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ARGONNE NATIONAL LABORATORY

In Pursuit of Clean Air: A Data Book of Problems and Strategies at the State Level

Volume 1 Introduction and Summary

D. B. Garvey and D. G. Streets

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ARGONNE NATIONAL LABORATORY
Energy and Environmental Systems Division

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IN PURSUIT OF CLEAN AIR: A DATA BOOK OF PROBLEMS AND STRATEGIES AT THE STATE LEVEL

Volume 1: Introduction and Summary

by

D.B. Garvey and D.G. Streets

Integrated Assessments and Policy Evaluations Group
Energy and Environmental Systems Division

February 1980

prepared for

U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Environment
Office of Technology Impacts
Policy Analysis Division and Environmental Impacts Division

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PREFACE

The Clean Air Act Amendments of 1977 reaffirmed a national commitment to clean air, setting up rigorous requirements intended to achieve and maintain the National Ambient Air Quality Standards in all areas of the country. The solutions to air quality problems, however, must take place at the state and local levels. This five-volume report provides a state-by-state summary of air quality, nonattainment areas, and attainment strategies, based, in part, on the revised State Implementation Plans submitted in response to the 1977 Amendments. The report is designed to provide useful information for policy analysis in the Department of Energy, especially for the examination of possible areas of conflict between the implementation of a national energy policy calling for the increased use of coal and the pursuit of clean air. The report provides an initial basis of information and will be updated as SIPs for nonattainment areas are altered and as the designations of areas are changed.

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The report was prepared by the Energy and Environmental Systems Division (EES) of Argonne National Laboratory (ANL), with the assistance of the ANL Applied Mathematics Division in digitizing the maps of designated nonattainment areas by use of the ALICE system. Mary Snider (ANL/EES) prepared the computer maps and D. Seymour (ANL/EES) provided the computer data. Additional contributions to the report were provided by R. Kotecki, former staff member of EES.

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LIST OF ABBREVIATIONS

Btu	- British thermal unit
CAAA	- Clean Air Act Amendments
EPA	- Environmental Protection Agency
FMVECP	- Federal Motor Vehicle Emission Control Program
NAAQS	- National Ambient Air Quality Standards
NSPS	- New Source Performance Standards
Pollutants	- CO = carbon monoxide
	HC = hydrocarbons
	NO_x = nitrogen oxides
	O_x = photochemical oxidants
	SO_2 = sulfur dioxide
	TSP = total suspended particulates
	VOC = volatile organic compounds
PSD	- Prevention of Significant Deterioration
RACT	- Reasonably Available Control Technology
SAROAD	- Storage and Retrieval of Aerometric Data
SIP	- State Implementation Plan

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EXECUTIVE SUMMARY

BACKGROUND

The 1977 Amendments to the Clean Air Act provide a comprehensive scheme for air quality management across the nation, covering areas where the air is currently cleaner than the levels set by the National Ambient Air Quality Standards (under the requirements for the Prevention of Significant Deterioration) and areas where the air is dirtier than the standards (so-called nonattainment areas). The legislation required states to submit revised cleanup plans (State Implementation Plans or SIPs) outlining procedures for achieving the standards by December 1982 (with possible extensions to December 1987 for carbon monoxide and ozone). The deadline for the submittal of the plans to the Environmental Protection Agency (EPA) was set at January 1, 1979, with July 1, 1979, set as the deadline for an EPA-approved plan to be in effect. Severe sanctions -- a ban on the construction of new sources of emissions and the withholding of federal funds for highway construction and sewage treatment plants -- were to be placed on any state failing to have a revised plan approved by the July 1 deadline.

Information on nonattainment areas--such as their location, the requirements for new sources of emissions sited in or near such areas, and the controls to be applied and the cleanup to be achieved by existing sources--is important for any analysis of the interactions between energy policy and air quality goals. Consequently, a project was begun in January 1979 to review all revised SIPs for nonattainment areas, outlining causes and proposed cures, and to provide digitized maps of the sub-county areas designated as nonattainment by the states. In addition, information was collected for each state on the new source review procedures and the emission limitations for sulfur dioxide (SO_2) and total suspended particulates (TSP) that applied to fuel combustion. In order to provide additional background material for evaluating the extent of nonattainment and the possible impacts on energy development, maps were prepared of the locations of monitors and of power plants. The ambient concentrations recorded at the monitors and the fuel use at the utilities were collected from existing data bases.

This information was gathered for all 48 contiguous states and is presented in volumes 2-5, organized by Federal Region. This summary volume

(Vol. 1) provides an overview of the detailed material, discussing the regulatory and legislative background of nonattainment and the requirements for SIPs for nonattainment areas, and examines nonattainment problems and strategies for attainment, on the basis of the material on revised SIPs in the state-by-state volumes.

NONATTAINMENT PROBLEMS AND ATTAINMENT STRATEGIES

In preparing SIPs, states typically designated a nonattainment area as small as could be justified around monitors recording violations. This was generally true for all pollutants except ozone, where county-level designations were typical. Although the states designated small sub-county areas as nonattainment, maps of these areas were available only as hand-drawn submittals in the SIPs. The areas were not standard, i.e., on county lines, but were drawn using highways, streets, and/or township lines as boundaries. County-level maps may distort the identification of possible problem areas, with too large an area assumed to be subject to a potential ban on the construction of new sources or to a constraint on the siting of new major sources. In the western U.S., where counties are extremely large in comparison to the rest of the country, the overstatement by county-level maps is even more serious. Consequently, this project undertook the task of providing a computerized set of maps of nonattainment areas as designated by the states. A sample of these maps is provided in Sec. 3, and the complete set is in the four other volumes of this report.

Extent of Nonattainment. Violations of the oxidant (O_x) standard are the most pervasive problem in the U.S., with the entire Northeast and parts of the Midwest designated as nonattainment. Nonattainment of particulate (TSP) standards is nearly as extensive as oxidant nonattainment, with violations occurring in many heavily industrialized areas in the Midwest and East. Although the western U.S. contains numerous TSP nonattainment areas, many of these may be redesignated as attainment if violations can be shown to be the result of rural fugitive dust. (According to EPA policy, particulate matter in rural areas, in the absence of man-made sources, is typically airborne native soil, not contaminated by industrial pollutants and thus not appropriate for regulation under standards designed to prevent adverse health effects.) There are few SO_2 nonattainment areas in comparison to TSP and

O_x, and they tend to be clustered in heavily industrialized Ohio and western Pennsylvania. Sulfur dioxide nonattainment areas in the western part of the U.S. are typically the result of the emissions from nonferrous smelters. (Primary nonferrous smelters can apply for exemptions from emission limitations, postponing the need to achieve any SIP requirements through January 1988, according to Section 119 of the 1977 Clean Air Act Amendments.)

Carbon monoxide (CO) nonattainment is limited to urban areas, reflecting the fact that transportation causes the major part (80%) of the pollutant. Nitrogen oxide (NO_x) nonattainment is currently limited to three urban areas -- Chicago, Denver, and Los Angeles/San Diego. The rest of the country has been designated as attainment/unclassified, reflecting the lack of valid monitoring data and the fact that the only current National Ambient Air Quality Standard (NAAQS) for NO_x is a relatively easily attainable annual standard. There are a significant number of unclassified areas for all pollutants; these areas cannot be considered to be in attainment, but rather are of unknown status. The preconstruction monitoring requirements of construction permits issued under the regulations for prevention of significant deterioration (PSD) will certainly contribute to the available air quality data and may turn up more nonattainment areas.

SO_2 Attainment Strategies. Sulfur dioxide nonattainment areas are usually the result of a few local stationary sources that are out of compliance with existing SIP limitations. The SO_2 attainment strategies of the revised SIPs call for:

- Bringing stationary sources that are currently out of compliance into compliance with emission limitations outlined in the current SIP. This strategy is typical of the states in the Midwest.
- Continuing use of low-sulfur oil in the Northeast and Middle Atlantic states.
- Indicating the emission limitations for smelters that are needed to bring an area into attainment, but not addressing the impact of an exemption order (Arizona, Utah, Montana, Nevada, and New Mexico).
- Relying on the new source review procedure outlined by the 1977 Amendments and EPA regulations for sources to be sited in nonattainment areas to maintain reasonable further progress toward attainment.

Increasing the stringency of emission limitations for large stationary sources (already subject to SIP limits) is not a typical strategy.

TSP Attainment Strategies. In contrast to those for SO_2, nonattainment areas for TSP are widespread, and the causes of the air pollutants are both source-specific and area-wide. The "traditional" sources of particulates are stack and fugitive process emissions from fuel combustion, solid waste disposal, and industrial processes. In many urban nonattainment areas, controls on traditional sources will not be adequate to attain the standards (particularly the secondary ones), since "nontraditional" sources (resuspended road dust, construction and demolition dust, tire particles, etc.) are significant contributors to particulate levels.

The strategies outlined in the new SIPs include:

- Redesignating rural areas as attainment, on the basis of the EPA rural fugitive dust policy.
- Drawing nonattainment areas as small as possible around monitors recording violations.
- Retaining current SIP emission limitations on particulate matter from stacks.
- Requiring reasonably available control technology (RACT) on fugitive industrial emissions.
- Planning to develop control strategies (such as street sweeping and washing construction truck tires) for nontraditional sources of fugitive dust in urban areas.
- Asking for an 18-month extension for submittal of a revised SIP for the secondary standards.

NO_x Attainment Strategies. NO_x nonattainment is currently limited to three urban areas, with the rest of the country designated as attainment/unclassified. A short-term standard and additional monitoring data may result in more nonattainment areas. The NO_x attainment strategies are:

- Relying on the improved motor vehicle controls required to attain the O_x and CO standards (such as the Federal Motor Vehicle Emission Control Program) to also reduce NO_x.
- Planning to study the possibilities of controls on stationary sources of NO_x (industrial and utility boilers).

O_x and CO Strategies. The 1977 Amendments and EPA established detailed requirements for the contents of new SIPs for O_x and CO nonattainment areas. All SIPs for O_x are to require emission controls on stationary sources of hydrocarbons and to include measures to reduce emissions from motor vehicles and the number of vehicle miles travelled. States requesting extensions of the deadline for attainment were also to provide a program for the inspection and maintenance of motor vehicles. The new SIPs followed these stipulations.

CO violations are directly caused by motor vehicles, and in almost all instances, CO nonattainment areas are also nonattainment for O_x. Consequently, the SIPs treated CO attainment as a side-effect of the transportation control measures aimed at achieving O_x attainment.

New Source Review Procedures. According to the 1977 Amendments, states could choose between two approaches for permitting new sources to locate in a nonattainment area: (1) provide an emissions growth allowance by requiring the cleaning up of existing sources to achieve more than just attainment, or (2) adopting the EPA emission offset policy. Under the first option (the so-called "accommodative SIP"), the state essentially provides offsets for the new sources, whereas under the second option the source owner must obtain the offsets. Approximately half of the states submitting revised SIPs expect to use EPA's emission offset policy, and half will use an emission growth allowance (with source-by-source offsets as a back-up, in case the growth allowance proves to be inadequate). Four states (those without violations or with few nonattainment areas) have not determined a policy. Those states with growth allowances have usually not quantified them, nor provided any solution to the allocation problem other than first-come, first-served.

CONCLUSIONS

Nonattainment problems and attainment strategies may affect some areas of a national energy policy intended to decrease dependence on oil and increase the use of coal:

Conversion of Existing Facilities to Coal

- The strategies of many eastern states for maintenance of the SO_2 standard may hamper a conversion policy. The Northeast and Middle Atlantic states (and specific areas of the Midwest, such as Chicago) had achieved attainment of the standards before the 1977 Amendments by switching from coal to less polluting fuels (low-sulfur oil or gas) in major fuel combustion facilities.
- A number of states currently have regulations that place an upper limit on the sulfur content of the fuel that can be burned in the state. (Connecticut, for example, enforces a 0.5% sulfur limit for all fuels, essentially precluding the use of coal without flue gas desulfurization.) These standards may be more stringent than necessary to attain and maintain the NAAQS.
- Conversion of major combustion sources to coal might exacerbate the TSP nonattainment problems of many urban areas in the East and Midwest, depending on the emission limits required. Unless converting plants use stringent controls, the emission rate of particulates will be much higher for coal than for the oil currently used in these areas.
- Regulations may affect coal conversion since conversions in nonattainment areas may be exempted from the control requirements and the need to find offsets. Increases in emissions from conversion would necessitate additional controls on existing sources to continue on a path of progress toward attainment.
- Strategies for TSP attainment in some urban areas (for example, in Indiana) call for reduction in the use of coal in small, uncontrolled industrial sources. Such a strategy could limit any effort to increase coal use in existing fuel-burning installations.

New Coal-Fired Combustion Facilities. The extent of constraints on the siting of new coal-fired facilities due to SO_2 nonattainment is not clear; the SIPs conclude that bringing out-of-compliance sources into compliance with existing emission limitations should result in attainment of the SO_2 standards. However, on the basis of past experience with noncompliance and delayed compliance by major point sources of SO_2, this may be unrealistic. SO_2 nonattainment may continue to be a serious problem.

Nevertheless, constraints on new coal-fired facilities from TSP nonattainment may be more significant:

- TSP nonattainment is widespread, with many small sources contributing to the pollutant load; attainment may be more difficult to achieve.

- SIPs for urban areas indicate a need to control fugitive process emissions and road dust from "nontraditional" sources in order to achieve attainment.
- The definition of a major source as one emitting at least 100 tons per year, after controls, will mean that many smaller sources of particulates will not be subject to EPA's new source review requirements. Unless states review smaller sources, TSP attainment may be hampered.

Constraints on new coal-fired facilities from nonattainment of the current annual NO_x standard will be very limited. There are only three areas currently in violation of the standards, and state attainment strategies rely on controls on motor vehicles. If EPA sets a short-term standard, and if more valid monitoring data are available, NO_x nonattainment may become a more serious consideration for new fossil-fuel combustion (especially since current control technology is capable of only limited reduction of NO_x emissions).

Unresolved Issues. The review of new SIP revisions has raised a number of questions that will need to be addressed:

- The states are required to provide annual reports on reasonable further progress toward attainment of the standards. Will reasonable further progress be achieved? What strategies will be shown to have been most successful?
- A number of states, especially in the northeastern U.S., argue that controls on sources only within the state will not be adequate to achievement attainment because out-of-state sources are significant contributors to the ambient pollutant level. How will the contribution of long range transport of pollutants to nonattainment problems be handled?
- The attainment status of significant portions of the U.S. is unknown, because the existing air quatity data are inadequate. Will nonattainment become a far more widespread problem as additional monitoring information is gathered?

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ABSTRACT

The Clean Air Act Amendments of 1977 and EPA regulations set up stringent requirements for the control of emissions in areas where the National Ambient Air Quality Standards were being exceeded. This volume (Volume 1) introduces and summarizes a report of detailed information, assembled in four companion volumes, on state implementation plans for attainment of those standards. Volumes 2-5 present outlines of each state's plan and maps of the nonattainment status of counties and subcounty areas in each state, for the 48 contiguous states.

The actions that must be taken to achieve national air quality goals, as prescribed by federal clean air legislation and subsequent regulations promulgated by the Environmental Protection Agency (EPA), may have significant impacts on the future siting and emission control requirements of new major sources of emissions, on future patterns of nationwide fuel use, and on the success of a national energy policy designed to increase the use of coal in both the utility and industrial sectors of the economy. Since the most recent Amendments to the Clean Air Act were passed by Congress in August 1977, attention has focused on the implications of various portions of the legislation for economic growth and development in general, and on the possible conflicts that might arise between energy policy goals and environmental policies for the maintenance and improvement of national air quality.

The 1977 Amendments to the Clean Air Act[1] (CAAA) provided a comprehensive scheme for air quality management across the nation, covering areas where the air is currently cleaner than the levels set by the National Ambient Air Quality Standards (NAAQS) under the requirements for the Prevention of Significant Deterioration (PSD) and areas where the air was dirtier than the standards (nonattainment areas). Those sections of the Amendments, and

subsequent EPA regulations, governing nonattainment areas have been of particular interest to energy policy makers. The legislation required states to submit revised cleanup plans (State Implementation Plans or SIPs) outlining procedures for achieving the standards by December 1982 (with possible extensions to December 1987 for carbon monoxide and ozone). The deadline for the submittal of the plans to EPA was set at January 1, 1979, with July 1, 1979, set as the deadline for an EPA-approved plan to be in effect. Severe sanctions -- a ban on new growth and a limit on federal funds for highway construction and sewage treatment plants -- were to be placed on any state failing to have a revised plan approved by the July 1 deadline.

Information on nonattainment areas -- such as their location, the requirements for new sources of emissions sited in or near such areas, the controls to be applied and the cleanup to be achieved by existing sources -- is important for an analysis of the interactions between energy policy and air quality goals. Consequently, a project was begun in January 1979 to review all the newly revised SIPs for nonattainment areas, to outline causes and proposed cures, and to provide digitized maps of the sub-county areas designated as nonattainment by the states. In addition, information was collected for each state on the new source review procedure and the emissions limitations for SO_2 and TSP that applied to fuel combustion. In order to provide additional background material for evaluating the extent of nonattainment and the possible impacts on energy development, maps were prepared of the location of monitors and of power plants. The ambient concentrations of pollutants recorded by the monitors and data on fuel use at utilities were collected from existing data bases. This information was gathered for all 48 contiguous states and is presented in four volumes, organized by Federal Region as follows: Volume 2, Regions I, II, and III; Volume 3, Regions IV and VI; Volume 4, Regions V and VII; and Volume 5, Regions VIII, IX, and X.

The present volume, Volume 1, provides an overview of the detailed material. Section 2 presents a discussion of the regulatory and legislative background of nonattainment and a brief description of the requirements for revised SIPs for nonattainment areas. In Sec. 3, graphic presentations of nonattainment areas are provided, with summaries of nonattainment problems. Strategies for attainment, based on the material on revised SIPs in the detailed state-by-state volumes, are examined in Sec. 4.

2 LEGISLATION AND REGULATIONS

2.1 BACKGROUND

Under the Clean Air Act Amendments of 1970,[2] the Environmental Protection Agency promulgated primary and secondary National Ambient Air Quality Standards for six pollutants -- carbon monoxide (CO), hydrocarbons (HC), nitrogen oxides (NO_x), particulate matter or total suspended particulates (TSP), photochemical oxidants (O_x), and sulfur dioxide (SO_2) -- to protect public health and welfare. Each state was required to develop and submit to EPA for approval a State Implementation Plan for achieving and maintaining the primary NAAQS by July 1975 and the secondary standards within a reasonable time.

In regulations promulgated in 1971,[3] EPA stated that an adequate SIP should include a program of preconstruction review of new emission sources or modifications of existing sources to prevent construction that would "interfere with the attainment or maintenance of a NAAQS."[4] The meaning of the phrase "to interfere with attainment" was not clarified, and was not an issue, until it became clear in 1975 that the statutory deadline for attainment of the standards would not be met in a large number of areas, particularly major urban centers. The consequences of such nonattainment were not clear. One interpretation suggested that the SIP regulations precluded any new construction or expansion in areas that were in violation of an applicable NAAQS.

On December 21, 1976, EPA issued an "Interpretative Ruling for Implementation of the Requirements of 40CFR51.18"[5] This ruling, which later became known as the Emission Offset Policy, made it possible for states to permit sources of emissions to locate or expand in nonattainment areas. A new major source of emissions, or major modification of an existing source, could be constructed in a nonattainment area if controls were used to reduce emissions to the lowest achievable emission rate (LAER) (defined as the lowest rate in any SIP or as achieved in practice by a similar type of source), and if emissions from existing sources in the nonattainment area were reduced to more than offset the projected new emissions. With an offset, nonattainment areas could absorb new pollutant sources and still be moving to attain the NAAQS.

2.2. THE CLEAN AIR ACT AMENDMENTS OF 1977

The Clean Air Act Amendments passed in August 1977 accepted EPA's emission offset policy as a temporary solution to growth in nonattainment areas. For the long term, states were required to submit new SIPs for nonattainment areas by January 1, 1979, outlining plans and legally enforceable procedures for achieving the attainment of the NAAQS by a new deadline -- December 31, 1982 (with a possible 5-year extension until December 31, 1987, for oxidants and carbon monoxide). If the revised SIPs were not approved by EPA by July 1, 1979, no major* source of the pollutant for which the area was nonattainment could be constructed or modified in the nonattainment area.

According to legislation, a new SIP for a nonattainment area should require all "reasonably available control measures" on existing sources as expeditiously as practicable. The SIP should provide for "reasonable further progress" toward attainment until all "reasonably available control measures" have been implemented. The former phrase is defined as "annual incremental reduction in emissions of the applicable pollutant (including substantial reduction in the early years following approval or promulgation of the revised SIP and regular reductions thereafter) which are sufficient... to provide for attainment of the applicable NAAQS by 1982 (or 1987 for CO and O_x in some cases)". The plan should identify the amount of growth that the state intends to permit in each nonattainment area, and quantify the amount of emissions (of any pollutant for which an area is nonattainment) that will be allowed to result from new major sources of emissions. New major sources seeking to locate or expand in nonattainment areas must meet a number of conditions that parallel the major conditions of EPA's emission offset policy. The proposed source must meet LAER and provide offsetting reductions in emissions.

In contrast to the EPA emission offset policy, which requires case-by-case offsets, the 1977 Amendments allowed the states to provide a growth allowance, consistent with the objective of reasonable further progress.

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*The definition of a major source of emissions currently[6] covers all new sources of criteria pollutants with the potential to emit more than 100 tons per year, calculated after the reductions achieved by emission control equipment.

By requiring more controls on existing sources than needed to achieve attainment, a state could provide the necessary offsets for the new source, rather than requiring the individual owner to find the offsets.

The Amendments outlined a number of other requirements for revised SIPs, including the need for transportation control measures in areas where an extension of the deadline for attaining the oxidant and carbon monoxide standards has been requested, and provided penalties for failure to meet the schedule for submitting a new SIP. According to Section 110(a)(2)I, no major stationary source of a pollutant could be constructed or modified in an area which was not attaining the standards for that pollutant unless a revised, approved SIP was in effect by July 1, 1979.

Failure to have an approved SIP could also result in limitations on certain federal funding, according to Sections 176 and 316 of the 1977 Clean Air Act Amendments. Section 176 allowed the EPA Administrator and the Secretary of Transportation to deny approval of projects or allocation of grants for highway projects (except for safety, mass transit, or air quality improvement measures). Section 316 gave the EPA Administrator discretionary authority to withhold or restrict grants for the construction of sewage treatment works.

2.3 SIP REQUIREMENTS

According to EPA's published criteria,[7] the new SIPs could either provide for attainment of the primary NAAQS for all criteria pollutants by December 31, 1982, or could provide for the attainment of the primary standards for sulfur dioxide, nitrogen oxides, and particulate matter by December 31, 1982, and request an extension for the attainment for carbon monoxide and oxidants to no later than December 31, 1987.

2.3.1 General Requirements

All revised SIPs are to contain:

- A definition of the geographic extent of the nonattainment area to be covered in the SIP.
- An accurate, comprehensive, and current (1977) inventory of existing emissions.
- A determination of the level of control needed for attainment by 1982 (including growth), using an EPA-approved air quality model.

- Adoption in legally enforceable form of all the measures needed to achieve attainment or, if adoption is not possible by 1979, a schedule for such adoption. Such control measures are to be based on "reasonably available control technology" (RACT).
- Emission reduction estimates for each adopted (or scheduled) control measure.
- A provision of reasonable further progress toward attainment, defined as annual incremental reductions in total emissions (from both new and old sources) to achieve attainment by the prescribed date. Reasonable further progress is to be determined by dividing the total emission reduction needed to attain the standard by the number of years between 1979 and either 1982 or 1987. Emission reductions between August 7, 1977, and December 31, 1979, are to be considered as being achieved in 1979.
- The identification and quantification of an emissions growth allowance to be allowed to result from new (or modified) stationary sources, or an emissions offset regulation to allow for growth of new major sources. Growth rates for mobile and minor stationary sources are to be included in the determination of a growth allowance. A system of monitoring the growth rates must also be provided.
- Provision for annual reporting on reasonable further progress, summarizing emissions growth from new sources and reductions from existing sources.
- A permit procedure for new sources, to comply with Section 193 of the 1977 Amendments.
- A commitment of manpower and resources needed to implement the SIP, including written evidence of budget support from the state or local government.
- Evidence of consultation with the public and with local government.
- Evidence that the SIP was adopted by the state only after public notice and hearings.

The new source review procedure of the 1977 Clean Air Act Amendments would require several other conditions (similar to those of EPA's emission offset policy):

- Reasonable further progress toward attainment must be ensured.
- Emissions from the proposed source must not cause or contribute to violations of the emissions growth allowance.

- The new source must meet the lowest achievable emission rate.
- All other major sources owned or operated by the applicant must be in compliance or on a schedule for compliance.

2.3.2 SIPs Containing Extensions

All SIPs providing for attainment of the carbon monoxide and/or oxidant standards later than December 31, 1982, must also contain:

- A program requiring an examination of alternative sites, sizes, and emission controls, and a cost-benefit analysis before any permit for a new source is issued.
- An inspection and maintenance program for mobile sources, or a schedule endorsed by the Governor for the adoption and implementation of such a program. The program must be implemented "as expeditiously as possible," but no later than 1982 for a centralized state-run system or 1981 for a private-garage system.
- "A commitment by the responsible government official" to expand and improve public transportation.
- Commitment to use available funds to expand and improve public transportation.

2.3.3 Pollutant-Specific Requirements

- Sulfur dioxide: The SIP must contain all the necessary emission limitations and procedures to achieve attainment; mere schedules for the adoption of such limitations will not be acceptable.
- Nitrogen oxides: The SIP can contain either the necessary emission limitations or a schedule.
- Particulate matter: Emission limitations or procedures for traditional sources (i.e., both stack and fugitive emissions from stationary sources) must be included in the SIP. If the control of nontraditional sources (e.g., urban fugitive dust, resuspension, construction) is needed for attainment, the SIP must contain measures for such control.
- Carbon monoxide and oxidants: The SIP must provide for control of volatile organic compounds (VOC) from stationary and mobile sources. The plan must also include regulations to require RACT for stationary sources for which EPA has published a control techniques guidance. For urban areas that are nonattainment for oxidants, the SIP is to provide various transportation plans

(to be explained in a guidance from EPA and the Department of Transportation) including public transit, parking controls, bus and carpool lanes, pedestrian malls, staggered work hours, traffic flow improvements, etc.

