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REGIONAL ISSUE IDENTIFICATION AND ASSESSMENT PROGRAM (RIIA)

ENVIRONMENTAL IMPACTS AND ISSUES
OF THE EIA MID-MID SCENARIO:
FEDERAL REGION III (MID-ATLANTIC)

BROOKHAVEN NATIONAL LABORATORY

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J. BRAINARD AND F.W. LIPPERT

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May 1, 1979

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TABLE OF CONTENTS

Acknowledgments.....	v
Major Findings.....	vi
1. INTRODUCTION.....	1
1.1 RIIA Study Description.....	1
1.2 RIIA Methodology and Assumptions.....	1
1.2.1 Overall Program Methodology.....	1
1.2.2 Assumptions.....	3
1.2.3 Criteria for Ranking of Impacts.....	4
2. REGIONAL OVERVIEW.....	7
3. THE EIA TRENDLONG MID-MID SCENARIO.....	9
3.1 National Scenario.....	9
3.2 The Regional Scenario.....	11
4. REGIONAL ASSESSMENT.....	16
4.1 National Issues.....	16
4.1.1 Long Range Pollutant Transport.....	16
4.1.2 Coastal Water Resources.....	18
4.1.3 National Socioeconomic Issues.....	18
4.2 Regional Issues.....	19
4.2.1 Air Quality.....	19
4.3.2 Water Quality and Availability.....	19
4.3.3 Land Use, Ecology and Solid Waste.....	19
4.3.4 Social, Economic, and Institutional Issues.....	22
4.3.5 Health and Safety.....	24
5. STATE ISSUES.....	27
5.1 Delaware.....	27
5.1.1 Air Quality Impacts.....	27
5.1.2 Water Quality and Availability Issues.....	29
5.1.3 Land Use, Ecology, and Solid Waste.....	29
5.1.4 Social, Economic, and Institutional Issues.....	29
5.1.5 Health and Safety Issues: Scenario-Induced Changes.....	30

5.2 Maryland and District of Columbia.....	30
5.2.1 Air Quality Impacts.....	30
5.2.2 Water Quality and Availability Issues.....	31
5.2.3 Land Use, Ecology, and Solid Waste Issues.....	31
5.2.4 Social, Economic, and Institutional Issues.....	33
5.2.5 Health and Safety.....	33
5.3 Pennsylvania.....	35
5.3.1 Air Quality Impacts.....	35
5.3.2 Water Quality Impacts.....	36
5.3.3 Land Use, Ecology, and Solid Waste Impacts.....	39
5.3.4 Social, Economic, and Institutional Issues.....	40
5.3.5 Health and Safety Issues.....	40
5.4 Virginia.....	42
5.4.1 Air Quality Impacts.....	42
5.4.2 Water Quality Impacts.....	44
5.4.3 Land Use, Ecology, and Solid Waste Issues.....	44
5.4.4 Social, Economic, and Institutional Issues.....	45
5.4.5 Health and Safety.....	45
5.5 West Virginia.....	47
5.5.1 Air Quality Impacts.....	47
5.5.2 Water Quality and Availability Issues.....	48
5.5.3 Land Use, Ecology, and Solid Waste Issues.....	48
5.5.4 Social, Economic, and Institutional Issues.....	50
5.5.5 Health and Safety.....	51

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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 mid-Atlantic 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 impede realization of the nuclear goals of the scenario (6900 MW for Pennsylvania and 3700 MW for Virginia). The need for Federal action to solve the radioactive waste disposal problem cannot be overemphasized.
- . About 50% improvement in sulfur oxides air quality is projected for the region (all states), based on emissions reductions both within the region and in neighboring regions. This improvement is highly dependent on cleanup of existing major fuel burning sources as well as implementation of new performance standards. Nitrogen oxides air quality may be less well-controlled.
- . Even through strip mine production is projected to decrease by 1990, coal production levels hypothesized by the scenario may be significantly constrained by the impact of new Federal regulations on reclamation (Pennsylvania, Virginia, and West Virginia).
- . In the event that offshore oil and gas exploration becomes successful, development may be constrained by continuing opposition on environmental grounds in Maryland and Delaware, relating to protection of coastal environmental resources.
- . Given the abandonment of several recent dam projects in the Delaware, water availability constraints may be important for inland sites where low flow augmentation is required.
- . The health and safety impacts of the scenario are dominated by the coal fuel cycle. By 1990, mining related injuries and deaths are projected to increase by about 25% over current levels, while public health impacts due to sulfur oxides air pollution are projected to decrease by about 40%. Impacts due to other air pollutants, however, were not quantified. Although health and safety impacts due to nuclear power plants in Pennsylvania and Virginia are projected

to increase, the numbers are quite small and are likely to constrain the scenario only because of public perception rather than actual risk.

- Pennsylvania has non-attainment areas (areas where ambient air pollution standards have not been met) which may constrain the siting of new energy-related facilities; one new coal fired power plant may be affected.

These impacts are discussed further in the sections that follow.

Nuclear: A severe constraint on the energy future postulated by the MID-MID scenario is the widespread opposition to nuclear power in the region. Although many of the specific environmental concerns are local in nature and amenable to local solutions (such as water related issues), timely licensing, especially where political forces can be mobilized at the state level, is extremely unlikely in the present climate. Especially in Pennsylvania, the Three Mile Island incident is likely to create severe licensing delays for the seven additional nuclear units postulated in the state by 1990. Moreover, in all of the Northeast, concern over radioactive waste management issues remains a prominent issue, and the need for federal action cannot be overemphasized.

Coal: The MID-MID scenario hypothesizes an increase in underground mining in the region from 156 million tons in 1975 to 200 million tons per year in 1990, and a decrease in strip mined coal production from 80 to 71 million tons per year by 1990. Nevertheless, the impact of strip mine reclamation rules is a central issue with regard to attaining the postulated level of coal production in the region. The economic impact of new regulations under the 1977 Surface Mining Control and Reclamation Act on the coal industry, especially on smaller mining concerns, has been fiercely debated in the coal producing states of the region (Maryland, Pennsylvania, Virginia, West Virginia). A total of 174,000 acres will have been disturbed for surface mining (reclaimed or not) by 1990, a 40% increase over the estimated area disturbed in 1977.

Water Quality and Availability: Energy-water conflicts in the region rank as one of the more important constraints to realization of the future embodied in the MID-MID scenario. Both in the coastal zone, where Delaware, for example, has one of the most restrictive coastal zone acts in the nation, and in inland areas, where consumptive use for evaporative cooling requires

low flow augmentation to meet river basin commission policies, severe constraints on energy facility siting must be expected. For example, 176 cubic feet per second (CFS) of low flow augmentation (which represents 12% of the present low flow) must be provided in the Delaware River Basin to accommodate postulated thermal plants in Pennsylvania, New Jersey, and Delaware portions of the basin. In light of the demise of the Tocks Island and Trexler dam proposals, this may be extremely difficult to achieve.

Many of the water quality problems in the region stem from past coal mining activity, especially in Pennsylvania and West Virginia. Unfortunately, much of the pollution comes from abandoned mines which cannot be readily controlled by current statutes, and thus, even with stringent application of new regulations (under NPDES or new Strip Mine regulations) to operating and new facilities, realization of water quality goals may be decades distant.

Solid Waste: Despite significant coal mining and a number of new coal-fired electric plants fitted with flue gas desulfurization systems, solid waste disposal is not anticipated to be a significant constraint to energy development in the region. Adequate disposal sites are expected to be found, although costs could be significantly affected by implementation of the Resource Conservation and Recovery Act.

Air Quality: Region III is heavily industrialized, and its sulfur oxides emission (1975) are 3rd highest among those in the ten federal regions (2nd highest on the basis of emissions per square mile). Even so, in 1975 58% of the ambient sulfate resulted from emissions from outside the region. Thus, local air pollution controls have only limited usefulness in improving air quality in Region III. For all the time periods analyzed, Region III was the region with the highest regional average sulfate concentration, because of its relatively high population density and its location just downwind from other large industrialized regions. It is estimated that the regionwide average concentration of sulfur dioxides will decrease from 24.9 ug/m³ in 1975 to 12.9 ug/m³ in 1990, and that of suspended sulfate from 14.9 ug/m³ in 1975 to 8.0 ug/m³. Achievement of these levels is dependent on emissions reductions both within the region and in neighboring regions, especially the Ohio Valley and TVA areas to the west.

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. Since much of the region is non-attainment for oxidants, these represent important concerns even if the postulated sulfur oxides emissions are achieved.

Institutional: One of the dominant political concerns of the mid-Atlantic region relates to the coastal environmental impacts of petroleum exploration and development in the Baltimore Canyon area. To the extent that current drilling has failed to result in commercial quantities of oil or natural gas, such issues may be moot. Nonetheless, continuation of the leasing program has resulted in concern on the part of state governments and private groups. Although all the coastal states of the Northeast have enacted some form of coastal zone environmental legislation in response both to federal mandates and to ongoing Outer Continental Shelf oil exploration, the legislatures of the coastal states of Federal Region III -- particularly those of Delaware and Maryland -- have been especially sensitive to energy related threats to their coastal resources. Delaware's Coastal Zone Act, as noted, is the most stringent coastal environmental legislation in the Northeast. The provisions of Maryland's Coastal Facilities Review Act, although not restrictive as those of neighboring Delaware, apply to an area comprising approximately 65 percent of the state's land area. Yet most new major energy facilities postulated by the scenario in either state would necessarily have to be sited in the areas covered by these acts.

Health and Safety Issues: There is considerable divergence between the current public perception of the importance of several issues 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 facilities in the region, yet our analysis indicates the expected number of radiation-induced cancers from nuclear power plant operation in the region, including occupation and general public exposure, will only be 0.5 per year in 1975 and 1.5 per year by 1990.

