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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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MEMORANDUM

SUBJECT: Guideline on Modification to Monitoring Seasons for Ozone

FROM: William G. Laxton, Director
Technical Support Division (MD-14)

TO: Director, Environmental Services Division, Regions I-VIII and X
Director, Office of Policy and Management, Region IX

The attached guideline can be used as the basis for approving regional changes to published monitoring seasons for ozone. The document reviews the derivation of the 1986 promulgated seasons, provides background on season selection from monitoring and meteorological perspectives, presents criteria for judging revisions and discusses administrative procedures for making formal changes. Any questions relating to the implementation of these guidelines can be directed to Ogden Gerald, Chief of the Monitoring Section, at FTS 629-5652.

Attachment

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GUIDELINE ON MODIFICATION TO MONITORING SEASONS FOR OZONE

TECHNICAL SUPPORT DIVISION

OFFICE OF AIR QUALITY PLANNING AND STANDARDS

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GUIDELINE ON MODIFICATION TO MONITORING SEASONS FOR OZONE

SECTION 1: INTRODUCTION AND BACKGROUND

Relaxations in monitoring requirements for ozone were first promulgated in 1986. Seasons for required ozone monitoring for State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS) are listed in Appendix D to 40 CFR 58 in terms of beginning and ending calendar months, by State, as shown in Table 1. These seasons are important because they play an important role in the estimation of annual ozone NAAQS exceedances and provide the basis for calculations in the Aerometric and Retrieval System (AIRS) summary files. The seasons may also be tied to State emission regulations.

The monthly ranges for ozone seasons were principally based on empirically derived relationships between monthly mean daily maximum temperature and observed peak ozone concentrations. The basic premise was that areas with monthly mean maximum temperatures predominantly below 55 degrees F are expected to have ozone concentrations less than 0.08 ppm. This relationship was determined empirically from observed ozone concentrations and also indicated by smog chamber studies. Since these anticipated ozone concentrations are sufficiently below the level of the current ozone standard (0.12 ppm), the requirement for ozone monitoring was not deemed necessary. Development of these seasons also involved subjective judgements, consideration of resource and data processing constraints, as well as the severity of existing ozone concentrations within each State. The monthly ranges by State were reviewed by the States and Regional Offices, proposed in the Federal Register and subjected to public review prior to final promulgation.

TABLE 1

OZONE MONITORING SEASON BY STATE

STATE	MONITORING SEASON
ALABAMA	MARCH . . . . . . NOVEMBER
ALASKA	APRIL . . . . OCTOBER
ARIZONA	JANUARY . . . . DECEMBER
ARKANSAS	MARCH . . . . . . NOVEMBER
CALIFORNIA	JANUARY . . . . DECEMBER
COLORADO	MARCH . . . . . . SEPTEMBER
CONNECTICUT	APRIL . . . . OCTOBER
DELAWARE	APRIL . . . . OCTOBER
DISTRICT OF COLUMBIA	APRIL . . . . OCTOBER
FLORIDA	JANUARY . . . . DECEMBER
GEORGIA	MARCH . . . . . . NOVEMBER
HAWAII	JANUARY . . . . DECEMBER
IDAHO	APRIL . . . . OCTOBER
ILLINOIS	APRIL . . . . OCTOBER
INDIANA	APRIL . . . . OCTOBER
IOWA	APRIL . . . . OCTOBER
KANSAS	APRIL . . . . OCTOBER
KENTUCKY	APRIL . . . . OCTOBER
LOUISIANA	JANUARY . . . . DECEMBER
MAINE	APRIL . . . . OCTOBER
MARYLAND	APRIL . . . . OCTOBER
MASSACHUSETTS	APRIL . . . . OCTOBER
MICHIGAN	APRIL . . . . OCTOBER
MINNESOTA	APRIL . . . . OCTOBER
MISSISSIPPI	MARCH . . . . . . NOVEMBER
MISSOURI	APRIL . . . . OCTOBER
MONTANA	JUNE . . . . . . SEPTEMBER
NEBRASKA	APRIL . . . . OCTOBER
NEVADA	JANUARY . . . . DECEMBER
NEW HAMPSHIRE	APRIL . . . . OCTOBER
NEW JERSEY	APRIL . . . . OCTOBER
NEW MEXICO	JANUARY . . . . DECEMBER
NEW YORK	APRIL . . . . OCTOBER
NORTH CAROLINA	APRIL . . . . OCTOBER
NORTH DAKOTA	MAY . . . . SEPTEMBER
OHIO	APRIL . . . . OCTOBER
OKLAHOMA	MARCH . . . . . . NOVEMBER
OREGON	APRIL . . . . OCTOBER
PENNSYLVANIA	APRIL . . . . OCTOBER
RHODE ISLAND	APRIL . . . . OCTOBER
SOUTH CAROLINA	APRIL . . . . OCTOBER
SOUTH DAKOTA	JUNE . . . . . . SEPTEMBER
TENNESSEE	APRIL . . . . OCTOBER

TEXAS[1]	JANUARY . . . . DECEMBER
UTAH	MAY . . . . SEPTEMBER
VERMONT	APRIL . . . . OCTOBER
VIRGINIA	APRIL . . . . OCTOBER
WASHINGTON	APRIL . . . . OCTOBER
WEST VIRGINIA	APRIL . . . . OCTOBER
WISCONSIN	APRIL . . . . OCTOBER
WYOMING	APRIL . . . . OCTOBER

[1] The ozone monitoring seasons for Texas were changed in 1989 as follows:

AQCRs 4,5,7,10,11	January. . .December
Remainder of Texas	March. . . . October

According to the provisions of 40 CFR 58.13(a)(3), the Regional Administrator (RA) has the authority to exempt periods or seasons of ambient air quality data collected at SLAMS. Appendix H of 40 CFR 50 also mentions such waivers for continuous ozone monitoring requirements for areas where it can be demonstrated that ozone NAAQS exceedances are extremely unlikely. Such exemptions or waivers have previously taken the form of a letter from the RA for SLAMS or a formal change in the Federal Register for both SLAMS and NAMS. In 1980, EPA Region V waived the requirement for ozone monitoring from October 16 through April 14 at SLAMS in Wisconsin. In April 1989, Region VI officially modified Texas's ozone monitoring season which was originally designated as the entire year, by publishing a notice of change in the Federal Register. Since this change involved NAMS, it was coordinated with EPA headquarters. The RA revised the ozone season to a 245 day time period of March - October for the 7 more northern regions of Texas. The State of Texas covers a large geographical area and historical monitoring data indicated that the 7 northern regions in Texas are not subject to high ozone concentrations during the winter months.

The present document is intended to provide guidance for justifying new modifications to existing ozone monitoring seasons, by time interval and geographic area and to describe administrative procedures for such changes. For historical purposes, a review of the derivation of the 1986 promulgated ozone seasons is presented in Section 2. Sections 3 and 4 provide background on selection of ozone seasons from monitoring and meteorological perspectives, respectively. Section 5 presents the criteria for judging revisions to existing ozone seasons and discusses the 1989 changes instituted by Region VI. Section 6 identifies data processing and other considerations. Section 7 outlines administrative procedures for formally changing the ozone seasons.

These guidelines were developed with several principles in mind. First, they are intended to be consistent with the rationale used in setting the ozone seasons promulgated in 1986. Second, they are designed to permit different ozone seasons within a given State, particularly States with large climatic differences. Third, their application is intended to ensure that the ozone potential for contiguous areas between different EPA Regions be considered and that Regional Administrators strive for uniformity in ozone monitoring requirements. Finally, they are intended to make use of more up to date information on observed ozone concentrations and relationships between monitoring data and meteorological conditions.

Some highlights of this guidance are as follows:

* An uninterrupted monitoring season should be adopted which will capture all of the exceedances of the ozone NAAQS for NAMS and SLAMS monitors.
* When exceedances occur during the first or last month of required monitoring, a longer monitoring season must be considered.
* Sites authorized to monitor less that the official ozone season be classified as Special Purpose Monitors (SPM).
* Reduction in required monitoring can result in considerable cost savings. If the ozone season can be shortened even 1 month, there are potential savings of approximately $950 per site.
* The smallest geographic area for consideration is a county. However, we do not suggest that the ozone season be changed for a single county, but instead for a multi-county region or entire State.
* Ozone season designations should not result in a patchwork quilt on either a State or national basis. At most two regions within each State would be desirable and this is principally intended for large States (e.g. Texas and California).
* The potential for ozone exceedances can be determined using a variety of procedures. The first and most reliable is the use of historical ozone monitoring data. Monitoring may be reduced for months without 1-hour ozone concentrations exceeding 0.10 ppm during the most recent 5 years. Where monitoring data is lacking, the second procedure involves the use of ozone monitoring data produced in areas with similar climatological conditions and underlying precursor emissions. Similarly, the third involves the use of meteorological indicators such as the monthly mean daily maximum temperature.

