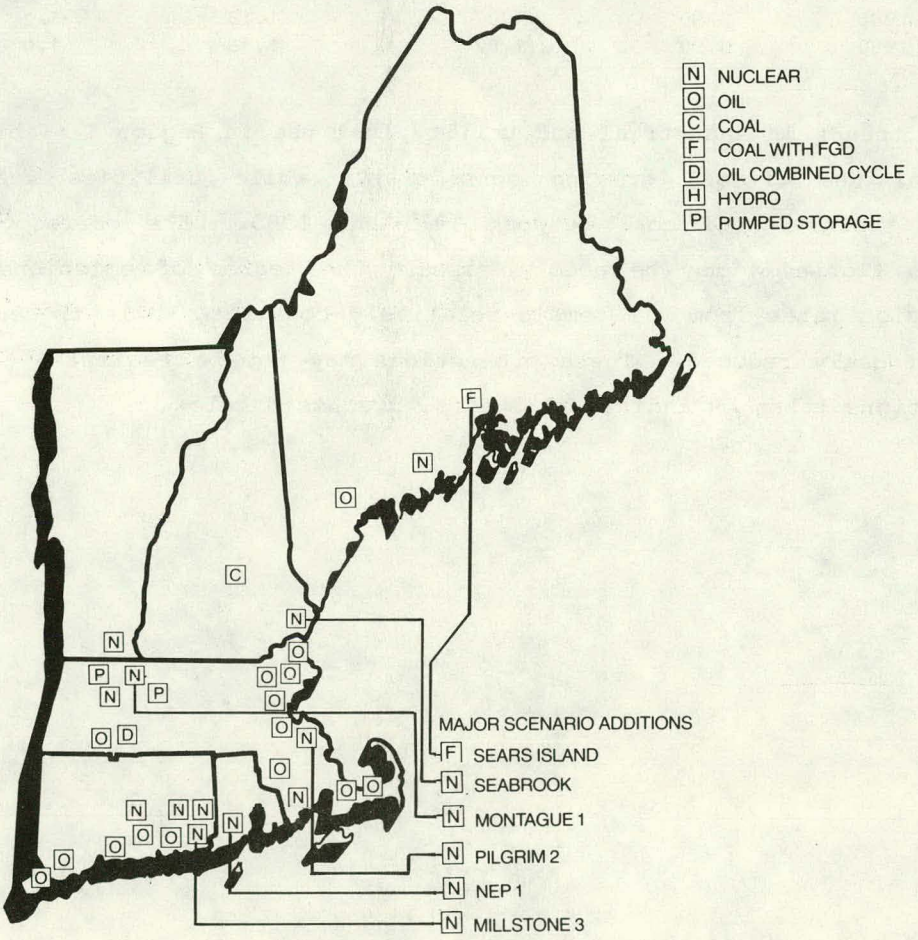


Figure 8. Major Electric Facilities in the Region by 1990

TABLE 5
FUEL USE TRENDS (10^{12} Btu/yr) IN REGION I

	Oil and Gas		Coal	
	Utilities	Industrial	Utilities	Industrial*
1975	410	199	43	6
1985	460	329	231	5
1990	254	387	218	6

*Excluding metallurgical coal.

TABLE 6
SO_2 EMISSION RATES (lb/10^6 Btu) IN REGION I

	Oil		Coal	
	Utilities	Industrial	Utilities	Industrial
1975	0.78	1.01	2.46	3.0
1985	0.90	1.0	1.13	1.2
1990	0.90	1.02	1.13	1.0

The trends in industrial and utility fuel use in Region I (Table 5) show industrial use of oil growing considerably while utilities dramatically increase their use of coal between 1975 and 1985. The corresponding SO_2 emissions (Table 6) may be used to assess the degree of emissions control. SO_2 emission rates from oil remain relatively constant, while those from coal are drastically reduced. These projections may not be realistic in view of the positions taken by individual states, discussed below.

IV. REGIONAL ASSESSMENT

4.1 National Issues

Many of the more important issues and impacts felt in New England as a result of the scenario are national and multi-regional in scope, requiring a scale for analysis much broader than the state or regional. Three important issues in New England are long-range transport of air pollutants, radioactive waste disposal, and U.S.-Canadian relationships.

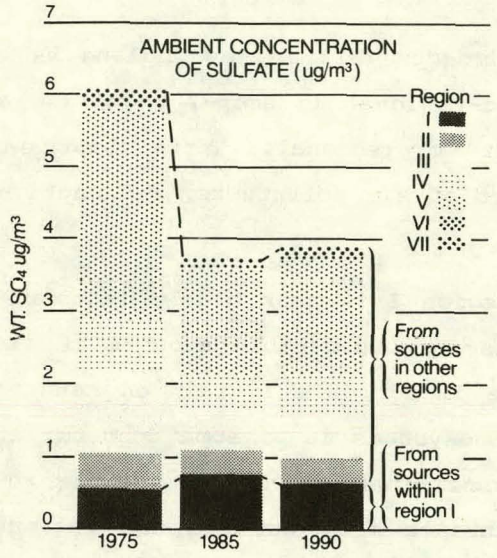
4.1.1 Long-Range Transport: Because Region I is near highly industrialized areas to the west and south, it recieves considerable amounts of air pollutants generated outside the region. The impact of acid rain on natural vegetation, agricultural crops, and aquatic ecosystems is of some concern; it is expected to be aggravated by increased fossil-fuel burning within the region but ameliorated by reductions of pollutants from outside the region. Both sulfates and oxidants in the air are postulated to have impacts on human health,* and the levels of both are thought to be dominated by long-range transport effects. Calculations indicate 91% of the population-weighted sulfate originated outside the region in 1975 and 85% in 1990.** The impacts shown in Table 7 reflect a judgemental tradeoff between the effects of increased nitrogen oxides (and very likely oxidants) and decreased sulfur oxides. Therefore, the issues of compliance of Midwestern sources and emissions reductions in Region II (NY/NJ) may continue to be important to New England.

Figure 9 indicates the trends in population-weighted sulfate in Region I (due to major fuel-burning sources) by region of origin. Region V (Ohio west to Wisconsin) is the major source and accounts for a significant fraction of the total sulfate in New England; the emission rates in Region V tend to be an order of magnitude larger than in Region I for all years.

Although the long-range transport analysis used to make these projections does not specifically take into account terrain features (such as the Alle-

*The specific estimates of health effects related to fossil-fuel combustion, presented below, are based entirely on SO_4 concentrations.

**Population-weighted concentrations are calculated by summing the product of concentration and population for individual grid-square elements and then dividing by the total population. These aggregated averages are most reliable for larger areas such as states or federal regions. In this report, ambient air quality concentrations are reported on a population-weighted basis.



- Overall ambient sulfate concentration decrease by 1985.
- 85-90% of sulfate concentration in the region is due to sources in other regions, with Region IV (The Midwest) the dominant contributor.

Figure 9. Sulfate Concentration in Region I.

TABLE 7
DISAGGREGATION OF NATIONAL IMPACTS TO REGIONAL LEVEL

	Air	Water	Regional socioeconomics
Electric Sector			
Coal	M[1],M[4]	M[3]	
Oil			
Nuclear		M[3]	H[2]
Supply			
Coal			
Oil			
Nuclear			
Gas			
Solar			
Hydro		M[3]	
Industrial Sector			
Coal	M[1],M[4]	M[3]	

[1]Long-range transport from Regions II, III, IV, and V.
[2]Nuclear waste management perceived as a national problem.
[3]U.S.-Canadian water use issues.
[4]U.S.-Canadian pollution transport issues.

gheny mountains) and urban or seacoast dispersion characteristics, is based on only one month's meteorological records, and reflects linear chemistry, the gross features shown in Figure 9 are believed to be qualitatively correct.

4.1.2 Radioactive Waste Management: One of the more severe constraints on the realization of the MID-MID scenario is the degree to which the high reliance on nuclear capacity in the electric sector will be constrained by widespread opposition by the public and state environmental agencies on grounds of inadequate arrangements for radioactive waste disposal.* The problem of disposal is widely perceived as a federal responsibility, to be solved by action at the national level, and continued inaction will provide a focus for continued opposition to further nuclear plants.

Much of the opposition to nuclear power in New England rests on more general issues of public health and safety and the adequacy of the federal regulatory aparatus, but, the issue of radioactive waste disposal is a tangible environmental issue unencumbered by esoteric probabilistic arguments and should be placed high on the agenda of federal action if continued reliance on nuclear power is to be attained in the region.

4.1.3 U.S.-Canadian Relationships: New England shares a number of energy, water, and pollution problems with Canada. Canada already supplies some of the oil, natural gas, and electricity used in New England, and may supply much more in the future, but many of the major energy projects proposed for New England, particularly those involving the use of boundary water for energy-related activities, have been opposed by the Canadians. Air quality problems in New England are significantly affected by industrial and utility activity in Canada.**

*Indeed, Governor Grasso of Connecticut has recently signed legislation ("An Act Concerning the Construction of Nuclear Power Facilities") which provides that no nuclear facilities may be built in the State until the State's Department of Environmental Protection has certified that there exists a bonafide national waste disposal method.