Annual total accidental injuries in coal mining are expected to increase from 3810-14500 in 1975 to 4900-21500 in 1990, in parallel with increases in coal production in the region. These levels reflect current accident rates and should be viewed as an upper bound in light of possible future improvements in mine safety.

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 from SO_4 exposure decrease from a range of up to 13% of all deaths in 1975 (29000 deaths) to up to 7% in 1990 (18000 deaths). These effects are postulated to be chronic, and thus the improvement 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 occupations 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 III, the Mid-Atlantic region, comprising Delaware, the District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia. Those for each of the other Federal regions in the nation (Figure 1) are covered in nine additional volumes. 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

¹The 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 analysis. 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 inter-regional 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 all air emissions from existing facilities will meet current SIP requirements,*** and all thermal electric generation plants located in

*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 2,3 and 4.

***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.

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.

TABLE 1
CONTROL TECHNOLOGY ASSUMPTIONS

	UTILITY	INDUSTRY	MINING																														
AIR	<p>EMISSIONS AND LOCAL AIR QUALITY:</p> <p><u>COAL</u></p> <ul style="list-style-type: none">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 REQUIREMENTSPLANTS WITH STARTUP DATES AFTER 1983 - BACT, 85% AND 90% CONTROL OR REMOVAL OF SO₂ CONSIDERED <p><u>OIL</u></p> <ul style="list-style-type: none">SIPS REQUIREMENTS <p><u>GAS AND METALLURGICAL COAL</u></p> <ul style="list-style-type: none">UNCONTROLLED	<p>EMISSIONS AND LOCAL AIR QUALITY:</p> <table><thead><tr><th></th><th>SO₂</th><th>PARTICULATES</th></tr></thead><tbody><tr><td><u>COAL</u></td><td></td><td></td></tr><tr><td>NEW LARGE SOURCES (250 X 10⁶ BTU/HR)</td><td>BACT, 80% REMOVAL 1.5 LB/10⁶ BTU</td><td>BACT, 99% REMOVAL 0.05 LB/10⁶ BTU</td></tr><tr><td>NEW SMALL SOURCES (100-250 X 10⁶ BTU/HR)</td><td>SIP, WITH PHYSICAL CLEANING</td><td>SIP, CYCLONES</td></tr><tr><td>NEW NON-MFB PLANTS (100 X 10⁶ BTU/HR)</td><td>SIP, FOR MFB</td><td>SIP, FOR MFB</td></tr><tr><td>EXISTING LARGE SOURCES (250 X 10⁶ BTU)</td><td>SIP, FOR MFB</td><td>SIP, FOR MFB</td></tr><tr><td>EXISTING SMALL SOURCES (100-250 X 10⁶ BTU/HR)</td><td>SIP, USING LOCALLY AVAILABLE COAL</td><td>SIP, USING SETTLING CHAMBER/EXPANDED CHIMNEY & CYCLONES</td></tr><tr><td>EXISTING NON-MFB PLANTS (100 X 10⁶ BTU/HR)</td><td></td><td></td></tr></tbody></table> <p><u>OIL AND GAS</u></p> <ul style="list-style-type: none">SIP, LIMITATIONS ON SULFUR CONTENT OF FUEL, AS A WEIGHT FRACTION.EMISSIONS FACTORS IN USEPA "COMPILATION OF AIR POLLUTANT FACTORS".		SO ₂	PARTICULATES	<u>COAL</u>			NEW LARGE SOURCES (250 X 10 ⁶ BTU/HR)	BACT, 80% REMOVAL 1.5 LB/10 ⁶ BTU	BACT, 99% REMOVAL 0.05 LB/10 ⁶ BTU	NEW SMALL SOURCES (100-250 X 10 ⁶ BTU/HR)	SIP, WITH PHYSICAL CLEANING	SIP, CYCLONES	NEW NON-MFB PLANTS (100 X 10 ⁶ BTU/HR)	SIP, FOR MFB	SIP, FOR MFB	EXISTING LARGE SOURCES (250 X 10 ⁶ BTU)	SIP, FOR MFB	SIP, FOR MFB	EXISTING SMALL SOURCES (100-250 X 10 ⁶ BTU/HR)	SIP, USING LOCALLY AVAILABLE COAL	SIP, USING SETTLING CHAMBER/EXPANDED CHIMNEY & CYCLONES	EXISTING NON-MFB PLANTS (100 X 10 ⁶ BTU/HR)			<p>NO ASSUMPTIONS MADE. AIR POLLUTANTS FROM MINING ACTIVITIES NOT CONSIDERED.</p>						
	SO ₂	PARTICULATES																															
<u>COAL</u>																																	
NEW LARGE SOURCES (250 X 10 ⁶ BTU/HR)	BACT, 80% REMOVAL 1.5 LB/10 ⁶ BTU	BACT, 99% REMOVAL 0.05 LB/10 ⁶ BTU																															
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EXISTING NON-MFB PLANTS (100 X 10 ⁶ BTU/HR)																																	
WATER QUALITY	<p>BPC, EFFECTIVE JULY 1977 BACT, EFFECTIVE JULY 1984 NSPS, EFFECTIVE JULY 1977</p> <p>UTILITY GENERATING LOCAL FACTOR - 55%</p>	<p>BPC, EFFECTIVE JULY 1977 BACT, EFFECTIVE JULY 1984 NSPS, EFFECTIVE JULY 1977</p>	<p>MINE DRAINAGE: "COAL SUPPLY REGION" (CSR) DRAINAGE DATABASE - COMPLIANCE WITH EFFLUENT LIMITATIONS ASSUMED.</p> <p>COAL WASHING: ASSUME 50% OF COAL IS CLEANED, 96% OF THAT BY WET METHODS. ALL FACILITIES HAVE ZERO DISCHARGE IN CSRs 7 - 10, 60% OF FACILITIES HAVE ZERO DISCHARGE IN CSRs 1 - 6, CSR 11 AND CSR 12. 40% OF FACILITIES IN THOSE CSRs PRODUCE 2,150 LITERS/METRIC TON OF COAL WASHED.</p> <p>COAL REFUSE PILE: 40% OF ANNUAL PRECIPITATION IN EACH CSR RESULTS IN EFFLUENT RUNOFF: 7.08 X 10⁶ HECTARES/METRIC TON OF COAL CLEANED ARE EXPOSED TO RAIN FOR ONE YEAR.</p> <p>RECLAMATION: SEDIMENTATION CAN ACHIEVE 80% CONTROL EFFICIENCY. OTHER RUNOFF RATES ARE FROM EPA NATIONAL ASSESSMENT OF NON-POINT SOURCE POLLUTION.</p>																														
WATER AVAILABILITY	<table><thead><tr><th>COOLING OPTION:</th><th colspan="2">NUCLEAR (1000 MW)</th><th colspan="2">FOSSIL (1000 MW)</th></tr><tr><th></th><th>WITH DRAWAL (MGD)</th><th>CONSUMPTION (MGD)</th><th>WITH DRAWAL (MGD)</th><th>CONSUMPTION (MGD)</th></tr></thead><tbody><tr><td>ONCE THROUGH</td><td>1400</td><td>4</td><td>830</td><td>3</td></tr><tr><td>POND OR CANAL</td><td>42</td><td>26</td><td>25</td><td>15</td></tr><tr><td>WET COOLING TOWER</td><td>28</td><td>17</td><td>17</td><td>10</td></tr><tr><td>DRY COOLING TOWER</td><td>0.3</td><td>0</td><td>0.2</td><td>0</td></tr></tbody></table>	COOLING OPTION:	NUCLEAR (1000 MW)		FOSSIL (1000 MW)			WITH DRAWAL (MGD)	CONSUMPTION (MGD)	WITH DRAWAL (MGD)	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	<p>DATA BASE:</p> <ul style="list-style-type: none">WATER CONSUMPTION DATA DEVELOPED FOR THE WATER RESOURCES COUNCIL.	<p>WATER REQUIREMENTS FOR COAL EXTRACTION AND WASHING, DUST CONTROL AND REVEGETATION ARE ASSUMED TO BE NEGLIGIBLE.</p>
COOLING OPTION:	NUCLEAR (1000 MW)		FOSSIL (1000 MW)																														
	WITH DRAWAL (MGD)	CONSUMPTION (MGD)	WITH DRAWAL (MGD)	CONSUMPTION (MGD)																													
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WET COOLING TOWER	28	17	17	10																													
DRY COOLING TOWER	0.3	0	0.2	0																													
SOLID WASTE	<ul style="list-style-type: none">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.	<ul style="list-style-type: none">NSPS AND SIP REQUIREMENTS USED TO DETERMINE ASH AND FGD SLUDGE PRODUCTION AND LAND REQUIREMENTS.	<ul style="list-style-type: none">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 ARKANSASPAST BUREAU OF MINES DATA AND MINRES PROGRAM WERE USED TO DETERMINE MINING RESIDUALS.																														

ABBREVIATIONS:

BACT	BEST AVAILABLE CONTROL TECHNOLOGY ECONOMICALLY ACHIEVABLE
BEA	BUREAU OF ECONOMIC ACTIVITY AREA
BPC	BEST PRACTICABLE CONTROL TECHNOLOGY
BTU	BRITISH THERMAL UNIT
FGD	FLUE GAS DESULFURIZATION
FPC	FEDERAL POWER COMMISSION
MFB	MAJOR FUEL BURNING INSTALLATIONS
MGD	MILLION GALLONS PER DAY
MW	MEGAWATTS
NSPS	NEW SOURCE PERFORMANCE STANDARDS
SIP	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 WORK-PLACE 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; CONFLICTS 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 INFUX 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

Federal Region III, the Mid-Atlantic region, comprising Pennsylvania, Maryland, Delaware, Virginia, West Virginia, and the District of Columbia,* marks the southern extension of the megalopolis that stretches from Boston, MA, through Norfolk, VA. As this suggests, most urban centers are located along the coast, although some core cities such as Pittsburgh, PA, and Charleston, WV are located inland. State population densities in the region range from roughly the national average (WV) to seven times the average (MD, with approximately 419 persons per square mile). In urban areas population densities are much higher than the national average (more than 15,000 persons per square mile in Philadelphia) and in some rural areas they are much lower.