SECTION 2: DERIVATION OF 1986 PROMULGATED OZONE SEASONS

The Code of Federal Regulations 40 Part 58 Appendix D specifies the time of year (i.e., "season") during which ozone monitoring is required for NAMS and SLAMS monitoring sites within each State.[1]

These seasons were derived to account for the low probability of occurrence of ozone levels that exceed the standard during the colder months of the year in many areas of the U.S. The presumption was made that ozone levels exceeding the standard are more likely during the warmer months or season. The ozone season is now used in estimating expected exceedances of the ozone standard on an annual basis.[2,3]

The designation of an ozone season by State was designed such that the whole State was required to comply with the ozone monitoring requirement for the season. There may be a desire by some States to modify existing state-wide monitoring season requirements to conserve available resources. Recently, such a request by Texas[4] was found to be allowable under 40 CFR Section 58.13.[5] This has resulted in a formal change to Appendix D to 40 CFR 58 by Region VI. As a result, there is a need to provide guidance for use in identifying alternative ozone monitoring seasons within States. One objective is to provide guidance for selecting alternative seasons within differing regions of a State based on meteorological/climatological data when ozone data may not be available to make this selection.[6]

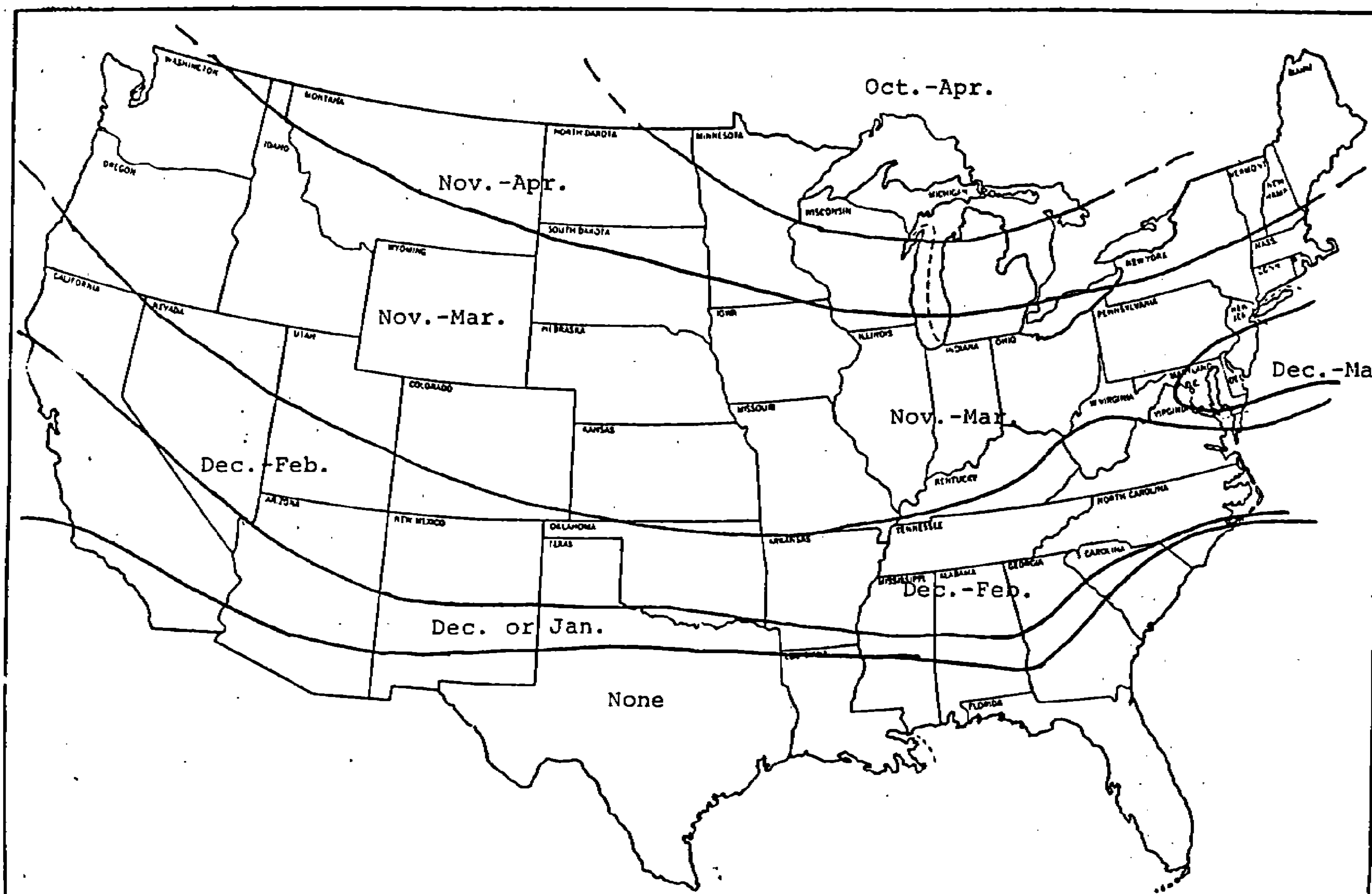
The basis for the currently required ozone monitoring seasons began with anticipation of a natural gas shortage during the winter of 1975.[7] At that time, several requests were made by industry to allow the shutdown of afterburners - used to control hydrocarbon emissions - to conserve natural gas usage. Part of the rationale for this relaxation was based on the suggestion that "low winter temperatures inhibit oxidant formation to the extent that hydrocarbon increases would not be detrimental to air quality."[7] As a result, an analysis was performed in 1975 to evaluate the incidence of exceedances of the ozone standard (0.08 ppm) at that time during the cooler months.[8] A review was conducted of ozone data - by State - as reported in the National Aerometric Data Bank (NADB) for the months January through March and November, December 1974. These months were selected based on a preliminary examination of nation-wide data that determined "during these months oxidant standard violations decrease substantially (while) outside of these months violations tend to increase markedly."[8]

A review of these data eventually led to the 1986 promulgated ozone monitoring seasons - by State- essentially based on a monthly mean daily maximum temperature threshold of 55 degrees. A detailed description of the events leading up to these seasons is contained in Appendix A.

The monitoring seasons shown in Table 1 were first proposed in the proposed revisions to Appendix D, 40 CFR Part 58 in March, 1985.[9] They were promulgated without change in March, 1986.[10]

The 1986 promulgated ozone seasons are different than the seasons that would be prescribed by the monthly mean daily maximum temperature criterion of 55 degrees for many sub-State and State-wide areas. This is described in Appendix A and shown here as Figure 1. Some States or parts thereof have months outside their 1986 promulgated ozone seasons with mean daily maximum temperature greater than 55 degrees. Conversely, other States

FIGURE 1 Months During Which the Mean Daily Monthly Maximum Temperature is 55°F or Less (30-year Mean)[8]