2.3.4 Additional Criteria

On April 4, 1979,[8] EPA provided further guidance on the criteria for SIPs, suggesting that states could use the "bubble" concept in a revised SIP. This concept would enable a facility to meet the total emission control requirements of a SIP for a given pollutant through a mix of controls on multiple process-related emission sources rather than specific limitations on each source. The approach is designed to be cost-effective, permitting "facilities to place a greater burden of control on sources where the marginal cost of control is low, and a lesser burden where cost is high."

The April promulgation also noted the change in the "oxidant" standard: as of February 1979 the standard was altered from 0.08 to 0.12 parts per million, and the designation of the pollutant was changed to "ozone". A state could, therefore, relax SIP requirements to achieve the new, less stringent, standard.

SIPs are also to show attainment of the secondary NAAQS as expeditiously as possible. A state can request an 18-month extension for the submittal and approval of a revised SIP for a secondary nonattainment area.

EPA noted that "it also appears possible in a number of cases that attainment might be possible by December 31, 1982, without adding any significant new regulatory requirements to the SIP".[9] In such cases, EPA suggested that the SIP revision might consist of an official notification that the deadlines for the primary and the secondary NAAQS contained in the Clean Air Act Amendments would be met by the existing SIP.

3 NONATTAINMENT AREAS

3.1 NONATTAINMENT AREA DESIGNATIONS

The Clean Air Act Amendments of 1977 (Section 107(d)) required each state to submit to EPA, within 120 days of the enactment of the law, a list showing the NAAQS attainment status of all areas within each state as of August 7, 1977. The Amendments required EPA to promulgate the state lists, with any necessary changes, within 60 days after submittal. On March 3, 1978,[10] EPA promulgated attainment status designations in the Federal Register, based either on state submittals or on determinations by the EPA Regional Office. These designations have been subsequently revised and modified on the basis of new air quality data. EPA did not establish any specific schedule for revising Section 107 designations, noting that "the designations are dynamic and designation changes are to be made whenever new and relevant information is brought to the attention of the State (or EPA if the State does not act.)"(Ref. 9, p.7).

EPA has stated that the nonattainment designations are only important for focusing attention on problem areas, rather than for defining the attainment/nonattainment status of any particular area. If an area is designated attainment, the preconstruction monitoring requirement under PSD provisions will provide one year of air quality data; similarly, if an area is designated nonattainment, the required air quality impact analysis would provide information. The final designation of areas will thus occur as individual permit applications are submitted. EPA's argument, however, fails to note that these nonattainment designations <u>are</u> significant in that they determine the areas for which new SIPs are required.

The 1977 CAAA required that designations be based on the air quality as of August 7, 1977. EPA, recognizing that data would not be uniformly available for that specific and recent a date, instead required that the states use the most recent four quarters of monitoring data available. If those data indicated no violations, then the previous four quarters were to be examined to avoid basing an attainment designation on anomalous conditions. If monitoring data were not available, air dispersion modeling could be used to evaluate air quality. If there were a conflict between monitoring data and modeling results, EPA advised using monitored values. Areas could

be classified, with regard to TSP and SO_2, as nonattainment for primary standards, nonattainment for secondary standards, unclassified, or attainment; and with regard to NO_x, CO, and O_x, as nonattainment or attainment. Areas clearly showing attainment or nonattainment were to be classified as such; areas with limited data could be designated as unclassified.

An area could be designated as nonattainment even though monitoring data indicated attainment, if it was determined that a source was using a supplementary, noncontinuous system of control or an an overly tall stack. (Air quality near a source may be better than the standards because the tall stack disperses the pollutants further.) Areas where recorded violations of the particulate standard could be shown to be the result of rural fugitive dust could claim attainment status. In several cases, states claimed TSP attainment designations despite monitored violations. Texas, for example, asserted that violations were the result of improperly sited monitors, such as monitors too close to the ground, unduly influenced by road dust. Oklahoma suggested anomalous conditions such as dust storms as the cause of violations, and requested attainment designations. In all cases, EPA determined the validity of the request and made the final designations.

3.2 LOCATIONS OF NONATTAINMENT AREAS

The following series of maps presents three different views of nonattainment areas:

- As counties containing nonattainment areas as designated by EPA and the states;
- As counties containing monitored violations as indicated by 1975 SAROAD* data; and
- As those areas actually designated by the states in revised SIPs.

3.2.1 Counties Containing Designated Nonattainment Areas

Figures 3.1-3.5 identify counties containing nonattainment areas, based on the original Section 107 designations of March 1978, updated through changes published in the Federal Register through May 1979. For TSP (Fig.

*SAROAD: Storage and Retrieval of Aerometric Data -- EPA's computer format for the transmittal of air data from state, local, and federal monitoring operations to the National Air Data Bank (NADB), managed by the Monitoring and Data Analysis Division, Office of Air Quality Planning and Standards, USEPA, Research Triangle Park, North Carolina.

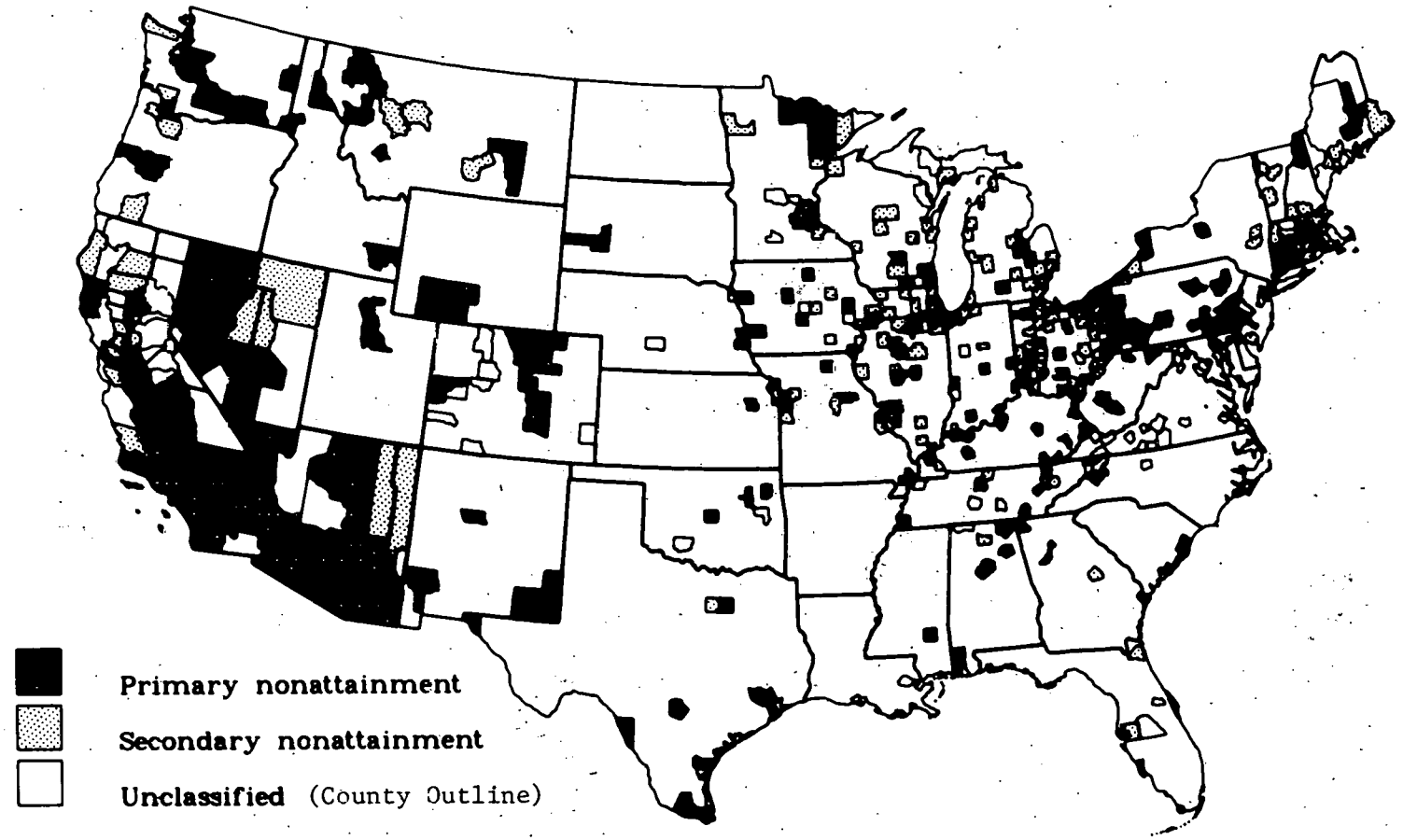

Fig. 3.1. U.S. Counties Containing Designated TSP Nonattainment Areas as of May 1979

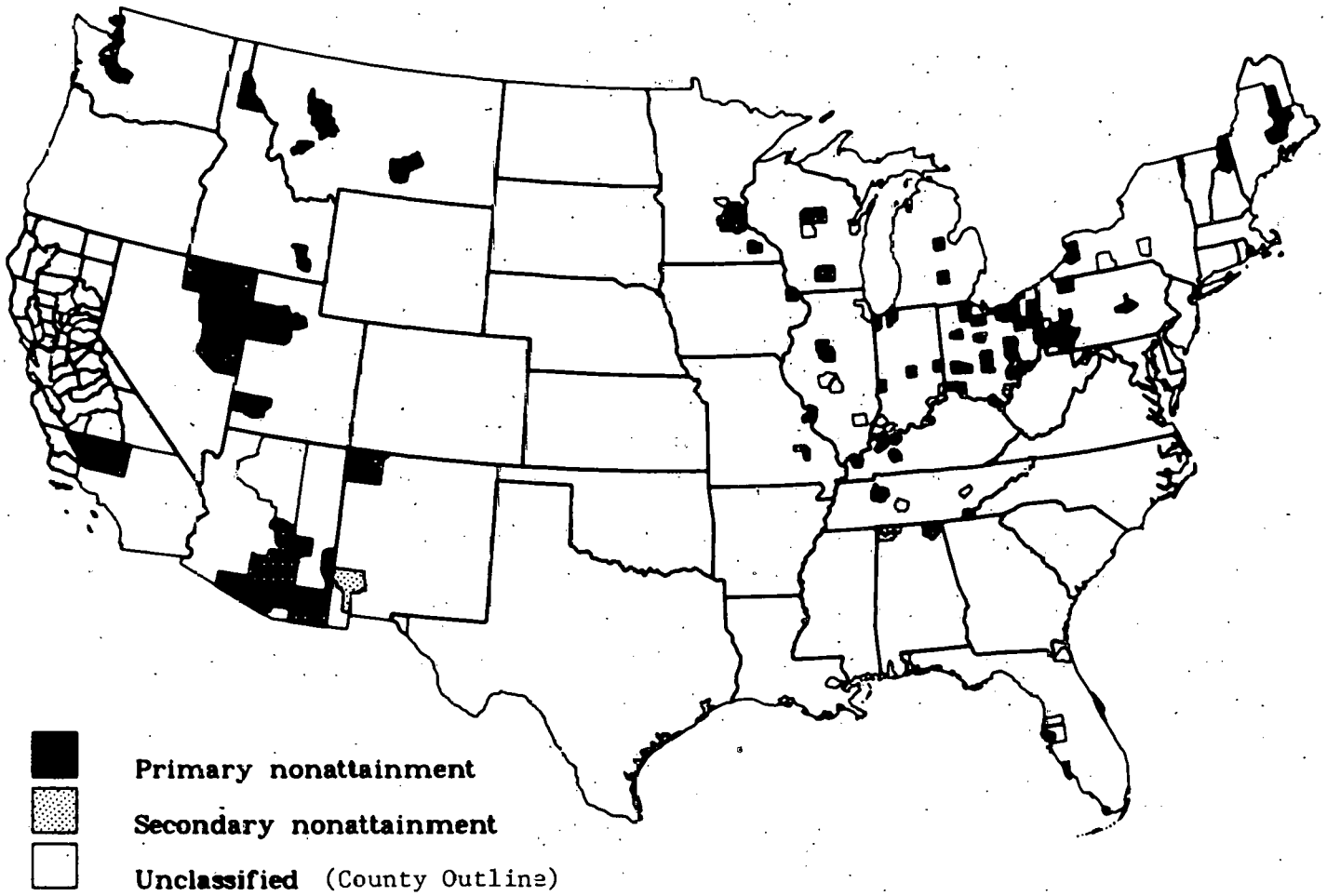

Fig. 3.2. U.S. Counties Containing Designated SO_2 Nonattainment Areas as of May 1979

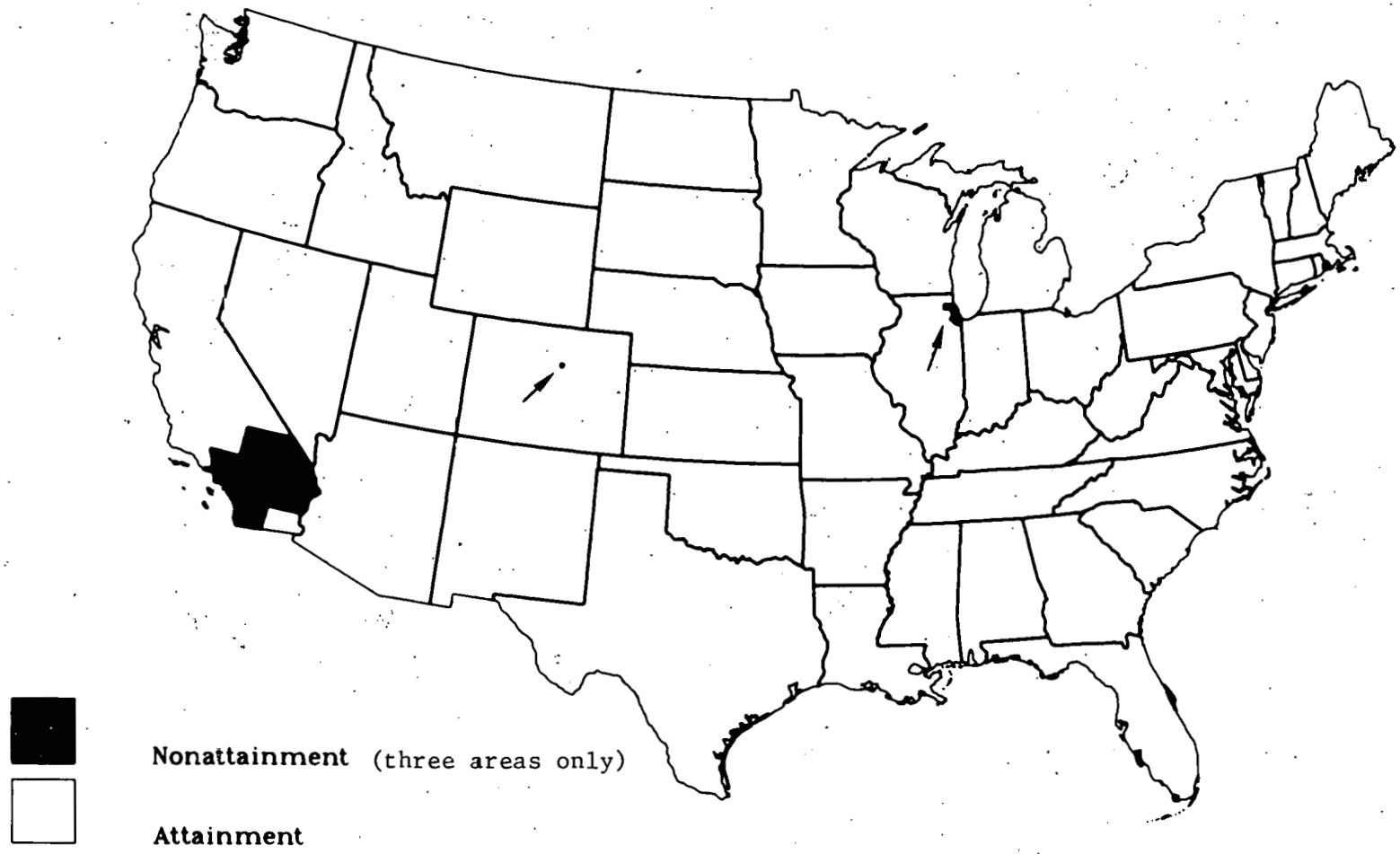

Fig. 3.3. U.S. Counties Containing Designated NO_x Nonattainment Areas as of May 1979

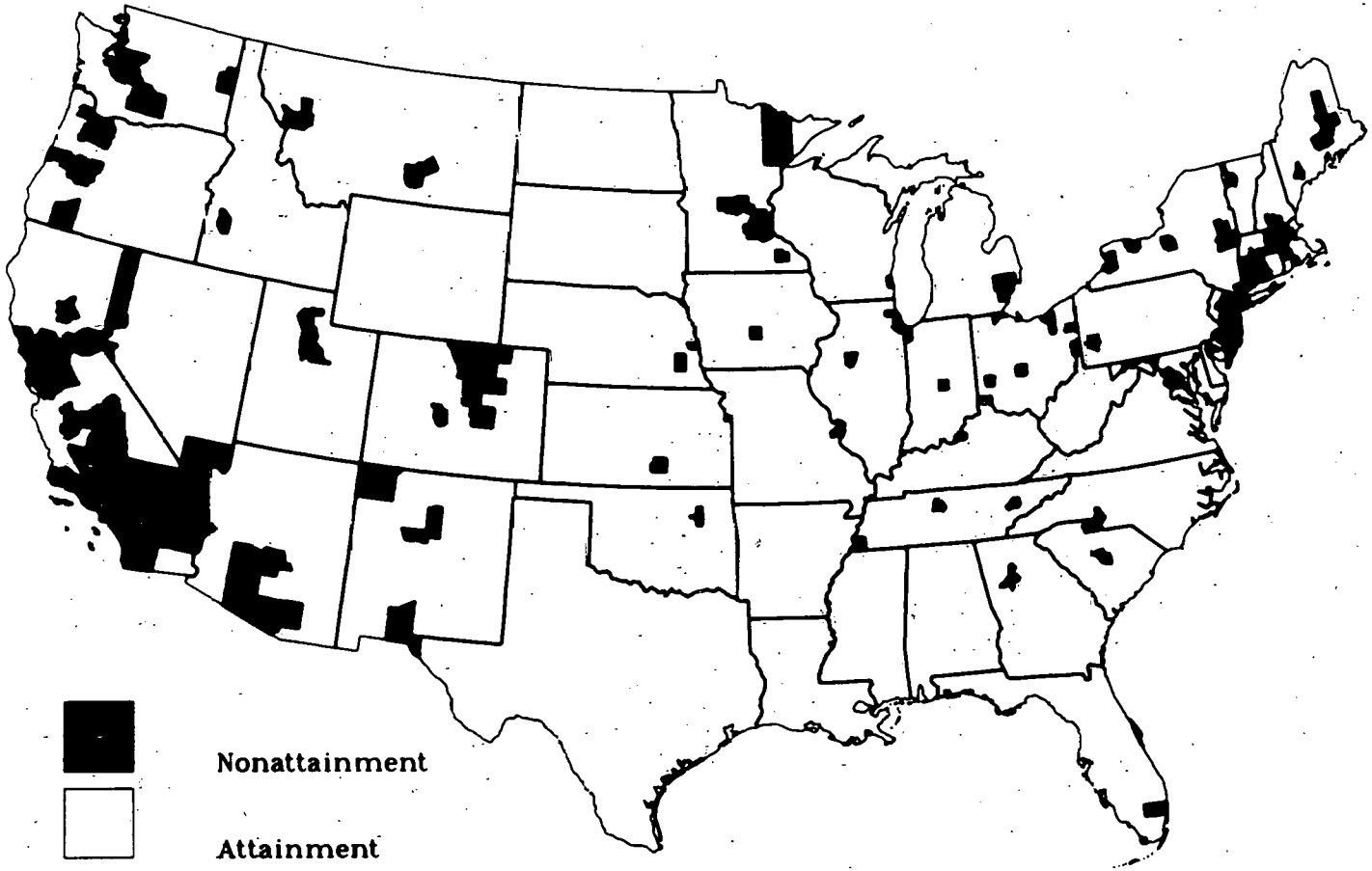

Fig. 3.4. U.S. Counties Containing Designated CO Nonattainment Areas as of May 1979

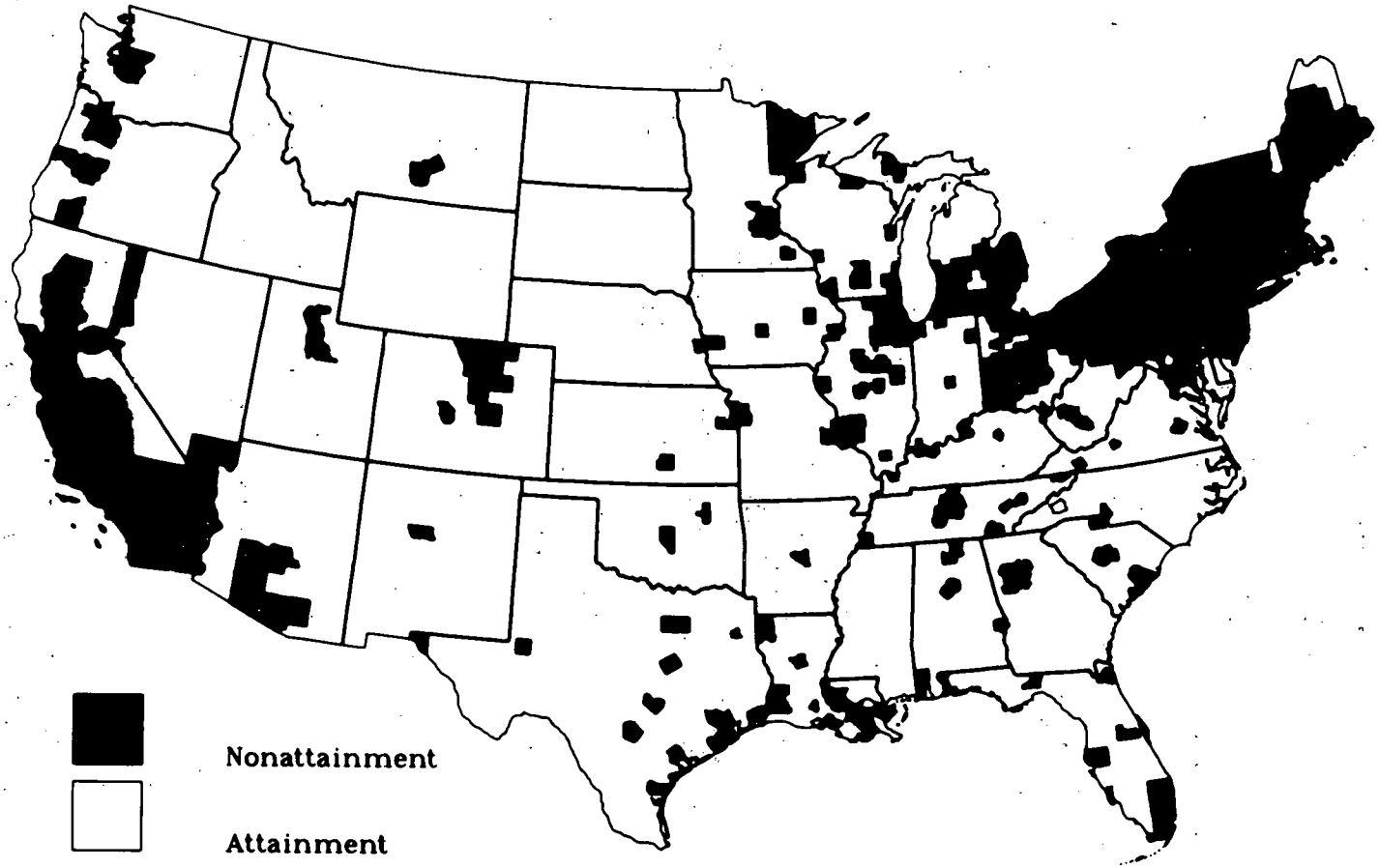

Fig. 3.5. U.S. Counties Containing Designated O_x Nonattainment Areas as of May 1979

3.1) and SO_2 (Fig. 3.2), counties are designated primary or secondary if either the 24-hour or annual averages were violated. If a county contained both primary and secondary nonattainment areas, the primary violation is indicated on the maps; similarly, if a county contains a secondary nonattainment area and an unclassified one, the secondary violation is shown.

The 1977 Clean Air Act Amendments had required that the designations be based on air quality as of the date of the Amendments -- August 7, 1977. Under EPA's guidance, the states used the most recent four quarters of air quality data available. For TSP and SO_2, areas that were clearly in violation or in attainment were classified accordingly; areas with limited data were designated as unclassified. For NO_x, CO, and O_x, areas could only be designated as nonattainment or attainment/unclassified. A distinction was not made between attainment and unclassified. Consequently, some of the counties indicated on the maps as in attainment for these three pollutants could conceivably be in violation of the NAAQS -- the collection of additional, valid air quality data is needed to make that determination. (The preconstruction monitoring requirement of PSD permits will certainly contribute to the available air quality data.)

3.2.2 Counties Containing Monitored Violations

To illustrate the distinction between the Section 107 nonattainment areas and monitored violations, the following maps (Figs. 3.6-3.10) have been prepared. The maps are based on 1975 SAROAD data; a shaded county indicates that a monitor in the county had recorded violations of either the 24-hour or annual average of the primary NAAQS.

These maps differ considerably from Figs. 3.1-3.5, which display counties containing nonattainment areas for the same set of pollutants. Table 3.1 provides a comparison of the number of counties within each Federal Region (see Fig. 3.11) containing designated nonattainment areas and monitored violations. There are fewer counties containing monitored violations of the SO_2 standard (Fig. 3.7) than counties containing designated SO_2 nonattainment areas (Fig. 3.2), especially in Ohio, Indiana, and Pennsylvania.