Employment in the region is largest in the manufacturing, government, and services sectors. Value added by manufacturing in the region was 48.3 billion dollars: 60% of this occurred in Pennsylvania. State unemployment rates in 1976 bracketed the national average with the highest rate in the District of Columbia (9.1) and the lowest in Virginia (5.9). The number of unemployed individuals in the region in 1976 was about three-quarters of a million people, more than 50% of whom resided in Pennsylvania. Total personal income in 1976 (constant 1972 dollars) was 118.8 billion dollars. Pennsylvania, with 57.8 billion dollars in personal income, and Delaware, with 3.2 billion dollars, were the extremes. Average per capita income ranged from \$5392 in West Virginia to \$8648 in the District of Columbia. Median family income in West Virginia was only 80% of the national average, whereas in Maryland it was about 120%. Urban intermediate budgets (for a four person family) and cost of living indices for selected cities and SMSAs in the region are well above the national average.

The region is also noted for its concentrations of coal mining, mostly underground, in Pennsylvania and West Virginia; it provided 56% of U.S. deep-mined coal and 26% of the surface mined coal in 1975.

*For the purposes of this report, the District of Columbia is included with Maryland.

Current energy use is dominated by the industrial sector, and by oil fuel. Although nuclear plants supply only a few percent of the region's needs, the recent accident at Three Mile Island, PA dramatized the nuclear role and heightened public perception of the attendant risks.

Air quality in the region is largely acceptable, except in localized urban areas and some industrial areas in Pennsylvania, and except for photochemical oxidants, which are in violation of ambient standards nearly throughout the region. Dominant winds are from the southwest in July and April, the northeast in October, and the northwest in January. Westerly or southwesterly winds bring long-range pollution from the heavily industrialized Tennessee and Ohio Valley areas.

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
(10¹⁵ Btu/yr)

	<u>1975</u>	<u>1985</u>	<u>1990</u>
<u>DOMESTIC PRODUCTION</u>			
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	<u>3.2</u>	<u>71.8</u>	<u>79.6</u>
TOTAL DOMESTIC PRODUCTION	59.1	71.8	79.6
<u>IMPORTS</u>			
Crude oil	8.7	16.5	20.9
Petroleum products	3.8	6.7	7.8
Natural gas	<u>1.0</u>	<u>1.9</u>	<u>12.6</u>
TOTAL IMPORTS	<u>13.5</u>	<u>25.1</u>	<u>31.3</u>
TOTAL SUPPLY	72.6	96.9	110.0
<u>DOMESTIC CONSUMPTION</u>			
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	<u>3.2</u>	<u>4.2</u>	<u>5.0</u>
TOTAL DOMESTIC CONSUMPTION	70.6	94.6	108.5
<u>EXPORTS</u>			
Coal	1.8	1.9	2.1
Refinery loss	<u>0.2</u>	<u>0.4</u>	<u>0.3</u>
TOTAL CONSUMPTION AND EXPORT	72.6	96.9	110.9
<u>DOMESTIC CONSUMPTION BY SECTOR</u>			
Residential	14.7	19.0	21.2
Commercial	11.3	13.5	15.0
Industrial	26.0	40.7	49.0
Transportation	<u>18.6</u>	<u>21.4</u>	<u>23.3</u>
TOTAL	70.6	94.6	108.5

the 1980s. Thus, the region's share of national population, employment and energy growth are near the national average rates in the scenario (See Figures 2, 3, 4, and 5).

3.2 The Regional Scenario

The energy supply and demand scenario for Federal Region III, summarized in Table 4, was the basis for the county-level utility, industrial, and mining siting patterns developed by ORNL, BNL, and MITRE, which in turn provided the basis for impact assessment. Figure 5 shows the fuel mix for the region in 1975 and 1990: the most significant change is the increased share of electricity.

Figure 6 shows the major electric facilities postulated in the scenario. The Delaware River Basin will be the site of approximately 30% of the 30,500 MW of new power facilities (60MW and larger) planned for Federal Region III between 1976 and 1990, and the Ohio River watershed will contain 25% of them; 53% of the proposed plants are postulated for Pennsylvania, which encompasses most of these two watersheds. The regional fuel mix in the electric sector (Figure 7) indicates the high reliance on coal (68.3% compared with the national average of 51.8%).

Coal and nuclear fueled plants are each slated to provide about 11,500 MW and pumped storage hydroelectric another 5500 MW. The other 2000 MW will come from smaller oil-fired peaking and combined cycle units.

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

<u>Sector</u>	<u>1975</u>	<u>1985</u>	<u>1990</u>
Residential	1047	1135	1162
Commercial	714	751	802
Industrial	2046	2628	2951
Transportation	1784	2066	2232
Raw Materials	115	205	258
TOTALS	5706	6785	7405
Electricity	616	956	1143
Oil	2610	3164	3458
Natural Gas	1258	1336	1385
Coal	1222	1329	1419
TOTAL	5706	6785	7406

POPULATION GROWTH 1975 TO 1985
PIES MID-MID SCENARIO
AVERAGE ANNUAL PERCENTAGE GROWTH RATES

■ VERY LOW: < .009 ▨ LOW: -.009 - .001 □ AVG: .002 - 1.97 ▩ HIGH: 1.98 - 2.80 ■ VERY HIGH: > 2.80

Figure 2. Population Growth in the EIA MID-MID Scenario.

EMPLOYMENT GROWTH 1975 TO 1985
PIES MID-MID SCENARIO
AVERAGE ANNUAL PERCENTAGE GROWTH RATES

■ VERY LOW: < -.008 ▨ LOW: -.008 - 1.22 □ AVG: 1.23 - 3.45 ▩ HIGH: 3.46 - 4.42 ■ VERY HIGH: > 4.42

Figure 3. Employment Growth in the EIA MID-MID Scenario.

Figure 4. Energy Growth in the EIA MID-MID Scenario.

Figure 5. Region III Fuel Mix, 1975 and 1990.

Figure 6. Major Electric Sector Additions 1979-1990.

Figure 7. 1990 Electric Sector Fuel Mix.

TABLE 5
FUEL USE TRENDS IN REGION III
(10⁹ Btu/yr)

	Oil & gas		Coal	
	Utilities	Industrial	Utilities	Industrial*
1975	400	716	1675	332
1985	165	816	2043	312
1990	166	922	2532	356

*Excluding metallurgical coal

TABLE 6
SULFUR OXIDES EMISSION RATES IN REGION III
(lb SO₂/10⁶ Btu)

	Oil & gas		Coal	
	Utilities	Industrial	Utilities	Industrial
1975	1.69	0.75	3.26	4.11
1985	1.87	0.72	1.17	2.07
1990	1.83	0.76	1.11	2.00

Trends in fuel use in the industrial and utility sectors in Region III (Table 5) show industrial use of oil growing slightly while utilities' use is drastically cut back in favor of coal. Sulfur oxides (SO₂) emissions rates (Table 6) may be used to assess the degree of emissions control implied: SO₂ emissions from oil remain relatively constant, while those from coal are drastically reduced. The decrease in utility coal emissions by 1985 reflects the assumption that SIPs will be fully met by 1985; the further decrease by 1990 is a result of the new NSPS proposals that call for eventual 90% SO₂ removal.

IV. REGIONAL ASSESSMENT

4.1 National Issues: Many of the potentially more important issues and impacts encountered in Region III as a result of this scenario are national or multi-regional in scope, requiring a focus for analysis much broader than the state or regional scale. These concern long range transport of air pollutants, protection of coastal water quality in the face of OCS oil and gas development, and socioeconomic impacts resulting from national energy policy.

4.1.1 Long Range Pollutant Transport: Region III is heavily industrialized, and its 1975 sulfur dioxide emissions were 3rd highest among those of the ten federal regions (2nd highest on the basis of emissions per square mile). Even so, in 1975, 58% of the population-weighted sulfate concentration* resulted from emissions from outside the region. Thus, local air pollution controls have only limited usefulness in improving air quality in Region III. For all time periods analyzed, Region III had the highest population-weighted sulfate concentrations of the ten Federal regions, both because of its relatively high population density and because of its location just downwind from other large industrialized regions.

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. Therefore long range transport of air pollutants into the region (as well as out of the region eastward) may continue to be important issues for the MID-MID scenario, even if the postulated sulfur oxides reductions are achieved.

Figure 8 indicates the dominant role of major fuel-burning sources in neighboring regions play with respect to sulfate concentrations in Region III. The substantial improvement in air quality projected is due to emissions controls in all regions but especially in Region V immediately to the west. Note that Region IV's contribution is relatively constant.

*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 decreases sharply between 1975 and 1985
- In all years, over 50% of the ambient concentration is due to sources in other regions. Regions IV and V (Midwest and Southeast) are the principal external sources of sulfates.

Figure 8. Contributions to SO₄ Concentrations from sources with the region and from sources in other regions.

TABLE 7			
DISAGGREGATION OF NATIONAL IMPACTS TO REGIONAL LEVEL			
	<u>Air</u>	<u>Water</u>	<u>Regional Socioeconomics</u>
Electric sector			
Coal	M ¹		
Oil			
Nuclear			H ²
Supply			
Coal			M ³
Oil		M ⁴	
Nuclear			
Gas		M ⁴	
Solar			
Hydro			
Industrial Sector			
Coal	M ¹		M ³

- 1 = Long range transport from Regions IV and V.
 2 = Nuclear waste management perceived as national problem.
 3 = Local socioeconomic hardships.
 4 = OCS impacts, amenable to mitigating measures.