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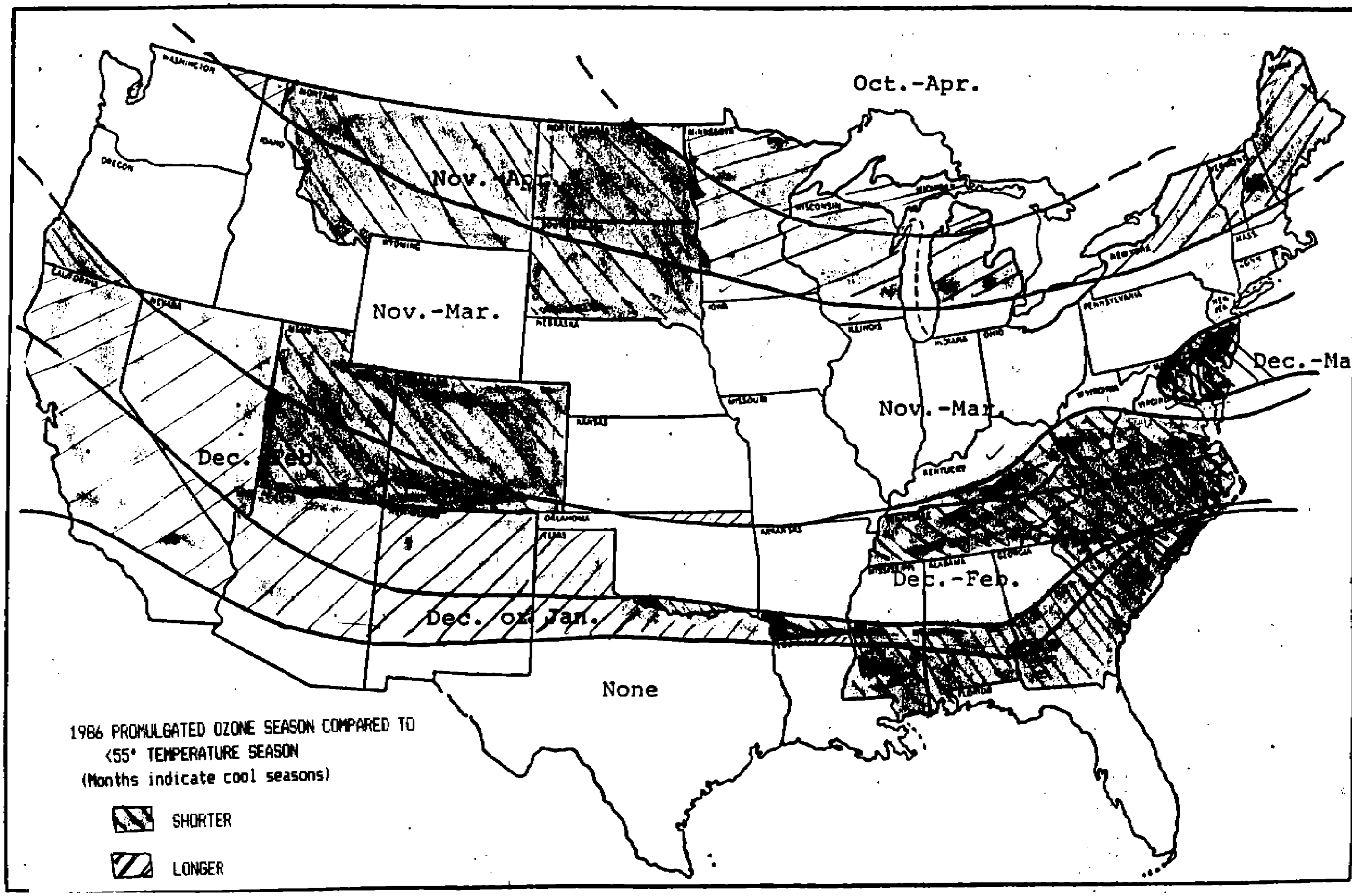
have months within their promulgated ozone seasons with mean daily maximum temperatures less than 55 degrees. These contrasts are presented in Figure 2. Only Regions VII and X have ozone seasons essentially consistent with the Figure 1 temperature profiles. Regions I, II, V, VI, and IX have ozone seasons more stringent than indicated by 55 degrees for parts of many States. The more northern areas of these Regions have a few months of required ozone monitoring in which mean daily maximum temperatures are less than 55 degrees. Regions IV and VIII, on the other hand, have entire States in which months experience mean daily maximum temperatures greater than 55 degrees and do not have required ozone monitoring. This apparent Regional inconsistency is reviewed in the following discussion which focuses on current ozone monitoring.

Actual monitoring seasons may be different than the required seasons. Based on a review of 1987 and 1988 ozone data reported to AIRS, it appears that most States are monitoring at least as much as indicated by the 1986 requirements. The actual ozone monitoring seasons are compared to temperature and required seasons in Figures 3a - 3d. The patterns shown are for 1987, but are essentially the same in 1988. More than half of the States which are not required to monitor for the entire year are doing so for at least some of their NAMS and SLAMS monitors. Such States can be found in all Regions, except in Region X. Several States also are reporting data for parts of the year (e.g. 1 month) outside their required season, including Region X (Washington). This non-required monitoring smooths out some of the inter-Regional inconsistencies seen in Figure 2, particularly for Region VIII, parts of Region III and the northern most states in Region IV.

FIGURE 2. Comparison of 1986 Promulgated Ozone Seasons with the Months During Which the Mean Daily Monthly Maximum Temperature is 55 Degrees or Less.



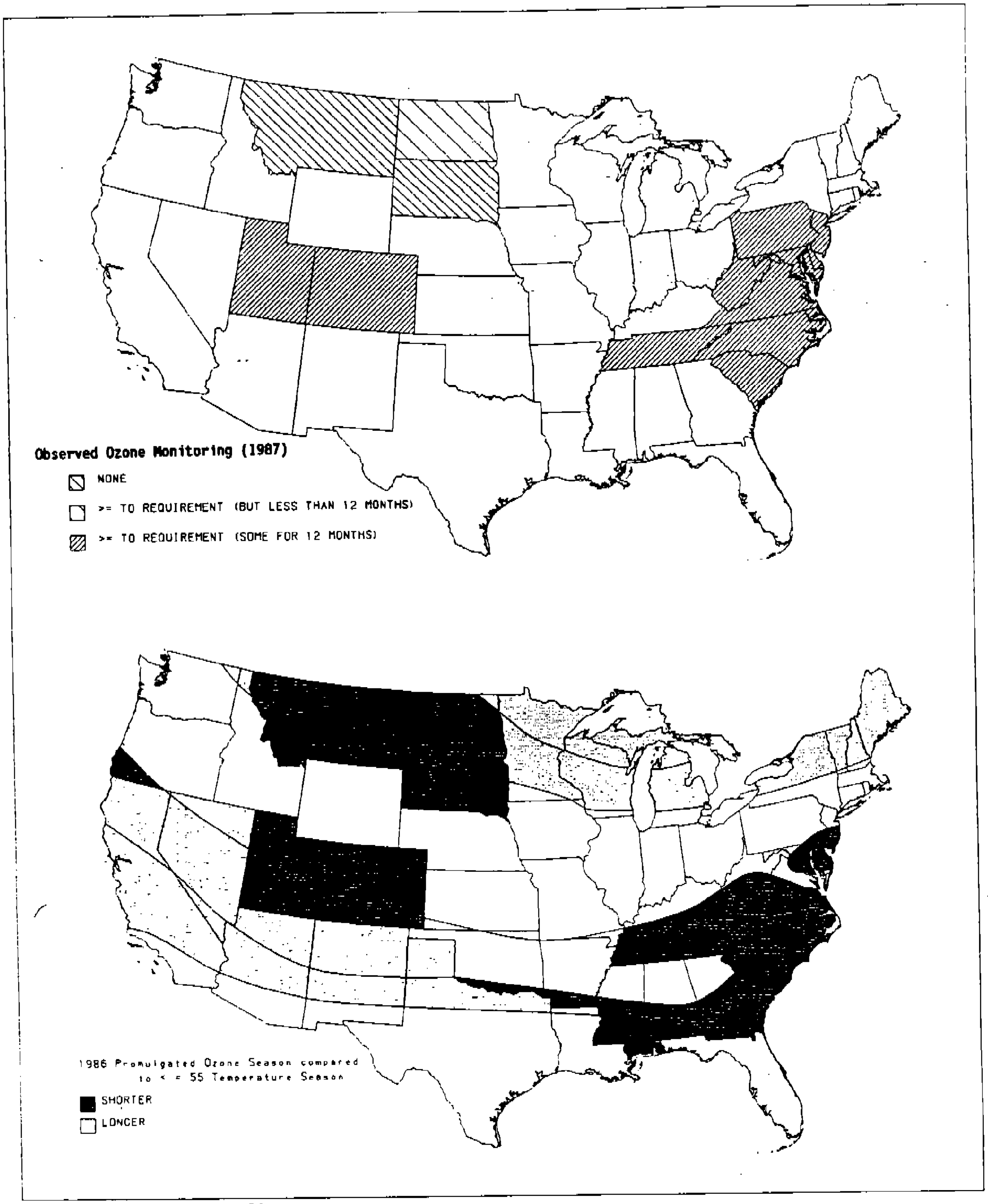


FIGURE 3a. Comparison of the 1986 Promulgated Ozone Season with the Months During Which the Mean Daily Maximum Temperature is 55 Degrees or Lower - Monitoring in States with the Required Ozone Season Shorter than the <55 Degree Temperature Season.