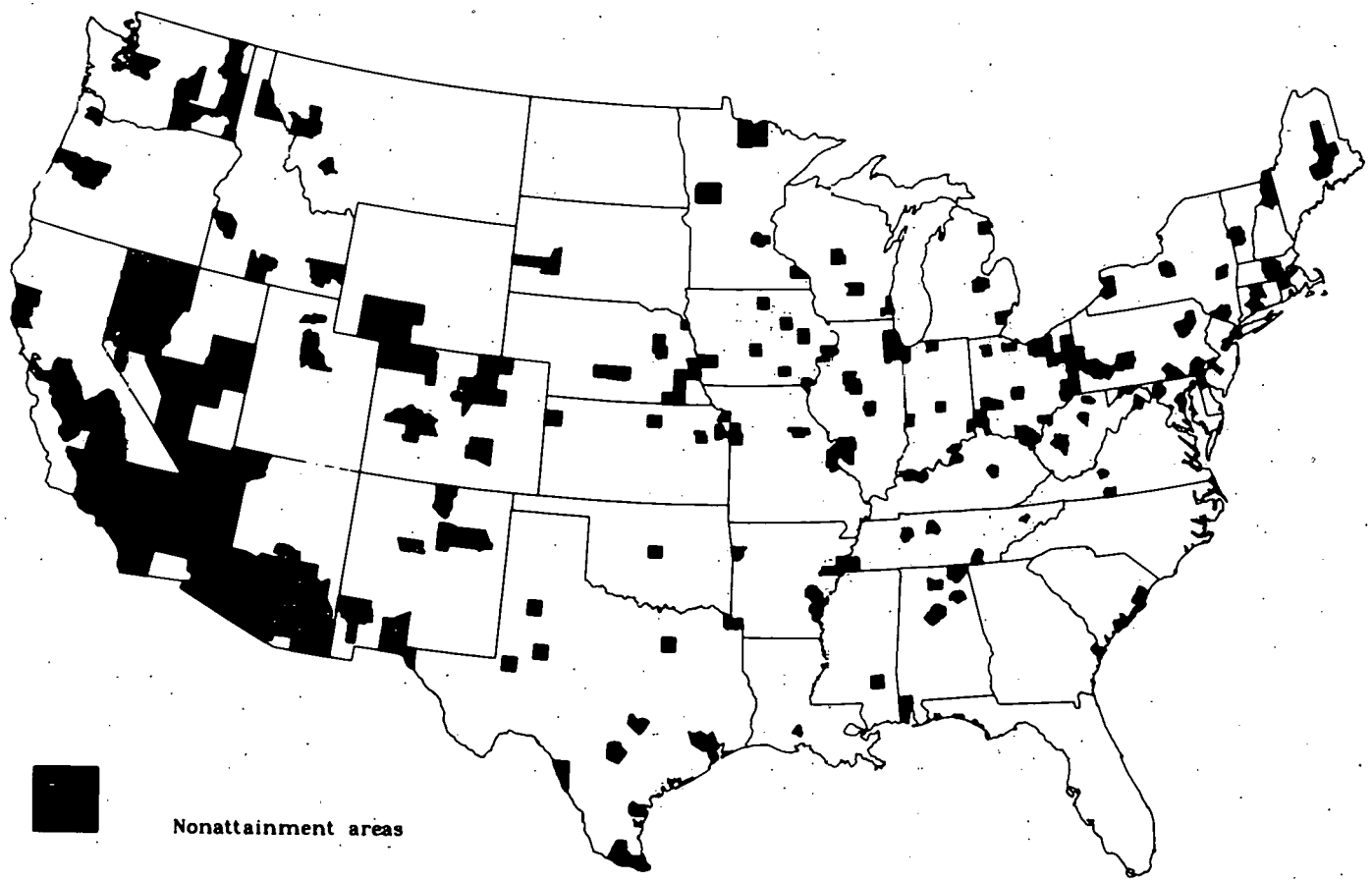

Fig. 3.6. U.S. Counties Containing Monitored Violations of Primary TSP Standards (Based on 1975 SAROAD Data)

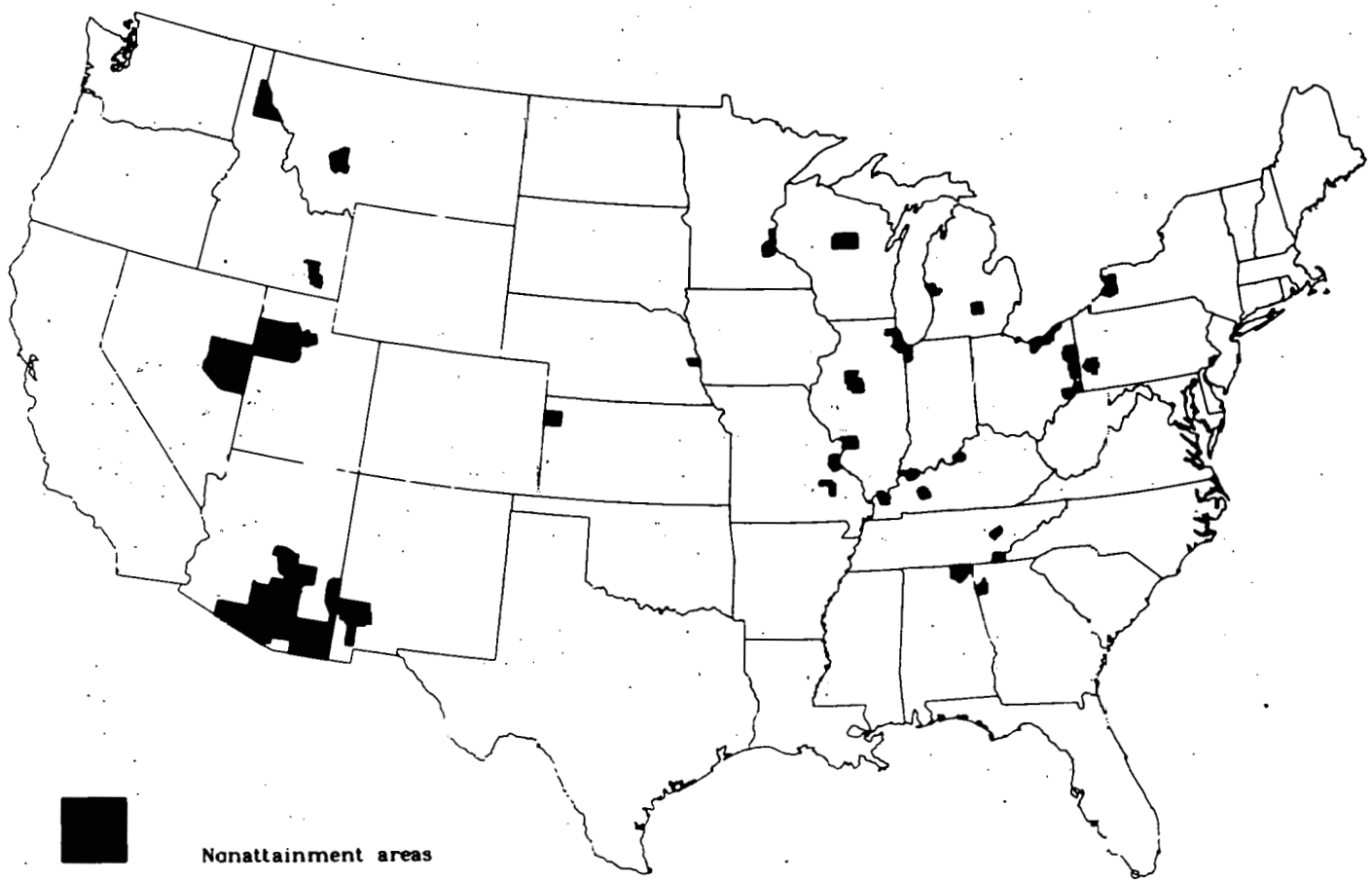

Fig. 3.7. U.S. Counties Containing Monitored Violations of Primary SO_2 Standards (Based on 1975 SAROAD Data)

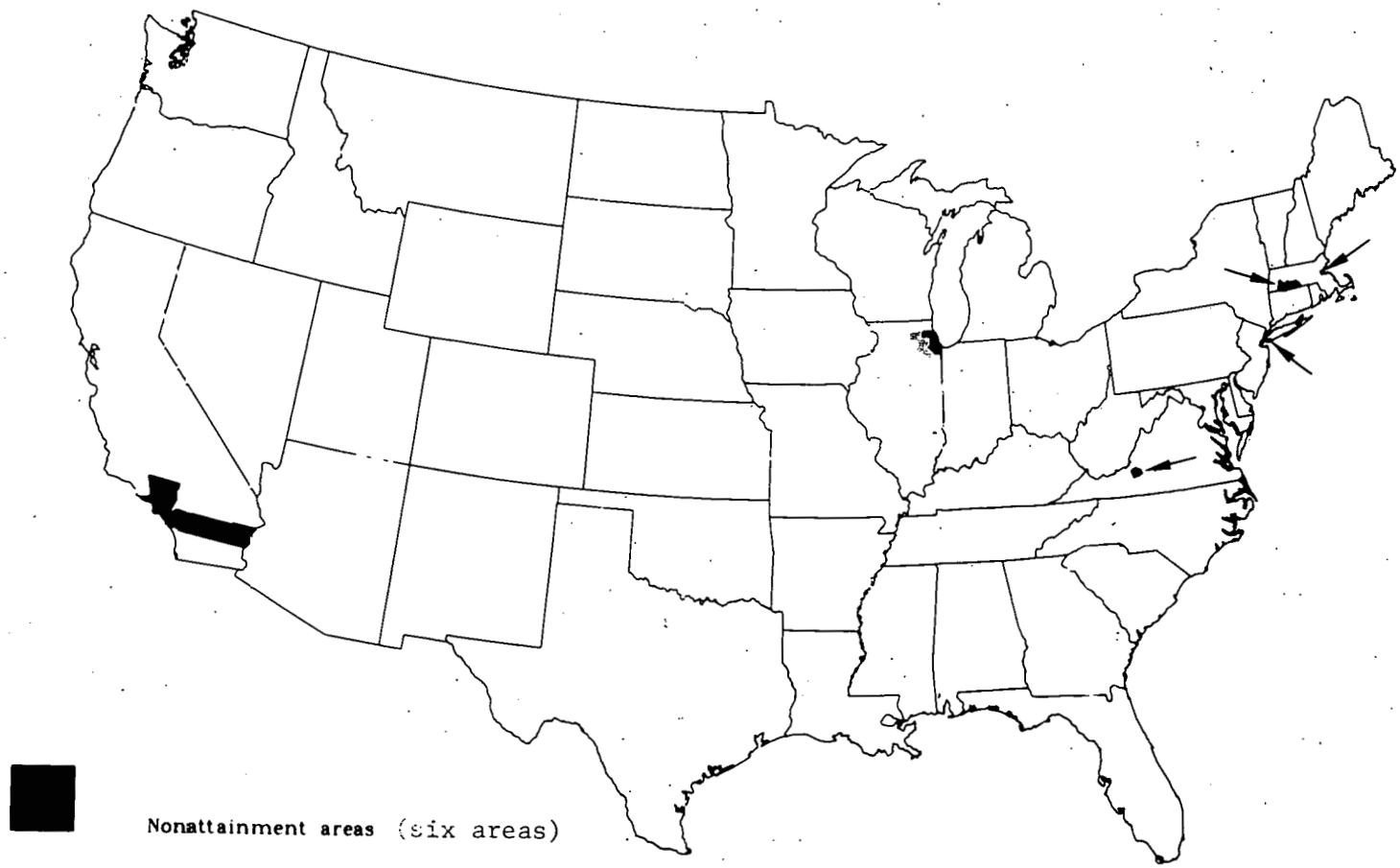

Fig. 3.8. U.S. Counties Containing Monitored Violations of Primary NO_x Standards (Based on 1975 SAROAD Data)

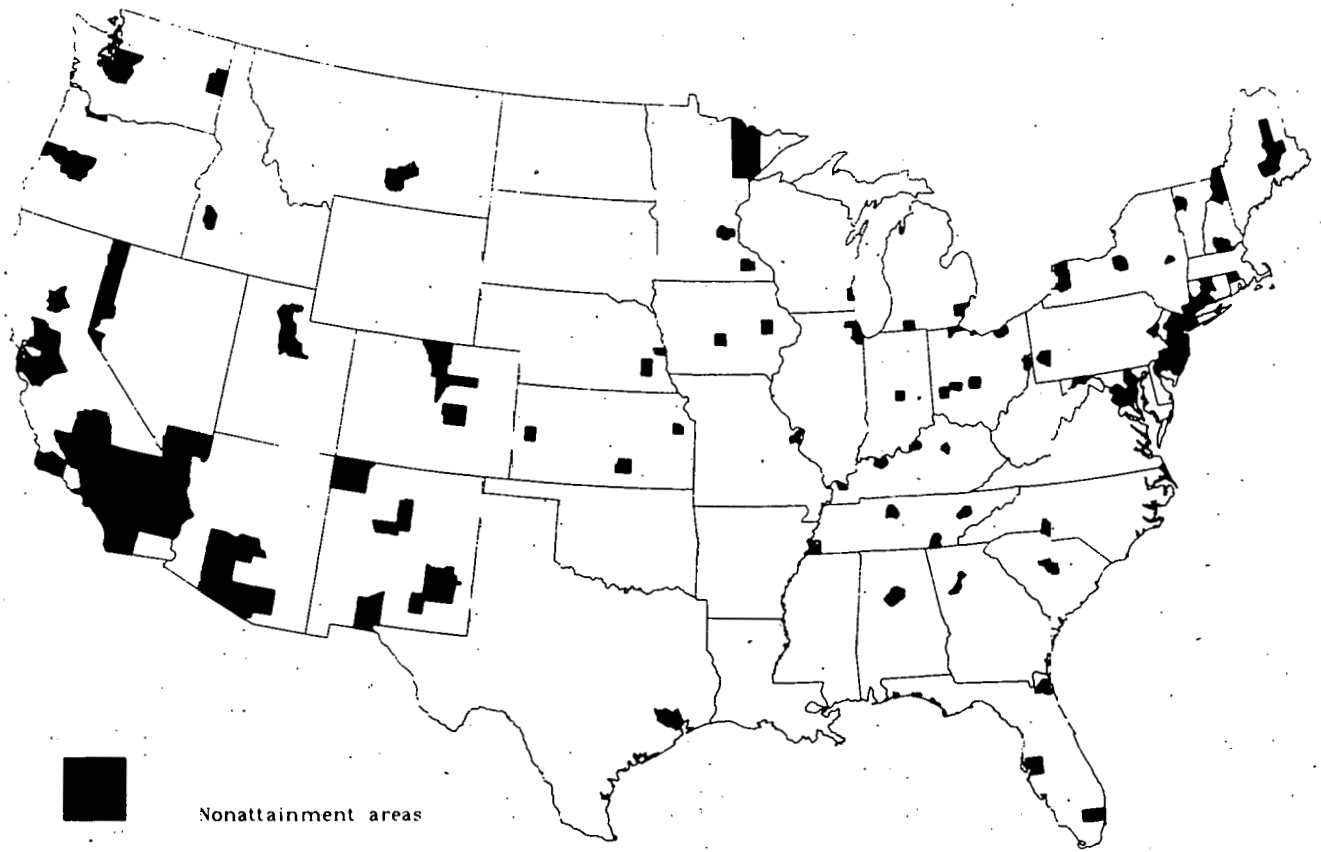

Fig. 3.9. U.S. Counties Containing Monitored Violations of Primary CO Standards (Based on 1975 SAROAD Data)

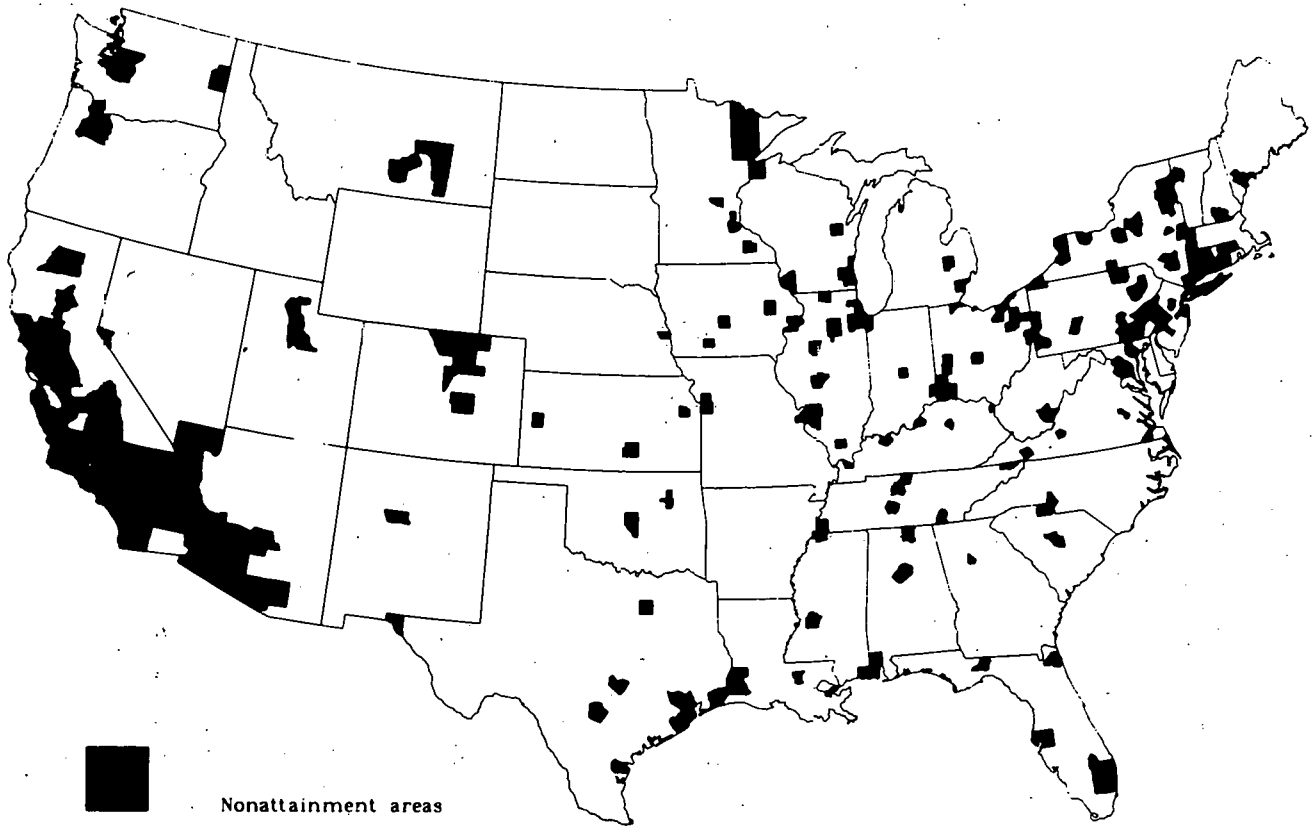

Fig. 3.10. U.S. Counties Containing Monitored Violations of Primary O_x Standards (Based on 1975 SAROAD Data)

Table 3.1. Number of Counties with Violations of NAAQS and without Data

Federal Region	Total No. of Counties	Designated as Violating Standard[a]					Monitored as Violating Standard[b]					Without Valid Monitoring Data[b]				
		O_x	TSP	CO	SO_2	NO_x	O_x	TSP	CO	SO_2	NO_x	O_x	TSP	CO	SO_2	NO_x
I	97	66	12	15	0	0	20	9	12	0	2	44	16	50	22	38
II	83	83	3	30	1	0	28	7	25	1	1	57	2	48	33	65
III	247	96	32	11	9	0	31	26	14	5	1	218	122	217	152	224
IV	736	53	36	11	13	0	28	22	13	10	1	702	423	707	509	585
V	524	150	73	29	46	1	37	45	13	18	1	474	311	490	378	442
VI	502	39	16	6	1	0	21	30	6	1	0	463	352	466	394	445
VII	412	18	21	7	4	0	11	25	9	6	0	394	312	395	358	395
VIII	292	14	19	15	6	1	12	19	11	4	0	279	178	281	252	282
IX	94	45	37	31	8	5	34	33	22	6	5	50	32	54	65	65
X	120	9	16	11	3	0	6	15	7	2	0	113	64	112	97	116
Totals	3107	573	265	166	91	7	228	231	132	53	11	2794	1812	2820	2260	2657
% of Total		18.4	8.5	5.3	2.9	0.2	7.3	7.4	4.2	1.7	0.4	89.9	58.3	90.8	72.7	85.5

[a]Based on nonattainment designations as of May 1979.

[b]Based on 1975 SAROAD data.

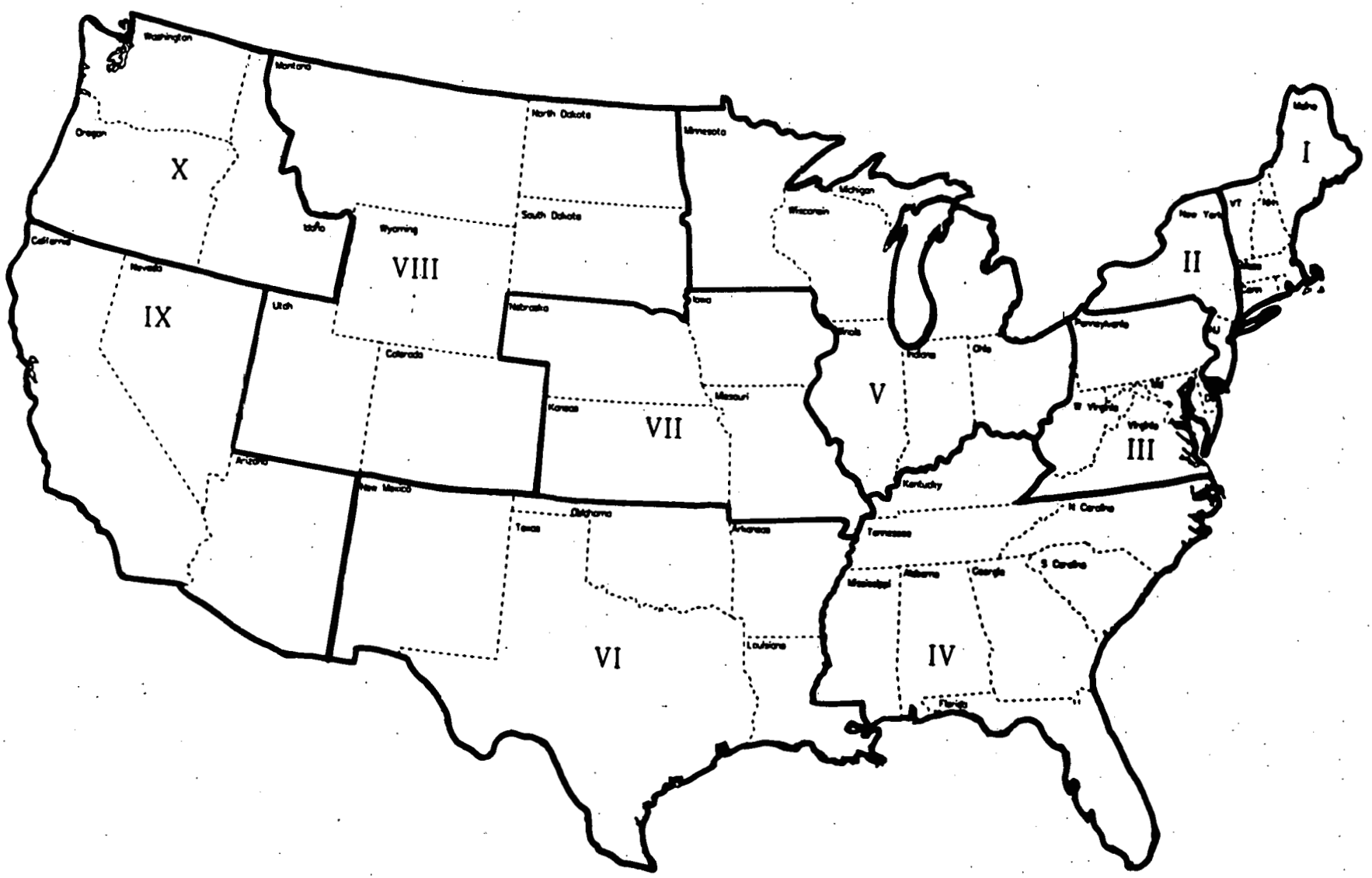

Fig. 3.11. Boundaries of the Federal Regions

The designations do not simply represent monitored violations. Modeling the impact of SO_2 sources was appropriate, if monitoring data were not available. In addition, in some cases EPA judged an SO_2 area to be nonattainment even though monitoring data did not indicate violations, if an SO_2 source in the area was determined to be using an unauthorized control system or a stack taller than is in accordance with good engineering practice.

The map of counties containing designated O_x nonattainment areas (Fig. 3.5) is significantly different from the SAROAD data map (Fig. 3.10), expecially for the Northeast and Middle Atlantic States. Since O_x is formed in the atmosphere and can be transported long distances, EPA had suggested that nonattainment designations be made on large geographic areas, despite the absence of monitored violations or of monitoring data.

The map of counties with monitored violations (Fig. 3.1) shows fewer discrepancies for TSP than for SO_2, in contrast to the map of designated areas (Fig. 3.6). There is a more extensive data base for determining nonattainment for TSP, since there are more monitors for TSP than for other pollutants. (In 1975, 4137 individual monitors provided data for TSP, compared to 2631 for SO_2, 824 for NO_x, 436 for CO, and 416 for O_x.) Some discrepancies arise because states designated an area as unclassified or attainment despite monitored violations, arguing that a monitor was improperly sited. Only three areas were designated as nonattainment for NO_x in Fig. 3.3 -- Denver, San Diego/Los Angeles, and Chicago. The monitor data in Fig. 3.8 indicate additional violations in New York City, Virginia (Roanoke), Georgia (Atlanta), and Massachusetts (Boston and Springfield), but not in Denver. (NO_x concentrations in the Denver area have been very close to the NAAQS in recent years -- 97 $\mu g/m^3$ in 1977 and 101 in 1978 -- according to the Colorado SIP.)

The differences between monitored and designated nonattainment areas may also be the result of differences in available air quality data. Although the SAROAD data base does not include as violations any annual values where the data were not available for all four quarters, the states may have used such data in determining attainment status. In addition, the states may have had access to monitoring data more recent than 1975, the last year of complete data available in SAROAD when this report was completed.

It must be noted, in reviewing the maps of nonattainment areas, that areas that are not shaded are not necessarily in attainment. These areas may simply not have valid monitoring data available. Table 3.1 indicates that for SO_2, for example, over 70% of the counties of the U.S. do not have monitor readings, while 85% of the counties lack data for NO_x. Within the industrialized Midwest Region V, SO_2 concentrations are not known in 60% of the counties and NO_x information is not available in over 80% of these counties. The potential clearly exists for nonattainment being a more widespread problem than the maps of monitored violations indicate. (Volumes 2-5 of this report provide detailed information on the location of monitors reporting valid data on various pollutants.)