It should be noted that the long range transport analysis used to make these projections does not specifically take into account the presence of terrain features (such as the Allegheny Mountains) or urban and seacoast dispersion characteristics; is based on only one month's meteorological records (July 1974); and reflects linear chemistry.* Nevertheless, the gross features shown in Figure 8 are thought to be qualitatively correct.

4.1.2 Coastal Water Resources: There has been continuing opposition to oil and gas development in the Baltimore Canyon area of the outer continental shelf. This opposition is based, in part, on a concern for protecting existing uses of the coastal waters, particularly for recreation and commercial fishing, and it may increase if major oil or gas deposits are found.

4.1.3. National Socioeconomic Issues: Offshore oil exploration as yet has had little socioeconomic impact in mid-Atlantic coastal communities. If offshore oil fields are located and developed, there may be some expansion of the fuel service port facilities in the region and a few new drilling/production platform construction yards. This may foster minor growth in the major port areas, but the socioeconomic impact of product delivery facilities will be minimal since the region already has an estimated refinery capacity of 800,000 barrels per day. If, then the replacement of imported oil by the new oil or the expansion of present facilities would reduce any regional impact.

The continued intrusion of western coal into eastern coal markets as a result of air quality regulations, decreasing cost competitiveness of eastern deep-mined coal, and federal surface-mine regulations will cause socioeconomic hardships in many regional coal fields. However, the scenario assumes a 15% growth in coal production in the region, mostly as a result of minemouth power plants and metallurgical coal needs.

*That is, we assume that the transformation rate from sulfur dioxide (SO_2) to sulfate (SO_4) is a constant.

4.2 Regional Issues

4.2.1 Air Quality: The MID-MID scenario predicts over 50% reduction in sulfate concentrations in the region by 1985, due to reductions both in local emissions and from neighboring regions. Trends in SO₂ emissions in the region are shown in Figure 9. Even with these reductions, Region III is projected to have the highest average sulfur oxides concentrations in the U.S. (Figure 10) so that realization of these reductions is a critical issue. The computed trends in sulfur oxides air quality (Figure 11) indicate a slight deterioration from 1985 to 1990.

4.2.2 Water Quality and Availability: Energy-water conflicts in the region act as one of the more important constraints to realization of the future embodied in the MID-MID scenario. Both in the coastal zone, where Delaware, for example, has one of the most restrictive coastal zone acts in the U.S., and in inland areas, where consumptive use for evaporative cooling requires low flow augmentation to meet River Basin Commission policies, severe constraints on energy facility siting must be expected. Unfortunately, much of the pollution comes from abandoned mines which cannot be readily controlled by current statutes; therefore even with stringent application of new standards (under NPDES or new strip mine regulations) to operating and new facilities, resolution of the conflicts may be decades distant.

4.2.3 Land Use, Ecology, and Solid Waste: Region III is an area of highly varied land use and habitat characteristics and has a large potential for energy resource development, but such development is in conflict with environmental protection goals. For example, recent findings regarding the damage of coastal pollution (from both onshore and offshore sources) to sensitive estuarine and tidal habitats and to commercial and recreational fish and shellfish species have resulted in increased anti-development sentiment within the region. The concern for the environment, as manifested in regulatory activities, has to date focused primarily on large industrial polluters and on potential coastal development resulting from offshore oil exploration. However, some studies indicate that onshore diffuse sources (e.g., residential and commercial developments) and coastal point sources (e.g., large rivers that concentrate pollutants and then dump them along the coast, where they merge and mix) are greater contributors to coastal

- Pennsylvania and West Virginia show sharp decreases in SO₂ emissions by 1985
- 4 of 6 states show slight increases in SO₂ emissions between 1985 and 1990.

Figure 9. SO₂ Emissions in the Region.

- Region III has highest annual average SO₄ concentrations in the country in 1985, despite sharp emissions reductions within the region (See Figure 9).

1990 SULFATE CONCENTRATION, ug/m³

Figure 10. Ambient SO₄ Concentrations by Region.

- SO₂ ambient air quality improves for all states by 1985.
- Slight increase in ambient SO₂ air quality between 1985-1990.

Figure 11. Trends in Ambient SO₂ Concentrations, by State.

pollution than are offshore transportation or development sources.* Accordingly, there is growing opposition to any but the most benign uses of regional coastal areas.

Although coastal land use and planning is a dominant concern, Region III has additional ecological problems: Large water demands result in periodic flow disruptions in areas of limited surface water supply; habitat disruption and air and water quality deterioration are caused by utility and industrial activities and by mining operations; and the pH levels of rain over large portions of the region are among the lowest (most acidic) in the Northeast, which is an issue of increasing concern.

The central scenario-related land use issue in the region is the reclamation of strip-mine lands. The economic impact of new regulations under the 1977 Surface Mining Control and Reclamation Act on the coal industry, especially on smaller mining concerns, has been fiercely debated in the coal producing states of the region. The MID-MID scenario hypothesizes an increase in underground mining in the region from 156 million/tons/yr in 1975 to 200 in 1990 and a decrease in strip mined coal production from 80 to 71 million tons/yr. Land requirements for ash and scrubber sludge disposal are not expected to pose significant problems in the region, given ample opportunities for exploiting the terrain to allow deposition depths of up to 200 or 300**ft.

4.2.4 Social, Economic, and Institutional: Local socioeconomic impacts should not delay any proposed power plant facilities in the region, although certain local problems may require mitigation. Figure 12 summarizes the socioeconomic impacts of the scenario in the region, with an indication of the laborshed and construction work force for each major power plant addition.+

*See e.g., A. Mueller et al, Contaminant Inputs to the New York Bight, NOAA Tech. Memo ERL-MESA-6, Marine Ecosystems Analysis Program, Boulder, CO, 1974.

**T. Le, P. Meier, and H. Rostoke, The Solid Waste Impacts of Increased Coal Utilization BNL 24786, Feb. 1979. The Bruce Mansfield plant in Western Pennsylvania, for example, will build a 420 ft impoundment for disposal of its lime limestone slurry.

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

- Total Electric Plant Construction Payroll in Region to 1990 estimated at \$7.7 billion.
- Annual 1990 local property tax revenues from electric plants estimated at \$52 million.
- On average, about 700 in-migrants per project during the construction phase.
- New plants dispersed throughout region, drawing on numerous labor markets.

Figure 12. Regional Socioeconomic Impacts.

One of the dominant political concerns of the mid-Atlantic region is related to the coastal environmental impacts of petroleum exploration and development in the George's Bank and Baltimore Canyon areas. To the extent that current drilling has failed to result in commercial quantities of oil or natural gas such issues may be moot.* Nonetheless, continuation of the leasing program has resulted in concern on the part of state governments and private groups. All the coastal states of the Northeast have enacted some form of coastal zone environmental legislation in response both to federal mandates and to ongoing OCS oil exploration, but the legislatures of the mid-Atlantic coastal states appear especially sensitive to energy-related threats to their coastal resources. Delaware's Coastal Zone Act, for example, is the most stringent coastal environmental legislation in the Northeast: it entirely prohibits all new heavy industry and all offshore gas, liquid, and solid bulk production transfer facilities in a wide coastal zone along the entire length of the state. The provisions of the Maryland Coastal Facilities Review Act, are not as stringent as those of the Delaware Act, but they apply to an area comprising approximately 65% of the state's land area. Most new major energy facilities in either state would necessarily have to be sited in the areas covered by these acts.

4.2.5 Health and Safety: Energy-related health and safety concerns in Region III involve both ends of the fuel cycle, coal mining and the conversion of fuels to energy.

Coal mining is an important part of the economy in Region III and is projected to increase with time. Table 8 shows the estimated occupational health and safety impacts in the region for each year. These data are based on national averages and reflect neither regional differences (except deep vs. surface mining), nor possible changes in accident rates over time.

*As of June 1979, only TENNECO and TEXACO have found any hydrocarbons in the Baltimore Canyon area, and neither has yet made any determination of commercial quantities.

TABLE 8
ESTIMATED HEALTH EFFECTS FROM COAL MINING IN REGION III

	Accidental		Occupational Diseases	
	<u>Deaths</u>	<u>Injuries</u>	<u>Deaths</u>	<u>Incidence</u>
1975	37-135	3810-14460*	0-90*	0-1060*
1985	44-164	4680-17600	0-110	0-1320
1990	46-169	4900-17900	0-115	0-1380

*approximate 60% confidence limits on estimates

For this analysis the public health impacts of fossil fuel combustion were indexed to annual average sulfate concentration, expressed as attributable mortality (Table 9). Population exposures to sulfates are projected to decrease substantially with time because of emission reductions both within and without the region. Other species that affect air quality such as NO_x and oxidants, may increase, but their effects were not quantified.

TABLE 9
ESTIMATES HEALTH EFFECTS FROM AIR POLLUTION FROM
FOSSIL FUEL COMBUSTION IN REGION III

	<u>Population- weighted SO₄ conc., ug/m³</u>	<u>Individual risk level deaths per 10⁶ person/year</u>	<u>Estimated attributable annual deaths*</u>
1975	14.9	75-200**	1800-29000**
1985	7.3	36-580	980-16000
1900	8.0	40-640	1100-18000

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

**Range shown represents approximately 60% confidence limits from a subjective probability distribution of coefficients relating mortality linearly with ambient sulfate concentration.