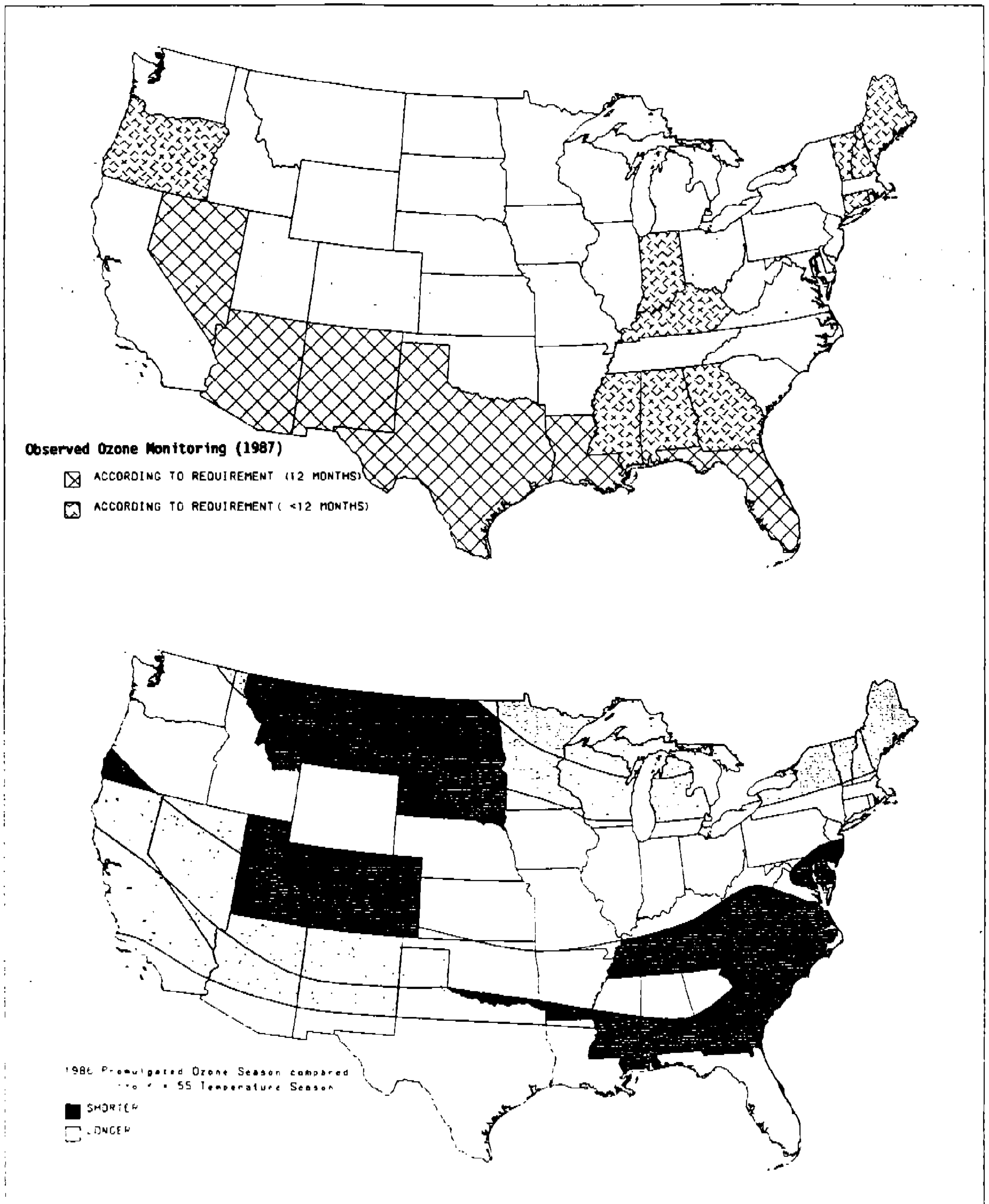


FIGURE 3b. Comparison of the 1986 Promulgated Ozone Season with the Months During Which the Mean Daily Maximum Temperature is 55 Degrees or Lower - States Monitoring According to the Requirement.

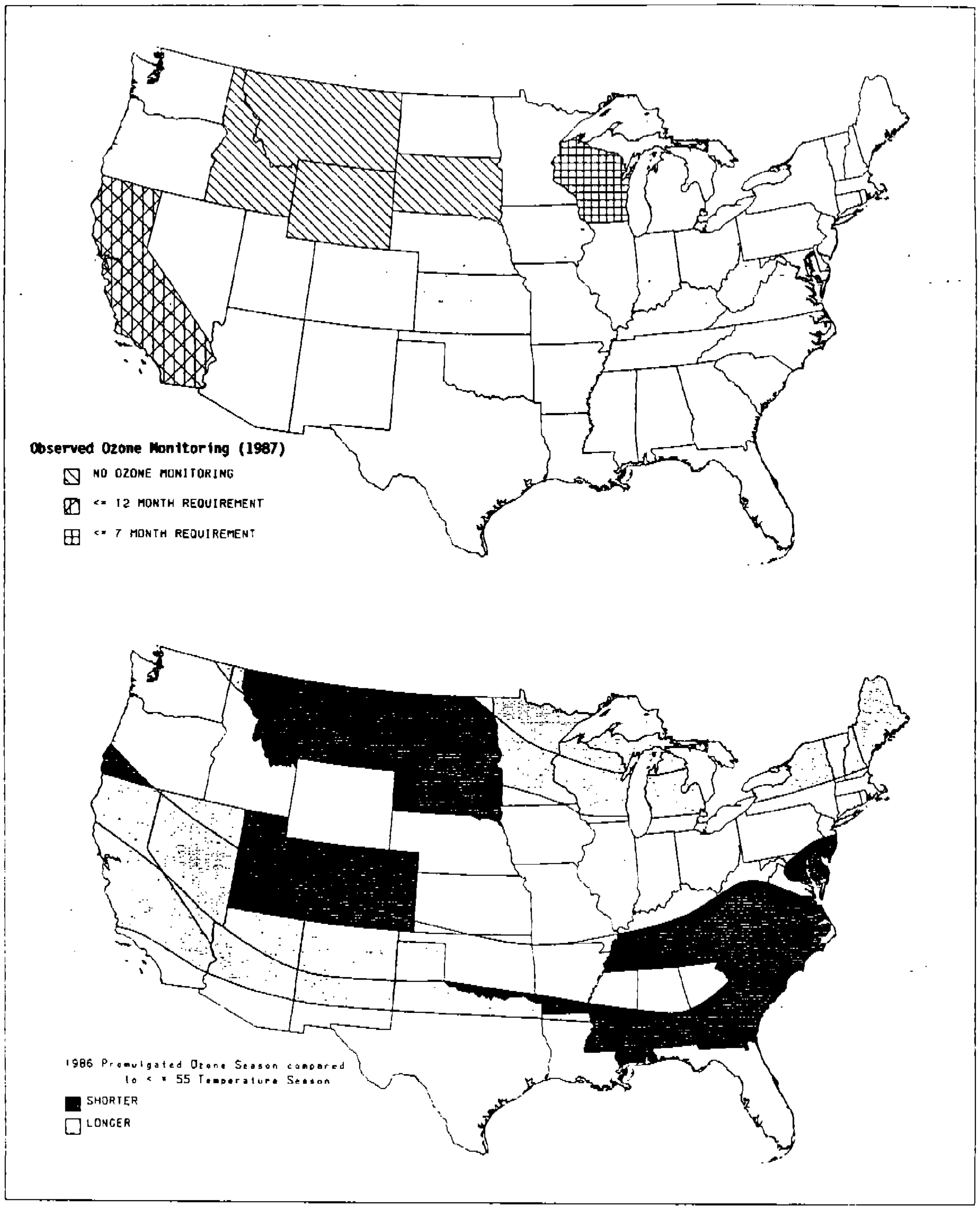


FIGURE 3c. Comparison of the 1986 Promulgated Ozone Season with the Months During Which the Mean Daily Maximum Temperature is 55 Degrees or Lower - States Monitoring Less than the Requirement for Some Sites.