3.2.3 Subcounty Areas Designated Nonattainment

The maps of U.S. counties containing nonattainment areas are readily available graphic displays of the general character and extent of the nonattainment problem. However, in most cases these maps seriously overstate the extent of the actual areas designated as nonattainment. A number of the initial March 1978 designations were made on a subcounty level -- 75% of TSP and 40% of SO_2 designations were only parts of counties. Although oxidant designations were made on a county level, NO_x and CO nonattainment areas were typically drawn around an urban center where monitors recorded violations of the standards. In the revised SIPs, the states, following EPA's suggestion, typically designated the geographic nonattainment area as small as reasonable around the monitor with recorded violations, particularly for TSP and SO_2 nonattainment areas. Ohio, for example, discarded the county-level designations set by EPA and drew SO_2 areas considerably smaller. California was the only state to consistently draw nonattainment areas on a scale larger than county level, usually encompassing entire air basins.

Although the states designated small sub-county areas as nonattainment, maps of these areas were not accessible, except as hand-drawn submissions in an SIP. The areas were not defined by any standard boundaries, such as county lines, but were drawn using highways, streets, or township lines as boundaries. Therefore, the use of county-level maps to identify problem areas for policy decisions introduced distortions, with too large an area being considered subject to a ban or a constraint on new sources. In the western U.S., where counties are extremely large, the over-statement by county-level maps is even more serious.

Consequently, this project undertook the task of providing a computerized set of maps of nonattainment areas, drawn as actually designated by the states, and presented in the other four volumes of this report. These maps are uniquely useful in detailed analyses of nonattainment constraints. As examples, Fig. 3.12 and 3.13 present maps of Ohio, showing counties containing SO_2 nonattainment areas (Fig. 3.12) and the SO_2 nonattainment areas as actually designated (Fig. 3.13). Clearly, the actual areas are far smaller than the counties. An effort has also been made to aggregate the designated areas to a level more useful than 50 individual state maps. On the scale of a national map, the areas become miniscule. On the scale of Federal Regions the actual areas are discernible. Appendix A presents a complete set of Federal Region maps for TSP and SO_2, the two pollutants of most concern to fossil-fuel energy technologies.

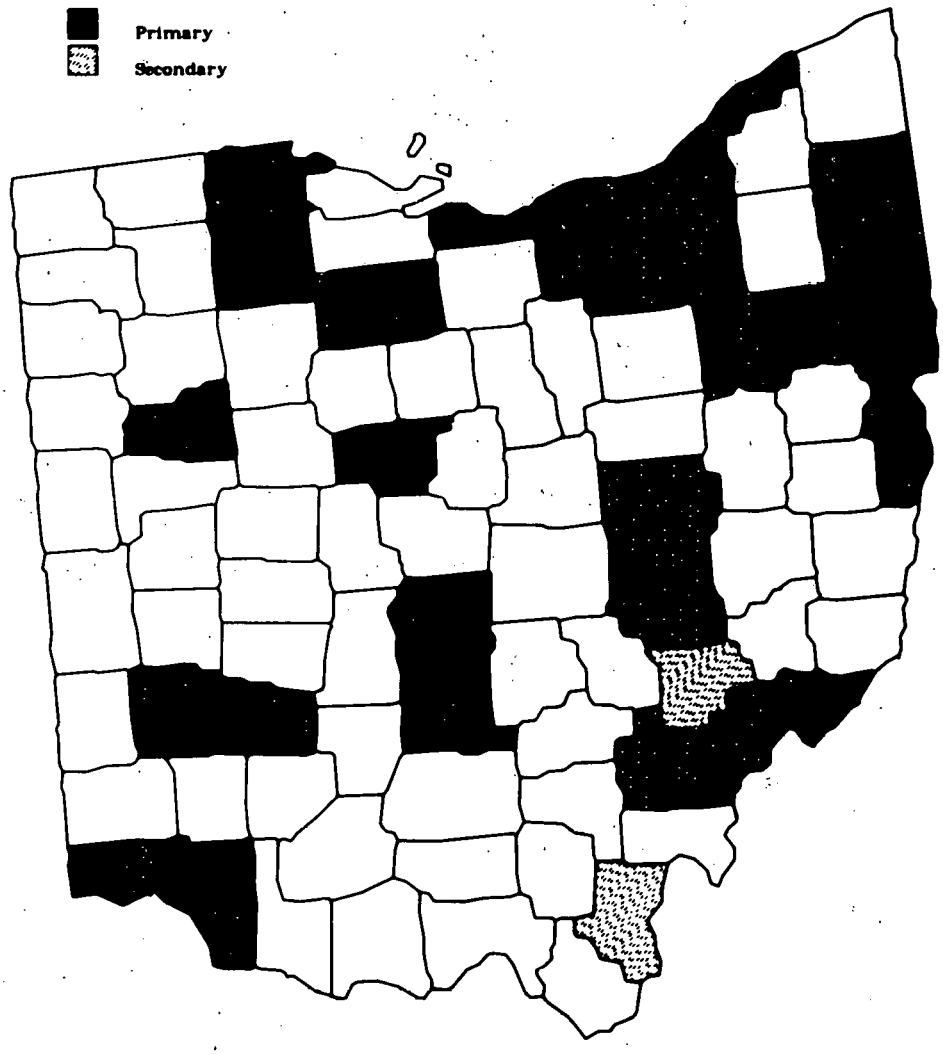

Fig. 3.12. Ohio Counties Containing SO_2 Nonattainment Areas, as of May 1979

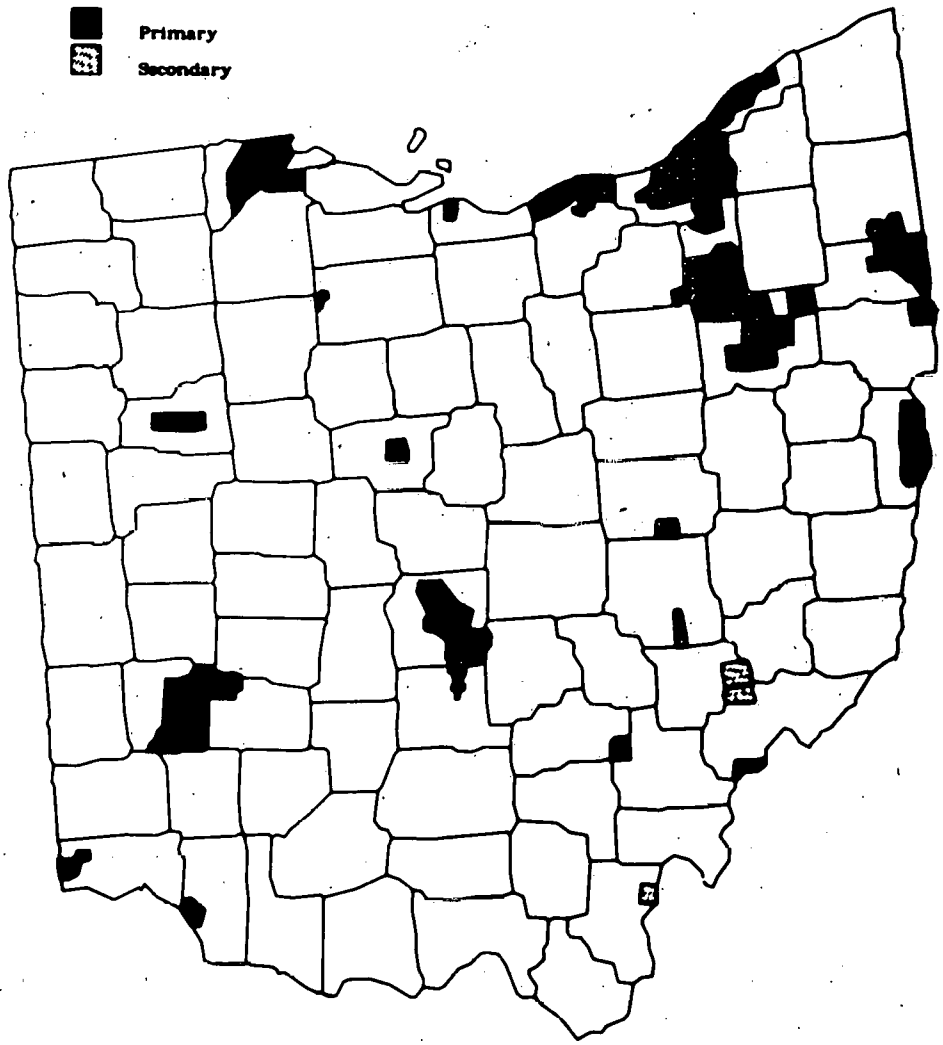

Fig. 3.13. Nonattainment Areas in Ohio, as Designated, as of May 1979

4 SIP ATTAINMENT STRATEGIES

4.1 STATUS OF SIP SUBMISSIONS

States that were required to submit new SIPs for nonattainment areas typically submitted the plans piecemeal, often separately for different pollutants and for different areas. EPA also reviewed and approved (or disapproved) the plans as they were submitted--piece by piece. Many states missed the statutory deadline of January 1, 1979, for submission of revised SIPs. Only one state, Wyoming, had a complete, newly-revised SIP approved by EPA by the deadline of July 1, 1979. (Wyoming's air quality problems, however, were relatively easy to address--nonattainment is limited to three small, source-specific TSP areas.) By September 1, 1979, Oregon and Washington had new approved SIPs, but by March, 1980, portions of SIPs from major states (such as Ohio and California) were still not approved. Figures 4.1 and 4.2 display the status of SIPs submitted for TSP and SO_2, as of February, 1980. SIPs for both pollutants were still not approved by that date for some of the industrial states in the Ohio River Basin (Ohio, Indiana, and West Virginia). According to the 1977 Clean Air Act Amendments, states without approved SIPs would not be able to grant construction permits to major new sources of the pollutant for which the area is in nonattainment. In fact, however, most states continued to process permits and often granted permits, with actual construction to be delayed until final approval of the new SIP.

States requesting extensions of the attainment deadline for CO and O_x were required by the 1977 Amendments to include a program for the inspection and maintenance of motor vehicles in the new SIP. The 29 states required to have these programs have had considerable difficulty in complying. As displayed in Fig. 4.3, by April 1980 five states (California, Colorado, Indiana, Kentucky, and Ohio) still had incomplete inspection and maintenance programs as a result of the failure of state legislatures to provide the necessary enabling legislation. In March 1980 EPA imposed sanctions on federal funds for Colorado, the first such action taken under the 1977 Amendments. In California, the absence of a statewide inspection and maintenance program and the failure to submit revised SIPs for portions of air basins has delayed construction permits for an estimated 40 major projects.[11]

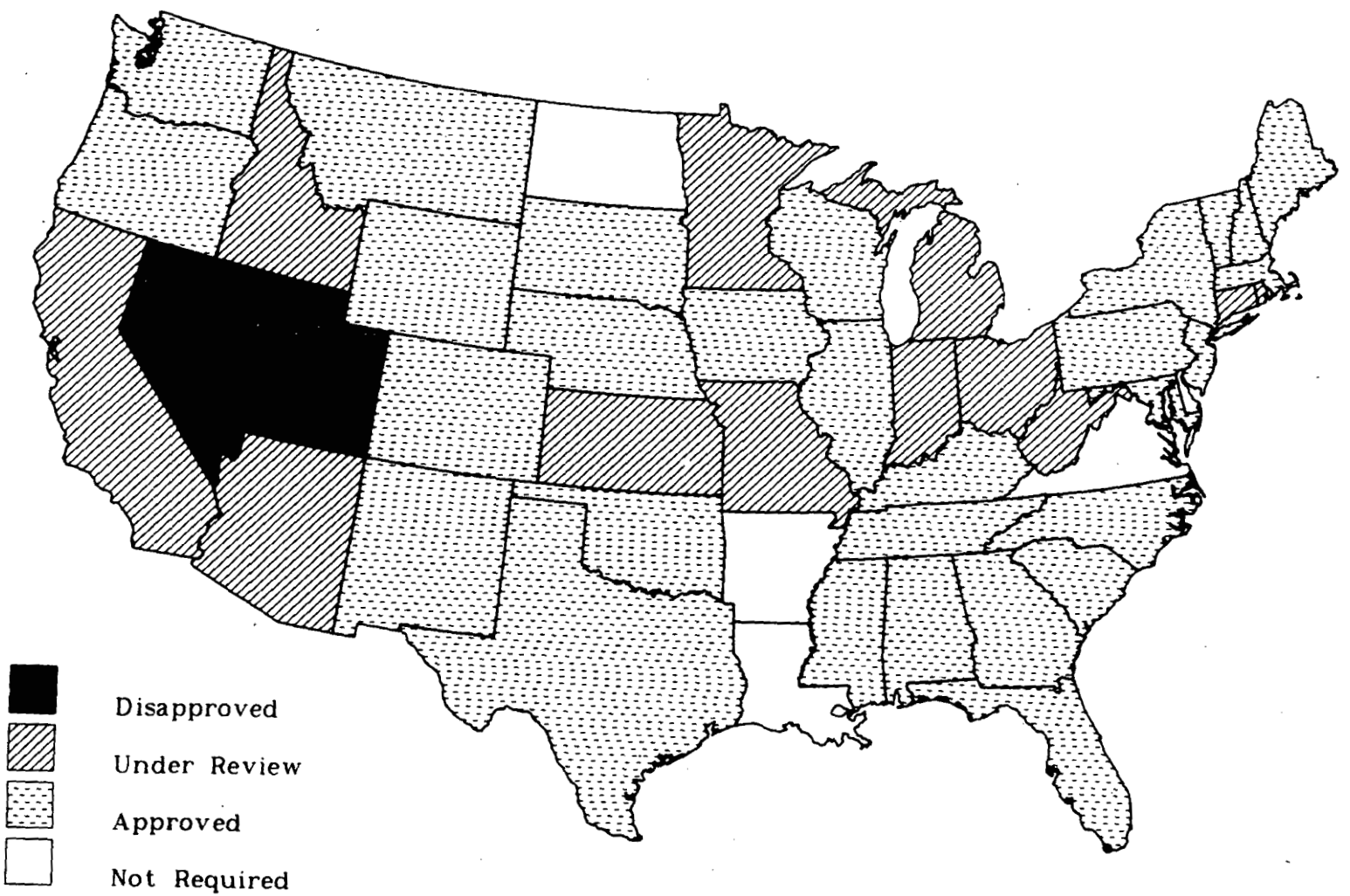

Fig. 4.1. Status of Revised SIPs for TSP Nonattainment Areas as of Feb. 1980

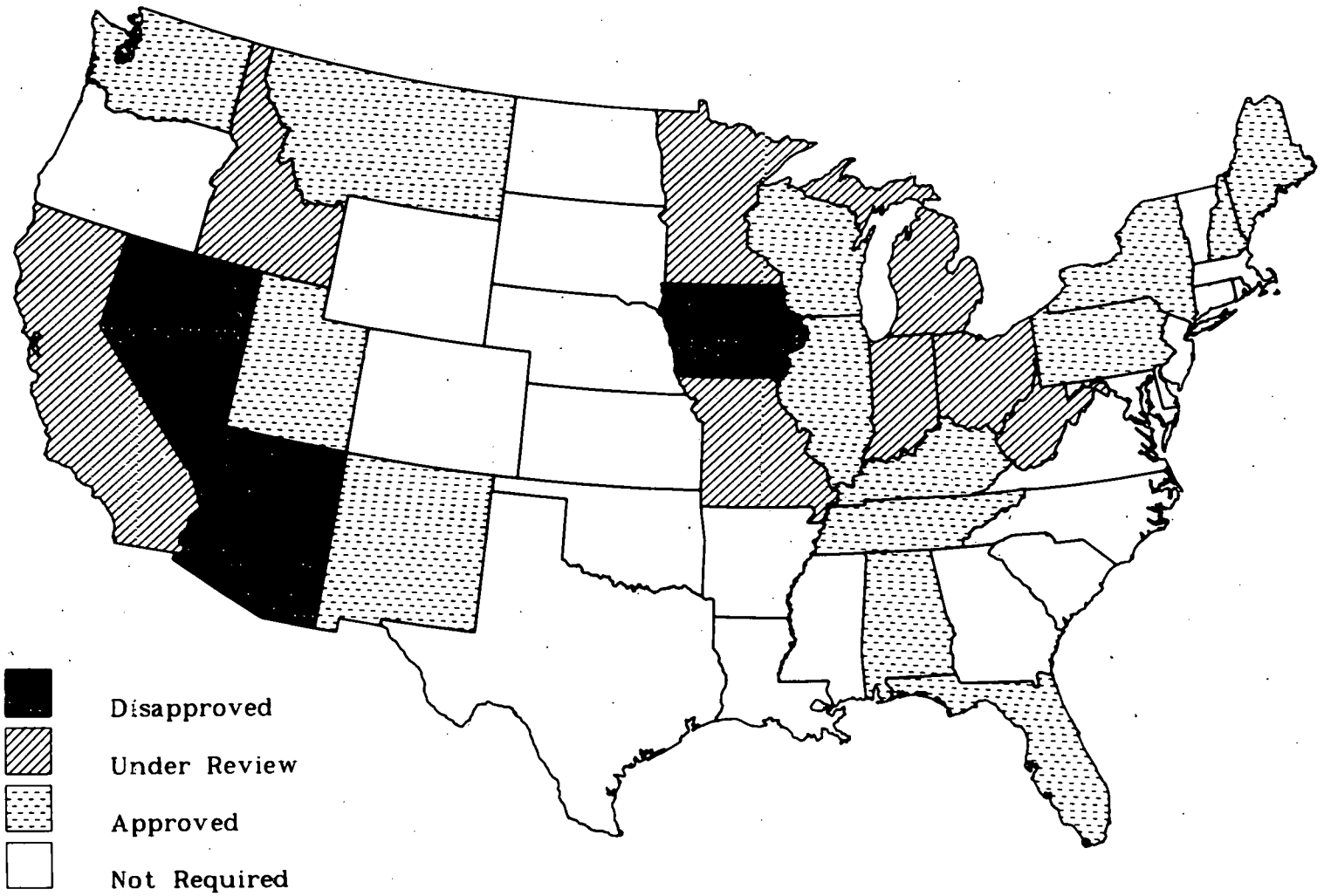

Fig. 4.2. Status of Revised SIPs for SO_2 Nonattainment Areas as of Feb. 1980

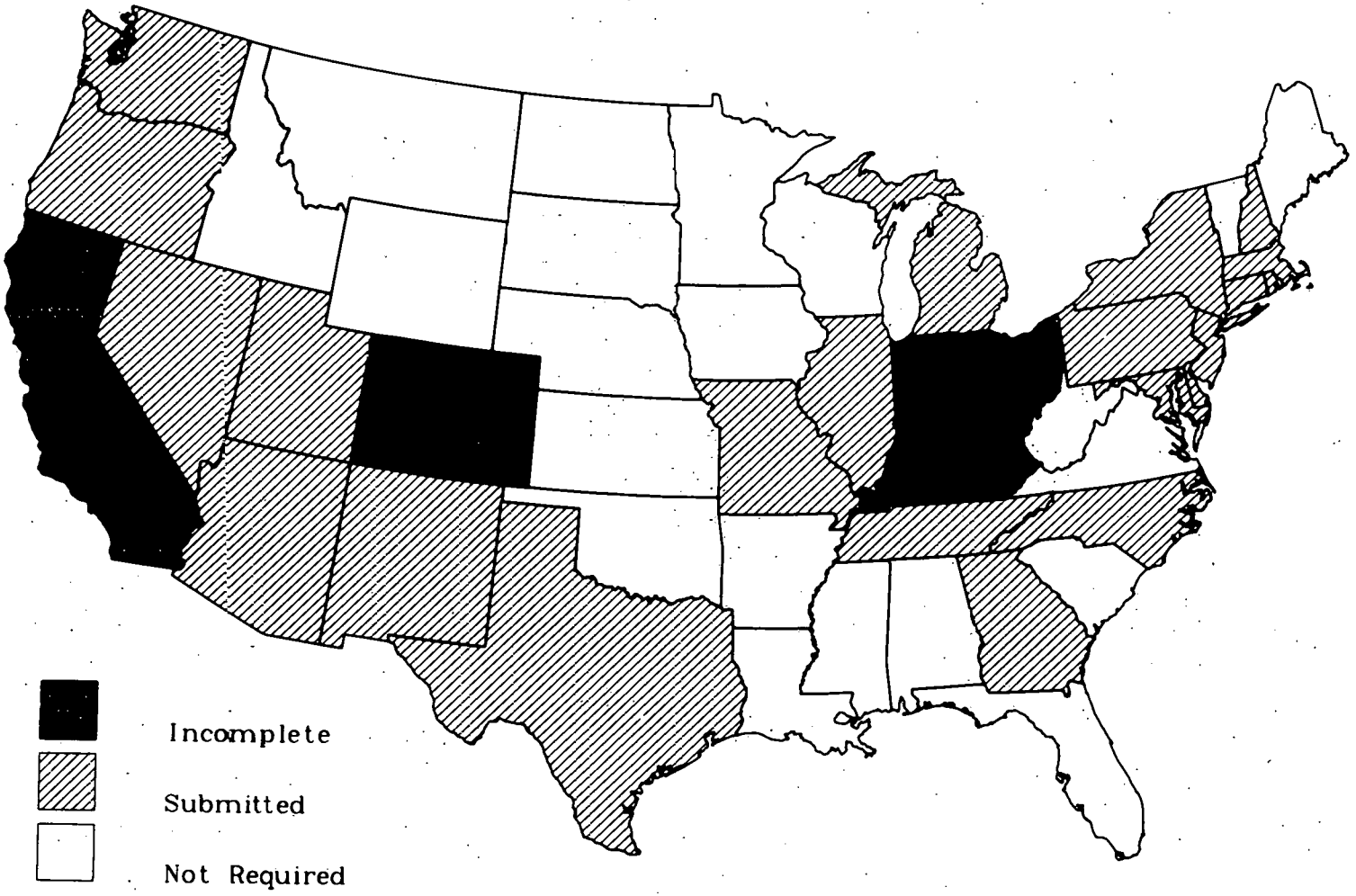

Fig. 4.3. Status of Automotive Inspection/Maintenance Program Submittals, April 1980

4.2 POLLUTANT-SPECIFIC ATTAINMENT STRATEGIES

The attainment strategies of the new SIPs vary from state to state and, in many cases, from one area within a state to another. Attainment strategies and the stringency of requirements on new and existing sources are dependent on the goals of a state--both for economic development and for environmental protection. The causes of violations are usually the result of local phenomena, such as meteorology, topography, land use, and characteristics of particular facilities, as well as the level of development and natural resources of a state. Transport phenomena are sometimes significant contributors to high concentrations of oxidants (ozone) and TSP (sulfates). Despite these local variations, patterns or trends in attainment strategies can be discerned. Similarities exist because:

- The same types of sources are responsible for nonattainment, and the control possibilities are similar;
- The 1977 Clean Air Act Amendments and EPA require certain strategies, such as inspection and maintenance of motor vehicles in ozone nonattainment areas;
- States seek solutions that are likely to be approved by EPA;
- Many states, lacking independent expertise, rely heavily on EPA advice (or the advice of consultants).

4.2.1 Sulfur Dioxide

Sulfur dioxide nonattainment areas are usually the result of a few local stationary sources. The areas occur throughout the industrialized states of the Midwest and Northeast and in localized areas of the South and West where major SO_2 sources, such as smelters, refineries, and coal-fired power plants are located.

Out-of-Compliance Sources. In many instances, the SO_2 emissions causing nonattainment come from sources that are not in compliance with existing SIP limitations. EPA Region V, for example, has a significant number of SO_2 nonattainment areas, largely the result of coal-fired power plants. In 1978, in a report to the General Accounting Office, the EPA Region V office stated that "233 powerplants are responsible for 81 percent of the Region's sulfur dioxide emissions. Even though 52 percent of these plants (121) are in compliance, they account for only 26 percent of the sulfur dioxide emissions.

The 112 plants not in compliance and those on cleanup schedules account for 74 percent of sulfur dioxide emissions and 78 percent of emissions from all powerplants."[12] Illinois, one of the states in Region V, addressed the SO_2 nonattainment problem in its revised SIP by retaining the existing SIP emission limitation on solid-fuel combustion sources, and adding regulations to govern the performance of emission control equipment.

In the revised SIP for Kentucky, 14 point sources of SO_2 were identified as the cause of eight nonattainment areas -- nine of those sources were out-of-compliance power plants. Kentucky's attainment strategy was simply to bring the power plants into compliance with existing SIP limitations, rather than making the emission limitations more stringent.

Nonferrous Smelters. Nonattainment areas for SO_2 in several western states (Nevada, Utah, Arizona, Montana, and New Mexico) are caused by the emissions from nonferrous smelters. The smelters are eligible for exemptions from compliance with SIP limitations until as late as 1988. The 1977 Amendments indicated that exemption orders for such primary nonferrous smelters could authorize continued use of supplementary control systems and tall stacks, but must also include interim requirements to prevent violations of the NAAQS.

Montana's revised SIP calls for control of between 75 and 80% of the sulfur emissions from three smelters. If the sources comply with the SIP limitations, the state predicts attainment by the December 1982 deadline. The SIP does not address the possibility that the sources may be granted exemptions. Similarly, New Mexico and Nevada outline the emission limitations necessary for attainment but do not address the question of smelter exemptions.

Use of Clean Fuels. The continued use of low-sulfur oil is the SO_2 attainment strategy outlined by most states in the Northeast. Attainment for such major cities as Boston, New York, and Baltimore had been brought about under previous SIPs by the substitution of low-sulfur oil for high-sulfur coal and/or oil in utility and industrial boilers. The attainment strategy in the current revised SIP for Philadelphia includes further substitution of low-sulfur fuel (particularly oil). Connecticut retained a statewide sulfur-

in-fuel limit of 0.5%, while Rhode Island required an emission limit of 0.55 lb of S per 10^6 Btu, for all coal burning facilities larger than 250 x 10^6 Btu/hr heat input. The 1977 Amendments (Sec. 124) had required that any revised SIP containing an attainment strategy based on oil or natural gas should contain a statement about the continued availability of such clean fuels. In most cases, however, the only such statement provided referred to contracts with suppliers.

Although Texas does not have any nonattainment areas for SO_2, the Texas Air Control Board investigated the air quality impacts of conversions of combustion sources from gas to oil in the Houston area. The study[13] concluded that the conversion of all industry to 0.8%-sulfur oil would cause violations of the NAAQS for SO_2 in Harris, Fort Bend, and Chambers counties (the Houston area). The study did not address conversion to coal.