A final major health related concern is radiation induced cancers due to nuclear plant operation, and these will generally increase with the increase in nuclear generation in the region (Table 10). Note that these data are based on average conditions and may not reflect local population density or meteorology.*

TABLE 10
ESTIMATED ANNUAL RADIATION INDUCED CANCER DEATHS
DUE TO NUCLEAR POWER PLANTS IN REGION III

	Nuclear power plant workers	General public	
		Routine	Non-routine*
1975	0-0.41	0-0.010	0-0.41
1985	0-1.07	0-0.028	0-1.07
1990	0-1.32	0-0.034	0-1.32

*Annualized effect of catastrophic accidents

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

V. STATE ISSUES

5.1 DELAWARE

The scenario projects the following major new facilities in the state:

- . By 1979 - 400-MW coal-fired plant in Sussex County.
- . By 1990 - 1000-MW coal-fired plant in New Castle County.

No coal is mined in the state.

The impacts arising from these changes are discussed in the following sections.

5.1.1 Air Quality Impacts:

- . 1990 statewide SO₂ emissions are expected to be lower despite a 1400-MW increase in coal-fired generation.
- . Both local and background sulfur oxides concentrations in the air are expected to be greatly lessened; those of nitrogen oxides may increase.

Delaware is a small state lying mostly on the coastal plain. The Wilmington area in the north is part of the northeastern urban corridor, and subject to the pervasive air quality problems characteristic to this densely populated area--including those related to transportation and chemical industry sectors. The climate is influenced by continental flows, modified by the proximity of the Atlantic Ocean and Chesapeake Bay. There are no PSD Class I areas in the state.

Background Issues:

- . Although Delaware is officially in attainment for SO₂, several monitoring sites show a worsening trend, and there are some excesses over the state secondary standard.
- . Total suspended particulates levels are in violation at several locations but show a generally improving trend.

Scenario-Induced Changes:

- . Sulfur oxides levels are expected to decrease between 1975 and 1985 and increase slightly thereafter (Figure 13).
- . Since controls for nitrogen oxides are less strict, the increase in coal burning may result in higher levels of these species and possibly also oxidants.
- . In spite of federally mandated sulfur oxides emissions controls, the overwhelming contribution in Delaware is from outside the state.

- Large reductions in sulfur oxides emissions by 1985, with modest increases to 1990.

- Sulfur dioxide concentrations follow the emissions reductions, but industrial sources are proportionately more important.

- Large reductions in ambient sulfate reflect emission decreases in upwind states.

Figure 13. Emission and Air Quality Trends in Delaware.

5.1.2 Water Quality and Availability Issues:

- . No major water quality or availability issues related to energy activities implied by the MID-MID scenario are expected in the state.

5.1.3 Land Use, Ecology, and Solid Waste Issues:

- . No significant land use, ecology, or solid waste issues related to the energy activities implied by the MID-MID scenario are expected in the state.

5.1.4 Social, Economic, and Institutional Issues:

- . Simultaneous construction of adjacent power plants could create a labor availability problem in 1990.
- . Nuclear power faces strong opposition in the state, which may effectively foreclose that alternative.

Under Delaware's 1971 Coastal Zone Act, all new heavy industries (and all new offshore gas, liquid, or solid bulk product transfer facilities) are entirely banned in a coastal zone encompassing the entire length of Delaware's shore and extending landward approximately 2 to 5 miles in most areas and seaward to the state's territorial limits. Other industrial and energy-related uses are not expressly prohibited but are tightly controlled through a permit system.

Possible nuclear alternatives may also face formidable obstacles due to strong opposition in the state. In 1975, for example, in response to proposals to build the Summit nuclear generating station, a bill was introduced in the state legislature to impose a two-year moratorium on the construction of nuclear power plants. The proposals were abandoned, and no other nuclear facilities have since been planned for the state. The bill has not been acted upon, but its timely introduction, coupled with the strong environmental concerns manifested in the Coastal Zone Act (the most stringent in the Northeast) suggests that prospects for nuclear power facilities - or for any other major energy developments in the state - are uncertain at best.

Scenario-Induced Changes:

- . The scenario calls for simultaneous construction of 1000-MW power plants in adjacent counties in Delaware and Maryland in 1990; a labor shortage in certain skills may require attention.

5.1.5 Health and Safety: Scenario-Induced Changes:

- . Population exposures to sulfates are projected to decrease substantially with time, because of emission reductions both within and without the region (Table 11).

TABLE 11

ESTIMATED HEALTH EFFECTS FROM AIR POLLUTION FROM FOSSIL FUEL COMBUSTION
IN DELAWARE

	Population- weighted SO ₄ conc., ug/m ³	Individual risk level deaths per 10 ⁶ person/yr	Estimated attributable annual deaths*
1975	12	69-990**	86-520**
1985	6.1	30-490	20-330
1990	6.9	35-550	24-390

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

**Range shown represents approximately 60% confidence limits from a subjective probability distribution of coefficients relating mortality linearly with ambient sulfate concentration.

5.2 MARYLAND AND DISTRICT OF COLUMBIA

The scenario projects the following major changes:

- . By 1990 - 1000 MW coal-fired plant in Cecil County
- . Increase in coal mining in the western portion of the state.

5.2.1 Air Quality Impacts:

- . State will be highly impacted by out-of-state emissions.

Maryland has two climatological regions, the coastal region in the east and the more mountainous region in the west. Most of the population is distributed in the first region, especially along the western and northern shore of Chesapeake Bay. Here coastal modifications to continental circulations are important, especially in the summer and fall. There are no PSD Class I areas in the state.

Background Issues:

- Local areas of non-attainment for particulates
- Widespread oxidant level violations.

Scenario-Induced Changes:

- Sulfur oxides levels are expected to decrease from 1975 to 1985 and then to increase slightly to 1990 (Figure 14).

5.2.2 Water Quality and Availability Issues:

- Chesapeake Bay location of 1990 new plant assures adequate water supplies.
- Water quality will be protected by using cooling towers with brackish water and blowdown treatment.
- Modest level of coal mining assure minimal impacts on inland water.

5.2.3 Land Use, Ecology, and Solid Waste Issues:

- Coal mining increases confined to underground mining, minimizing land disturbance.
- Adequate land available for disposal of coal extraction wastes.
- Problems of disposals of ash from existing plants may become exacerbated.

Coal mining in Maryland is done mainly in the northwestern part, in Allegany and Garrett Counties. Production has been relatively small, 2.5 million tons of surface coal and 0.1 million tons of underground coal in 1975. The MID-MID scenario projects a slight decrease in surface mining and a ten-fold increase in underground mining. Land availability for disposal of coal extraction wastes does not appear to present a significant constraint. Most of the mining in the state is projected to remain in Garrett County.

- Sulfur oxides emissions drop in 1985 and then increase to nearly the same level by 1990.

- Sulfur dioxide concentrations show only modest changes.

- Sulfate concentrations are greatly reduced, reflecting emissions reductions in upwind states.

Figure 14. Emissions and Air Quality Trends in Maryland

Maryland currently has a number of coal-fired generating plants. In the many urbanized areas of the state disposal of fly and bottom ash has been one of the major concerns of the electric utilities. The Potomac Electric Power Company, which serves the District of Columbia and portions of Maryland and Virginia, has been reported to truck coal ash 90 miles to limestone quarries in Pennsylvania because of restrictive zone ordinances and a county-wide ban on disposal of wastes.

5.2.4 Social, Economic, and Institutional Issues:

- . Possible construction labor shortage by 1990.
- . State licensing board could be overruled by county level vetoes.

As a result of serious controversies focusing on environmental degradation of Chesapeake Bay and its tributaries associated with the Calvert Cliffs nuclear generating station, Maryland enacted its innovative 1971 Power Plant Siting Act (PPSA) which addresses long-range energy and land-use planning through provisions for prior state acquisition of acceptable power plant sites. Although this Act has been criticized on the grounds that it does not include adequate provision for citizen participation, it has apparently been effective in streamlining and rationalizing the power plant siting process in Maryland.

Maryland's PPSA covers only power generating facilities and associated transmission lines. Other types of energy-related facilities (i.e., refineries, oil and gas pipelines, oil storage facilities) are regulated under Maryland's 1975 Coastal Facilities Review Act and related wetlands and flood plain legislation. Although the state's coastal environmental legislation is not as stringent as that in neighboring Delaware, county-level veto powers could adversely affect individual projects except for power facilities covered under the PPSA.

5.2.5 Health and Safety:

Scenario-Induced Changes:

- . Coal mining deaths and injuries will increase, but do not appear to be a constraining factor (Table 12).
- . Adverse public health effects of air pollution will decrease (Table 13).
- . Nuclear risks are minimal (Table 14).

TABLE 12

ESTIMATED HEALTH EFFECTS FROM COAL MINING IN
MARYLAND

	Accidental		Occupational diseases	
	<u>Deaths</u>	<u>Injuries</u>	<u>Deaths</u>	<u>Incidence</u>
1975	0.2-0.6	11- 41	0-0.6	0-0.8
1988	0.4-1.6	40-146	0-0.6	0-0.10
1990	0.5-1.7	46-173	0-1.0	0-12

TABLE 13

ESTIMATED HEALTH EFFECTS FROM AIR POLLUTION FROM FOSSIL FUEL COMBUSTION IN
MARYLAND AND D.C.

	<u>Population-weighted SO₄ conc., ug/m³</u>	<u>Individual risk level death per 10⁶ persons/yr</u>	<u>Estimated attributable annual Deaths*</u>
1975	15.1	76-1200	370-5900**
1985	7.8	38- 620	220-3500
1990	8.8	43- 690	280-4400

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

**Range shown represents approximately 60% confidence limits from a subjective probability distribution of coefficients relating mortality linearly with ambient sulfate concentration.