**For a detailed discussion of U.S.-Canadian relationships and their impact on the region's energy future, see J. Carroll, "Environmental Aspects of Eastern Canada-Northeastern U.S. Energy Relations: An Identification Issues," RIIA Issue Paper No. 2, Division of Regional Studies, BNL, May 1979.

4.2 Regional Issues

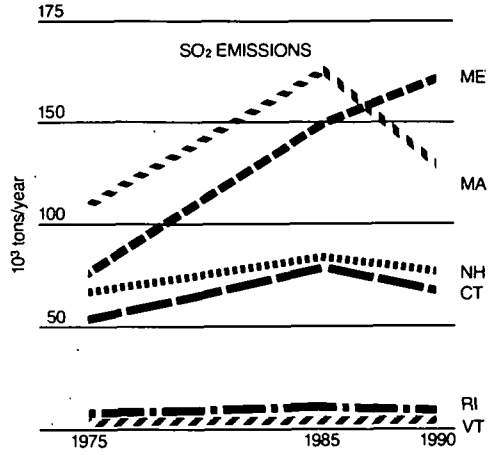
4.2.1 Regional Air Quality: Regional air quality considerations are different in the southern and northern portions of the region. In the south, the large population centers are part of the Washington-Boston megalopolis, and human health exposures are important. In the north, the emphasis is more on protection of visibility and ecological values. The region has several Class I PSD areas, for which pristine air quality is a goal.

Long-range transport effects are important because both atmospheric aerosol and oxidant concentrations tend to be dominated by outside sources. The complexities of transport across mountain ranges have not been considered in this analysis, nor those of atmospheric dispersion and chemistry in either the urban or seacoast environments of Region I; and area sources, which may be important in urban areas, are not included in the model. However, this analyis does indicate that improved sulfur oxides air quality in New England will depend heavily on the degree to which the postulated controls are realized in the regions to the north and west. The computed trends in SO_2 emissions are shown on Figure 10; the resulting trends in ambient concentration are shown on Figure 11.

4.2.2 Water Quality and Availability: The major inland water issues in New England related to energy activities concern the use of water for cooling electric generation plants. Competing uses for water at times of low flow and difficulties in providing adequate flow augmentation may pose serious obstacles to the siting of some plants. The impact of the consumptive water use at the planned Montague nuclear plant in Massachusetts, for example, is of concern as far downstream as the Connecticut River estuary in Southern Connecticut.

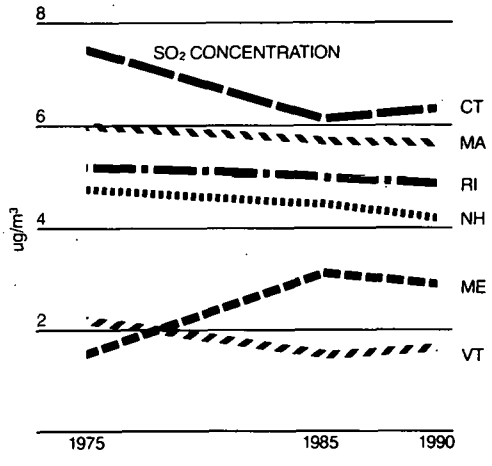
The major coastal issues concern the severe impacts that oil spills and once-through power plant cooling systems can have on marine organisms. Increased barge and tanker traffic in harbors and coastal waterways, particularly LNG tankers in urban ports, may also conflict with existing uses.

4.2.3 Land Use, Ecology, and Solid Waste: The MID-MID scenario anticipates only one new coal-fired power plant in the region (Sears Island) and no significant level of industrial coal use. Solid waste issues are unlikely to be the constraining factor at Sears Island. The principal coal-related solid waste problems will be associated with the oil-to-coal conversions under the



- Sharp increases of SO_2 emissions in Maine are a result of the postulated new coal-fired power plant in Waldo County.
- Emissions in the other states all increase by 1985, although to a quite varying degree.
- Sharp decline of emissions in Massachusetts in 1985-1990 due to retirement of old oil fired electric capacity.

Figure 10. SO_2 Emission Trends



- Annual average ambient concentrations of SO_2 generally decrease in all states except Maine.
- Worsening of sulfur oxide air quality in Maine is due to the major coal-fired electric plant postulated for Waldo County.

Figure 11. Trends in Ambient SO_2 Concentrations

Energy Supply and Environmental Coordination Act (ESECA). these conversions will likely be constrained primarily by air quality but the absence of land for disposal near the plants is a strong factor in utility resistance to ESECA, since many of these plants are in urban or coastal areas where land use pressures have foreclosed areas previously available. At present, the only ESECA conversion likely to be made is that of the three Brayton Point units.*

Nuclear waste management problems have two aspects: the general public and political concern over every new nuclear plant has been used as a basis for political platforms at the state and local level, and more specific manifestations. For example, several existing nuclear plants in New England will run out of storage pool capacity for spent fuel assembles in the mid-80s. This, coupled with the current lack of national planning for nuclear waste management, may constrain future nuclear energy development. In addition, many local governments, following the lead of New London, CT, and New York City, are now considering local ordinances that ban shipment of nuclear wastes through their jurisdictions.

The major ecological problem related to energy activities in Region I is potential disruption of the aquatic ecosystem by oil pollution and power plant cooling systems. Estuarine ecosystem productivity is one of the issues that surfaced for the coastal zone. Acid rain may become a serious problem in the future, but there is currently considerable doubt concerning the severity of acid rain impacts in New England.

Restoration of anadromous fisheries in New England rivers is another central issue in the relicensing of older run-of-the-river hydropower plants. The provision of fish ladders for all dams on rivers that have anadromous fish (whether for hydropower or not), and the maintenance of instream flow may be limiting criteria.

Sensitivity to environmental problems in the region is high, and continued ecological-energy confrontations seem probable. Development proposals that threaten critical or unique habitats, such as tidal marshes, or involve disruption or development of natural areas with great economic value

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*The following ESECA conversions are postulated in the MID-MID Scenario: three units at Brayton Point in Somerset, MA, totaling 1100 MW; Norwalk Harbor, CT, 333 MW; Middletown, CT, 420 MW; Mt. Tom, MA, 144 MW.

such as fishery areas, or prime forestland, seem the most likely to invite confrontation. In addition, proposals that involve the development and use of large areas of land (for example Dickey-Lincoln) are certain to be sensitive.

4.2.4 Social, Economic, and Institutional Issues: The vast majority of the new energy facilities planned for 1976 and 1990 are situated along the coast, in areas with high population densities and major transportation arteries, which enhance the availability and accessibility of workers for projects. Generally 10% or less of a construction work force finds it necessary to relocate to a site area, and area accommodations are sufficient to accept these immigrants with little difficulty. A possible exception to the commuting rule could be the Sears Island, ME, project. Potential manpower availability problems could be increased if several of the nuclear plants scheduled to become operational in 1990 do not have their construction schedules staggered.* Figure 12 summarizes the socioeconomic impacts of the scenario in the region, with an indication of laborshed and construction work force for each of the major power plant additions.

Offshore oil development will compete only minimally for labor with the proposed power plants and is not expected to cause facility delays. The scenario foresees only 0.1×10^6 barrels per day of offshore oil by 1990 and $241 \times 10 \times^6$ cubic feet for gas, production levels unlikely to lead to major onshore socioeconomic impacts. Indeed, such levels may well lead to revitalization of many old fishing towns that could readily absorb the necesary OCS development support facilities.**

The legislature of every state in New England has passed or introduced bills to curb, regulate, or impose moratoria on construction of nuclear power plants, storage of radioactive wastes, and/or transport of radioactive materials. Although many of these statutes, if enacted and tested, may eventually be found to conflict with federal preemption, their possible future impact on the development of nuclear power in this region should not be discounted, for they reflect widespread and growing disquietude and opposition to the use of nuclear power.

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*For further details, see W. Metz. Socioeconomic Impact of Proposed Powr Plants in the Northeast, RIIA Issue Paper No. 1, Division of Regional Studies, BNL, May 1979.

**See, e.g., New England River Basins Commission, A Methodology for the Siting of Onshore Facilities Associated with OCS Development, Dec. 1975

- Total electric plant construction payroll in region to 1990 estimated at $1.3 billion.
- Annual 1990 local property tax revenues from electric plants estimated at $32 million.
- On average, about 185 immigrants per major project during the construction phase.
- New plants are generally located near metropolitan regions, with major labor markets in close proximity.