New Source Review. Maintenance of the standards is usually predicated on new sources of SO_2 complying with EPA's New Source Performance Standards (NSPS). Three states, however, have adopted more stringent requirements than the 1979 federal standards for coal-burning sources larger than 250 x 10^6 Btu/hr:

NSPS:	1.2 lb SO_2 per 10^6 Btu
New Mexico:	0.34 lb SO_2 per 10^6 Btu
Wyoming:	0.2 lb SO_2 per 10^6 Btu
Arizona:	0.8 lb SO_2 per 10^6 Btu

Summary of SO_2 Attainment Strategies. The SO_2 attainment strategies of the revised SIPs call for:

- Bringing stationary sources that are currently out-of-compliance into compliance with existing SIP emission limitations. This strategy is typical of the states in Regions V and VI.
- Continuing use of lower sulfur oil in Regions I, II, and III.
- Stating the emission limitations for smelters needed to bring an area into attainment, but not addressing the impact of an exemption order (Arizona, Utah, Montana, Nevada, and New Mexico).

- Requiring the new source review procedure outlined by the 1977 Amendments and EPA regulations. In most cases, the regulations are simply copied from the requirements into the SIP. Variations in implementing the review procedure are usually not included.

Increasing the stringency of SIP emission limitations for stationary sources is not a typical attainment strategy.

4 2.2 Total Suspended Particulates

In contrast to SO_2, nonattainment areas for TSP are widespread, and the causes of the air pollutant are both source-specific and area-wide. The traditional sources of particulates are stack and fugitive process emissions from fuel combustion, solid waste disposal, and industrial processes. These traditional sources are to be controlled to RACT levels in a newly revised SIP.

In many nonattainment areas, however, controls on traditional sources will not be adequate to attain the standards (particularly the secondary ones) since "nontraditional" sources may be significant contributors to particulate levels. EPA has estimated that nontraditional sources (e.g., resuspended dust, construction and demolition dust, tire particles, and dust from unpaved roads) contribute from 25 to 30 $\mu g/m^3$ to city-wide TSP levels[14] (compared to an annual average primary NAAQS of 75 $\mu g/m^3$). In the revised SIPs, urban road dust was estimated to be 45% of the TSP burden in Chicago, and 47% in Connecticut. Since nontraditional sources are not amenable to straightforward emission limitations and controls, EPA has only required that schedules for control of such sources be included in a SIP. Development and adoption of actual control measures can be delayed.

Reclassifying TSP Nonattainment Areas. A number of states approach an attainment strategy for TSP by first attempting to reduce the size of the nonattainment areas. Some SIPs provided evidence that recorded violations of the standards were due to rural fugitive dust, improper monitor siting, temporary sources, or unique malfunctions of controls on sources otherwise in compliance with regulations. EPA's position was to allow discounting of these violations and permit reclassification of the area to an attainment or unclassified status. Typically, states in the Southwest have requested rede-

signation based on the rural fugitive dust policy. If the violations were not amenable to this approach, states have frequently designated as nonattainment an area as small as reasonable around a monitor with recorded violations.

TSP Control Strategies. The revised SIPs usually apply existing SIP emission limitations to stack emissions from traditional point sources, arguing that these sources are already subject to stringent limitations and additional controls would not be cost effective. (Existing limitations typically require a removal efficiency of over 95%.) In some cases, a SIP strategy includes achieving compliance with existing regulations by sources currently out of compliance or under delayed compliance orders. However, the impact of such noncomplying sources is less than the impact of SO_2 sources on SO_2 nonattainment areas.

Controlling particulate emissions from the stacks of existing major sources will not, in most cases, bring about attainment. Although cleaning up smaller sources of particulates has the potential to reduce TSP levels, the states typically do not address these sources, but move on to outline proposed strategies for controlling fugitive industrial emissions. Fugitive industrial emissions are characterized as all emissions from an industrial process that do not exit from a stack or vent. They come from a variety of sources (leaks, poor seals, storage piles, unpaved roadways, and parking lots), they are difficult to measure, and their air quality impact often cannot be estimated with current modeling techniques. Although EPA has issued a guidance document on the control of fugitive industrial particulates, the SIPs are generally vague about the limitations or controls to be required other than a general statement about RACT.

For those states where control of traditional TSP sources (both stack and fugitive emissions) will not be adequate for attainment, the SIP must include a schedule for studying measures to control nontraditional sources. Control measures that have been suggested include street sweeping, washing the wheels of trucks leaving construction sites, paving, wetting, or oiling all unpaved roadways and parking lots, and the revegetation of construction sites. Implementation of control measures must be made before the December 1982 attainment deadline. In Illinois, for example, the SIP (which has not yet been approved) calls for a study to begin in December 1979, on the poten-

tial control of dust from unpaved roads, re-entrainment, construction and demolition, and agricultural tilling. By January 1981, appropriate regulations are to be implemented. Whether this schedule is feasible and whether adequate control measures can be developed is questionable.

Secondary TSP Standards. Control of nontraditional sources of TSP is likely to be necessary for many states to attain the secondary particulate standards. The 1977 Amendments provide that EPA can approve an 18-month extension of the deadline for submitting a plan to achieve the secondary standards. In January 1979, EPA stated that such a plan should be approved by December 1980 (or 18 months after the July 1979 deadline for SIPs to attain the primary standards). Failure to have a revised SIP for the attainment of the secondary standards was to lead to sanctions on growth and funding. Since the entire SIP revision process is late, the date for the imposition of these sanctions is unclear. Nevertheless, SIPs are required to cover attainment of the secondary standards, although there is no statutory deadline for attainment.

Summary of TSP Attainment Strategies. TSP nonattainment areas are more common than SO_2 areas, attainment strategies are more complicated, and attainment will be more difficult to achieve. The few large sources are already well controlled; the remaining sources are smaller and numerous. Attainment strategies focus on the large sources, even if this means efforts to control fugitive emissions. The typical TSP source is sufficiently small that many emitters will fall below new source review size under the latest definition of a major source as one emitting 100 tons per year, after controls. This may hamper attainment unless states review smaller sources. The strategies include:

- Designating rural areas as attainment on the basis of the EPA rural fugitive dust policy;
- Drawing all nonattainment areas as small as EPA will accept;
- Retaining current SIP emission limitations on particulate matter from stacks;
- Requiring RACT on fugitive industrial emissions;

- Developing control strategies for nontraditional sources of fugitive dust in urban areas; and
- Asking for an 18-month extension for submittal of a revised SIP for the secondary standards.

4.2.3 Nitrogen Oxides

The designated nonattainment areas for this pollutant are limited to downtown Chicago, the city of Denver, and the air basins surrounding Los Angeles/San Diego, although (as indicated in the maps showing monitor data) more urban areas do in fact have recorded violations of the NAAQS.

Illinois NO_x Attainment Strategy. The Illinois SIP indicated that the implementation of the Federal Motor Vehicle Emissions Control Program (FMVECP), in combination with the existing limitations on stationary sources, would be adequate to achieve attainment by December 1982. The existing NO_x emission limits for new fuel combustion sources larger than 250 x 10^6 Btu/hr are: gas, 0.2 lb NO_x per 10^6 Btu; oil, 0.3 lb/10^6 Btu; and coal, 0.7 lb/10^6 Btu. Existing sources larger than 250 x 10^6 Btu/hr in the major metropolitan areas of Chicago and St. Louis are to meet 0.3 lb of NO_x per 10^6 Btu for gas and oil and 0.9 lb/10^6 Btu for coal.

The SIP assumed that NO_x violations are localized (restricted to the central business district of Chicago) and are closely related to emissions from mobile sources. For 1977, NO_x emissions were estimated to be 35% from point sources (fuel combustion and industrial processes); 23% from area sources (residential and off-highway mobile); and 42% from on-highway mobile sources. The state projected that attainment required a 13.4% reduction in mobile source emissions and that the use of the FMVECP and the introduction of other (unspecified) transportation control measures would achieve a 25% reduction in NO_x emissions.

Colorado NO_x Attainment Strategy. The Colorado SIP noted that the Denver region is only marginally exceeding the NAAQS (0.054 ppm compared to 0.05 ppm for the standard). The NO_x emissions were 37% from motor vehicles; 50% from large stationary sources (including power plants); and 10% from space heating. The SIP stated that the NAAQS will be attained by the December 1982 deadline, as a result of the increased controls on mobile sources needed to

attain the CO and O_x standards. No additional specific NO_x controls were projected to be needed. The state agency planned, however, to study possible controls on stationary sources since only 2.5% of these NO_x emissions are currently controlled. The SIP projected an NO_x concentration of 0.048 ppm by 1982, through implementation of FMVECP, and EPA accepted this portion of the SIP.

California NO_x Attainment Strategy. According to the draft SIP, the San Diego area is only marginally in nonattainment (0.06 ppm), with NO_x emissions the result of both mobile and industrial sources. Requiring NO_x controls of either a fluidized bed unit or ammonia injection had been considered for utility and industrial boilers. However, the San Diego Air Pollution Control District decided that these techniques were still too experimental, and instead of requiring "technology-forcing" controls, the development of a detailed attainment strategy would be deferred. The SIP promised a further analysis to determine the most effective mix of controls, and proposed to submit a detailed plan to EPA by the end of 1979.

According to San Diego district officials, the area is now petitioning the California Air Resources Board to be designated as attainment, on the basis of a study of the calibration techniques used in monitoring NO_x. (Laboratory tests indicated that the technique was incorrect and that an estimated 15% level of error resulted.) San Diego, however, will continue to be in violation of the California state NO_x standard (one-hour averages not to exceed 0.25 ppm). The district plans to increase mobile source control and to examine the local impact of several large combustion sources (including three gas and oil-fired power plants).

Summary of NO_x Attainment Strategies. NO_x nonattainment areas are currently limited to only three urban centers. Most of the rest of the country has been designated as attainment/unclassified. A short-term standard and additional monitoring data may reveal more nonattainment areas. In general, the three nonattainment areas plan to achieve attainment by:

- Relying on increased controls on motor vehicles required to attain the O_x and CO standards; and
- Studying possible controls for stationary sources.

4.2.4 Ozone and Carbon Monoxide

Ozone nonattainment areas are widespread and are usually designated in accordance with EPA guidelines as large geographic areas, such as counties or air basins. Ozone is formed in the atmosphere by a number of complex chemical reactions involving NO_x and hydrocarbons. There is considerable controversy over the role of NO_x emissions in the creation of ozone, suggesting that the important parameter is not total NO_x or HC, but the ratio of the concentrations. Nevertheless, attainment strategies address control of one of the precursors of ozone -- reactive hydrocarbons or volatile organic compounds (VOC). In almost all major metropolitan areas, violations reflect the contribution of mobile sources to HC emissions. A number of eastern states attribute violations to the transport of pollutants from sources many miles away (often in other states). Many rural monitors record violations, despite the absence of identifiable sources of either HC or NO_x; these violations are also attributed to pollutant transport. EPA recognized the latter problem, setting up separate requirements for ozone nonattainment areas that were rural (defined as having a population of less than 200,000) and more stringent requirements for urban ozone nonattainment areas.

Stationary Sources. EPA stated that all SIPs for O_x nonattainment areas should require RACT on those major stationary sources of HC for which the federal agency had issued a control technique guidance document. These stationary sources include petroleum refineries and storage facilities, gasoline distributors and retailers, surface coating plants, and asphalt paving operations. Controls include requirements such as installing floating double seals on oil and gasoline storage tanks; measures to prevent evaporation; switching to less volatile paints and solvents; and the substitution of water-emulsified asphalt for cutback asphalt. Most SIPs simply adopted the controls outlined in EPA's guidances. SIPs for rural O_x nonattainment areas were not required to include any further control strategies.

Mobile Sources. SIPs for urban nonattainment areas included transportation control measures designed to reduce HC emissions from motor vehicles. The strategies can be categorized as those intended to reduce the emissions from automobiles, assuming normal (or current) use, and those intended to reduce the number of vehicle miles traveled. The Federal Motor Vehicle

Emission Control Program required new cars to achieve lower emission levels of NO_x and HC. Emission reductions are calculated from the replacement of older, more polluting cars with newer, cleaner cars, on the basis of normal vehicle turnover rates. In marginal O_x nonattainment areas, the reduction projected to result is often sufficient to allow prediction of attainment by the December 1982 deadline. If an area required additional transportation controls for attainment, the SIP typically adopted EPA's list of reasonably available control measures, with a schedule for the selection and implementation of specific measures. The transportation control measures were in general designed to increase the use of mass transportation, reduce reliance on single-occupant vehicles, and improve the flow of traffic.

Extension of the Attainment Deadline. SIPs requesting an extension of the deadline for O_x attainment to December 1987 were required to include a mandatory inspection and maintenance program for motor vehicles. Twenty-nine states requested such an extension. Although most states experienced difficulty in achieving the passage of adequate legislation as of March 1980, only Colorado has had sanctions imposed as a result of the absence of an inspection and maintenance program.

Carbon monoxide. Carbon monoxide nonattainment areas occur in the centers of almost all major urban areas, with the violations directly caused by emissions from motor vehicles. All CO nonattainment areas are also nonattainment for O_x, with the exception of Boise, Idaho, and Lincoln, Nebraska. EPA addressed CO and O_x jointly in the criteria for approval of SIPs, concentrating on control strategies for the more difficult attainment problem--O_x. CO attainment was treated as a side-effect of the transportation control measures aimed at achieving O_x attainment. Many states followed EPA's suggestions and did not develop separate attainment strategies for CO, but addressed the two pollutants (CO and O_x) together by transportation control measures.

Summary. The 1977 Amendments and EPA outlined more specific control measures for attainment of the O_x standard than for any other pollutant. Most SIPs did not reflect EPA's less stringent O_x standard. The SIPs for Houston, Los Angeles, and Boston expressed pessimism about ever meeting O_x

standards without significant economic disruption. SIPs, in general, adopted the strategies suggested by EPA of:

- RACT on stationary sources;
- Transportation control measures, relying heavily on the reductions projected to result from the FMVECP;
- Inspection and maintenance programs for motor vehicles in the 29 states requesting extensions to 1987.

4.3 NEW SOURCE REVIEW PROCEDURES

According to the 1977 Amendments, states could choose between two approaches for permitting new sources to locate in a nonattainment area: (1) provide an emissions growth allowance, by requiring the cleanup of existing sources to achieve more than just attainment, or (2) adopting the EPA emission offset policy. Under the first option, the state essentially provides offsets for the new sources, while under the second option, the source owner must obtain the offsets. Our review of SIPs indicates that 24 states have adopted an emission offset approach for all pollutants; 19 chose a combination of growth allowance and offsets; Georgia planned to rely on growth allowance alone; and four states (those without violations or with limited nonattainment areas) have not developed any specific procedure. Fig. 4.4 displays the states and their new source review procedures.* The states that have provided a growth allowance have not quantified the projected allowance nor provided any mechanism for determining the allocation of the available growth allowance. In addition, the states in the northeast predict little or no growth of major sources of emissions in the near future.

The choice between growth allowance and offsets, however, varied from one pollutant to another. Typically, states projected a growth allowance for minor sources of HC in a nonattainment area for O_x, with an offset requirement reserved for major sources or for use if the growth allowance proved to be inadequate. As displayed in Fig. 4.5, 35 of the 43 states with TSP nonattainment areas planned to follow an emission offset policy. Maine, Illinois, and Tennessee provided a small growth allowance for new sources of particulate

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*Note that the category of "No procedure" in Figs. 4.4-4.6 includes both states without nonattainment areas and those without clearly delineated new source review procedures in a SIP.

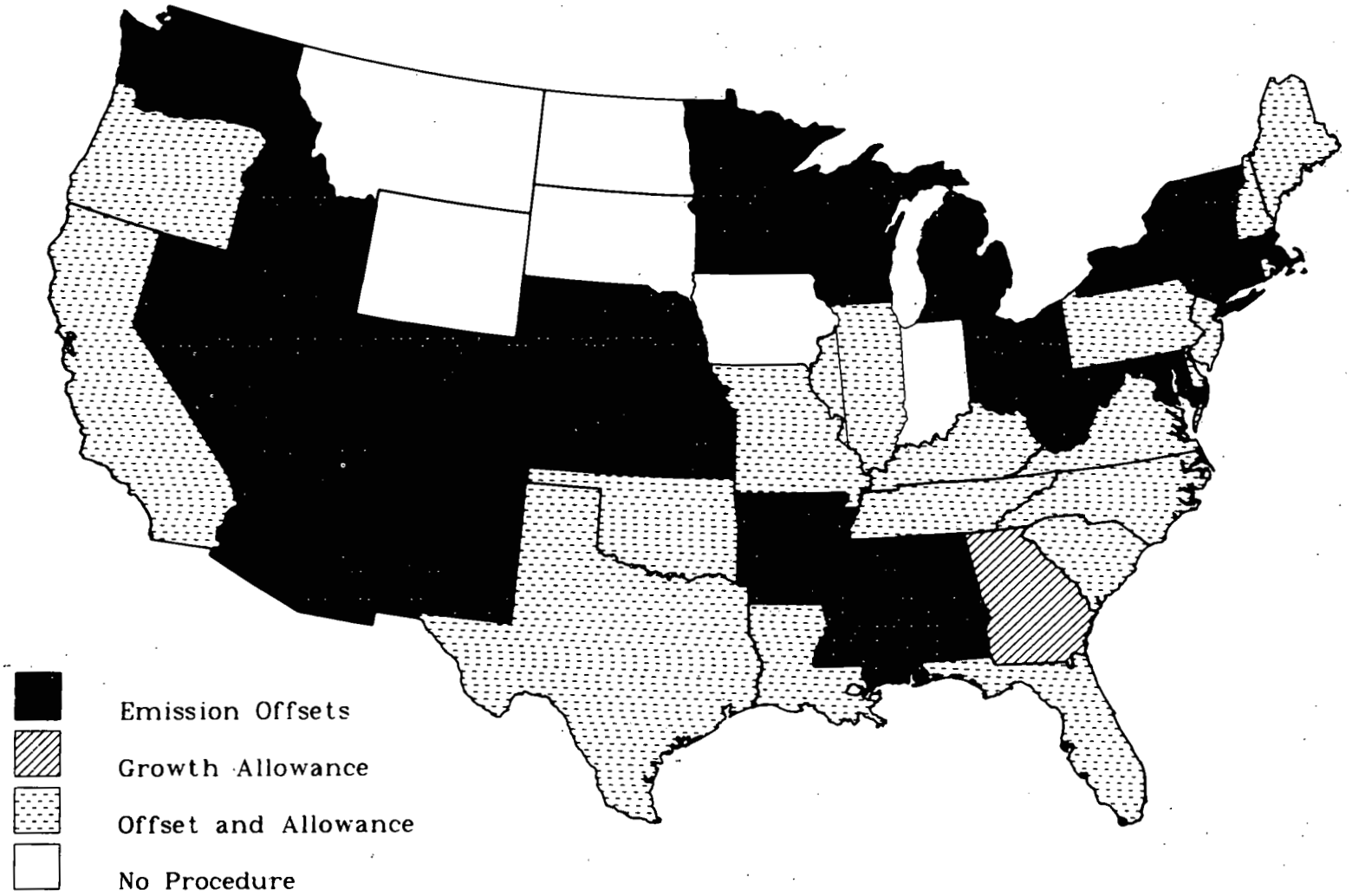

Fig. 4.4. New Source Review Procedures in Revised SIPs for Nonattainment Areas as of Feb. 1980

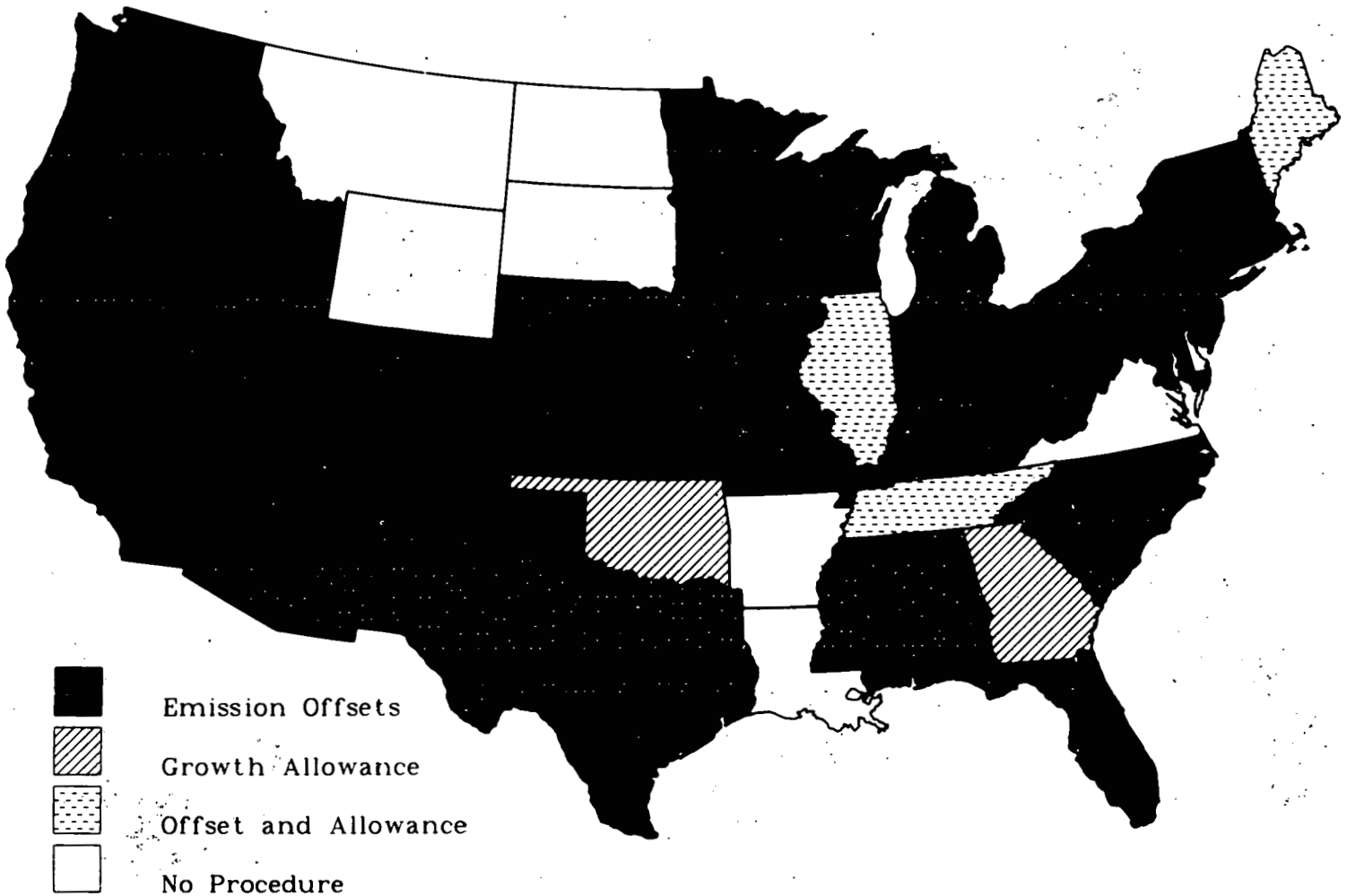

Fig. 4.5. New Source Review Procedures in Revised SIPs for TSP Nonattainment Areas as of Feb. 1980

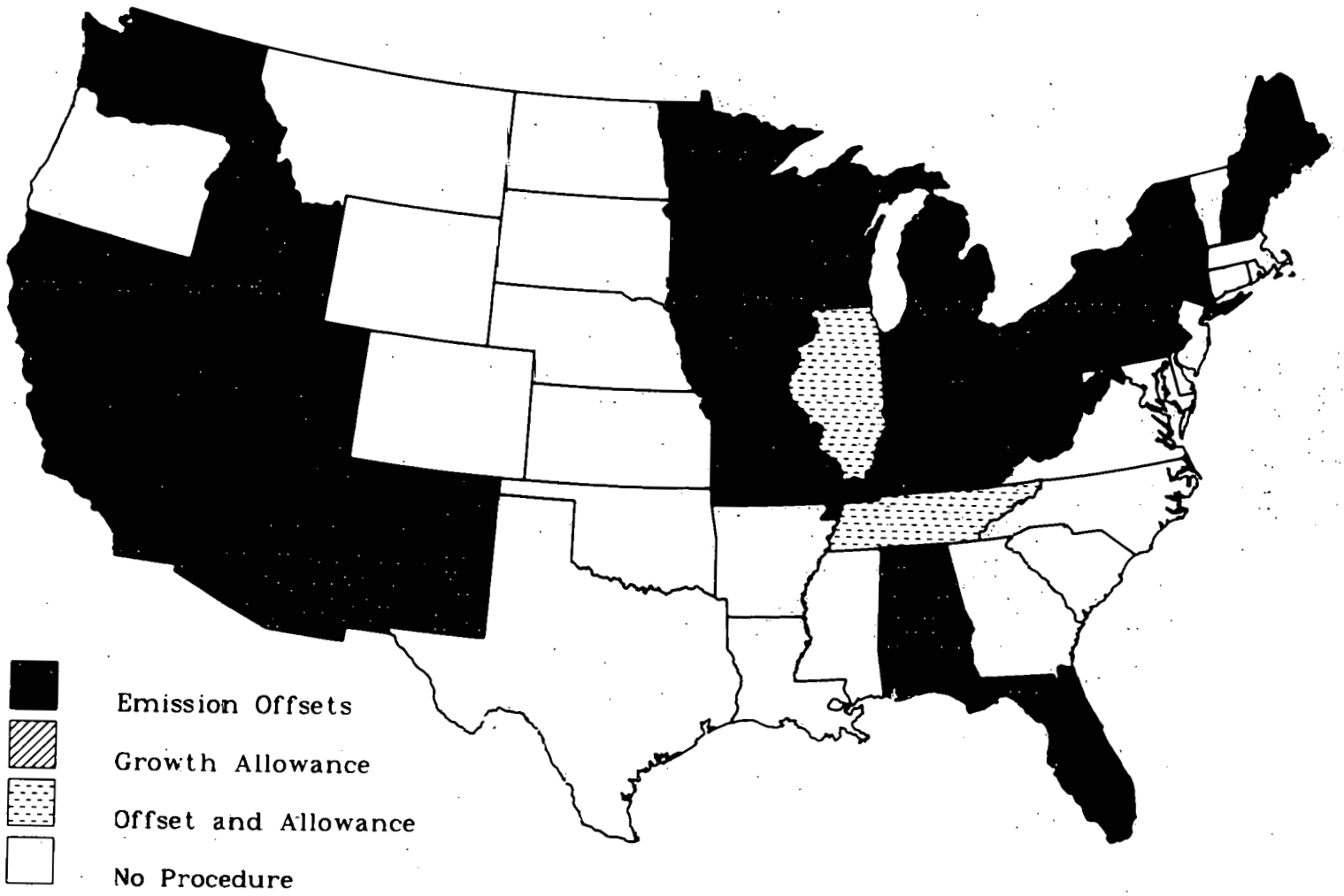

Fig. 4.6. New Source Review Procedures in Revised SIPs for SO_2 Nonattainment Areas as of Feb. 1980

matter, with an offset policy established as a backup. Illinois planned to limit use of the growth allowance to small sources that were unable to find offsets. Georgia and Oklahoma expected to provide an adequate growth allowance. Montana, South Dakota, and Wyoming all noted that the nonattainment areas were too small to be likely sites for new sources. The majority (21 out of 24) of the states with SO_2 nonattainment areas planned to follow an emission offset procedure for new sources of SO_2 (Fig. 4.6). Illinois and Tennessee proposed both a growth allowance and offsets, while Montana again provided no procedure for new sources in the states' three small, source-specific nonattainment areas.