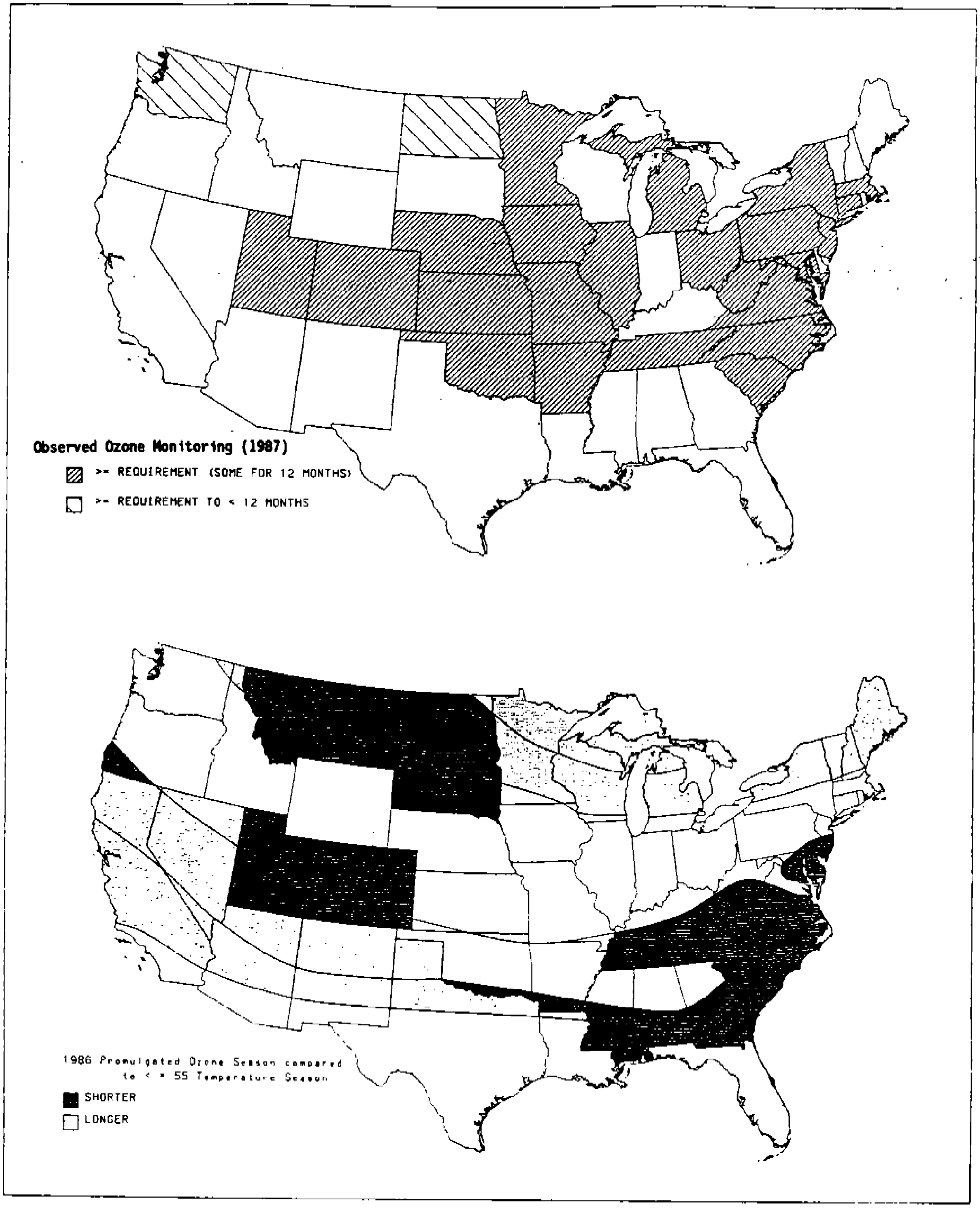


FIGURE 3d. Comparison of the 1986 Promulgated Ozone Season with the Months During Which the Mean Daily Maximum Temperature is 55 Degrees or Lower - States Monitoring More than the Requirement for Some Sites.

There are also four mountain States (Idaho, Wyoming, Montana and South Dakota) which did not have any ozone monitors operating during 1987. Montana has since initiated ozone monitoring. Based on population and precursor emissions, those States and EPA Regions have decided that ozone monitoring is not necessary. The lack of any ozone monitoring sites in these States lessens the concerns about inconsistently short monitoring seasons for Region VIII.

A few States, however, are monitoring (based on data reporting) less than the required seasons for some or all of their ozone monitors. These include (1) Wisconsin with an April through October requirement, whose SLAMS are currently monitoring (with an approved RO waiver) from mid April to mid October, and (2) California with a 12-month monitoring requirement, where a small subset of their SLAMS are currently reporting data for April through November or other periods less than 12 months.

SECTION 3: SELECTION OF OZONE SEASONS FROM MONITORING PERSPECTIVES

In the task of developing seasonal ozone monitoring criteria, the various purposes for ozone monitoring were listed along with an assessment of whether the stated purpose could be met with less than all of the exceedances. Table 2 presents this information in tabular form. As seen in Table 2, there are enforcement and health related purposes which are best achieved if all of the violations of the standard are monitored.

Since enforcement and health protection are judged to be extremely important, it will be presumed that the ozone season policy should be designed to capture all the exceedances of the current ozone NAAQS (.12 ppm). Although these guidelines generally apply to NAMS and SLAMS routine monitoring, some situations should be considered separately and may justify longer or shorter monitoring seasons. For example, when considering maximum concentration NAMS ozone sites downwind of large MSA's (urban areas greater than 1,000,000 population), it may be desirable to operate the ozone monitors year round. In fact, many of these sites already monitor more than the required season. Such an annual data base in large MSAs would be useful to provide background information to evaluate future changes to the NAAQS. For instance, an 8-hour ozone standard could be considered at some future time, as well as a change in the level of the standard. Both changes may require evaluation of data outside the time period that would encompass all the violations of the current NAAQS.

Table 2. Data Needs for Specific Monitoring Purposes

PURPOSE	ALL EXCEEDANCES	MAX. VALUE
AIR QUALITY ASSESSMENT		
Determine current air quality and trends	X*	X
ENFORCEMENT OF REGULATIONS		
Determine compliance with air quality standards		
- Federal primary	X	
- State or local	X	
Provide data for preparation of environmental impact statements		X
DEVELOPMENT AND EVALUATION OF CONTROL PLAN		
Evaluate results of control measures		X
- Local		
- Larger area		
RESEARCH - ORIENTATION		
Evaluate the contribution to observed concentration of specific sources, by type and location of emissions		
- Natural		X
- Man-made		
Provide information on chemical reactions involving the pollutants and their reactivity		X
Provide a basis for describing processes that affect pollutant concentration		X
Test monitoring equipment		

PUBLIC HEALTH		
Determine long-term trends	X*	
Provide a basis for invoking short-term or emergency control measures	X	
MISCELLANEOUS		
Evaluate effects of exposure on humans		X
Determine effects on plants, animals and materials		X
Assess representatives of existing monitoring sites		X

*Only required if the trend statistic is the number of exceedances.

For the remaining NAMS/SLAMS ozone sites, the policy as stated previously will be to design a monitoring season which will capture all of the exceedances of the ozone NAAQS. For those areas experiencing few exceedances, the capture of all of the exceedances will be critical for attainment/nonattainment decisions. For those areas with numerous exceedances, it is still important for health protection purposes to cover those time periods when the ozone is at the level of the standard but could be the pollutant determining the pollution standard index (PSI). In fact, even when the ozone levels are between .10 and .12 ppm and the index is in the upper-moderate range as a result of being driven by the ozone value, it may be advantageous to have a record of this type of impact. This may be necessary to prevent the PSI values from decreasing due to a reduction in ozone monitoring.

There also may be a need for seasonal monitoring reduction for part of a SLAMS network. For instance, in a network of 12 monitors which display significant concentration gradients spatially, a subset of the monitors with the highest concentrations may warrant year-round monitoring. The lower concentration sites, however, may not have observed exceedances or have the potential for exceedances during certain time periods. It would be reasonable, therefore, for these lower concentration sites to be exempt from ozone monitoring, while maintaining longer ozone monitoring for the remainder of the network. The administrative procedures for implementing these variations in ozone seasons are discussed in Section 7.

Where there are historic monitoring data available, the data should be screened for some reasonable time period to get an envelope within which all exceedances have occurred. Since the standard addresses the number of expected exceedances over a 3-year period, as a minimum, 3 years of data should be used. During the 1980's, 2 years so far have stood out as years of exceptional high ozone occurrences and also in number of exceedances. The years are 1983 and 1988. If the criteria of only looking at a 3-year period were employed and that period would have been 84, 85, 86, for example, a different ozone season would emerge than one in which 1983 or 1988 were part of the data record. It is, therefore, recommended to use a minimum of 5 to 7 years of data to demonstrate the suitability of an ozone season redesignation for a given State/county. If the minimal 5 years of data are not available at a site (or in a monitoring area), then surrogate measurements could be used in conjunction with or in lieu of ambient ozone measurements. Suitable surrogates would probably be meteorological information such as average of maximum daily temperatures or solar radiation potential, etc. Whichever criteria are used to develop an envelope around actual or expected ozone exceedances, to accommodate for the previously discussed considerations (i.e., migrating ozone peak value distributions or pollutant standard index driven by ozone levels between .10 and .12 ppm) it is suggested that at least 2 weeks be added to the envelope of exceedances. In particular, when exceedances occurs during the first or last month of required monitoring, a longer monitoring season must be considered.