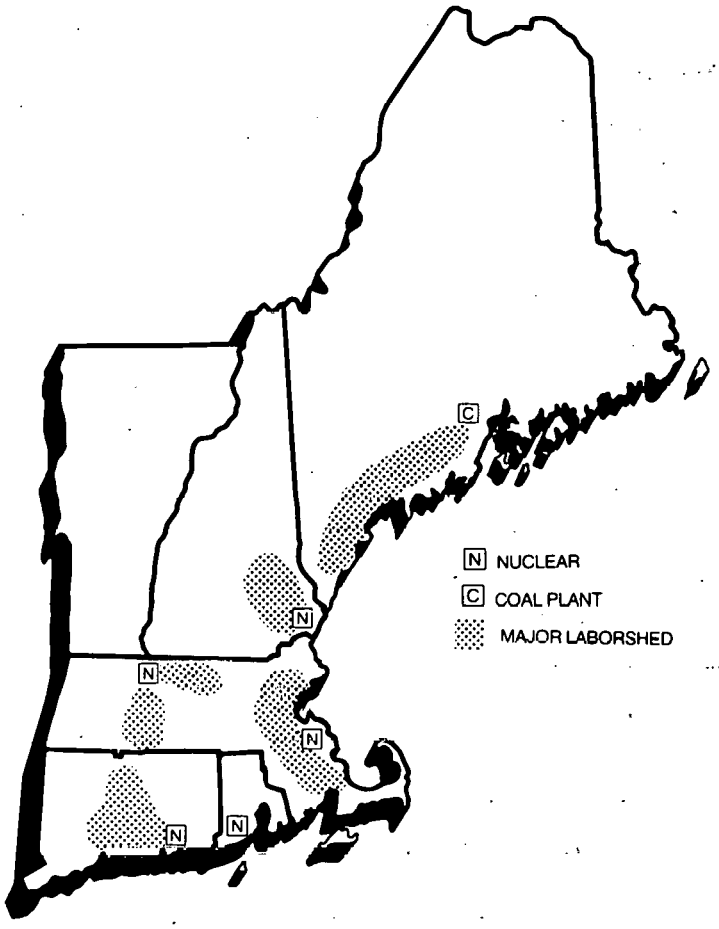

Figure 12. Socioeconomic Impacts

A particularly controversial issue in many New England states concerns the perceived relationship between rising electricity bills and the financing of nuclear power plants. At issue is whether a utility should be permitted to charge current customers for the cost of construction work in progress (CWIP) by including this cost in the rate base, or whether it should wait to earn a return on its investment until the plant is in service. The financial strain on the utility from prohibiting CWIP charges may lead to postponement or delay of some nuclear projects, particularly the Seabrook, NH, facility. Currently, five of the six New England states disallow CWIP (New Hampshire, has introduced but not yet enacted legislation to prohibit CWIP financing) and the issue is a politically sensitive one throughout much of the region.

4.3.5 Health and Safety: Given that sulfate levels in the region are estimated to decrease the concomitant health effects from fossil fuel combustion, as indicated by population exposure to sulfates derived from fuel burning emission sources, will also decrease, as indicated on Table 6.* Nevertheless, there is growing recognition in the region of the importance of interregional pollution transport; and indeed by 1990, some 85% of the deaths shown on Table 6 can be attributed to sources located outside of the region.** In addition, any health effects due to NO_x or oxidants may worsen; such effects have not been quantified.

The other major health related concerns, given the absence of coal mining in the region, is radiation induced cancers from nuclear plant operation. With the increase in nuclear generation in the region, these will generally increase, as indicated on Table 7. Note that the nuclear health effects are based on average conditions and do not reflect local population density or meterology.

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*For detailed documentation of these computations, see S. Morris, el at, "Health Effects of the EIA MID-MID Scenario", Biomedical & Environmental Assessment Division, Brookhaven National Laboratory, forthcoming report.

**All of the New England States except New Hampshire are coplaintiffs in a suit against EPA contesting current attainment rules in light of interstate movements of pollution.

TABLE 8

ESTIMATED HEALTH EFFECTS FROM AIR POLLUTION FROM FOSSIL FUEL COMBUSTION[2]

	Population-weighted SO^4 conc., ug/m^3	Individual risk level deaths per 10^6 person/year[b]	Estimated attributable annual deaths[b]
1975	6.1	30-490[2]	3780- 5900
1985	3.8	19-380	690-11000
1900	3.7	19-300	250- 4000

[2]Effects shown are on an annual basis, but may actually occur in some future years.

[b]The range shown represents approximately 60% confidence limits from a subjective probability distribution of coefficients relating mortality linearly with ambient sulfate concentration.

TABLE 9

ESTIMATED ANNUAL RADIATION INDUCED CANCERS DUE TO NUCLEAR POWER PLANTS

	Nuclear Power Plant Workers	General Public	
		Routine	Non-Routine[a]
1975	0-0.29	0-0.008	0-0.3
1985	0-0.47	0-0.012	0-0.9
1990	0-1.45	0-0.023	0-0.9

[a]Annualized effect of catastrophic accidents

V. STATE ISSUES

5.1 CONNECTICUT

5.1.1 Air Quality:

- o Scenario hypothesized ESECA conversions at Norwalk and Middletown are in TSP non-attainment areas.
- o Local air quality analysis predicts potential SO_2 violations in Fairfield County.
- o Control of air pollution from upwind states is a critical factor in achieving air quality goals.

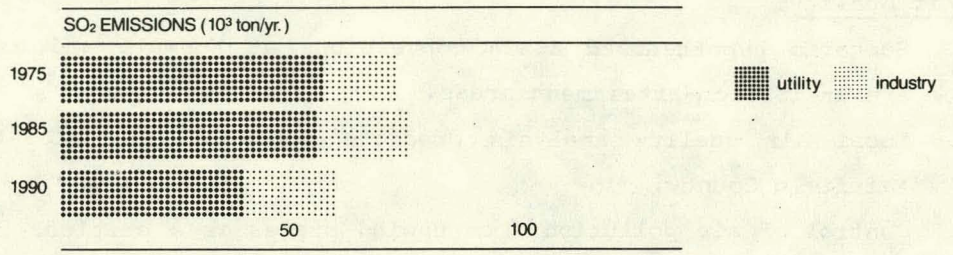
Industrial SO_2 emissions are postulated to increase in Connecticut by 48% and utility emissions to decrease by 4%. Since the current oil sulfur content limit is 0.5%, the coal conversions will require scrubbers to meet this requirement. The local air quality analysis predicted SO_2 air quality standards violations in Fairfield County due to the additional sources there. Since the standard in question was the 3-hr average this is unlikely, as the effects of new and existing sources would not necessarily be additive. A more detailed analysis at the sub-county level would be appropriate. There are no non-attainment areas for SO_2, but three AQCRs have shown particulate problems (see Figure 13).

Since improvements in air quality are due largely to controls on sulfur oxides in the face of increases in fuel use, concentrations of other pollutants, including nitrogen oxides and oxidants may increase. The influx of air pollution into Connecticut is an important issue, and a citizens' group has instituted legal action against upwind states and sources. The tobacco crop is sensitive to oxidants, which are already at fairly high levels throughout the state, (Figure 13), and a worsening of this situation could have severe impacts.

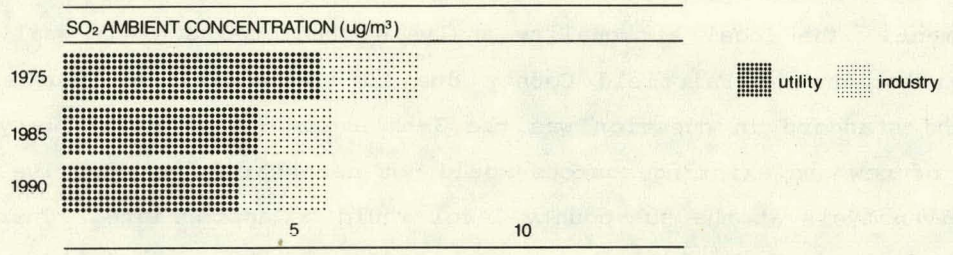
Connecticut has no PSD Class I areas, but visibility is important and should be improved by the postulated improvement in sulfur concentrations.

Scenario-Induced Changes:

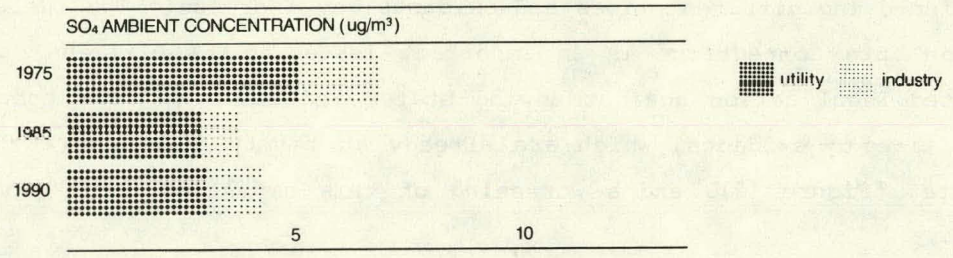
- o An overall improvement in population-weighted SO_2 and SO_4 by 1985 will result from reductions in upwind, out-of-state sources.
- o In-state SO_2 emissions will be reduced by 1990.



- SO_2 emissions will increase slightly between 1975 and 1985 but will drop below 1975 levels by 1990.