4.4 SUMMARY

Based on the review of revised SIPs, the following conclusions can be drawn about attainment strategies for the pollutants of most concern to fossil-fueled energy development:

- SO_2 attainment can be fairly easily achieved by bringing existing out-of-compliance sources into compliance with existing SIP emission limitations. More stringent emission limitations are not viewed as needed.
- Strategies in the northeastern states for the maintenance of the SO_2 standards rely on continued use of clean fuels.
- TSP nonattainment will be more difficult to correct than SO_2 nonattainment. Control of fugitive emissions will become increasingly important.
- In many urban, industrialized areas, control of "non-traditional" sources of fugitive emissions will be necessary.
- NO_x attainment strategies rely on the increased controls on motor vehicles required to attain the O_x and CO standards rather than requiring controls on stationary sources.

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REFERENCES

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2. Clean Air Act Amendments of 1970, P.L. 91-604.

3. 40 CFR Part 51.

4. 40 CFR Part 51.18.

5. 41 FR 55524, An Interpretive Ruling for Implementation of the Requirements of 40 CFR 51.18 (December 21, 1976).

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7. 43 FR 21673, Criteria for Proposing Approval of Nonattainment Area Implementation Plan Revisions (May 19, 1978).

8. 44 FR 20372, Proposed Rulemaking on Approval of SIP Revisions for Nonattainment Areas (April 4, 1979).

9. EPA, Questions and Answers on 1979 SIP Revisions, memo to Regional Offices, p. 18 (October 11, 1978).

10. 43 FR 8962, NAAQS: States' Attainment Status (March 3, 1978).

11. Bureau of National Affairs, *Current Developments*, Environment Reporter, p. 1979 (February 8, 1980).

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14. EPA, *National Assessment of the Urban Particulate Problem*, EPA-450/3-76-024, p. 30 (July 1976).

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APPENDIX

MAPS OF DESIGNATED NONATTAINMENT AREAS FOR SO_2 AND TSP, BY FEDERAL REGION

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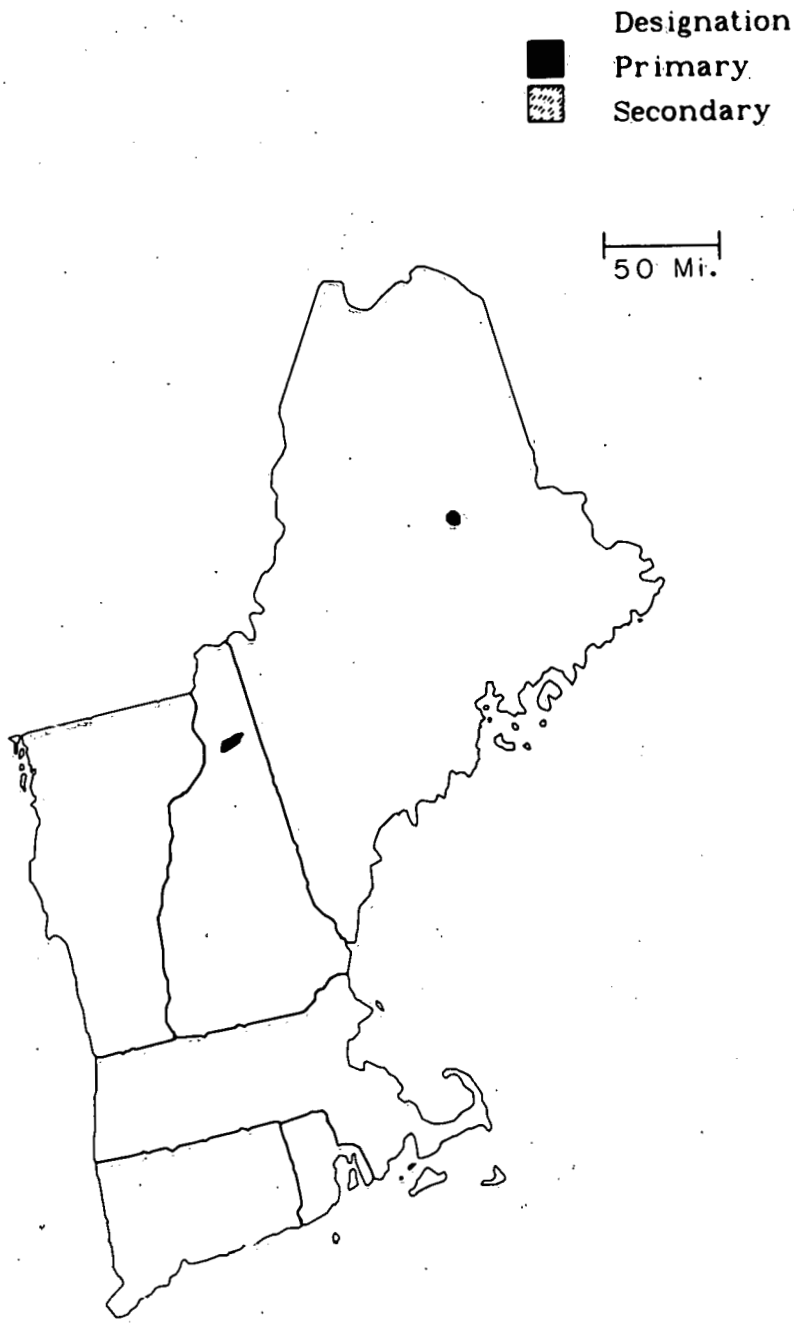