The cost savings of shortening or even having a reduced ozone season are probably quite variable with each individual agency's operational philosophy. Some agencies will disconnect the monitor and transport it to a central location for storage and maintenance, if needed. Other agencies may choose to leave the instrument in the field warm, i.e., turned on but not calibrated and the data not collected. In either case, the cost savings would be in proportion to the time the sampler was off line in terms of supplies, QA and supervision, calibration/maintenance, and data reduction, also travel, if the site only has an ozone instrument in it.

For year round operation, these costs are as follows:

Sampling	$6264
Data Reduction*	2000
Calibration/maintenance repair	1376
QA and supervision	1766
Total Annual	$11,406

*Equally divided between manual and automatic data reduction.

If the ozone season can be shortened even 1 month, the potential savings would be 1/12 of the annual cost or $950 per site. In the case of a State with an annual ozone season, being provided 6 months of relief in a portion of the State would net a $4752 savings benefit.

SECTION 4: SELECTION OF OZONE SEASONS FROM METEOROLOGICAL PERSPECTIVES

The objective of this section is to provide guidance for selecting alternative monitoring seasons within States based on meteorological/climatological data when ozone data is not available to make this selection. Other studies which examined the relationship of ozone to other meteorological parameters indicated that temperature, wind speed and solar radiation are most often related to high ozone although the relative importance of these and other parameters can vary by location.[11,12,13,14,15] Smog chamber studies have also shown a correlation of temperature to ozone formation.[7,16] In addition, many empirical analyses have demonstrated that daily maximum temperature was a relatively reliable indicator of the potential for the occurrence of high ozone concentrations. Although daily maximum temperatures may be a reliable indicator for the potential formation of high ozone concentrations, this does not necessarily establish a direct causal relationship; however, because of the interdependency of many other parameters on maximum temperature and high ozone concentrations.

Additional studies have shown a positive relationship between low wind speed and high ozone concentrations.[11,17,18] However, the relationship is apparently not as reliable as that for temperature; whereas low daily maximum temperature has been shown to be a relatively stable indicator of low concentrations, the influence of wind speed as an indicator may vary appreciably by location.[11,12]

As described in Section 2 and in Appendix A, the basis for identifying a State's ozone monitoring season in absence of available monitoring data was the range of months when mean daily maximum temperatures were expected to be greater than approximately 55 degrees F. For most States, these "monthly ranges" do not vary appreciably within the State (see Fig. 1). However, for others, the monthly ranges may be significant. This is most pronounced in those States with significant north-south extents (e.g., Texas, California) such that significant climatic differences exist within the State. Thus, by using a monthly mean daily maximum temperature of 55 degrees F as an indicator, monitoring for ozone in one portion of a state may not be necessary in another portion (e.g., northern sections) during some part of the ozone season when monitoring is now required.

For example, prior to the recent RO redesignations, ozone monitoring in Texas was required for the entire year while States to the east (e.g., Mississippi, Alabama, Georgia) have monitoring seasons from March through November.[1] Portions of north-central and northern Texas are at the same latitudes as the northern portions of Mississippi, Alabama, and Georgia where the monthly mean daily maximum temperatures are less than approximately 55 degrees F generally from December through February. Thus, it may be reasonable to presume - based on this temperature criterion, that ozone monitoring may only be needed from, for example, March through November in the Texas panhandle while monitoring in north-central Texas may only be needed from February through November. The remainder of Texas would continue with the current full year of monitoring.

A similar example exists in California where the current monitoring season is January through December. Northern portions of California are in climatic zones where the monthly mean daily maximum temperature is less than approximately 55 degrees F generally from December through February. Also, portions of northern California are at the same latitudes as Utah and Colorado where monitoring seasons are currently May through September and March through September, respectively. Again, based on this temperature criterion, it may be reasonable to establish a shorter season for northern California (e.g., March through November) than central and southern California which may remain all year.

In summary, the methodologies previously employed to assist in defining the current Statewide seasons used a monthly mean daily maximum temperature of approximately 55 degrees F as a threshold when high ozone concentrations (i.e., greater than 0.08 ppm) were not likely to occur. States wishing to define an alternative within State monitoring seasons could use a similar approach by using monthly mean daily maximum temperature data to identify the range of months when high ozone concentrations are not likely to occur. A temperature threshold of approximately 55 degrees F may represent a relatively conservative estimate for the occurrence of ozone concentrations greater than the current standard of 0.12 ppm. The reasons for using such a conservative cut-off, however, are (1) to permit growth potential, (2) the possibility of future, more stringent ozone standards, (3) monitoring for reasons other than attainment demonstration and, (4) the interdependency of other factors in addition to temperature which may result in ozone exceedances in local areas.

Thus, in the absence of ozone monitoring data, estimates may be made of the range of months for differing regions of a State when monthly mean daily maximum temperatures are expected to be greater than or less than approximately 55 degrees F to designate the ozone monitoring seasons. These estimates may be made by using climatological summaries (e.g., Figure 1) based on National Weather Service temperature observations or other acceptable climatological information.

It is recognized that the monthly mean daily maximum temperature approach for establishing monitoring seasons in absence of monitoring data has limitations. For example, applying a temperature threshold of 55 degrees for monitoring may miss individual days when high maximum temperatures may result in a potential ozone exceedance. Therefore, in addition to this temperature threshold, a State or Region may wish to propose other, more protective, meteorological criteria for establishing the monitoring season. This may be based on a knowledge of the local meteorological conditions which may be conducive to high ozone potential.

SECTION 5: CRITERIA FOR JUDGING REVISIONS TO OZONE SEASONS

Based on the discussion in Section 3, the primary objective for ozone monitoring is protection of public health and the determination of all ambient concentrations greater than the level of the NAAQS. Accordingly, a simple rule may be followed to determine the seasonal requirement for ozone monitoring: any location for which an ozone monitor is determined to be necessary, an uninterrupted particular time of the year must be monitored if it has the potential for ozone exceedances.

There shall be two basic constraints regarding time and geographic coverage. As was the case for the 1986 promulgated ozone seasons, the period of required monitoring must be uninterrupted (e.g. April - November). The required monitoring period cannot have any gaps (e.g. it cannot be April - September plus November). The smallest geographic area for consideration is a county. However, we do not suggest that the ozone season be changed for a single county, but instead for a multi-county region. In particular, multiple counties comprising urban ozone demonstration areas would be preferred to avoid questions during ozone attainment reviews and enforcement/sanction actions. Furthermore, ozone season designations should not result in a patchwork quilt on either a State or national basis. At most two regions within each State would be desirable and this is principally intended for large States (e.g. Texas and California).

The following discussion will focus on procedures to justify reductions in current ozone seasons. The same logic, however, could be used to increase the season for monitoring. In either case, States are encouraged to review the adequacy of their current ozone monitoring duration as part of their annual network review.

The potential for ozone exceedances can be determined using a variety of procedures. The first and most reliable is the use of historical ozone monitoring data. The second involves the use of ozone monitoring data produced in areas with similar climatological conditions and underlying precursor emissions. The third, to be considered for areas lacking prior monitoring data, involves the use of meteorological indicators such as the monthly mean daily maximum temperature. This section will conclude with a discussion of monitoring consistency.

Use of Historical Ozone Data. Ambient concentrations produced in a monitoring area can provide the basis for revisions to existing ozone monitoring seasons. A review of historical ozone data for this purpose must be based on 5 years of most recent data, in order to ensure that both favorable and unfavorable meteorological conditions are represented. In addition, these data should be representative of both current and expected near-term future conditions. This will help to anticipate effects of possible growth in ozone precursor emissions.

Historical ozone data would initially be examined at each monitor in a local monitoring network, on a calendar basis. The network may represent an urbanized area as well as the downwind locations influenced by local precursor emissions. In general, only the subset of the monitors producing the maximum concentrations during the most recent 5 years need be examined. Based on the outcome of such a review, ozone monitoring must be maintained during those calendar periods in which exceedances have previously been observed. In fact, in order to protect against potential exceedances of the NAAQS (0.125 ppm), a lower threshold concentration should be utilized as a safety factor. For this purpose, a value of 0.100 ppm (three significant figures) is suggested, which is 20 percent below the NAAQS. Accordingly, if there is a time period without historical exceedances above 0.100 ppm in the entire monitoring network, then the network's monitoring may be discontinued for that period.

Use of Ozone Data from Representative Areas. For those areas which do not have sufficient ozone data, a second and perhaps supplementary approach which can be used to predict NAAQS exceedance potential is to make use of ozone monitoring data from nearby areas with similar climatology and precursor emissions. For example, areas of reasonably close proximity with the same latitude, altitude, rainfall and or temperature can be considered. With this approach, a shorter ozone season may be justified than one predicted by the 55 degree F threshold. An illustration of this approach is the modification to the ozone seasons for three regions or Air Quality Control Regions (AQCR) in Texas (AQCR 1, 2 and 4) which made use of monitoring information from adjacent areas in lieu of historical ozone data.