- SO_2 ambient concentrations, however, are expected to decrease between 1975 and 1985 and again between 1985 and 1990.



- SO_4 ambient concentrations decline between 1975 and 1985 and increase slightly thereafter.

Figure 13. Emissions and Air Quality Trends in Connecticut

5.1.2 Water Quality and Availability:

- o Water quality impacts and consumptive use of water for thermal generation on the Connecticut River in Massachusetts (particularly at the proposed Montague plant) may affect water quality and availability in Connecticut.
- o As the majority of planned thermal capacity additions and ESECA conversions are clustered along the coast, the potential aggravation of water quality problems in Long Island Sound is a key issue.

Consumptive use of water for thermal power generation on the Connecticut River in states upstream of Connecticut is estimated at some 47 cfs for the 1990 MID-MID scenario, some 2.1% of the low flow of 2160 cfs. This may not be a significant fraction in itself, but, coupled with the potential flood skimming diversions via the Northfield, MA, pumped storage project, it makes the entire issue of upstream allocation of Connecticut River water a matter of serious concern in the state, if only from the viewpoint of setting legal precedents. The first major trans-basin diversion involving the Connecticut River, litigated before the Supreme Court in the 1930s,* was upheld, but many observers expect new debate on interstate riparian issues if these projects proceed.**

Background Issues:

- o Large segments of the Connecticut River are water quality limited because of combined point, sewer, and non-point source problems.
- o Water quality in Long Island Sound is affected by numerous point and non-point sources characteristic of extensive residential and industrial development.

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*See, e.g., Engineering News Record, April 1931, for a discussion.

**See, e.g., NERBA draft policy on Connecticut River diversion, in Environmental News, EPA Region I, Jan. 1979. The riparian rights issues associated with energy-related projects on the Connecticut River are discussed in detail in M. Lapping, Legal Aspects of Water/Energy Problems in the Northeast Region, in C. Bryant, Editor, Selected Institutional Aspects of Energy Development in the Northeast, RIIA Issue Paper No. 3, Division of Regional Studies, BNL, May 1979.

5.1.3 Land Use, Ecology, and Solid Waste:

- o Protection of coastal resources and amenities is of key concern in Connecticut.
- o The disposal of wastes from plants required to convert to coal under ESECA orders may be a problem because most of these plants are located coastally while potentially available sites are inland.

Connecticut is one of the nation's leaders in resource recovery from municipal waste, with large-scale facilities under construction or planned in Bridgeport, Hartford, and New Haven, each with the potential for producing significant amounts of refuse-derived fuel suitable for use as an industrial boiler fuel or as a supplementary fuel in coal-burning utility plants. This potential is not explicitly considered in the MID-MID scenario, but, because of its environmental benefits compared with conventional landfill disposal, it represents an important overall gain to the state.

Background Issues:

- o Connecticut is a state with diverse land use pressures and patterns. The existing and postulated thermal plant siting does not complement this pattern; rather, it appears to locate plants in areas of intensive growth pressure.

5.1.4 Social, Economic, and Institutional:

- o All the proposed new power plants are sited in the heavily populated coastal counties. The labor force of the state is quite skilled and no shortages of workers are forecast. No significant work force in migration is anticipated.
- o A number of institutional issues and problems may crop up in the time covered by the MID-MID scenario which will affect energy development. Some of these, such as water diversions, have been covered in other sections of this report.

Connecticut has comprehensive siting laws and planning mechanisms covering major energy facilities. Although decision of the State Power Facility Evaluation Council can override those of local authorities for most types of energy facilities, local voter approval is required for the construction of oil refineries. This reflects concern and apprehension over the potential environmental impact of Outer Continental Shelf oil exploration and associated onshore development. Connecticut, through its Office of Policy Management,

also takes an active role in statewide energy planning and forecasting, in contrast to the primarily reactive posture toward utility initiatives adopted by many other New England states.

The Connecticut Legislature is currently considering a bill that would impose a moratorium on the construction of nuclear power facilities pending resolution of the nuclear waste problem.* At the same time, legislation supported by a coalition of pro-nuclear groups has recently been introduced to ban local restrictions on nuclear material transport such as those adopted by New London.

5.1.5 Health and Safety:

- o A major safety concern regarding nuclear power is the transportation of nuclear materials.
- o Concern over the effects of low level radiation may affect licensing of Millstone 3.

Nuclear power is viewed as a potential health concern. Low level radiation from a number of possible sources but specifically from the Millstone nuclear complex is perceived by some as a potential cancer threat to residents of the immediate area surrounding the site. This idea is supported by the Clam Shell Alliance, which also has raised a number of environmental issues. The analysis indicates, however, that the expected annual number of radiation-induced cancers in the general public, in the entire state, attributable to nuclear power plants rises from 0.112 in 1975 to only 0.36 in 1990, including the annualized effect of potential catastrophic accidents. The other major concern regarding nuclear power is the transport of nuclear materials. Legislative action on this issue (Rep. John Anderson and Rep. David Lavine) is currently being considered.

Conservation of energy is a highly verbalized concern of state energy officials. Associated with this initiative are a number of measures that have direct health consequences. Certainly insulation materials (i.e., urea-formaldehyde and asbestos) are known or suspected to be health hazards. An increase in the number of home fires has been attributed partly to increased

*This bill was recently signed by Gov. Grasso (see section 4.1.2).

use of wood and other materials as supplemental heating sources; continuation of this trend is a concern. Another conservation measure encouraged by state agencies is to reduce home hot water temperatures, and this has had the secondary positive effect of reducing the number of burns, which has recently been rising.

Scenario-Induced Changes:

- The expected annual number of radiation-induced cancers in the general public in Connecticut attributable to nuclear power rises from 0.112 in 1975 to 0.36 in 1990, including the annualized effect of catastrophic accidents.
- The range of estimated total deaths attributable to fossil-fuel combustion falls from 100-1700 in 1975 to 76-1200 in 1990.
- The maximum personal risk to death from fossil combustion sources decreases by from 0.53×10^{-3} in 1975 to 0.32×10^{-3} in 1990.

5.2 RHODE ISLAND

5.2.1 Air Quality:

Key Issues

- The small size of Rhode Island, coupled with modest emissions, makes out-of-state sources the dominant factor by about 10:1 for SO_2 and 100:1 for SO_4.
- The Metropolitan Providence Intrastate Air Quality Control Region is in violation of the primary TSP standard.

Scenario-Induced Changes:

- SO_2 emissions from major sources are projected to decrease (Figure 14).
- Population-weighted concentrations of SO_2 are projected to decrease between 1975 and 1990, and those of SO_4 to decrease between 1975 and 1985 and to increase slightly between 1985 and 1909.

5.2.2 Water Quality and Availability:

- There are no major scenario related water availability problems in Rhode Island.
- Siting of NEP 1, an 1150-MW nuclear unit near Charleston on Block Island Sound, will raise the usual problems of thermal pollution. Groundwater requirements during construction may conflict with other uses.

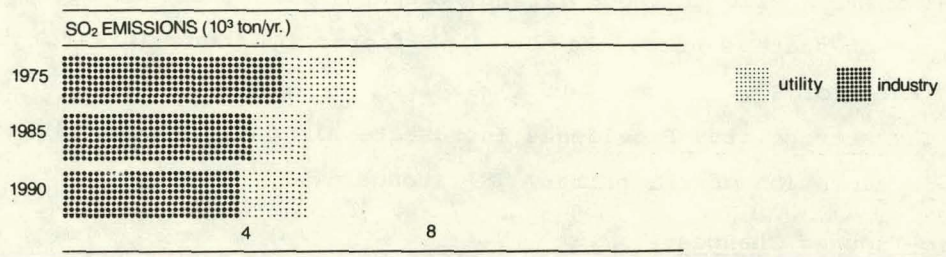
5.2.3 Land Use, Ecology and Solid Waste:

- There are no major scenario-related issues regarding land use, ecology or solid waste in Rhode Island.

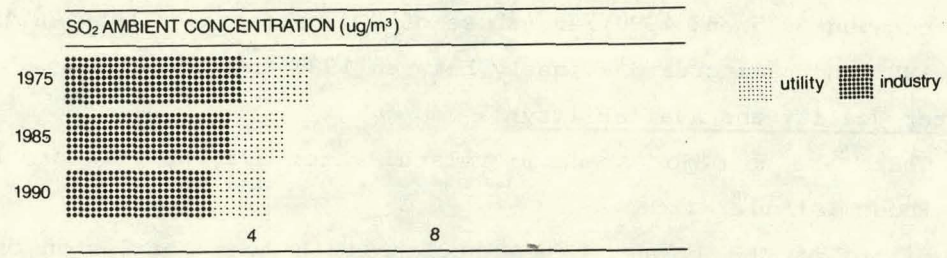
5.2.4 Social, Economic, and Institutional:

- There are no major, scenario-related socioeconomic impacts in Rhode Island.
- Several institutional issues will have a bearing on nuclear development particularly the proposed NEP-1 nuclear facility.