Fig. A.1. Federal Region I: SO_2 Nonattainment Areas as Designated May 1979

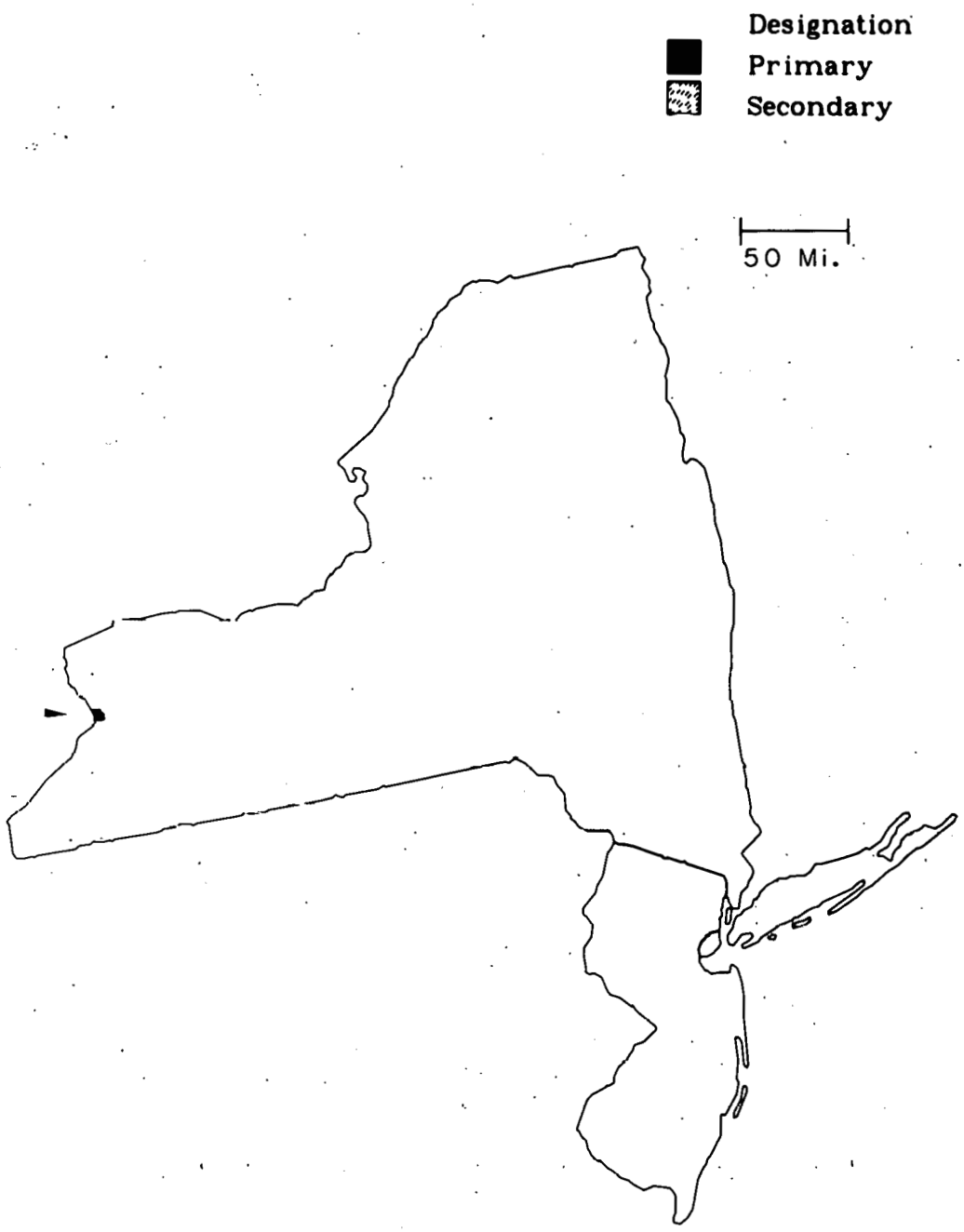

Fig. A.2. Federal Region II: SO_2 Nonattainment Areas as Designated May 1979

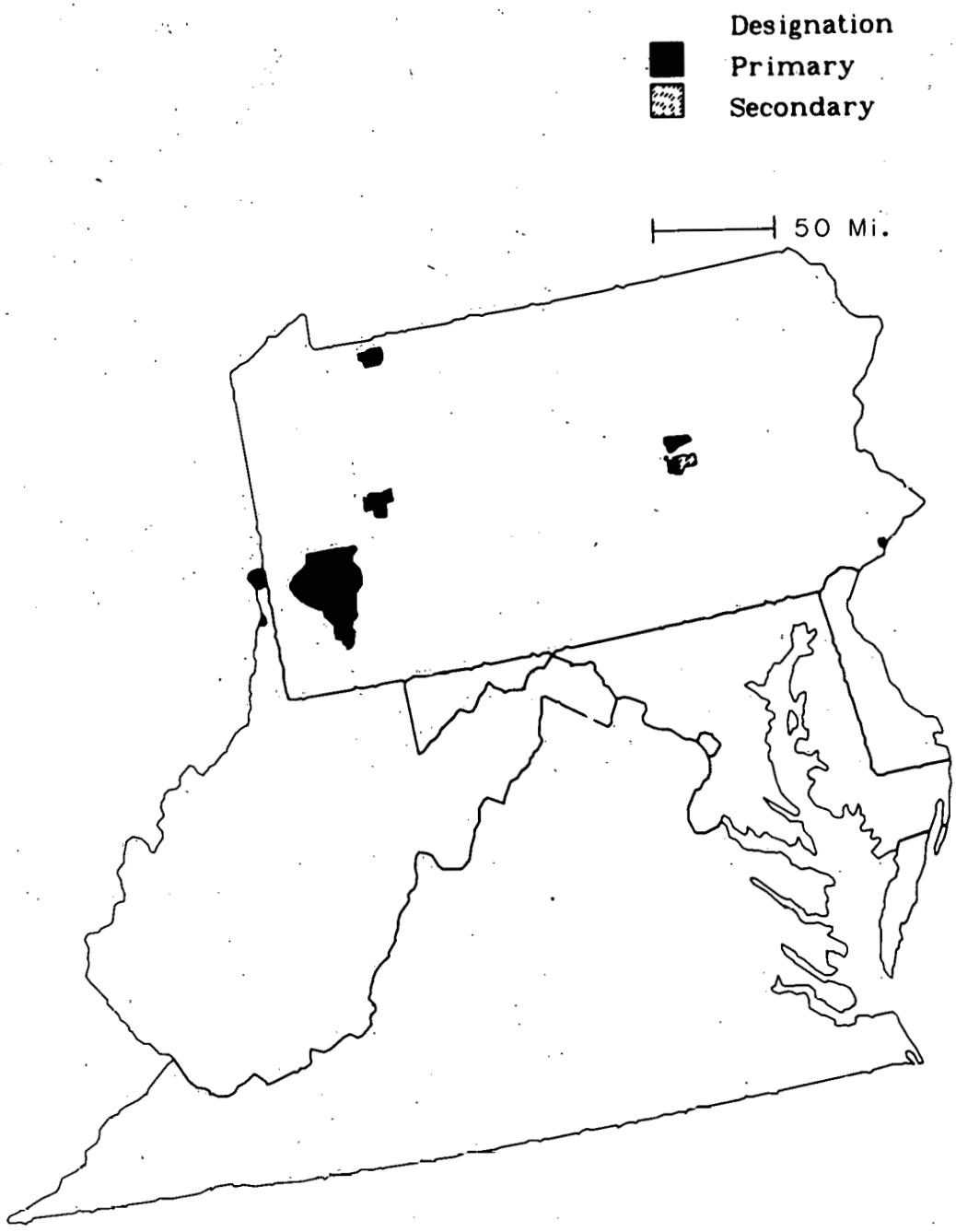

Fig. A.3. Federal Region III: SO_2 Nonattainment Areas as Designated May 1979

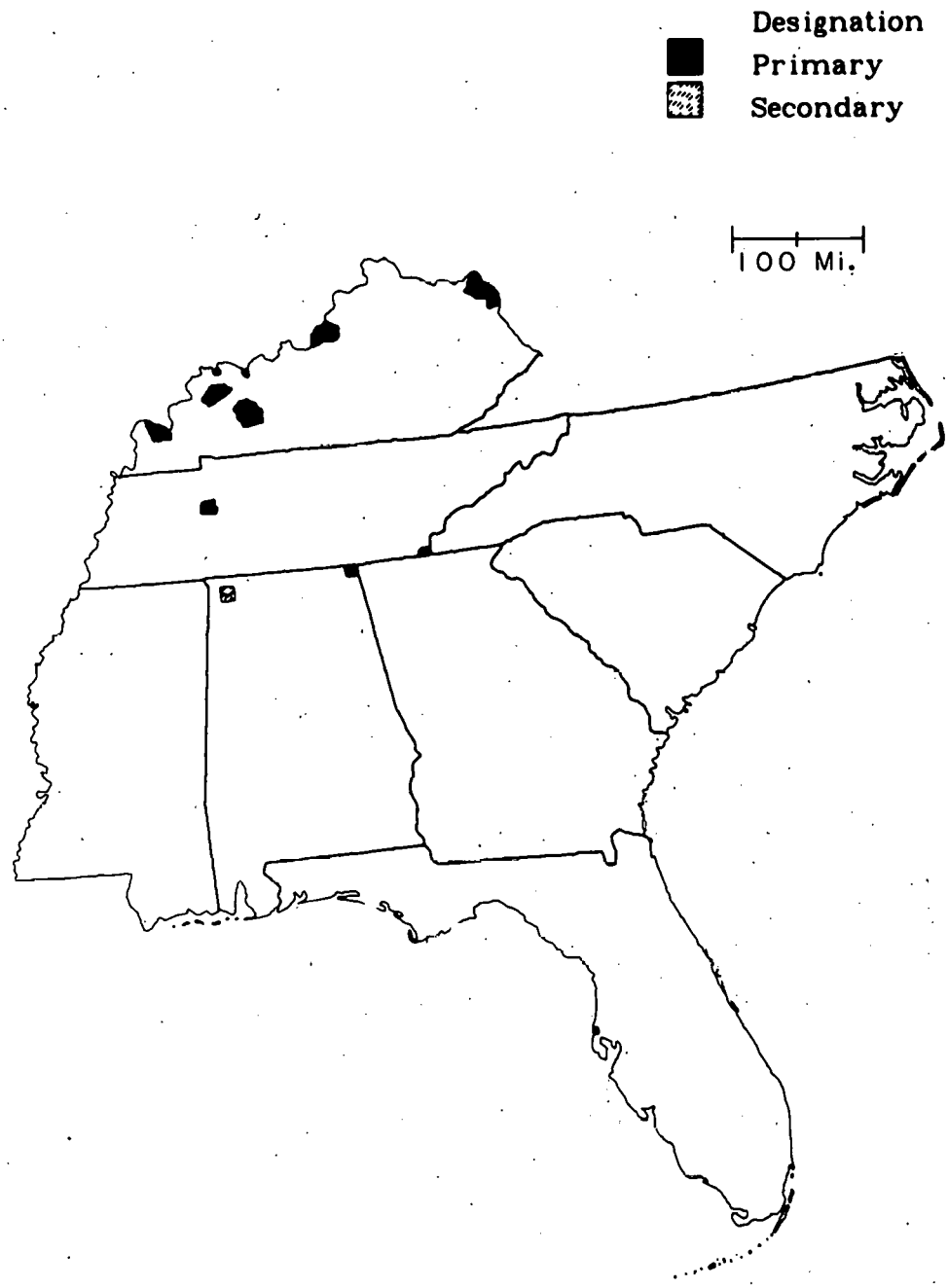

Fig. A.4. Federal Region IV: SO_2 Nonattainment Areas as Designated May 1979

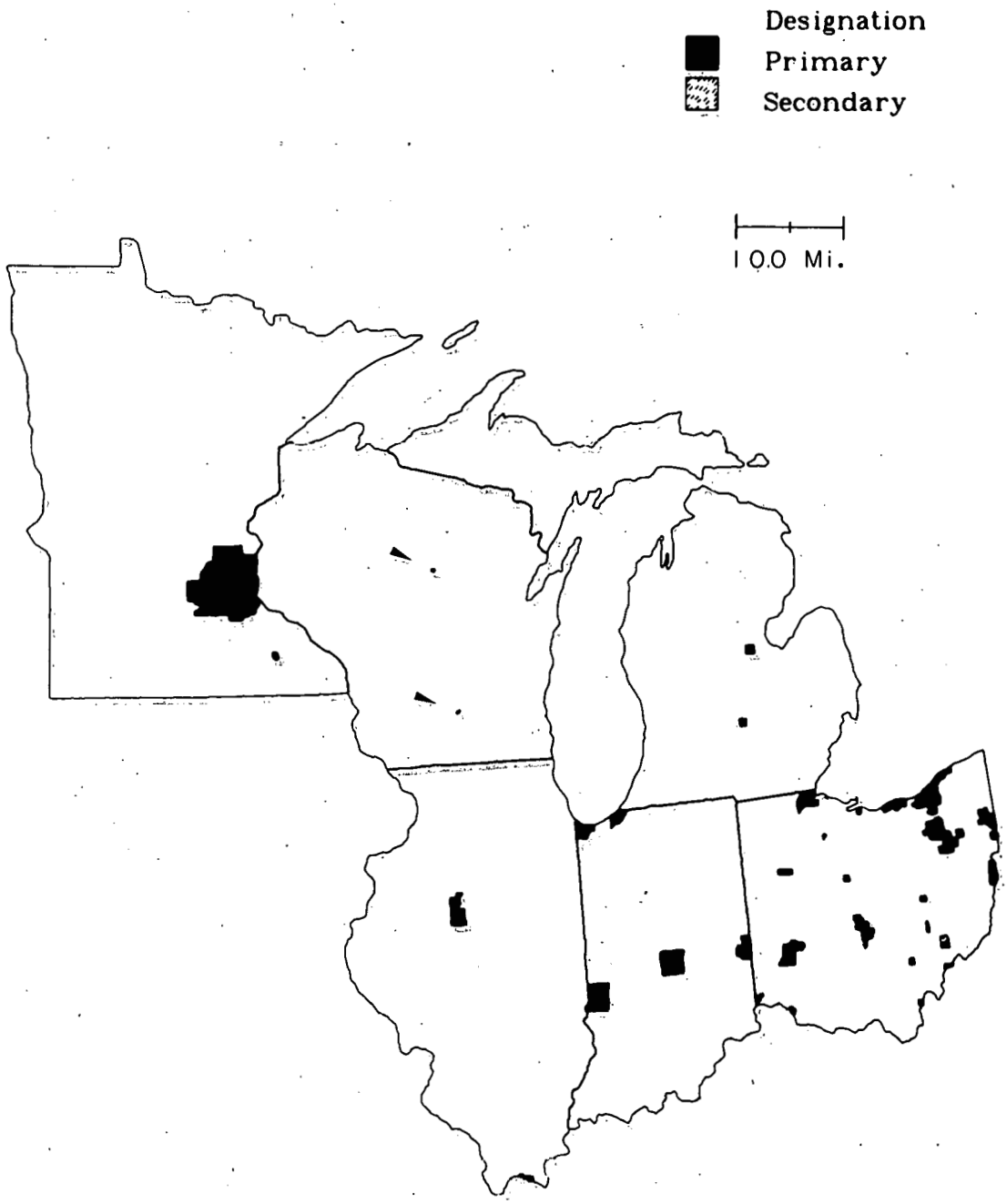

Fig. A.5. Federal Region V: SO_2 Nonattainment Areas as Designated May 1979

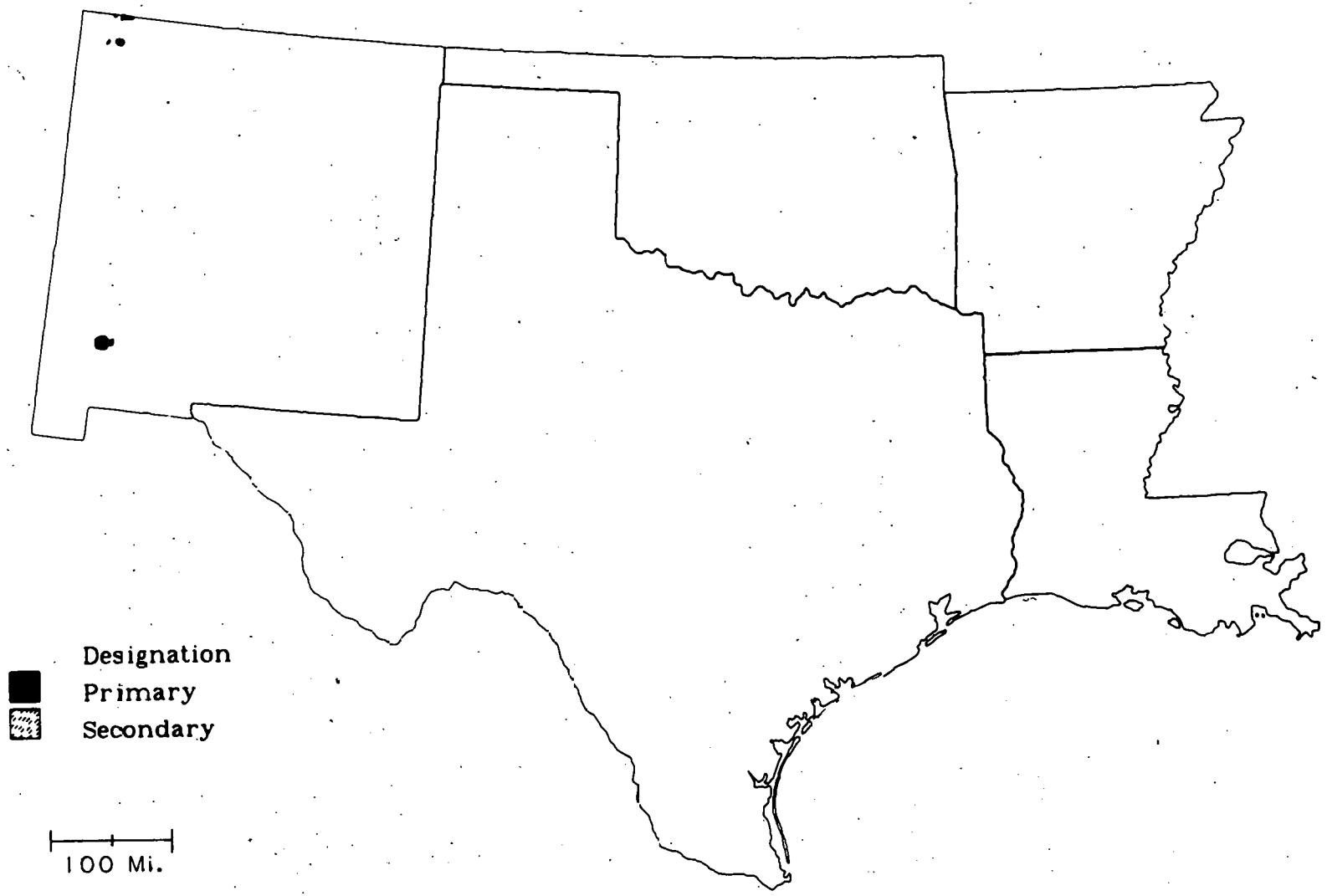

Fig. A.6. Federal Region VI: SO_2 Nonattainment Areas as Designated May 1979

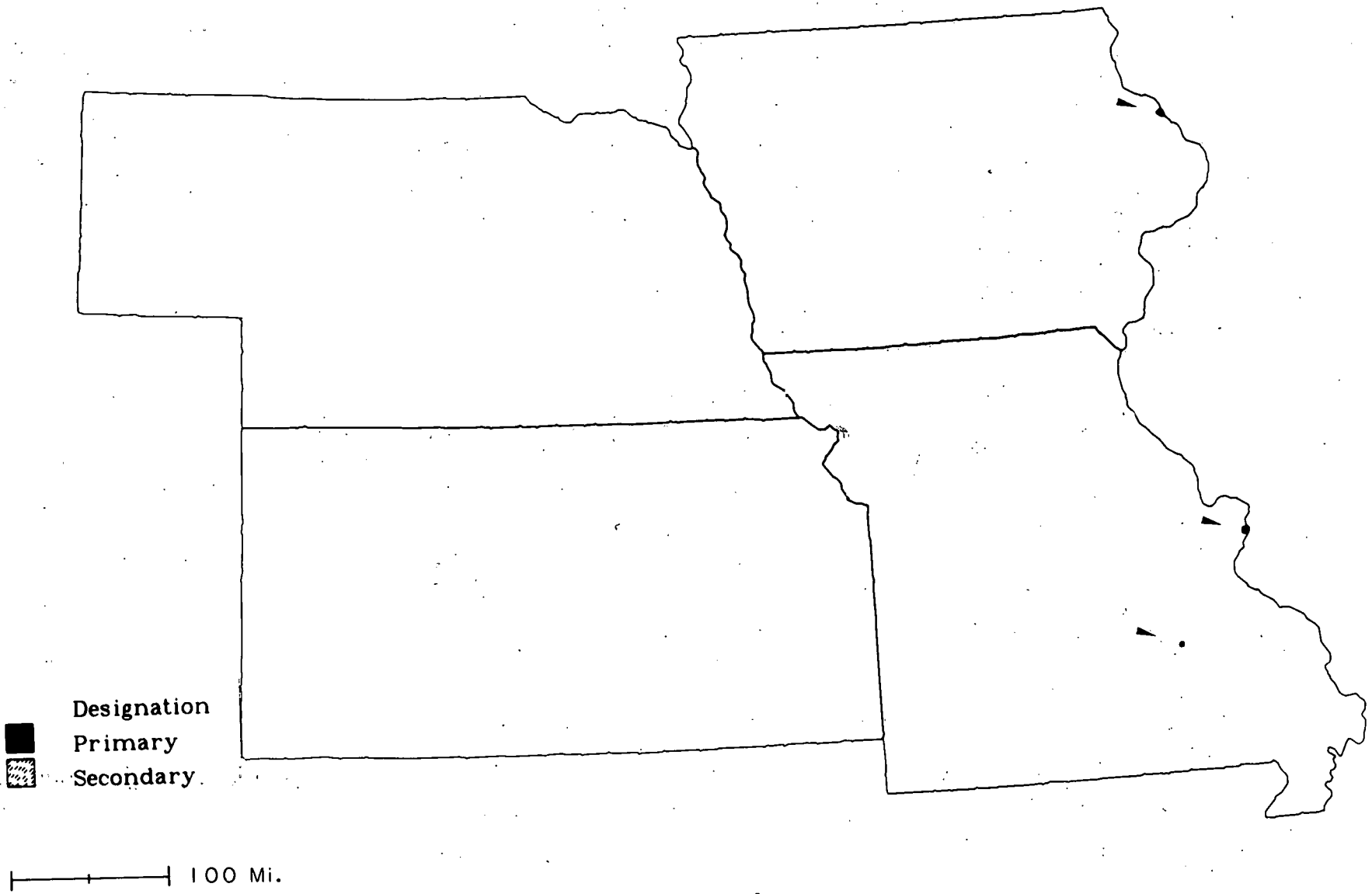

Fig. A.7. Federal Region VII: SO_2 Nonattainment Areas as Designated May 1979

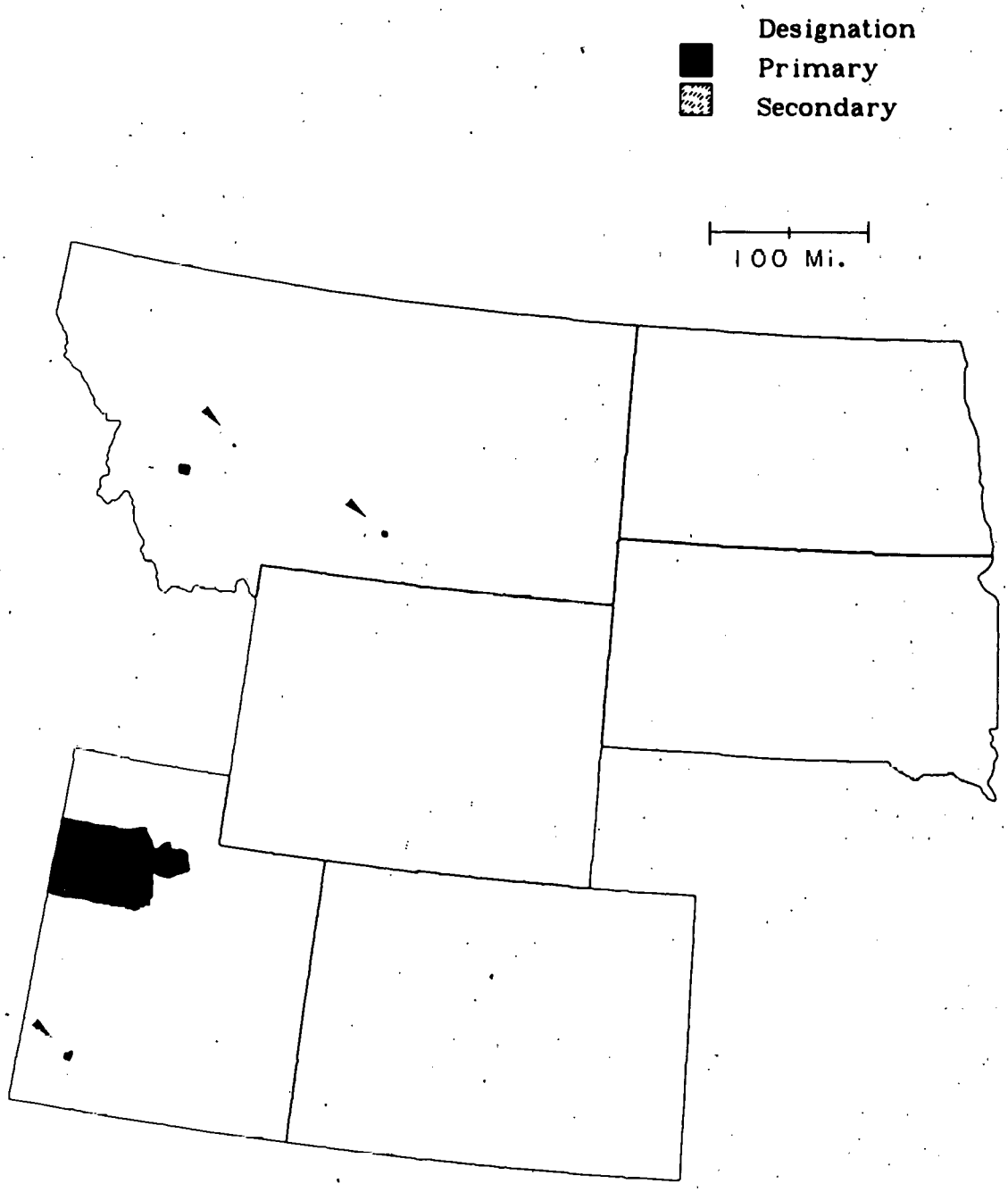

Fig. A.8. Federal Region VIII: SO_2 Nonattainment Areas as Designated May 1979

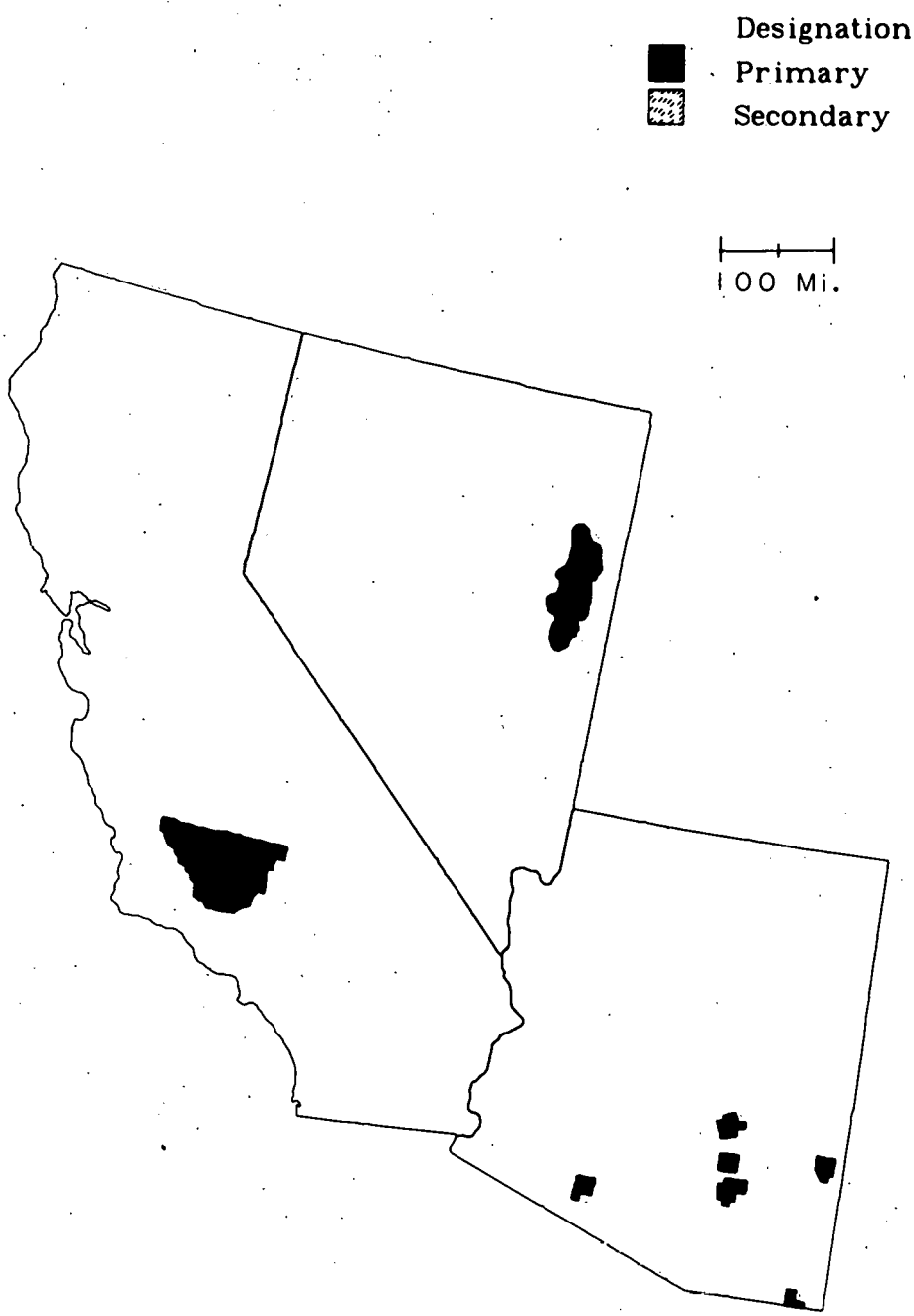

Fig. A.9. Federal Region IX: SO_2 Nonattainment Areas as Designated May 1979

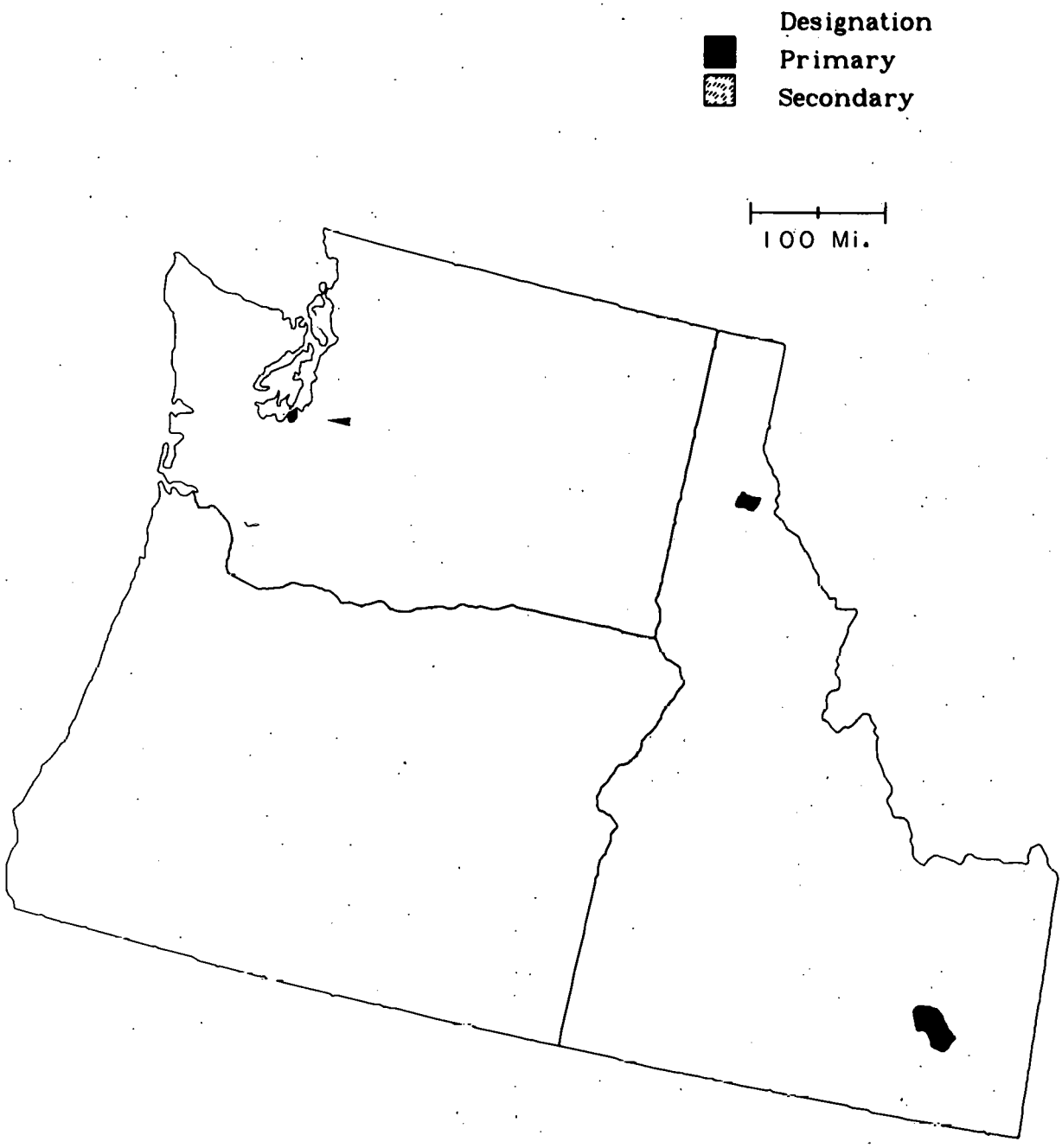

Fig. A.10. Federal Region X: SO_2 Nonattainment Areas as Designated May 1979