TABLE 14

ESTIMATED ANNUAL RADIATION-INDUCED CANCER DEATHS
DUE TO NUCLEAR POWER PLANTS IN MARYLAND

	<u>Nuclear power plant workers</u>	<u>General public</u>	
		<u>Routine</u>	<u>Non-routine*</u>
1975	0	0	0
1985	0-0.10	0-0.0026	0-0.10
1990	0-0.12	0-0.0031	0-0.12

*Annualized effect of catastrophic accidents.

5.3 PENNSYLVANIA

The scenario projects the following major changes:

1982 = 2100 MW nuclear plant in Lucerne County.

1984 = 800 MW coal plant in Indiana County.

1985 = 2436 MW (3-units) coal-fired plant in Bucks County.

1986 = 885 MW nuclear plant in Beaver County.

1990 = 1666 MW coal plant in Armstrong County.

- Increase in underground coal mining from 45 to 57 million tons/yr but decrease in surface mining from 45 to 27 million tons/yr by 1990.

5.3.1 Air Quality Impacts:

- Net reduction in SO₂ emissions planned by 1985 despite increase in capacity.
- Much of the air quality improvement depends on reduction in neighboring states.
- Industrial emissions controls will be important.

Pennsylvania is the most industrialized state of the region, and its emissions are quite important with respect to both regional and northeastern air quality.

The Blue Ridge and Allegheny Mountains separate the urban centers of the coastal plain, such as Philadelphia, from the urban centers of the Allegheny Plateau, such as Pittsburgh. The atmospheric transport of pollution across these mountain and valley systems is extremely complex and is not well resolved in state-of-the-art assessment models. The western urban centers of the state are under the influence of continental circulation patterns which involve sources in the Ohio River Valley. The urban centers are on the eastern side of the state (coastal plain) are influenced also by sources within the coastal corridor from Washington, DC, to Boston.

There are no PSD class I areas in the state.

Background Issues:

- The state has extensive non-attainment areas for both sulfur oxides and particulates, which are believed to be mainly related to local effects of industrial sources.

- Upwind background is also high because of similar situations in neighboring states.
- Some sources are contemplating stack-height increases rather than emissions reduction to achieve compliance. This will not improve downwind background, as postulated in the scenario analysis.

Scenario Induced Changes:

- The Armstrong County (1990) coal plant could be constrained by non-attainment or "near-attainment," depending on control strategies adopted between now and 1990.
- The large increase in coal burning could have other impacts, both local (trace metals, etc.) and long range (nitrogen oxides increases, leading to oxidants increases).
- Sulfur oxides levels should decrease, on the basis of the scenario analysis assumptions (Figure 15).

5.3.2 Water Quality Impacts:

- The cooling tower blowdown concentration effect would cause water quality violations at several inland sites (Figure 16).
- Water availability is a critical problem for thermal generating sites in the Delaware and Western Pennsylvania river basins.
- Significant water quality improvements would result from NPDES and surface mining regulations.

The central water availability problem is the adequacy of low flows in the summer months to meet the consumptive demands of thermal power plants. In Delaware Basin, the River Basin Commission requires all new power plants to provide offsetting low flow augmentation, yet, at the same time, reservoir proposals such as the Tocks Island Project have met fierce public opposition. Thus, at the present time, the augmentation source for all new scenario-hypothesized thermal plants in the Delaware basin (including the Limerick and Hope Creek nuclear stations) remains an unsolved problem. Similar problems of consumptive use and low flow augmentation are expected to arise in the Upper Ohio subbasins in Western Pennsylvania.

- Drastic decreases in sulfur oxides emissions from 1975, especially utility sources.
- Industrial sources very important in 1990.

- Sulfur dioxide ambient concentrations follow emissions reductions, showing importance of local sources.

- Sulfate concentrations roughly halved, utility contributions remain important.

Figure 15. Emissions and Air Quality Trends in Pennsylvania

Scenario Induced Changes:

- Cooling tower blowdown may violate standards for copper, nickel, radium, and lead, in part because of high existing background (see Figure 16)*

Figure 16. Water Quality Standard Violations Due to Cooling Tower Blowdown Concentration Effects

*For a detailed analysis see E. Kaplan, Water Quality Investigations at Proposed Freshwater Sites for Thermal Power Generation Additions, RIIA Issue Paper #4, Division of Regional Studies, May 1979. Total Dissolved Solids, $\text{NO}_3\text{-NO}_2$, SO_4 , cyanide, Cu, Fe, Pb, and Mn backgrounds are currently above standard during at least the low flow period at all sites examined. Increments from biocides and demineralizer regeneration wastes were not included in this detailed analysis, but these are usually comparatively small - see, eg Final Environmental Statements, Fulton Generating Station, Philadelphia Electric Company, April 1975.

- . Alkalinity violation may be eased by new plants.
- . Increased underground coal mining will strain water resources.

5.3.3 Land Use, Ecology, and Solid Waste Impacts:

- . Additional land disturbance due to surface mining.
- . Continued water quality problems due to acid mine drainage.

Pennsylvania, a major coal-producing state, already has a significant utility coal-fired generation capacity (14 Gw in 1975) and is expected to add another 6 GW capacity by 1990, and is therefore likely to face considerably greater land requirements for utility waste disposal than any other state in the region. Much of the capacity in Pennsylvania, however, is postulated for rural areas with terrain characteristics that can readily be exploited for land disposal. Currently in southwestern Pennsylvania, for example, most coal ash disposal sites are ravines or basins with depths of up to 200 or 300 ft, which significantly reduces acreage requirements. Although the prospects for mine disposal of FGD sludge may not be very promising in light of acid drainage problems in mining areas, recent precedents at the Bruce Mansfield plant, where a 420-ft impoundment will serve to fill a ravine with such wastes, illustrates the potential for imaginative and environmentally sound solutions.

The average acidity of rain, calculated from samples taken from 1973 to 1975, was below pH 4.30 for the entire state of Pennsylvania and below pH 4.22 for about half of the state.* These values are the lowest (most acidic) in the Northeastern U.S.

Scenario Induced Changes:

- . No land use availability problems per se are anticipated.
- . Continued acid drainage problems (water quality) are expected, especially with iron concentrations.
- . If effluent guidelines are observed, new waste water discharges should be acceptable.
- . Strip-mine reclamation may be difficult if not impossible in some areas.

*pH is a measure of acidity, on a scale of 0 (highly acidic) to 14 (highly alkaline). Normally rain has a pH of 6 to 8. If its pH is below 6; it is commonly referred to as acid rain.

5.3.4 Social, Economic, and Institutional Issues:

Scenario-Induced Changes:

- . Local socioeconomic problems could delay energy facility development in Greene County, PA, where a 9.83% increase over 1978 county population is projected for 1990 due to the rapid growth in deep-mined coal production (from 7.1 million tons/yr in 1975 to 17.8 by 1990) anticipated in the MID-MID scenario. Annual costs for additional county services and facilities are estimated at about \$3,076,020 by 1990 (1977 dollars).
- . Mine problems of labor availability in eastern Pennsylvania during the mid 1980s might cause a few delays in power plant construction.

5.3.5 Health and Safety:

Scenario-Induced Changes:

- . Increases in mining accidents and deaths (Table 15).
- . Decrease in sulfur oxides air pollution and associated public health impacts (Table 16).
- . Cancer risks from nuclear power continue to be minimal (Table 17).

TABLE 15
ESTIMATED HEALTH EFFECTS FROM COAL MINING IN
PENNSYLVANIA

	Accidental*		Occupational diseases	
	Deaths	Injuries	Deaths	Incidence
1975	12-46	1140-4420	0-26	0-300
1988	13-49	1400-5280	0-31	0-380
1990	14-49	1388-5200	0-32	0-390

*These estimates do not anticipate decline in accident rates over time and should be interpreted as upper bounds in view of likely continued improvements, especially in underground mine safety.

TABLE 16

ESTIMATED HEALTH EFFECTS FROM AIR POLLUTION FROM FOSSIL FUEL COMBUSTION IN PENNSYLVANIA

	Population-weighted SO ₄ conc., ug/m ³	Individual risk level deaths per 10 ⁶ persons/yr	Estimated attributable Annual deaths*
1975	16	80-1300	950-1500**
1985	7.0	35- 560	469-7400
1990	7.7	38- 620	520-8300

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

**Range shown represents approximately 60% confidence limits from a subjective probability distribution of coefficients relating mortality linearly with ambient sulfate concentration.

TABLE 17

ESTIMATED ANNUAL RADIATION-INDUCED CANCER DEATHS
DUE TO NUCLEAR POWER PLANTS IN PENNSYLVANIA

	Nuclear power plant workers	General public	
		Routine	Non-routine*
1975	0-0.27	0-0.0068	0-0.27
1985	0-0.54	0-0.0014	0-0.54
1990	0-0.71	0-0.0018	0-0.71

*Annualized effect of catastrophic accidents

5.4 VIRGINIA

The scenario projects the following major changes:

- 1977 - 2-930 MW nuclear units in Louisa County.
- 1978 - 100 MW pumped storage unit in Franklin County.
- 1981 - 2-940 MW nuclear units in Louisa County.
- 1982 - 500 MW pumped storage unit in Rockingham County.
- 1983 - 500 MW pumped storage unit in Rockingham County.
- 1983 - 1120 MW pumped storage unit in Bath County.
- 1984 - 975 MW pumped storage unit in Bath County.
- 1990 - 311 MW pumped storage unit in Bath County.
- 1990 - 250 MW pumped storage unit in Rockingham County.
- . slight decreases in both underground and surface coal mining.

5.4.1 Air Quality Impacts:

- . Modest increases in SO₂ emissions, due to oil-coal conversions and industrial activity (Figure 17).
- . Slight improvements in SO_x air quality due to reductions in neighboring states (Figure 17).