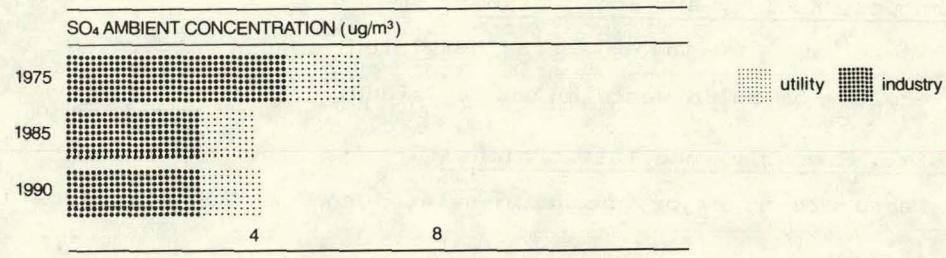
Local socioeconomic issues should pose no problem for Rhode Island energy development. The area around the old Charleston Naval Air Station, can easily accommodate the workers needed for activities supporting the offshore oil developments at Quonset. For NEP-1, labor availability may pose a problem in the boilermaker craft since the workers would be drawn from a Boston-based



o SO_2 emissions will decrease between 1975 and 1985.



o SO_2 ambient concentrations will decrease between 1975, 1985 and 1985.



o SO_4 ambient concentrations will decrease between 1975 and 1985 but increase slightly thereafter.

Figure 14. Emissions and Air Quality Trends in Rhode Island

union hall. The utility and the Rhode Island Construction Trades Union estimate that 75 to 85% of the labor force will be Rhode Islanders if proper training and apprenticeship are provided.

New England Power Company's plan for NEP 1, an 1150-MW nuclear power plant has met with considerable citizen opposition. The state legislature is currently considering a bill that would give the General Assembly the power of final approval or veto of all plans for energy facilities in the state. Utility officials have stated that such a bill, if enacted, could delay the project as much as three years. However, the proposed site for NEP has not yet been secured by the utility from General Services Administration (GSA), which is charged with disposal of this federal property. Extensive litigation concerning optimal use of this land must be anticipated, resulting in further delays in licensing.

5.2.5 Health and Safety:

- The estimated range of annual deaths attributable to emissions from fossil fuel combustion (sulfates) falls from 29-470 in 1975 to 23-360 in 1990.
- The estimated number of annual radiation-induced cancers in the general public increases from 0.001 in 1975 to 0.17 in 1990, including the annualized effect of catastrophic accidents. The sharp increase is due to the nuclear unit (NEP 1) postulated for Washington County.

5.3 MASSACHUSETTS

5.3.1 Air Quality:

- The MID-MID scenario includes 380 MW of combined-cycle capacity in Hampden County, 70 MW of combined-cycle capacity in Bristol County, and ESECA conversions in Bristol and Hampden Counties.

Massachusetts has no non-attainment areas for SO_2 and only a few local non-attainment areas for TSP. The state has granted higher-sulfur fuel variances for certain point sources, and would like to continue and extend this program; therefore, further SO_2 emissions increases are to be expected. The Brayton Point plant in Bristol County is being converted from oil to coal (voluntarily) under an agreement with EPA allowing up to 3.5% sulfur coal to be used in exchange for tighter controls on particulate emissions.*

The long-range transport analysis showed a decrease in population-weighted concentrations of SO_4 and, to a lesser extent of SO_2. However, much of the population is near the seacoast and thus subject to maritime air movements not taken into account in this analysis.

Massachusetts has no Class I PSD areas, but, like Connecticut, is concerned about visibility and ecological effects. A Massachusetts citizens' group is also a party in the Connecticut suit against interstate air pollution.

Scenario-Induced Changes:

- The state will experience nearly constant industrial SO_2 emissions from 1975 to 1990 (Figure 15).
- Utility emissions will increase substantially from 1975 to 1985 and then decrease between 1985 and 1990, but will remain above the 1975 level (Figure 15).
- Population-weighted concentrations of SO_2 will decrease between 1975 and 1990; those of SO_4 will decrease between 1975 and 1985 and increase slightly thereafter (Figure 15).

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*This agreement between the Masschusetts Department of Environmental Quality Engineering and the utility, in which SO_2 emissions were traded off against particulate emissions, with the utility installing additional particulate control equipment in exchange for a guarantee that emission standards will remain unchanged for 15 years, represents a considerable innovation. It should be noted that since the emissions calculations for this facility were based on 2.2% sulfur coal, SO_2 emissions for Massachusetts may be understated.

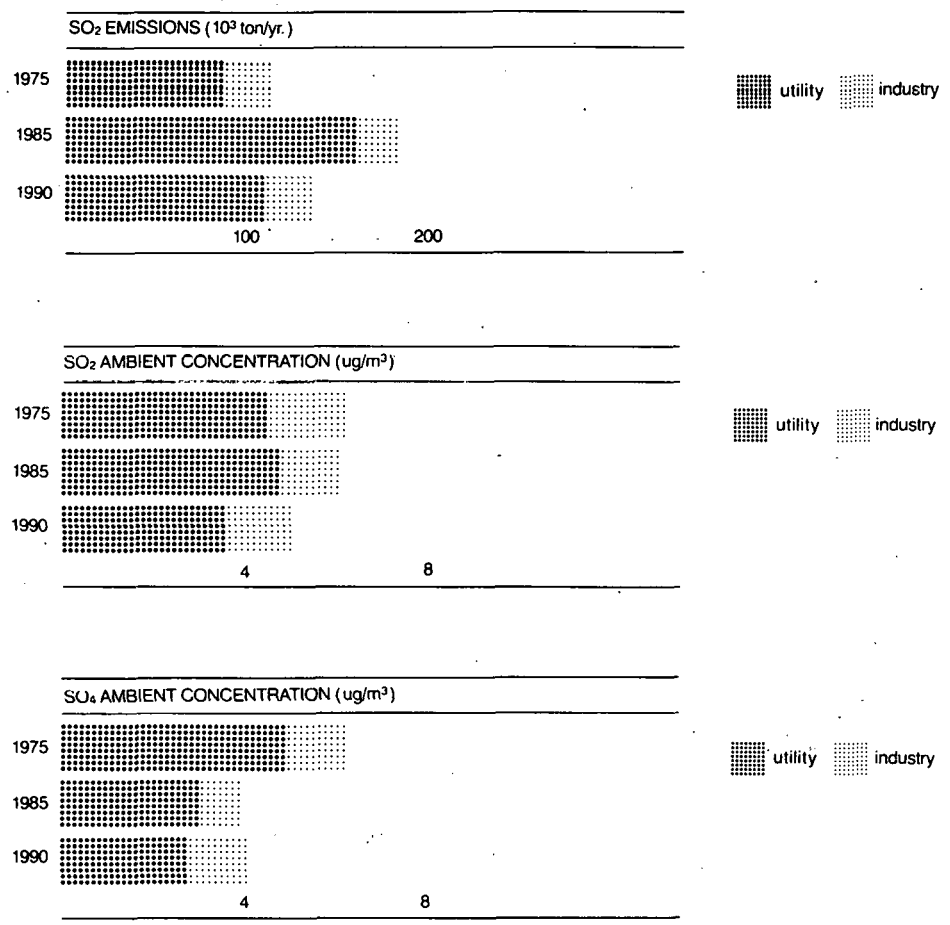

Figure 15. Emissions and Air Quality Trends in Massachusetts

5.3.2 Water Quality and Availability:

- o Iron, manganese, cadmium, cyanide, and alkalinity levels currently exceed applicable standards in the Connecticut River, and cooling tower blowdown at the proposed Montague site would raise these levels.
- o Groundwater quality and availability are of concern in coastal areas. The groundwater table may be disrupted during construction of Pilgrim 2.

Water quality issues will be of general concern in both the Montague and Pilgrim 2 hearings. Regarding cooling tower blowdown, where concentration results solely from evaporative loss and discharge back to the river over a reduced cross section determined by diffuser configuration, it is not clear whether the utility would be required to treat this waste stream.* A decision by the 4th U.S. Circuit Court** has taken the view that pollutant discharge, as defined by the Act, refers only to substances added to the intake stream. A discharge permit may be written by a state or regional EPA office limiting the levels of some substances due to the concentration effect; but such limitations, if any exist, have not yet been tested in the courts. The water quality computations addressed only cooling tower blowdown effects; inclusion of the impacts of discharging biocides and scale preventative would require further analysis.**

Background Issues:

- o The proposed diversion of Connecticut River floodwaters raises serious riparian rights issues (see Section 5.1.2).
- o Aggressive water quality management programs have greatly improved surface water quality in the state but have not had a measurable affect on groundwater quality.

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*R. Stoll, attorney, Office of the General Counsel, EPA, Washington, DC, personal communication (4/20/79).

**Appalachian Power vs Train, 4th Circuit Court, 545 Fed W (1351), p. 1377 (k) Credit for Intake of Pollutants.

**For complete details, see E. Kaplan, Water Quality Investigations at Proposed Freshwater Sites for Thermal Power Generation Additions, RIIA Issue Paper No. 4, Division of Regional Studies, BNL, May 1979.