The following discussion presents the data review conducted by EPA Region VI:

The State of Texas is divided into 12 Air Quality Control Regions (AQCRs), as shown in Figure 4. Ozone data from 1979 through 1987 were reviewed for the earliest and latest month of an ozone exceedance. Since AQCRs 1, 2 and 4 had no ozone data, the adjacent AQCRs that had ozone data were reviewed. AQCRs 3, 6 and 8 are adjacent to AQCRs 1 and 2. From pooling the

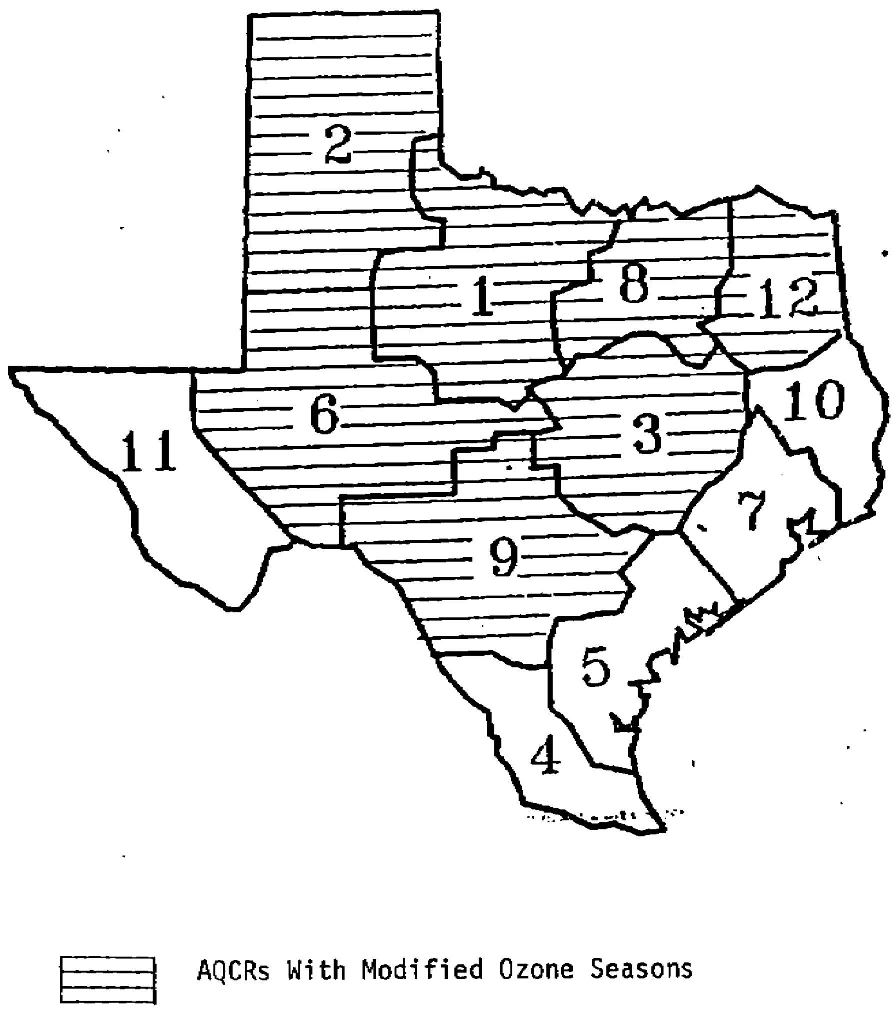


FIGURE 4. Texas Air Quality Control Regions (AQCRs) with Redesignated Seasons for Required Ozone Monitoring.

data in these three AQCRs, the earliest reported ozone exceedance was April 24 and the latest ozone exceedance was October 12. Therefore, the ozone season for AQCRs 1 and 2 was also designated as March 1 through October 31. For AQCR 4, the adjacent AQCRs were 5 and 9. In AQCR 5 and 9, the earliest ozone exceedance was April 16 and the latest ozone exceedance was October 15. Due to the proximity of AQCR 4 to the Gulf Coast which has historically reported ozone exceedances throughout the year, however, AQCR 4 was redesignated again with a year-long ozone season.

Use of Meteorological Indicators of Ozone Potential. When the extent of State-wide ozone monitoring data are reviewed, some areas will be found which do not have the requisite minimum of 5 years of historical data and are not adjacent to existing monitoring areas. This is a likely situation for many low population or low emission areas. If an area lacks representative worst case ozone concentrations for the most recent 5 years, revisions to promulgated ozone monitoring requirements can be based on alternative indicators of ozone potential. Two indicators based on meteorological data are suggested. Both indicators are based on temperature which was determined in Section 4 to be the most consistent indicator of ozone potential.

(1) Monthly mean daily maximum temperature relative to 55 degrees F. This is the primary indicator of ozone exceedance potential used to define the 1986 promulgated ozone seasons by State. Areas with monthly mean daily maximum temperature less than 55 degrees F would not be required to monitor for ozone. In order to establish sub-State areas with particular temperature characteristics, we suggest developing a temperature isopleth map for the

State, or subdividing the state into smaller areas (e.g. counties or AQCRs) and using representative climatological data for each area.

(2) State specific temperature indicator. In addition to using the 55 degree F monthly mean daily maximum threshold, a State or Region may have supporting evidence of other more protective meteorological criteria associated with high ozone potential for their particular location (e.g. daily maximum temperatures greater than 80 degrees F). Therefore, a State or Region may wish to consider dual meteorological criteria for establishing ozone monitoring seasons when 5 years of ozone monitoring data are not available.

Monitoring Consistency. The official monitoring requirement as defined by the ozone season would be the same for an entire network of both SLAMS and NAMS. This will ensure that statistics are calculated properly within the AIRS data system. In some cases, however, special considerations may warrant less monitoring for selected sites within an area. This was discussed in Section 3. Although Regional Office waivers have been used in the past to authorize exclusions of certain periods from required monitoring, we now require that sites authorized to monitor less that the official ozone season be classified as Special Purpose Monitors (SPM). This policy is intended to ensure that exceedance statistics will be calculated correctly for all SLAMS, and to provide an appropriate monitor descriptor on AIRS for any site not monitoring according to the required period. Since the calculation of exceedance rates on AIRS assumes that missing months within the ozone season have the same exceedance potential as monitored periods, exceedance rates for monitors not sampling the entire ozone season could be overestimated. We do not want to produce incorrect statistics for a SLAMS monitoring site. AIRS has a separate code for SPM. Thus, exceedance rates for SPM could be distinguished from those of SLAMS and NAMS which monitor throughout the entire ozone season. Although there are no data reporting requirements for SPM, we would encourage such SPM ozone data to continue to be submitted to EPA, either as raw data or as part of the SLAMS annual report.

As part of the evaluation of revised monitoring seasons, information from adjacent areas should also be examined to ensure consistent monitoring requirements among contiguous areas with similar climatology and precursor emissions, both within and across EPA Regions. Specifically, adjacent areas with similar conditions should ideally have the same requirements. Therefore, the minimum monitoring requirements should be judged according to the highest observed ozone among these areas. Since the authority to modify monitoring seasons resides with the Regional Administrator, obtaining consistency between EPA Regions may not be as easy as obtaining consistency within EPA Regions and the potential, therefore, exists for inter-regional inconsistencies. This may in fact be the case for the currently promulgated seasons, as discussed in Section 2. We recommend that ozone potential for contiguous areas between different EPA Regions be considered and that Regional Administrators strive for uniformity in ozone monitoring requirements.

Section 6 DATA PROCESSING AND OTHER CONSIDERATIONS

Data Processing Considerations

The promulgated ozone season plays an important role in the estimation of annual NAAQS exceedances. All ozone season days are assumed to have the same potential for producing exceedances, and are used as the basis for making comparisons with the NAAQS. In the AIRS summary files, annual statistics are only based on data within the ozone season, which is defined for all sites within a county or State. Any data collected outside the official season are not counted, unless exceedances are observed. In this case, AIRS extends the season to include the first or last exceedance day.

Although ozone seasons are defined for all States in Appendix D to 40 CFR 58 according to intervals of calendar months, current seasons for specific areas might justify change to other calendar time periods, e.g. mid-month to mid-month. The AIRS data system has recently been changed to accommodate this definition.