Virginia comprises three regions: the coastal plain of the east, the central Piedmont Plateau, and the mountainous Appalachian area of the west. Most of the economic and urban activity is located in the coastal plain along the western shore of the Chesapeake and in the southern Piedmont area. In these urban areas coastal circulation patterns from semi-permanent pressure systems dominate the summer and autumn circulation. In winter and spring, flows are more continental, from the northwest, except as modified along the coast.

Aside from oxidants, there are no non-attainment problems in the state. Shenandoah National Park is a mandatory PSD class I area, located in north-western mountainous region.

Background Issues: None

Scenario Induced Changes:

- . Improvement in visibility at Shenandoah National Park because of 40% reductions in sulfate concentration.
- . Continual attainment of air quality standards, based on the postulated new plant generation mix.

- Increases in sulfur oxides emissions, especially industrial.

- Only modest changes in sulfur dioxide concentrations.
- Utility sources dominate for all years (annual average).

- Sulfate concentrations are reduced from 1975.
- Utility sources dominate.

Figure 17. Emissions and Air Quality Trends in Virginia

5.4.2 Water Quality Impacts:

- . Construction and operation of pumped storage facilities may impact turbidity and BOD of affected streams.
- . Utility discharges may contribute to violations for total dissolved solids and phosphorus.

The State of Virginia contains portions of the six Aggregated Subareas (ASA's), four of which are projected to have large water-for-energy demands with problems during seasonal low flow periods. Problem basins include ASA 205 (Chesapeake), ASA 206 (Potomac), ASA 301 (Roanoke - Cape Fear), and ASA 502 (Upper Ohio). Energy can be considered a major contributor to these problems, especially during peak periods of maximum base load electric generation. Furthermore, since the preponderance of water used in other sectors is by domestic users and manufacturing, the induced water quality effects resulting from pollutant concentrations during low flow periods may have serious impacts. Specifically, electric utility discharges may contribute to violations of domestic water supply criteria for total dissolved solids and phosphorus. Future water demands associated with the growing urban and manufacturing demands of the eastern seaboard may conflict with energy development and constrain the siting of energy facilities. Without alternate means of low flow augmentation these violations will force increasing problems with siting.

5.4.3 Land Use Ecology and Solid Waste Issues:

- . Additional land disturbance due to surface mining and pumped storage facility construction.

Forecasted energy development will have little impact upon the terrestrial resources of Virginia. Surface mining will disturb 26,000 acres between 1975 and 1990 according to the MID-MID scenario but since the passage of the Surface Mining Reclamation and Control Act, most of the environmental impacts should be short term and minimal.

Creation of the pumped storage reservoirs, facilities, and transmission lines will result in loss of some aesthetic values, habitats, and recreational land. However, the scenario does not postulate any new massive solid waste disposal problems, aside from the issue of nuclear waste disposal.

5.4.4 Social Economic and Institutional Issues:

Scenario Induced Changes:

- Preservative of scenic beauty and recreational lands may be impacted by further strip mining and pumped storage development.
- Coastal zone may suffer from offshore oil drilling, if development proceeds.
- Postulated energy mix (coal, nuclear, pumped-storage) could be affected by continual problems with nuclear plant operation and siting.

5.4.5 Health and Safety:

Scenario Induced Changes:

- Modest changes in coal-related impacts (Tables 18,19).
- Cancer risks from nuclear power increase, but continue to be minimal. (Table 20).

TABLE 18

ESTIMATED HEALTH EFFECTS FROM COAL MINING IN VIRGINIA

	Accidental*		Occupational Disease	
	<u>Deaths</u>	<u>Injuries</u>	<u>Deaths</u>	<u>Incidences</u>
1975	6-21	550-2150	0-14	0-160
1985	5-19	540-2020	0-13	0-150
1990	5-20	560-2110	0-13	0-160

*The estimates, however, do not reflect improvements in accident rates over time, and should be interpreted as upper bounds in view of likely continued improvements in especially underground mine safety.

TABLE 19

ESTIMATED HEALTH EFFECTS FROM AIR POLLUTION FROM FOSSIL FUEL COMBUSTION IN VIRGINIA

	Population-weighted SO ₄ conc., ug/m	Individual risk level deaths per 10 ⁶ person/year	Estimated attributable Annual deaths*
1975	11	54-8600**	270-4300**
1985	6.8	34-540	190-3100
1990	7.5	38-600	240-3800

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

**Range shown represents approximately 60% confidence limits from a subjective probability distribution of coefficients relating mortality linearly with ambient sulfate concentration.

TABLE 20

ESTIMATED ANNUAL RADIATION-INDUCED CANCER DEATHS DUE TO NUCLEAR POWER PLANTS IN VIRGINIA

	Nuclear power plant workers	General public	
		Routine	Non-routine*
1975	0-0.14	0-0.0035	0-0.14
1985	0-0.43	0-0.0011	0-0.43
1990	0-0.49	0-0.0013	0-0.49

*Annualized effect of catastrophic accidents

5.5 WEST VIRGINIA

The scenario projects the following major changes:

1979 - 626 MW coal-fired unit in Pleasant County.

1980 - 626 MW coal-fired unit in Pleasant County.

1980 - 1300 MW coal-fired plant in Mason County.

- Increase in underground coal mining from 107 million tons/yr in 1975 to 134 tons/yr in 1990; for surface mining, from 23 million to 37 million tons/yr.

5.5.1 Air Quality Impacts

- Net reduction in SO₂ emissions projected despite increase in capacity.
- Dramatic improvements in sulfur oxides air quality, based on emissions reductions both locally and upwind in neighboring states.
- Visibility in PSD Class I areas should improve.

West Virginia is primarily continental in climate and lies mostly in the Allegheny Plateau, sloping westward toward the Ohio River Valley. The state is subject to stagnation periods of high air pollution due to both its climate and its location near the nation's highest emission areas.

Hancock and Brook Counties in the northern peninsula are currently identified by EPA as experiencing violations of Nation Ambient Air Quality Standards (NAAQS) for sulfur dioxide and total suspended particulates. Ohio and Marshall Counties are also experiencing occasional problems with suspended particulates. Utility and industrial siting within or near these counties will be restricted in the future. Counties immediately to the west of Ohio are also in violation of NAAQS and could impact the adjacent West Virginia counties. Other counties in West Virginia experiencing NAAQS violations for suspended particulates are Kanawha and Fayette where Charleston is located.

The two PSD Class I wilderness area in the state are located near the Virginia border, and thus should not be affected by the energy facility siting postulated by the scenario.

Background Issues:

- Nonattainment problems in the northern peninsula, due in part to interstate transport.
- Air quality improvement depends in part on emission reductions in neighboring states.

Scenario Induced Changes:

- Sulfur oxides are expected to improve dramatically between 1970 and 1985, and worsen slightly thereafter. (Figure 18).
- Other pollutants (NO_x, trace metals, etc.) related to coal combustion may show less improvement, because of the state's continual high reliance on coal.

5.5.2 Water Quality and Availability Issues:

- Seasonal low-flow problems indicated for ASA 206 (Potomac)
- Combined mining and utility discharges may lead to water quality violations in ASA 502 (Upper Ohio).

Water-for-energy problems are indicated in two of the four ASAs contained in the State of West Virginia. ASA 206 (Potomac) is projected to have problems during seasonal low flow periods associated with the operation and development of water consumptive steam-electric generating facilities.

In ASA 502 (Upper Ohio) energy development of all types, fueled by the basin's large reserves of coal, is projected to increase substantially over the next decade. Increased industrial growth, beyond that reflected in the manufacturing projections used in this analysis, is also possible as a result of projected development in the coal-rich Upper Ohio mainstem. Combined mining and utility discharges may violate total dissolved solids and phosphorus criteria even if effluent guidelines are met. Energy-related discharges of metals, particularly iron, will be reduced, but background violations may remain.

Severe water shortages during low flow periods, that are not revealed as problems at the ASA level, exist along the lower Monongahela River (within ASA 501), and are possible on several other tributaries.

5.5.3 Land Use, Ecology, and Solid Waste Issues:

- Further land disturbances due to coal mining.
- Severity of impacts from coal waste disposal depends on implementation of the Resource Conservation and Recovery Act.
- Acid mine drainage problems may continue.
- The postulated controls on local SO₂ emissions should ameliorate any local vegetation impacts due to plume impaction.

Projected land disturbances by 1990 include 9000 acres from deep mining and 70,000 acres from surface mining. The surface mining activity will create

- Decreases in both industrial and utility emissions.

- Sulfur dioxide concentrations are roughly halved by 1985.
- Utility contributions dominate for all years (annual average).

- Sulfate concentrations are roughly halved.
- Utility contributions dominate.

Figure 18. Emissions and Air Quality Trends in West Virginia

land disturbance problems for West Virginia; however, the Surface Mining Reclamation Act will minimize these problems if implemented fully. Solid waste from utilities and industries using coal-fired boilers with scrubbers will present some problems, but not significant, unless EPA rules this waste to be hazardous under the Resource Conservation and Recovery Act.

There have been indications of vegetation damage from short-term SO₂ impacts in West Virginia; however, SO₂ levels are predicted to decline in 1985 and 1990, and consequently the impacts upon croplands and forests will diminish.

5.5.4 Social, Economic, and Institutional Issues:

Scenario Induced Changes:

- . Possible impacts from construction worker population increase in Pleasants County (1981).
- . Increased coal production may strain existing railroads and coal haul roads.

Energy development in West Virginia is projected to reflect the State's role as the nation's second leading coal producer by emphasizing development and utilization of its coal reserves. Twenty-two counties are expected to experience coal mine construction of some consequence, while only two counties, Pleasants and Mason, are projected to receive coal-fired generating units. Pleasants is the only county that should encounter significant socioeconomic impacts from immigrating construction workers with the maximum population increase (23 percent) possibly occurring in 1981. The coal mining counties should all have a sufficient labor supply within commuting distance or require little in-migration. However, during the operation periods one county, Upshur, is projected to gain about 470 permanent residents with an increase in the cost of annual public services and facilities amounting to about \$242,000. The total number of workers required in these 13 counties is estimated to be about 20,400 at the noncoincident peaks of the facilities. For both local jurisdictions and the State as a whole, the importance of coal-related impact lies in the large portion of the existing and future economic base generated by coal and not in the effect of in-movers.