5.3.3 Land Use, Ecology and Solid Waste:

- o The ecological impact of transbasin diversion via the Northfield pumped storage project may be extensive.
- o The ecologic impacts of OCS development and support activities are of grave concern to the New England commercial fishing industry.
- o The disposal site for solid wastes due to the Brayton Point ESECA conversion is sufficient only to 1984.

The Brayton Point plant, the only one in the region now considered likely to undergo ESECA conversion, will use an ash disposal site some 12 miles distant, requiring expensive trucking, and with sufficient capacity for only 5 years; an alternative site (presumably even more distant) will be required if some use for the ash cannot be developed.

The planned diversion of Connecticut River floodwaters into the Boston water supply system via the Northfield pumped storage project raises serious concerns about ecosystem impacts as well as a host of downstream riparian rights issues. The Connecticut River is frequently subject to serious flooding problems and its valley also has a unique agricultural productivity (tobacco, asparagus, and corn being important cash crops); any drastic change in hydrologic regime altering its role in enhancing fertility would be of serious long-term concern.*

Massachusetts is interested in exploring the potential for offshore oil, but the effects of this activity on fishing, the environment, and health are of general concern. Drilling operations could pollute the coastal waters with heavy metals such as beryllium and cadmium. Tanker spills and increases shipping traffic also pose a potential hazard. Significant finds of oil and gas could require the dredging of ports such as New Bedford which is known to have large amounts of PCBs residing on its harbor botton. Disturbing this relatively stable mass could contaminate fishing and lobster grounds.

5.3.4 Social, Economic, and Institutional:

- o Labor availability in specialized crafts would pose a problem only if the construction schedules of too many facilities overlap or if other construction activities in the Boston area increased too greatly (see Figure 12 for plant-specific impacts).

*M. Ertel, Study of Possible Environmental Effects of Proposed Diversion of Connecticut River to Quabbin Reservoir, Report on Phase I. Institute for Man and His Environment, U. of Massachusetts, Amherst, Feb. 1974.

- Major institutional actions will be required to decide the riparian rights issues evolving from any potential diversion of Connecticut River waters.

Since 1974 Massachusetts has had a comprehensive Energy Facilities Site Evaluation Act. As amended, this statute invests the state with decision-making powers over most types of major new energy facilities including electric generating plants; oil refineries, storage terminals, and pipelines; and natural gas facilities. The Massachusetts General Court (the state legislature) is currently considering legislation that would impose a moratorium on nuclear power plant construction pending resolution of nuclear waste problems. The impact of these measures on future energy facility siting cannot be accurately predicted or evaluted now, but may seriously inhibit the construction of nuclear power plants in the states.

Local socioeconomic impacts of proposed new energy facilities should not cause any schedule delays. The sites of the combined-cycle and other oil-fired power plant units are near heavily populated areas and are readily accessible to construction workers. Few workers will relocate during the construction period, and operations personnel who relocate will be easily accommodated. For the two nuclear facilities, Pilgrim 2 and Montague 1, it is estimated that about 10% of the staff will relocate.

Background Issues:

- In the recent past, state representatives have expressed concern over the boom-and bust impacts of energy developments on local economics.
- The resolution of (past) solid waste disposal site proposals must be viewed as unsatisfactory in light of the potential demand for sites for coal-fired power plant wastes. Proposals for such sites may raise intra-state equity issues.

5.3.5 Health and Safety:

- Concern over hazards of LNG tanker traffic in Boston Harbor may constrain LNG imports.
- Dredging of New Bedford Harbor and other old ports to support onshore facilities for OCS development may release significant amounts of PCBs.

- o Concern over use of urea-formaldehyde as a home insulation material may affect conservation objectives.
- o Evaluation of nuclear sites is of grave concern because of their location near transportation bottlenecks on the way to major recreation areas.

Currently one of the most prominent energy-related health issues in the state is the use of urea-formaldehyde (UF) to insulating buildings and homes. Within the past year about 500 complaints, primarily of skin and eye irritation along with respiratory impairment, were received from families who recently insulated their homes with UF, which may have been used in an estimated 3000 to 5000 homes in the state. Under certain circumstances, possibly as a result of improper mixing and installation, UF breaks down to produce formaldehyde fumes. Massachusetts is in the forefront of the movement to ban the use of UF insulation, but a number of similar complaints in other states (CR, NH, WI, MN) have been reported including one suspected death, that of an infant in Minneapolis. The Massachusetts State Department of Public Health and the Center for Desease Control in Atlanta, GA, are planning an epidemiological study of this situation.

Scenario-Induced Changes:

- o The estimated range of annual deaths attributable to fossil-fuel combustion (sulfate emissions) falls from 180-2900 in 1975 to 140-2200 in 1990, and the average personal annual risk of death decreases from 0.51×10^{-3} in 1975 to 0.32×10^{-3} in 1990.
- o The estimated number of annual radiation-induced cancers in the general public increases from 0.07 in 1975 to 0.32 in 1990, including the annualized effect of catastrophic accidents. The sharp increase is due to the Montague and Pilgrim nuclear units postulated by the Scenario.

5.4 VERMONT

5.4.1 Air Quality:

- o No major problems are identified or expected from energy-related activities implied by the MID-MID scenario.

Both industrial and utility emissions were projected to increase in Vermont, although the absolute levels will remain quite low. This is consistent with the reported desire of the state to relax its sulfur-in-fuel limit from 1% to 2%. The entire state meets the SO_2 and primary TSP ambient air quality standards.

The long-range transport analysis projects a decrease in population-weighted concentrations of both SO_2 and SO_4 due primarily to out-of-state reductions (see Figure 16). Visibility is expected to improve at the Class I PSD area in Vermont (Lye Brook Wilderness).

5.4.2 Water Quality an Availability: No major problems are identified or expected from energy-related activities implied by the MID-MID scenario.

5.4.3 Land Use, Ecology, and Solid Waste: No major problems are identified or expected.

5.4.4 Social, Economic, and Institutional: No major problems are identified or expected.

In response to widespread public concern over safety problems associated with the operation of the Vermont Yankee nuclear plant and with nuclear power in general, Vermont enacted legislation in 1975 giving the state legislature the power of final approval or veto of proposed nuclear facilities. The effect of this legislation on future energy supplies in the state is uncertain because it has not yet been tested and no additional nuclear facilities in Vermont are now being planned. Of more immediate (and positive) potential impact is the outcome of current negotiations by Vermont utilities and by state power authorities with Quebec and with Ontario Hydro for the purchase of Canadian electric power.*

5.4.5 Health and Safety: The major immediate energy-related public health concern in Vermont centers, surprisingly, on solar energy. Already as many as 60% of all homes are estimated to use wood to supply at least part of winter home heat (in other than purely decorative fireplaces), and the number of home

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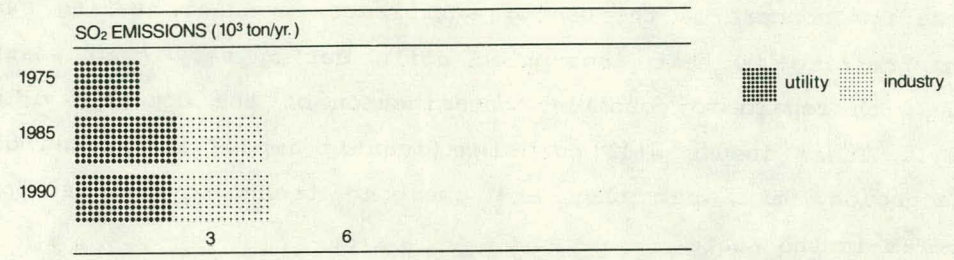
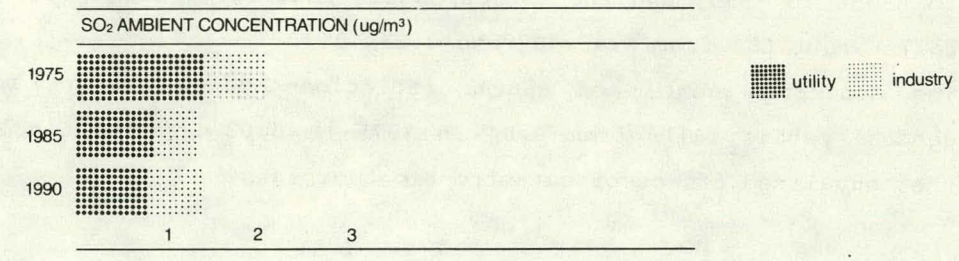
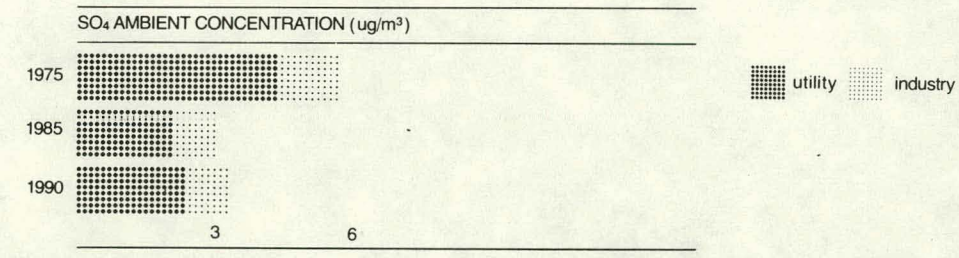
*See Carroll, op. cit., for further discussion.