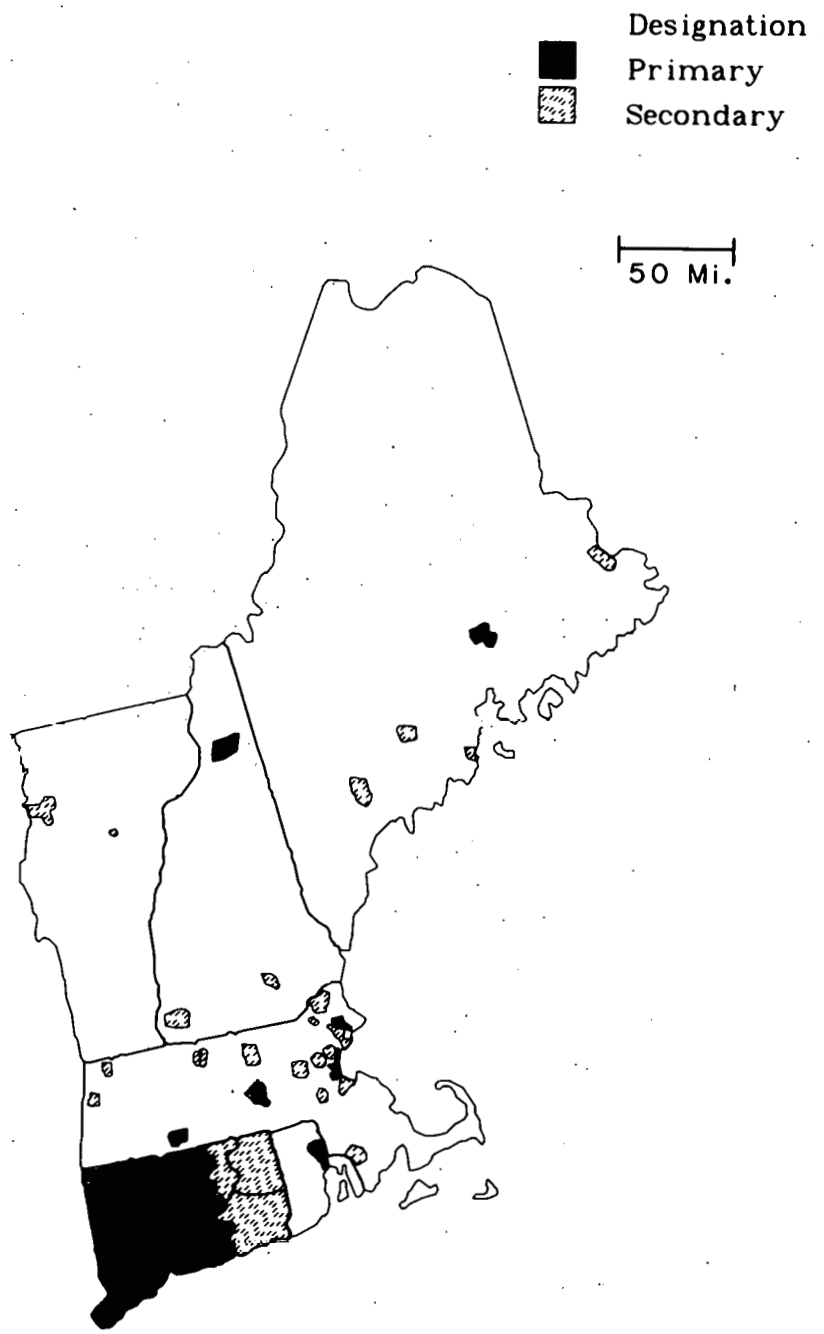

Fig. A.11. Federal Region I: TSP Nonattainment Areas as Designated May 1979

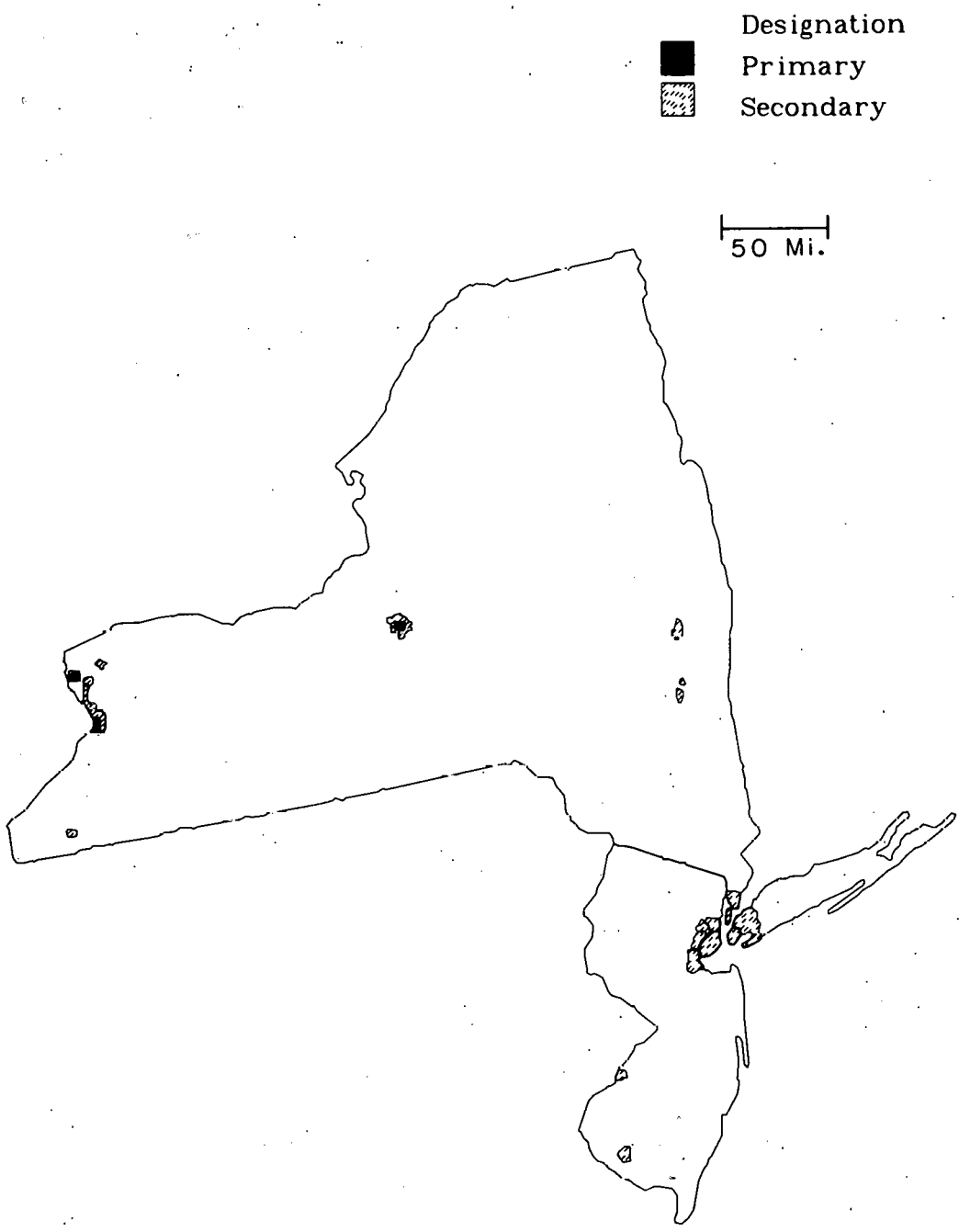

Fig. A.12. Federal Region II: TSP Nonattainment Areas as Designated May 1979

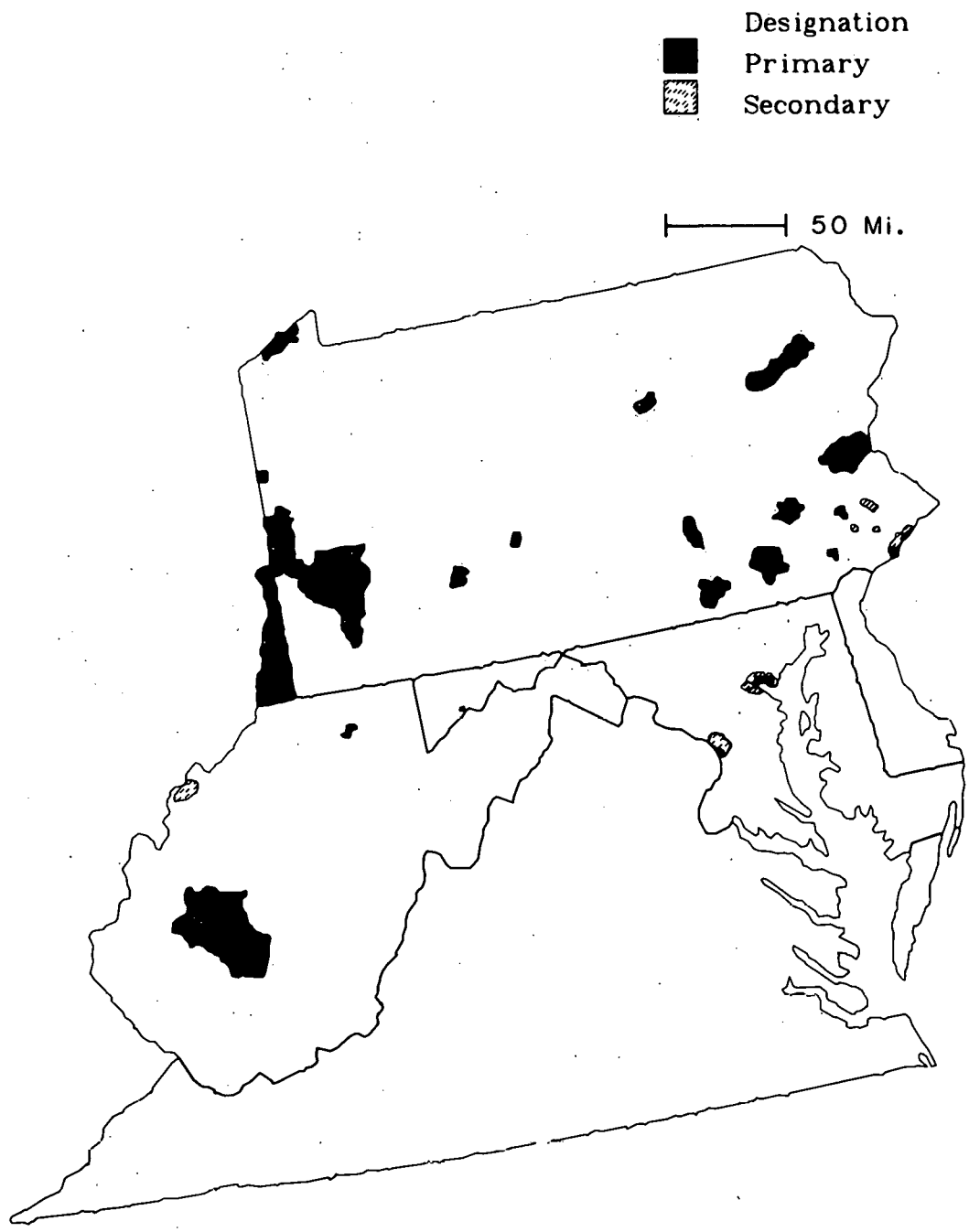

Fig. A.13. Federal Region III: TSP Nonattainment Areas as Designated May 1979

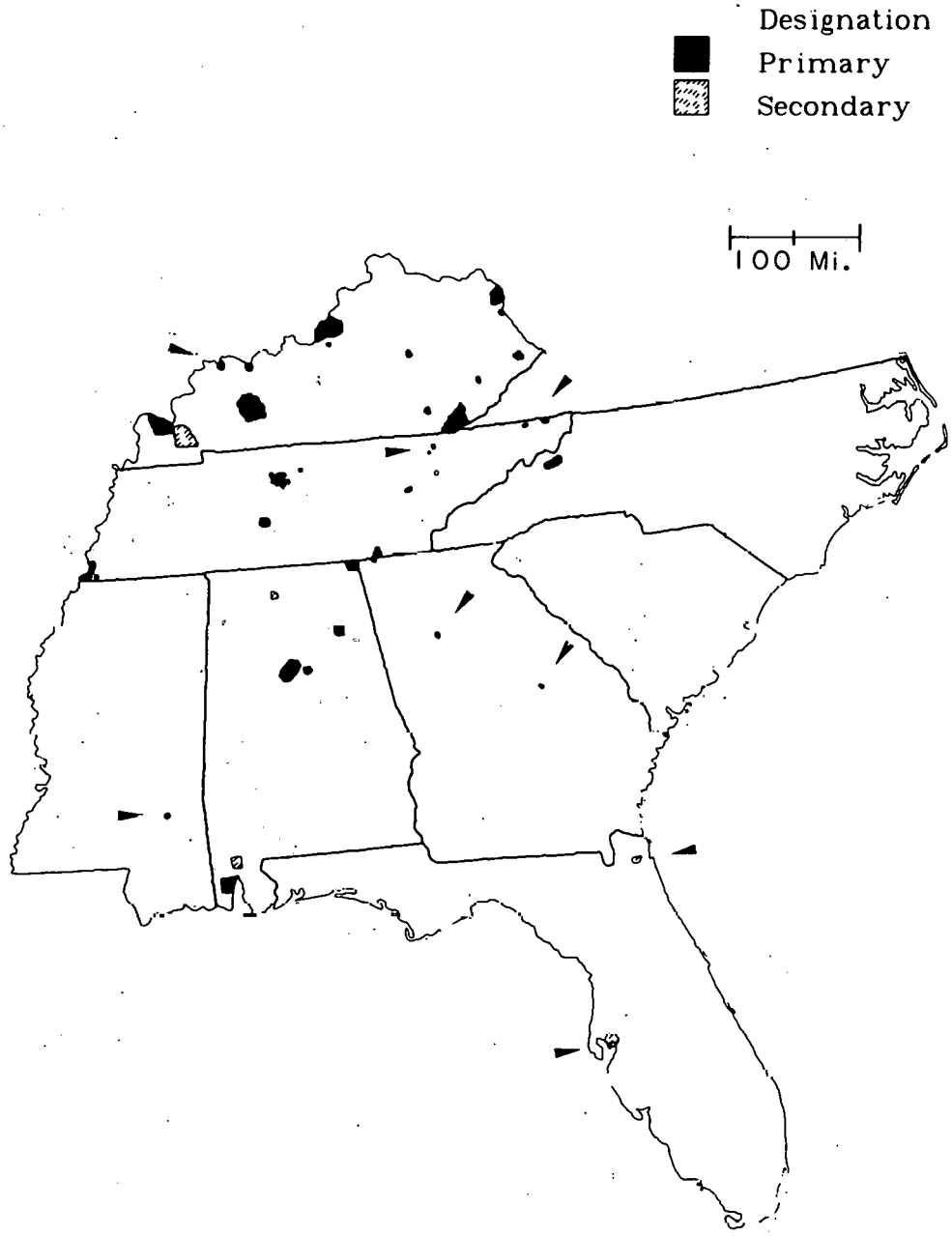

Fig. A.14. Federal Region IV: TSP Nonattainment Areas as Designated May 1979

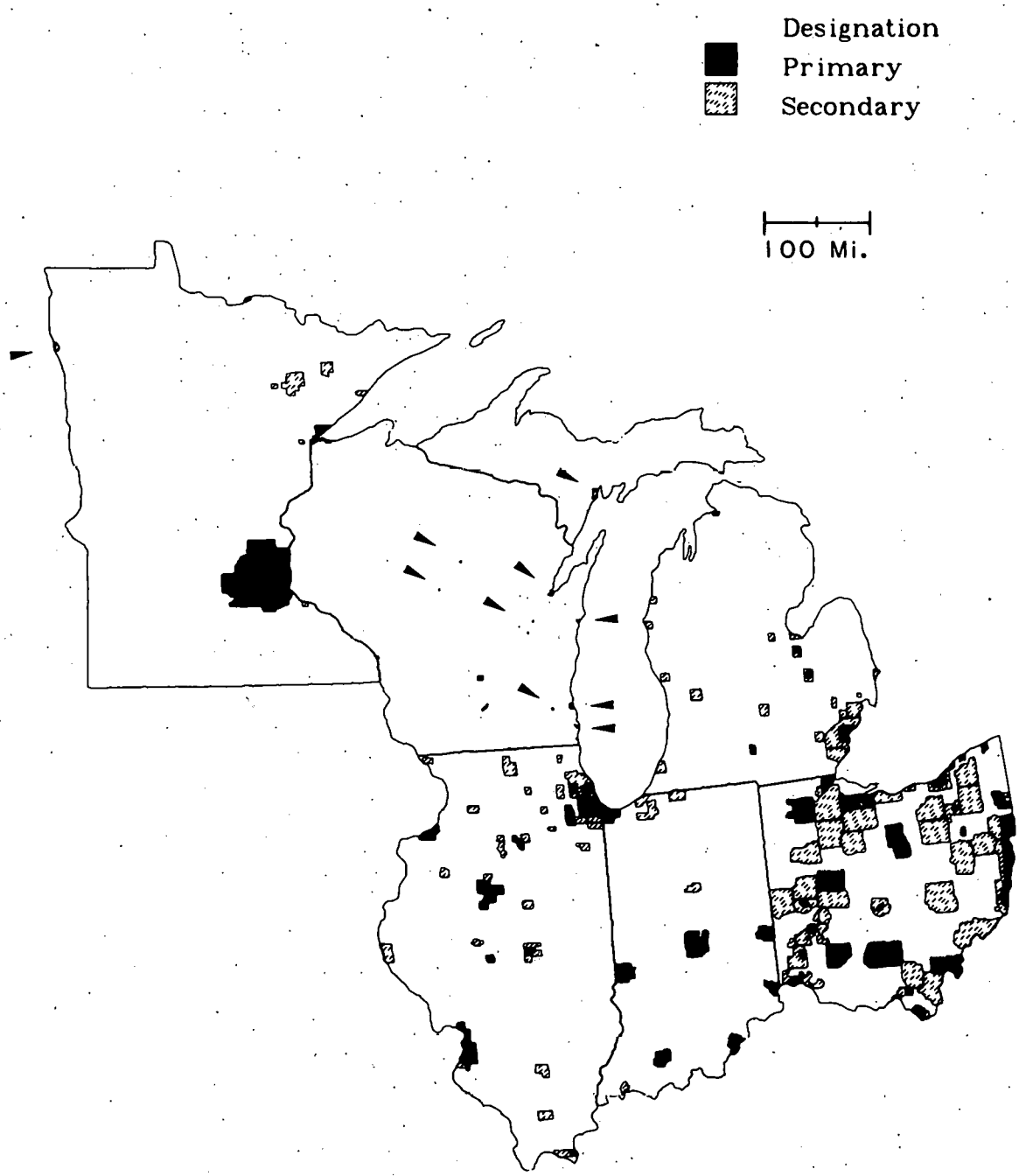

Fig. A.15. Federal Region V: TSP Nonattainment Areas as Designated May 1979

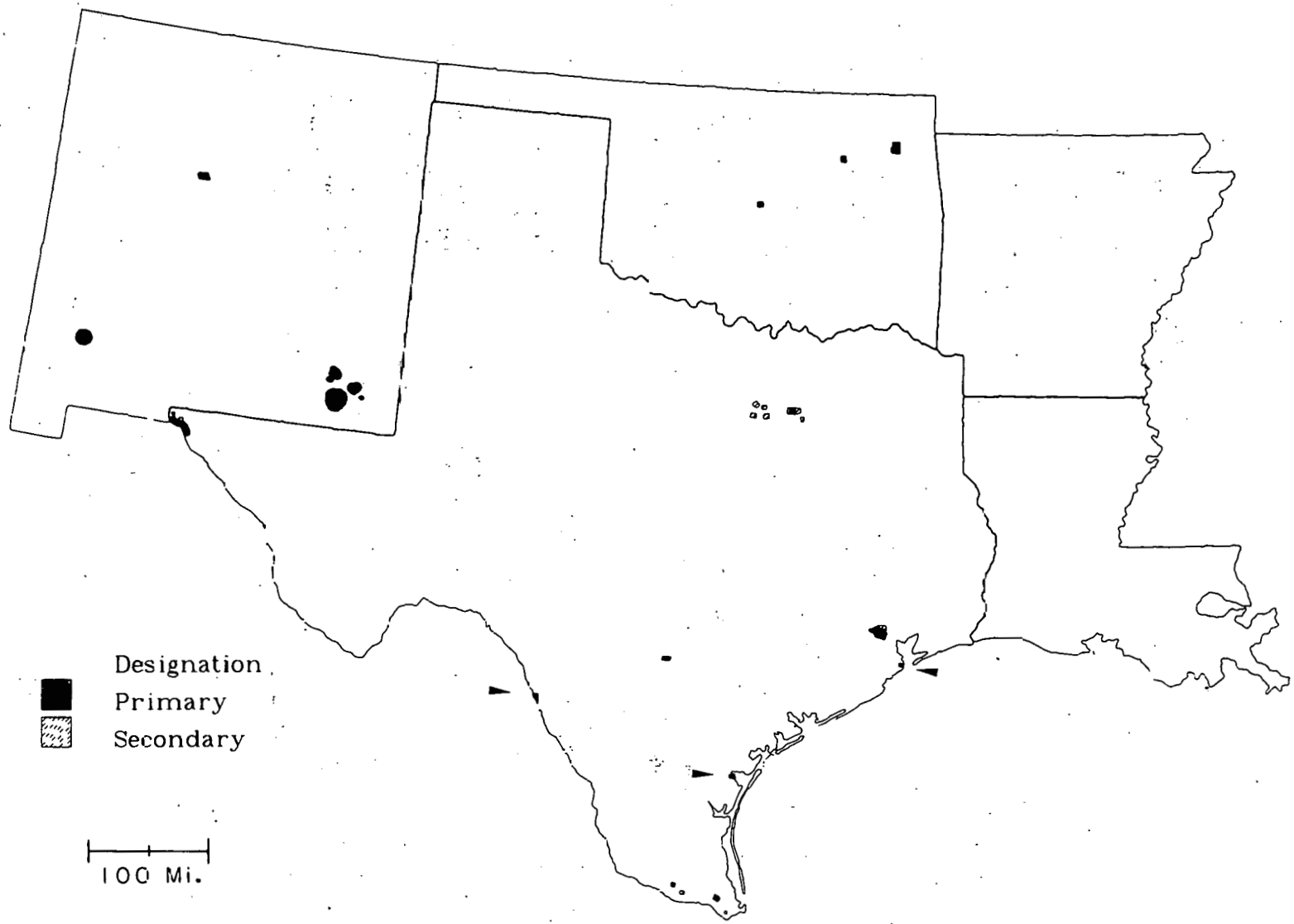

Fig. A.16. Federal Region VI: TSP Nonattainment Areas as Designated May 1979

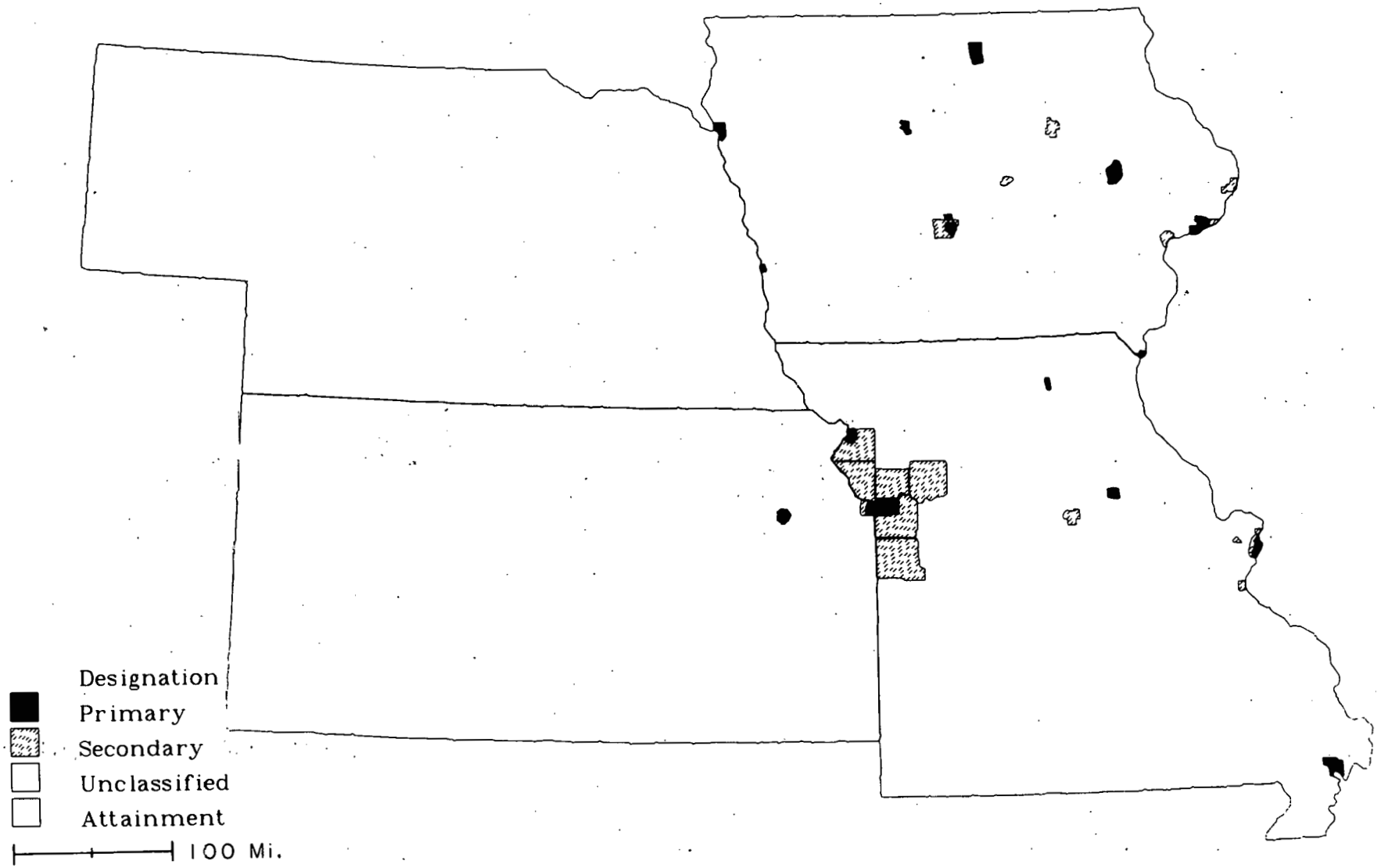

Fig. A.17. Federal Region VII: TSP Nonattainment Areas as Designated May 1979

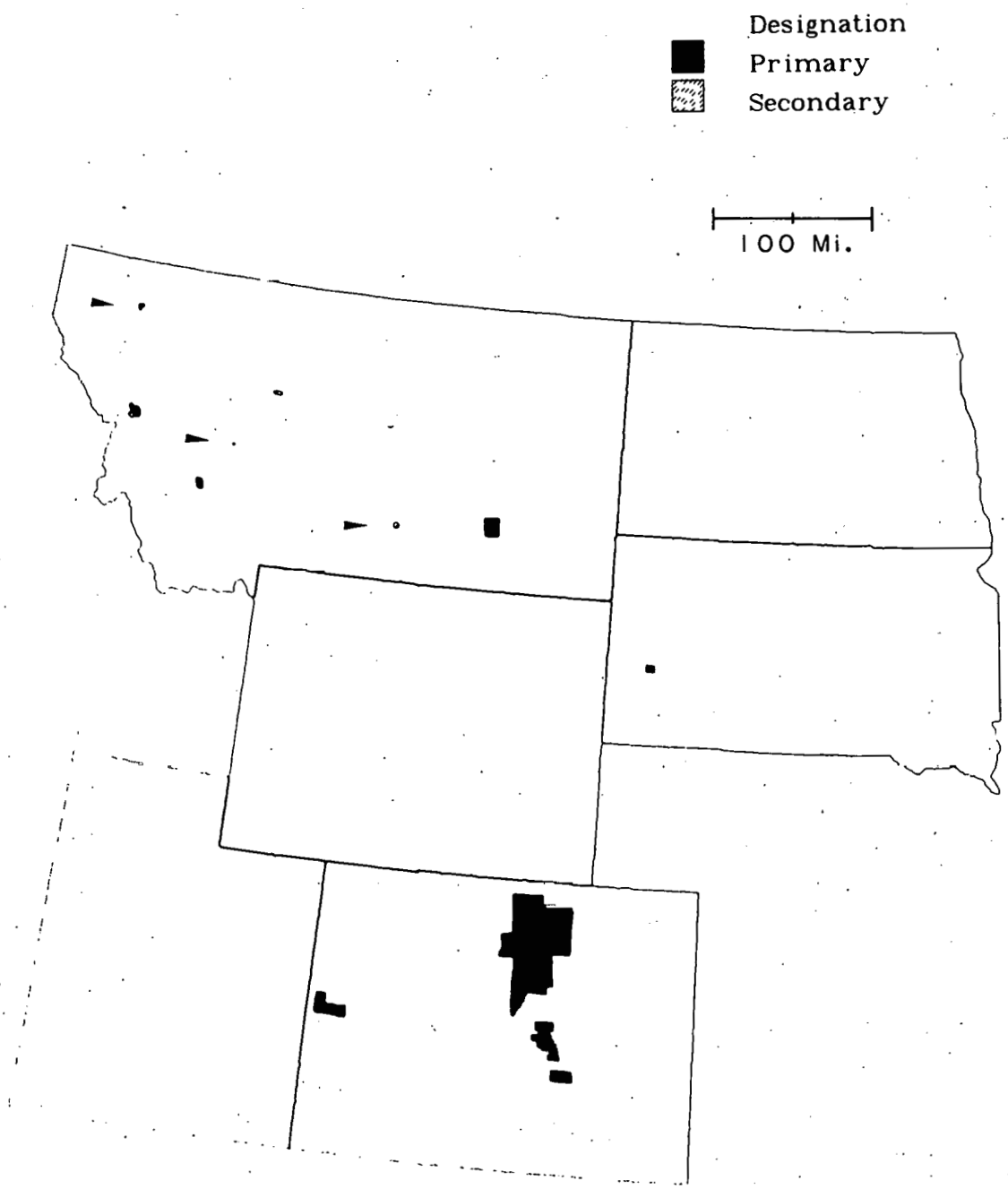

Fig. A.18. Federal Region VIII: TSP Nonattainment Areas as Designated May 1979

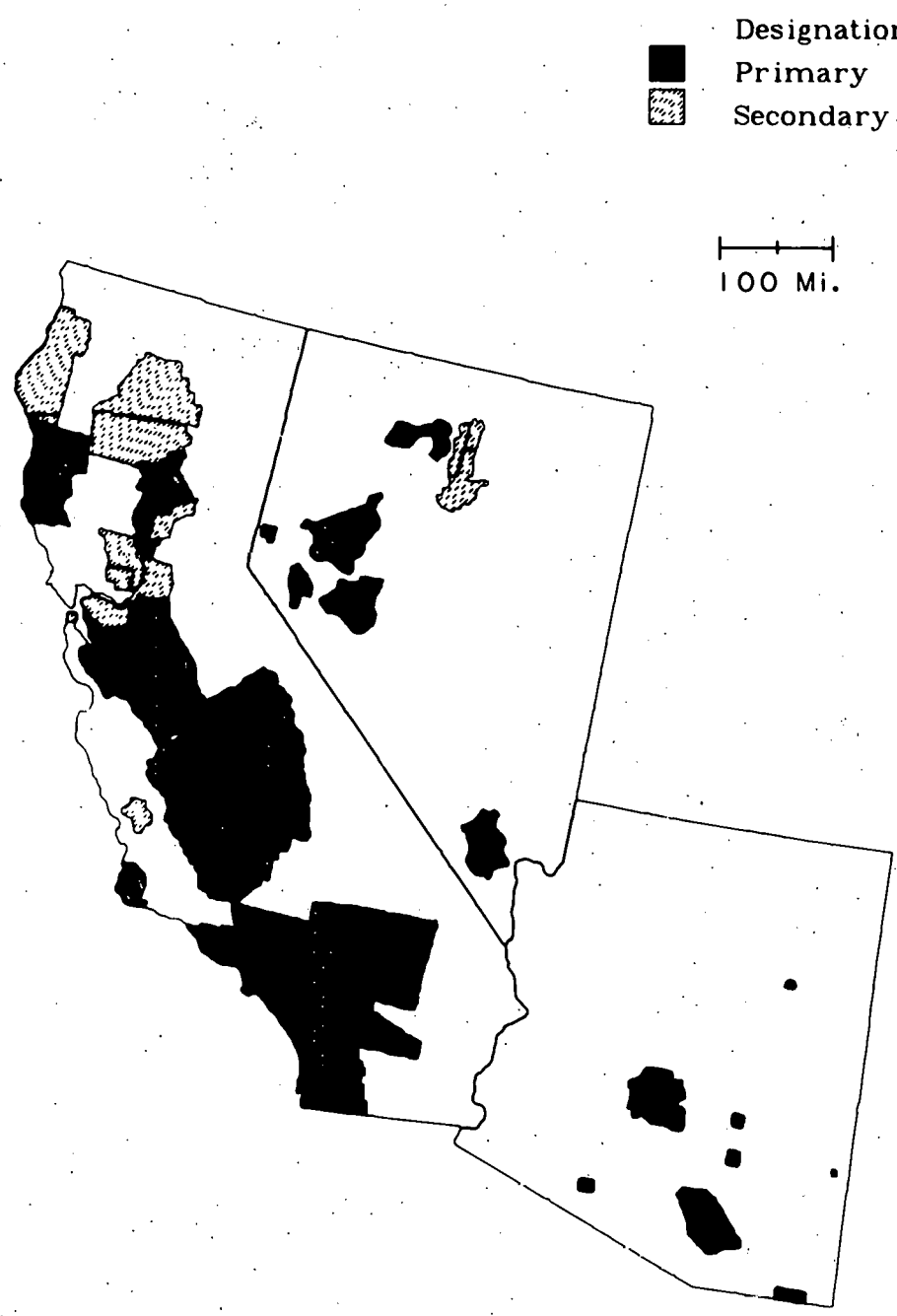

Fig. A.19. Federal Region IX: TSP Nonattainment Areas as Designated May 1979

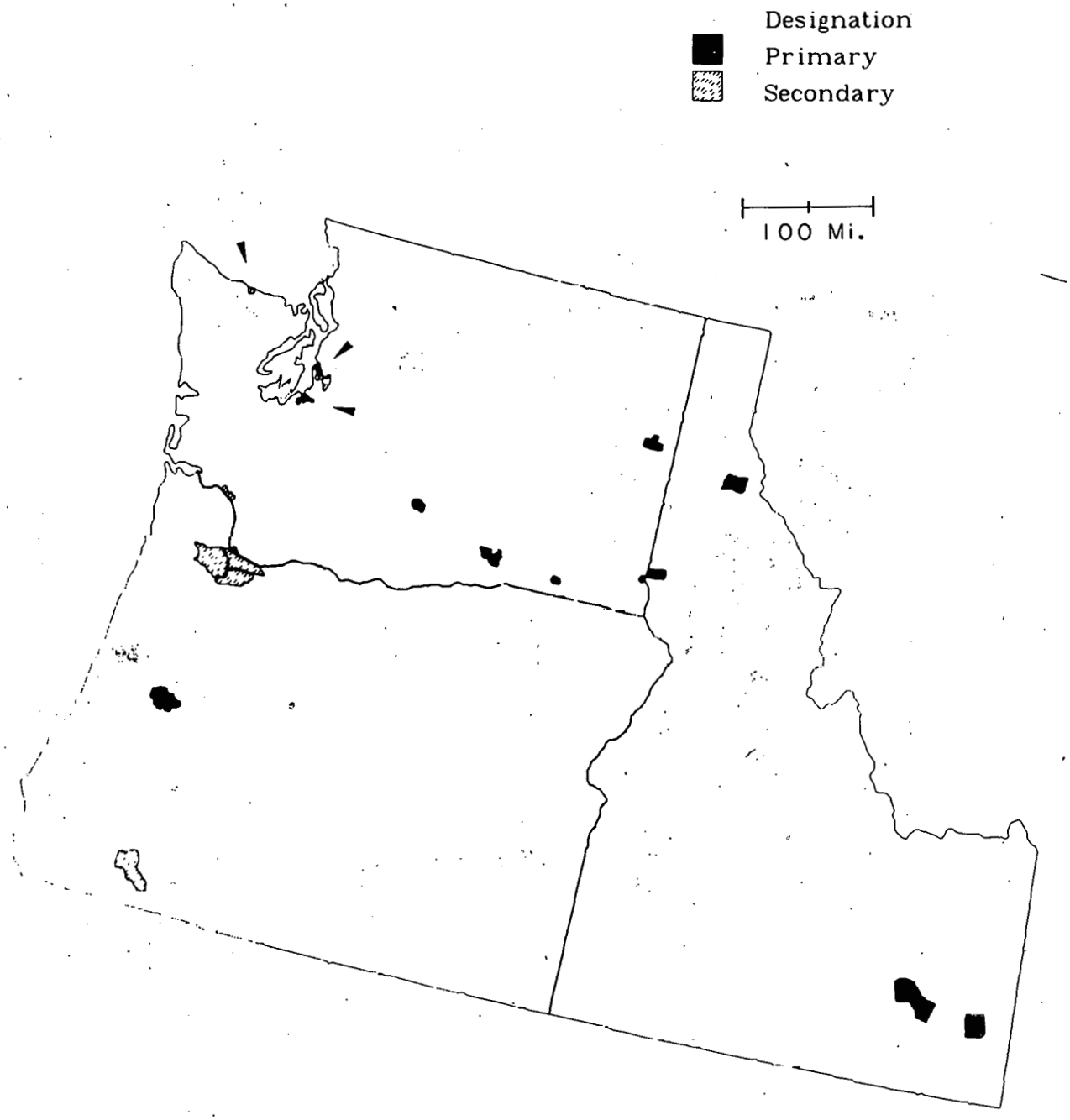

Fig. A.20. Federal Region X: TSP Nonattainment Areas as Designated May 1979