West Virginia produces a high sulfur coal, less desirable now because of air quality standards imposed on users. The number of miners has fluctuated and state officials say there continues to be difficulty in providing housing

and community facilities in mine areas when needed, resulting in some community instability and adding to labor-management problems. Railroads and coal haul roads are severely stressed, with an estimated 1,000 miles of inadequate coal haul roads and 137 and 183 inadequate vehicle bridges in 1980. The MID-MID scenario projects little additional generating capacity (up from 10,851 MW in 1975 to an estimated 13,113 MW in 1990, all in coal steam). West Virginia does not have a siting law; however, the Public Service Commission is required to approve construction of plants and transmission lines over 200 kv. West Virginia is concerned about the interstate impacts of regional power plant siting decisions.

5.5.5 Health and Safety:

Scenario Induced Changes:

- . Increased accidents and occupational disease due to coal mining. (Table 21)
- . Decreased public health impacts due to sulfur oxides. (Table 22)

TABLE 21
ESTIMATED HEALTH EFFECTS FROM COAL MINING IN
W. VIRGINIA

	Accidental*		Occupational diseases	
	<u>Deaths</u>	<u>Injuries</u>	<u>Deaths</u>	<u>Incidence</u>
1975	18-71	2069-7850	0-50	0-600
1985	26-94	2699-10260	0-65	0-780
1990	27-97	2910-10400	0-69	0-820

*These estimates, however, do not reflect improvements in accident rates over time, and should be interpreted as upper bounds in view of likely continued improvements in especially underground mine safety.

TABLE 22
ESTIMATED HEALTH EFFECTS FROM AIR POLLUTION FROM FOSSIL FUEL COMBUSTION IN
W. VIRGINIA

	<u>Population- weighted SO₄ conc., ug/m</u>	<u>Individual risk level deaths per 10⁶ persons/yr</u>	<u>Estimated attributable Annual deaths*</u>
1975	19	95-1500	170-2700**
1985	9.2	46- 730	85-1400
1990	9.9	50- 790	92-1500

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

**Range shown represents approximately 60% confidence limits from a subjective probability distribution of coefficients relating mortality linearly with ambient sulfate concentration.

TABLE 23

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 ¹	M ^{1,3}	M ¹	¹ Widespread public opposition: concern over impacts of low level radiation.
**The Likelihood of not Attaining Projected Regional Energy Mix because of Adverse Environmental Impacts	H ¹	M ^{1,3}	M ¹	² Local air quality.
**The Likelihood Specific Technologies or Resources will not Attain Projected Level of Use				³ ACQR level non-attainment issues.
Electric Sector				⁴ Concern over health and safety impacts in underground mining.
Coal	M ²	M ²	L	⁵ Potential for refuse-to-energy conversions and biomass utilization not fully reflected in scenario.
Oil	L ¹	L ¹	L ¹	
Nuclear	H ¹	M ¹	H ¹	⁶ LNG hazards.
Supply				
Gas	M ⁶	L	L ⁷	⁷ OCS development impacts.
Oil	M ⁵	L ⁵	M ⁵	
Urban Waste	L ⁵	L	L	
Solar	L ⁴	L	L ⁴	
Coal Mining	M ⁴	L	M ⁴	
End Use				
Industry	M ³	H ³	L	
***The Likelihood Specific Technologies or Resources could be Available at Levels Greater than Projected Development	L ⁵	L ⁵	L ⁵	

*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.

TABLE 24

SUMMARY OF STATE LEVEL ENVIRONMENTAL IMPACTS: DELAWARE

	Air	Water		Land		Health & Safety ³	Social and Economic			
Energy Source	Quality	Quality	Availability ²	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio- logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
Electric Sector										
Coal	M	M	M	L	L	L	L	L	L	M
Oil	M	M	M	L	-	L	L	L	L	L
Nuclear	-	-	-	-	-	-	-	-	-	-
Supply										
Gas	L	M	L	M	L	L	L	L	L	M
Oil	L	M	L	M	L	L	L	L	L	M
Urban Waste	L	L	L	L	L	L	L	L	L	M
Solar	L	L	L	L	L	L	L	L	L	L
Coal Mining	-	-	-	-	-	L	L	-	-	-
End Use										
Industry	H	-	-	-	L	L	L	L	L	L

¹Criteria For Ranking Impacts Found In Table 2²Includes Ground Water³Includes Health Effects Not Covered By Air Quality

TABLE 25

SUMMARY OF STATE LEVEL ENVIRONMENTAL IMPACTS: MARYLAND

	Air	Water		Land		Health & Safety ³	Social and Economic			
Energy Source	Quality	Quality	Availability ²	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio- Logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
Electric Sector										
Coal	M	M	M	L	L	L	L	L	L	L
Oil	M	M	M	L	-	L	L	L	L	L
Nuclear	-	M	M	M	H	M	L	L	L	M
Supply										
Gas	L	M	L	M	L	L	L	L	L	M
Oil	L	M	L	M	L	L	L	L	L	M
Urban Waste	L	L	L	L	L	L	L	L	L	M
Solar	L	L	L	L	L	L	L	L	L	L
Coal Mining	-	L	L	L	L	L	L	L	L	L
End Use										
Industry	M	-	-	-	L	L	L	L	L	L

¹Criteria For Ranking Impacts Found In Table 2²Includes Ground Water³Includes Health Effects Not Covered By Air Quality

TABLE 26

SUMMARY OF STATE LEVEL ENVIRONMENTAL IMPACTS: PENNSYLVANIA

	Air	Water		Land		Health & Safety ³	Social and Economic			
Energy Source	Quality	Quality	Availability ²	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio- logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
Electric Sector										
Coal	M	M	M	L	M	L	L	L	L	L
Oil	M	M	M	L	-	L	L	L	L	L
Nuclear	-	M	M	M	H	M	L	L	L	H
Supply										
Gas	L	L	L	L	L	L	L	L	L	L
Oil	L	L	L	L	L	L	L	L	L	L
Urban Waste	L	L	L	L	L	L	L	L	L	L
Solar	L	L	L	L	L	L	L	L	L	L
Coal Mining	L	H	L	H	L	M	M	M	L	H
End Use										
Industry	M	-	-	-	L	L	L	L	L	L

¹Criteria For Ranking Impacts Found In Table 2²Includes Ground Water³Includes Health Effects Not Covered By Air Quality

TABLE 27

SUMMARY OF STATE LEVEL ENVIRONMENTAL IMPACTS: VIRGINIA

	Air	Water		Land		Health & Safety ³	Social and Economic			
Energy Source	Quality	Quality	Availability ²	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio- Logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
Electric Sector										
Coal	M	-	-	-	-	-	-	-	-	-
Oil	M	M	M	L	L	L	L	L	L	L
Nuclear	-	M	M	M	H	M	L	L	L	M
Supply										
Gas	L	M	L	M	L	L	L	L	L	M
Oil	L	M	L	M	L	L	L	L	L	M
Urban Waste	L	L	L	L	L	L	L	L	L	M
Solar	L	L	L	L	L	L	L	L	L	L
Coal Mining	L	H	L	H	L	M	L	M	L	H
End Use										
Industry	M	-	-	-	L	L	L	L	L	L

¹Criteria For Ranking Impacts Found In Table 2²Includes Ground Water³Includes Health Effects Not Covered By Air Quality

TABLE 28

SUMMARY OF STATE LEVEL ENVIRONMENTAL IMPACTS: WEST VIRGINIA

	Air	Water		Land		Health & Safety ³	Social and Economic			
Energy Source	Quality	Quality	Availability ²	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio- logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
Electric Sector										
Coal	M	M	M	M	M	L	L	L	L	L
Oil	-	-	-	-	-	-	-	-	-	-
Nuclear	-	-	-	-	-	-	-	-	-	-
Supply										
Gas	L	L	L	L	L	L	L	L	L	L
Oil	L	L	L	L	L	L	L	L	L	L
Urban Waste	L	L	L	L	L	L	L	L	L	L
Solar	L	L	L	L	L	L	L	L	L	L
Coal Mining	L	H	L	H	L	M	L	M	L	H
End Use										
Industry	M	-	-	-	L	L	L	L	L	L

¹Criteria For Ranking Impacts Found In Table 2²Includes Ground Water³Includes Health Effects Not Covered By Air Quality

TABLE 29

SUMMARY OF REGION III ENVIRONMENTAL IMPACTS

	Air	Water		Land		Health & Safety ³	Social and Economic			
Energy Source	Quality	Quality	Availability ²	Ecology/ Land Use	Solid Waste	Occupational And Other	Local Socio- logic Factors	Local Economics	Regional Economics	Legislative/ Institutional
Electric Sector										
Coal	M	M	M	L	M	L	L	L	L	L
Oil	M	M	M	L	-	L	L	L	L	L
Nuclear	-	M	M	M	H	M	L	L	L	H
Supply										
Gas	L	M	L	M	L	L	L	L	L	M
Oil	L	M	L	M	L	L	L	L	L	M
Urban Waste	L	L	L	L	L	L	L	L	L	L
Solar	L	L	L	L	L	L	L	L	L	L
Coal Mining	L	H	L	H	L	M	L	M	L	H
End Use										
Industry	M	-	-	-	-	L	L	L	L	L

¹Criteria For Ranking Impacts Found In Table 2²Includes Ground Water³Includes Health Effects Not Covered By Air Quality