- SO_2 emissions are expected to double between 1975 and 1990, nonetheless, emissions levels will remain significantly low.



- SO_2 ambient concentrations will decline between 1975 and 1985 and increase slightly between 1985 and 1990.



- SO_4 ambient concentrations will halve between 1975 and 1985.

Figure 16. Emissions and Air Quality Trends in Vermont

fires has increased drastically in the past two years. Several agencies are now mounting campaigns to focus public attention on the hazards of wood burning in inadequate facilities (or those that violate building codes). Another cause for concern is the use of antifreeze in solar heating systems (to prevent freezing in heat absorption coils during very cold weather), particularly with regard to possible contamination of the domestic drinking water supply. These issues will not significantly impede attainment of the scenario technology mix, but they are emerging technology-related public health concerns in the state.

Scenario-Induced Changes:

- The estimated range of annual deaths in Vermont attributable to fossil-fuel combustion (sulfate emissions) falls from 13-210 in 1975 to 8-130 in 1990, and the corresponding individual risk probability falls about 50% from 0.46×10^{-3} to 0.23×10^{-3}.
- The estimated number of annual radiation-induced cancers in the general public falls from 0.04 in 1975 to 0.03 in 1990, including the annualized effect of catastrophic accidents.

5.5 NEW HAMPHSIRE

5.5.1 Air Quality:

- The local air quality analysis projected exceedance of Class I PSD increments in Coos County due primarily to industrial emissions.
- Both industrial and utility emissions are projected to increase between 1975 and 1985 and then to decrease to less than 1975 levels by 1990 (Figure 17).
- Population-weighted concentrations of SO_2 will decline between 1975 and 1990, but those of SO_4 will decline from 1975 and 1985 and increase slightly thereafter (Figure 17).

The emissions of SO_2 from major sources in New Hampshire are projected to remain fairly constant over the period 1975-1990. There are some local non-attainment problems due to pulp mills, but otherwise no important pending regulatory constraints.

The local air quality analysis projected exceedance of the Class I PSD increments of Coos County due primarily to industrial emissions. The long-range transport analysis showed very low SO_4 concentrations because of decreases from out-of-state sources, and visibility was therefore expected to improve in the Class I areas of New Hamsphire.

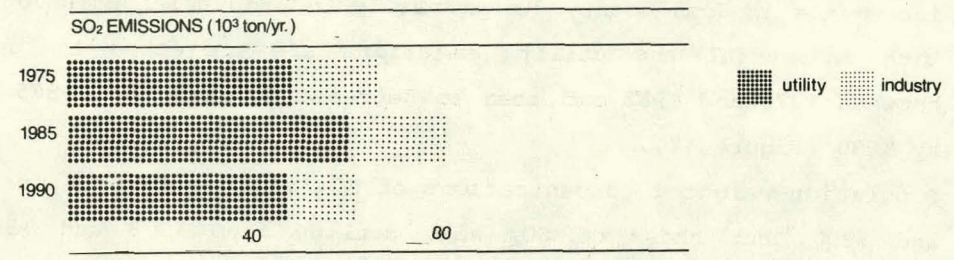
5.5.2 Water Quality and Availability:

- Conflicts over the use of groundwater during construction of Seabrook I have already arisen.
- No other major problems are identified or expected.

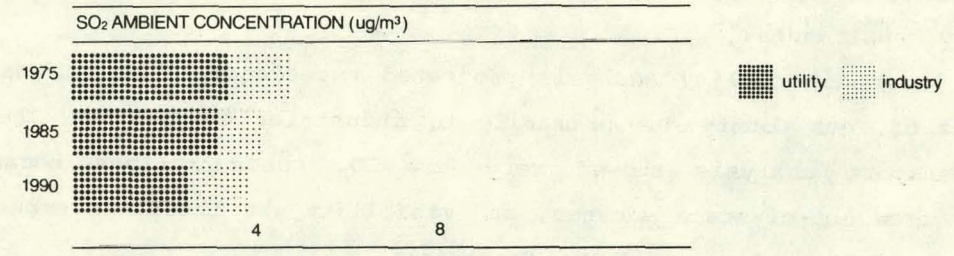
5.5.3 Land Use, Ecology, and Solid Waste: No major problems are identified or expected.

5.5.4 Social, Economic and Institutional:

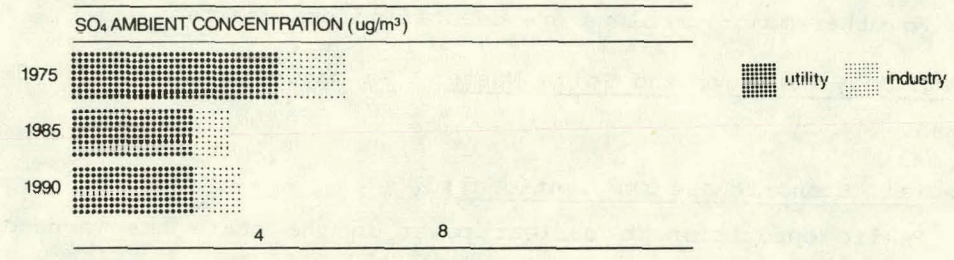
- Public opposition to nuclear power in the state has focused on the Seabrook nuclear generating station.
- Local socioeconomic impacts would interfere with energy development in the state.
- Growing public opposition to nuclear power facilities, a regionwide and nationwide phenomenon, has been most dramatically manifested in recent massive public demonstrations against construction of the Seabrook nuclear generating station in New Hampshire. Completion of this facility is now further impeded by financing problems due in



- SO_2 emissions will increase between 1975 and 1985 and then drop below 1975 levels by 1990.



- SO_2 ambient concentrations, however, show a constant decrease out to 1990.



- SO_4 ambient concentrations will decrease between 1975 and 1975 and 1985 and increase slightly therafter.

Figure 17. Emissions and Air Quality Trends in New Hampshire

part to this widespread opposition. The recent election of Governor Hugh Gallen (who campaigned on an anti-CWIP platform) has no doubt spelled an end to the construction work in progress (CWIP) charges on which Public Service of New Hampshire was relying for a substantial part of the Seabrook plant's financing.

Additional legislation aimed at curbing or regulating nuclear power facilities has been introduced in the New Hampshire Legislature. One bill would prohibit the disposal of nuclear wastes within the state, and another would mandate state investigation and monitoring of low-level radiation emissions.

The obstacles to the construction of the Seabrook plant posed by current or proposed legislative impediments and by public opposition could result in power supply delays and shortfalls that would be felt throughout the New England Power Pool.

Local socioeconoimc impacts should not interfere with proposed energy developments in New Hampshire. Most energy facilities will be sited in the populous southern part of the state and therefore readily accessible to construction workers. Of the June 1975 Seabrook construction work force of 2200, for example, only 246 had immigrated to Rockingham (where the plant is sited) and adjacent Stratford County in the last two years.

5.5.5 Health and Safety:

- The estimated range of annual deaths attributable to fossil fuel combustion falls from 25-300 in 1975 to 17-270 in 1990, and the corresponding individual personal annual risk of death falls from 0.048×10^{-3} to 0.03×10^{-3}.
- The estimated number of annual radiation-induced cancers in the general public rises from essentially zero in 1975 to 0.17 in 1990, including the annualized effect of catastrophic accidents. The sharp increase is due largely to the Seabrook nuclear unit postulated by the Scenario.

5.6 MAINE

5.6.1 Air Quality:

- Total statewide SO_2 emissions are expected to triple by 1990, even with full NSPS controls (Figure 18).

The scenario postulates substantial increases in power generation and fuel use in Maine, including 1150 MW of coal-fired capacity corresponding to the proposed Sears Island Plant, and a 60-MW combined-cycle plant by 1985.* In addition, a 600-MW oil-fired plant has recently come on line. These major additions will result in a substantial increase in emissions in Maine over those in the 1975 base year, even with controls for sulfur oxides emissions. Accurate projection of the effects of these changes is hampered by the presence of continental maritime flow patterns, which are near important population centers (and near some sources), and by the great distance from the large Midwestern sources that dominate long-range transport effects. The long-range transport analysis does show an exchange between local and long-range effects of SO_2 and a slight improvement for SO_4 due to reductions elsewhere, so that visibility in the two Class I PSD areas in Maine (Acadia National Park and Moosehorn Wilderness) is expected to improve.

Background Issues:

- Maine has some local non-attainment problems for SO_2 associated with paper mills (which are not included in this analysis) and also a few local TSP violations. These situation could subject future plant siting to constrains that would depend on a sub-county local analysis.

Scenario-Induced Changes:

- Total statewide SO_2 emissions are expected to triple by 1990, even with full NSPS controls (Figure 18).
- The long-range analysis showed the possibility of a PSD Class I SO_2 exceedance for Acadia National Park by 1985.
- Population-weighted concentrations of SO_2 will increase between 1975 and 1985 and decrease slightly thereafter; those of SO_4 will decrease between 1975 and 1985 and increase slightly thereafter, as shown in Table 17.

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*The scenario coal requirement makes this a larger plant than is curently planned by the utilities for Sears Island.

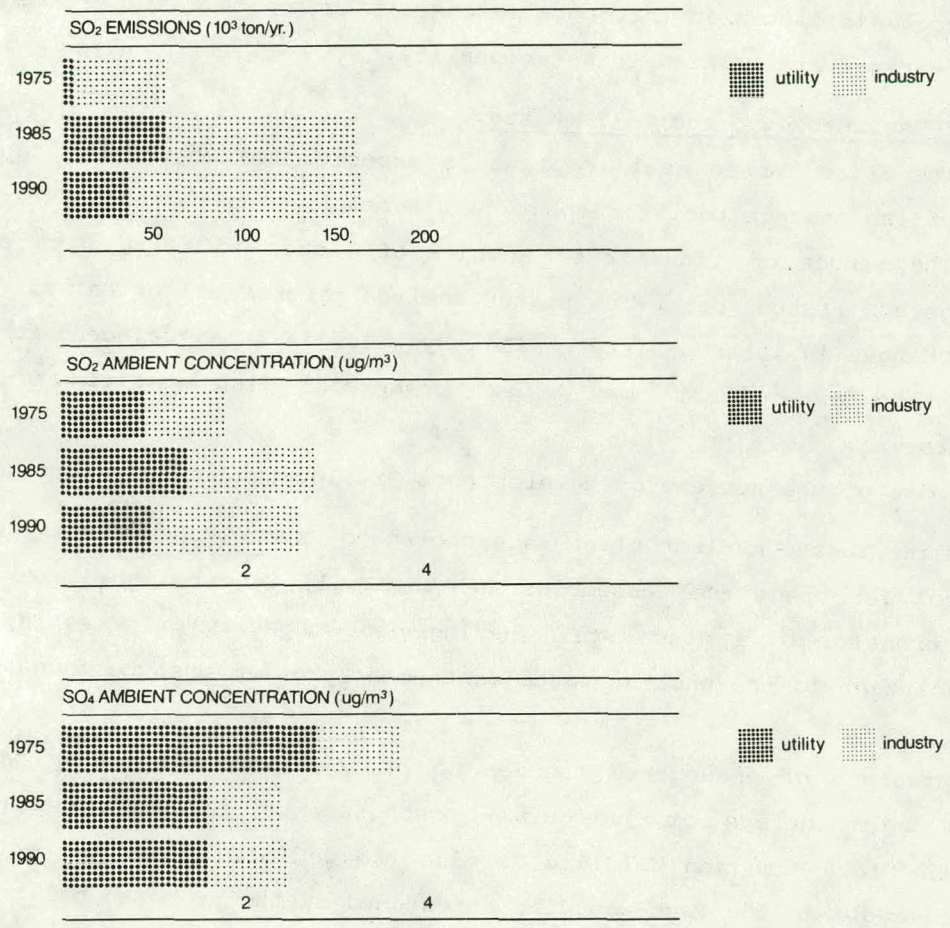

Figure 18. Emissions and Air Quality Trends in Maine

- o Industrial SO_2 emissions will increase by 100,000 tons/yr between 1975 and 1985 and by 30,000 tons/yr between 1985 and 1990.

5.6.2 Water Quality and Availability:

- o No major water availabilty problems are identified or expected from energy-related activites implied by the MID-MID scenario.
- o No major water quality problems are identified or expected; however, ecologic issues in the Sears Island siting and Maine Yankee rerating hearings are related to water quality.

5.6.3 Land Use, Ecology, and Solid Waste:

- o The Maine Yankee nuclear plant is expected to exhaust the capacity of its storage pool for spent fuel assemblies in the near future.
- o The ranges of a number of species of flora and fauna with endangered, listed, or review status include part or all of Maine.
- o Changes in water quality or flow dynamics in areas adjacent to operating power plants may affect commercial fish species and their larvae.
- o Most of the new energy developments are located in caostal counties.

The Maine Yankee nuclear plant is expected to exhaust the capacity of its storage pool for spent fuel assembies and this will require immediate action (possibly transfer to a plant still having pool capacity). A satisfactory regional solution to the nuclear waste management problem must be found by the mid 1980s.

The presence of endangered species on or near proposed energy facility sites may cause delays or indefinite postponements in construction; for example, the U.S. Fish and Wildlife Service had indicated that the existence of the bald eagle in the East would be threatened by the proposed oil refinery at Eastport. The Maine Yankee nuclear plant rerating may aggravate existing thermal, entrainment, and impingement problems. The Sears Island coal plant is meeting opposition from intervenors, who will raise similar issues of adverse impacts on the marine ecosystems from chemical treatment of plant cooling water and, if cooling towers are used, from blowdown discharges. The offshore areas of Cumberland, Lincoln, and Waldo Counties, where power plants are proposed, are highly productive fishing grounds that may be disrupted by the cooling systems.

5.6.4 Social, Economic, and Institutional:

- The locations of most proposed energy developments are in the areas with most of the state's population.
- No major social or economic problems are identified or expected from energy-related activities implied by the MID-MID scenario.

It is estimated that the Sears Island coal-fired power plant (1150 MW) will employ 1875 workers at peak construction. Most of these will be Maine residents, as were 92% of the workers on the Maine Yankee plant. The Sears Island plant will have a greater in-migration of workers than the Maine Yankee site because it is farther from Portland. The local socioeconomic impact, centered in Waldo County and extending into Penobscot County, should not cause delays in the construction schedule.

The proposed Sears Island electrical generating facility has been the focus of considerable political debate and controversy raised by groups perceiving the plant as posing a variety of environmental problems and hazards, perhaps the most serious being its location only 10 to 12 miles from the outer island of Acadia National Park.

Background Issues:

- Maine has no energy facility siting legislation, but does have laws that set standards and procedures for the siting of major developments along the coast and inland.

5.6.5 Health and Safety:

- The use of wood as a residential and commercial fuel may result in increased accidents.
- The estimated range of annual deaths in Maine attributable to fossil-fuel combustion falls from 20-230 in 1975 to 12-190 in 1990, and the corresponding individual personal annual risk of death falls from 0.03×10^{-3} to 0.19×10^{-3}.
- The estimated number of annual radiation-induced cancers in the general public rises from 0.07 in 1975 to 0.09 in 1990, including the annualized effect of catastrophic accidents.

Maine, like Vermont and New Hampshire, has recently developed a strong dependence on wood as a home heating fuel. It is estimated that 80 to 85% of homes are heated primarily by oil and 15 to 20% by electricity, but 40 to 55%

burn wood for supplemental heating. The health concerns associated with this use of wood are (1) pollution from wood combustion, (2) home fires due primarily to faulty installation of wood-burning stove, and (3) accidents during wood harvesting.

TABLE 8

THE IMPACT OF ENERGY DEVELOPMENT IN THE EIA TRENDLONG MID-MID SCENARIO ON REGIONAL ENVIRONMENTAL QUALITY IN 1990

	Regional Dimensions*			Notes
	Local	Subreg.	Regional	
The Likelihood of Projected Regional Energy Use or Development Producing Significant Environmental Impacts	H[2,1]	M[1,2]	M[1,2]	[1]Widespread Public Opposition: Inadequacies of Waste Disposal Arrangements: Concern over impacts of low level radiation.
**The Likelihood of not Attaining Projected Regional Energy Mix because of Adverse Environmental Impacts	H[2,1]	M[1,2]	M[1,2]	[2]Resistance to ESECA conversions, PSD Problems in Maine.
**The Likelihood Specific Technologies or Resources will not Attain Projected Level of Use				[3]Potential for refuse to energy conversions and biomass fully reflected in scenario.
Electric Sector				
Coal	M[2]	M[6]	M[6]	[4]LNG hazards.
Oil	L	L	L	
Nuclear	H[1]	H[1]	H[1]	[5]Concern over OCS impacts.
Supply				
Gas	M[4]	L	L	[6]Concern over interregional pollution transport with respect to SO_4 standard.
Oil	M[5]	L	L	
Urban Waste	L	L	L	
Solar	L	L	L	
Coal Mining	L	L	L	
End Use				
Industry	L[3]	L[3]	L[3]	
***The Likelihood Specific Technologies or Resources could be Available at Levels Greater than Projected 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.

***Technologies and resources available to higher degree:
- Low - Technologies or resources presently available could be substituted at reasonable costs and impacts.
- Medium - Technologies or resources presently or potentially available but the acceptability of costs and impacts uncertain.
- High - Technologies or resources unavailable or available at high costs or impacts.