A reduction in monitoring within the official ozone season will affect the calculation of estimated exceedance rates. If monitoring is not performed within the promulgated season for a particular year, the exceedance calculation rules treat such non-monitored situations as missing data. This has the effect of increasing the exceedance estimate, if any exceedances are observed. AIRS assigns the same ozone season to all SLAMS, NAMS and SPM monitors in a particular State or county. AIRS does not have the capability to define a separate ozone reason for each individual monitor. Thus, it is important to monitor consistently within the official season.

A final point worth noting regards the calculation of estimated exceedances for data collected prior to the date of an official change in the ozone season. AIRS does not have the capability to store this date. All historical data calculated prior to the date of the change in the ozone season, as well as the data collected afterward, are all calculated using the same rules. Therefore, it must also be recognized that a change to the ozone season may change the estimated number of exceedances for historical data. Accordingly, it may be advisable to keep a hardcopy of the earlier expected exceedance results. In general, if the monitoring season is reduced, then there will be a reduction in the estimated number of exceedances under the new monitoring season. This is because of missing data in the months which were previously required to perform ozone monitoring. For those areas which pass the criteria contained in this guideline, exceedances could not have been observed in these months for the most recent 5 years, and we feel that the revised statistics would reflect a more accurate estimate for the expected number of exceedances.

<u>Other Considerations</u>

Some States have adopted the promulgated ozone seasons as part of the emission control regulations for precursor emissions sources, e.g. cutback asphalt and sources utilizing natural gas afterburners. These same emission regulations also help to reduce ambient concentrations of toxic chemicals. A change to the official ozone season could encourage (or force) States to modify the applicable emission regulations and may cause interim problems with the enforcement of the existing regulations. If existing emission regulations are thereby threatened, a change to the official ozone season may not be warranted.

Section 7 ADMINISTRATIVE PROCEDURES FOR CHANGING OZONE MONITORING SEASONS

All official changes to the ozone monitoring season which will affect both SLAMS and NAMS in a county, group of counties or entire State should be made in the Federal Register, to modify Appendix D to 40 CFR 58. This was the approach taken by Region VI for the changes for Texas. A notice of change is all that is required and public review is not necessary. The Regional Administrator should be responsible for the Federal Register notice, but either the State or the Regional Office can initiate this action and the necessary data analysis and review. It is suggested that changes to the ozone season be coordinated with the States to ensure that all interested parties are cognizant of the pending changes. Furthermore, since these changes will affect NAMS, any proposed changes must be concurred upon by OAQPS. A formal request to the Director of the Technical Support Division will be necessary. This will help ensure national consistency among ozone monitoring and also ensure that the National Air Data Branch will make the appropriate changes to AIRS, so that NAAQS statistics are properly calculated.

When a change to the monitoring season is not desired for an entire county, group of counties or an entire State, but only a reduction in the length of monitoring for certain SLAMS monitors in that area, then the status of these monitors must be changed from SLAMS to Special Purpose Monitors (SPM). As described earlier, exceedance rate calculations are based on the official ozone season and; therefore, a change to SPM carries with it all of the data processing ramifications discussed in Section 6. A letter of notification from the Regional monitoring coordinator to the Headquarters NAMS coordinator would be the appropriate administrative procedure. In addition, it is suggested that this scheduled ozone monitoring period be incorporated into the comment section of the monitoring site file on AIRS, for all affected monitors. This will ensure that national analyses of ozone data will be properly prepared.

APPENDIX A: Events Leading up to the 1986 Promulgated Ozone Seasons

Nation-wide ozone data were first analyzed to consider selective relaxation of hydrocarbon controls (afterburners)[8] for the winter of 1975. It was emphasized that the existing ozone data base could not be completely relied upon to make the necessary judgements. Air quality data for some States were found to be "unavailable, insufficient, or otherwise inadequate for making sound judgements."[8] Thus, to overcome these deficiencies, meteorological data were examined for an indication of the potential development of significant ozone levels on a State-by-State basis. Reference was made to a 1974 study,[16] where peak ozone concentrations, as reported in the National Aerometric Data Bank (NADB), were compared to daily maximum temperature. This study found that the incidence of high ozone levels (i.e., greater than 0.08 ppm) diminishes at maximum daily temperatures less than about 55 degrees F. This study also found that ozone levels greater than 0.10 ppm "rarely occurred below 80 deg. F." An illustration of the relationship of ozone to temperature found in this study is shown in Figure A-1. Additionally, smog chamber studies have also suggested that ozone concentrations greater than 0.08 ppm are not likely at temperatures less than approximately 55 degrees F.[7,16]

Thus, because of the rather consistent statistical relationship of daily maximum temperature to oxidant/ozone formation, daily maximum temperature was presumed to be "a reasonably reliable surrogate to indicate the potential for certain areas to experience high oxidant/ozone levels during certain months."[8]

In order to supplement the ozone data deficiences mentioned above, daily maximum temperature data were considered as an indicator of significant ozone

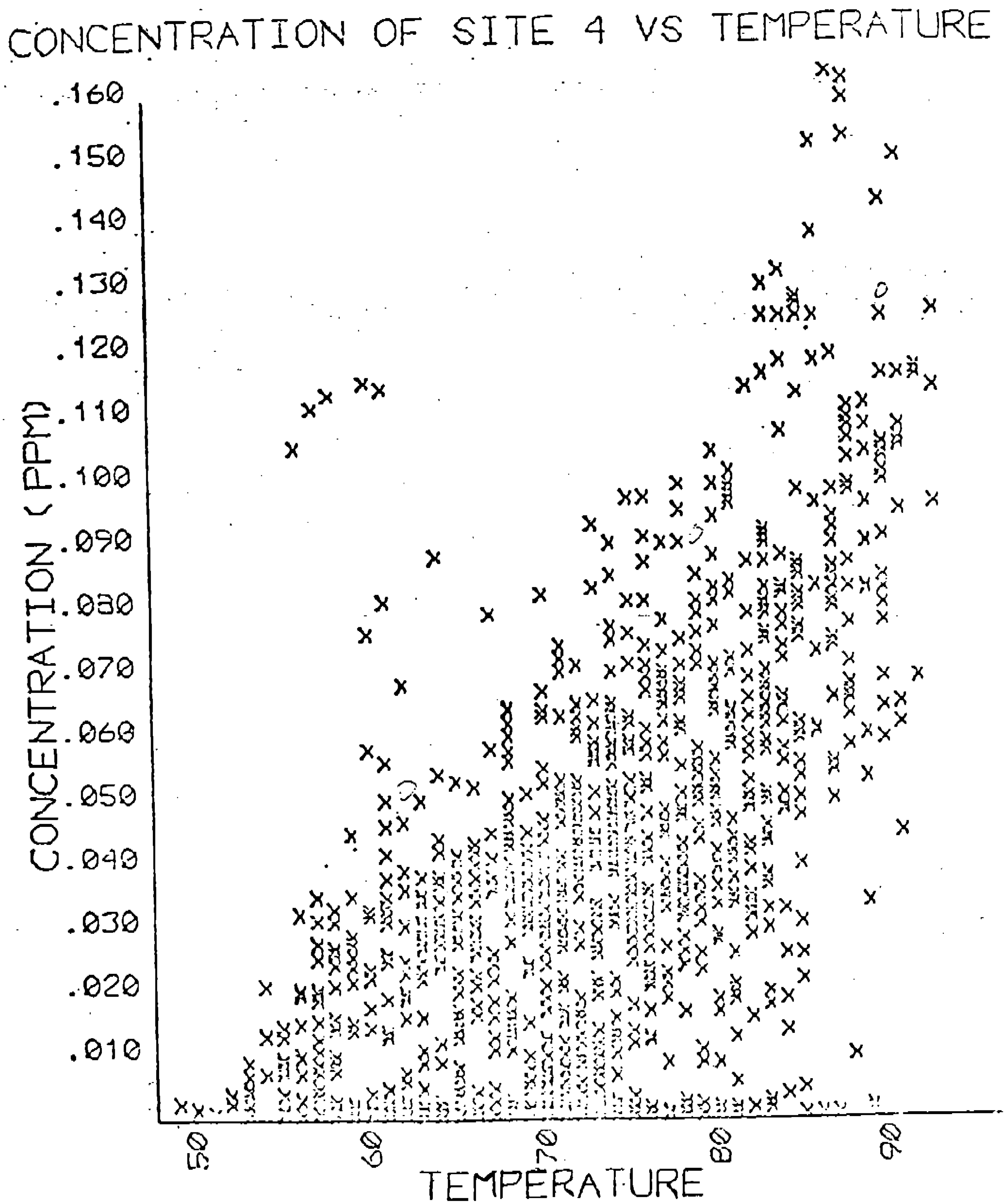
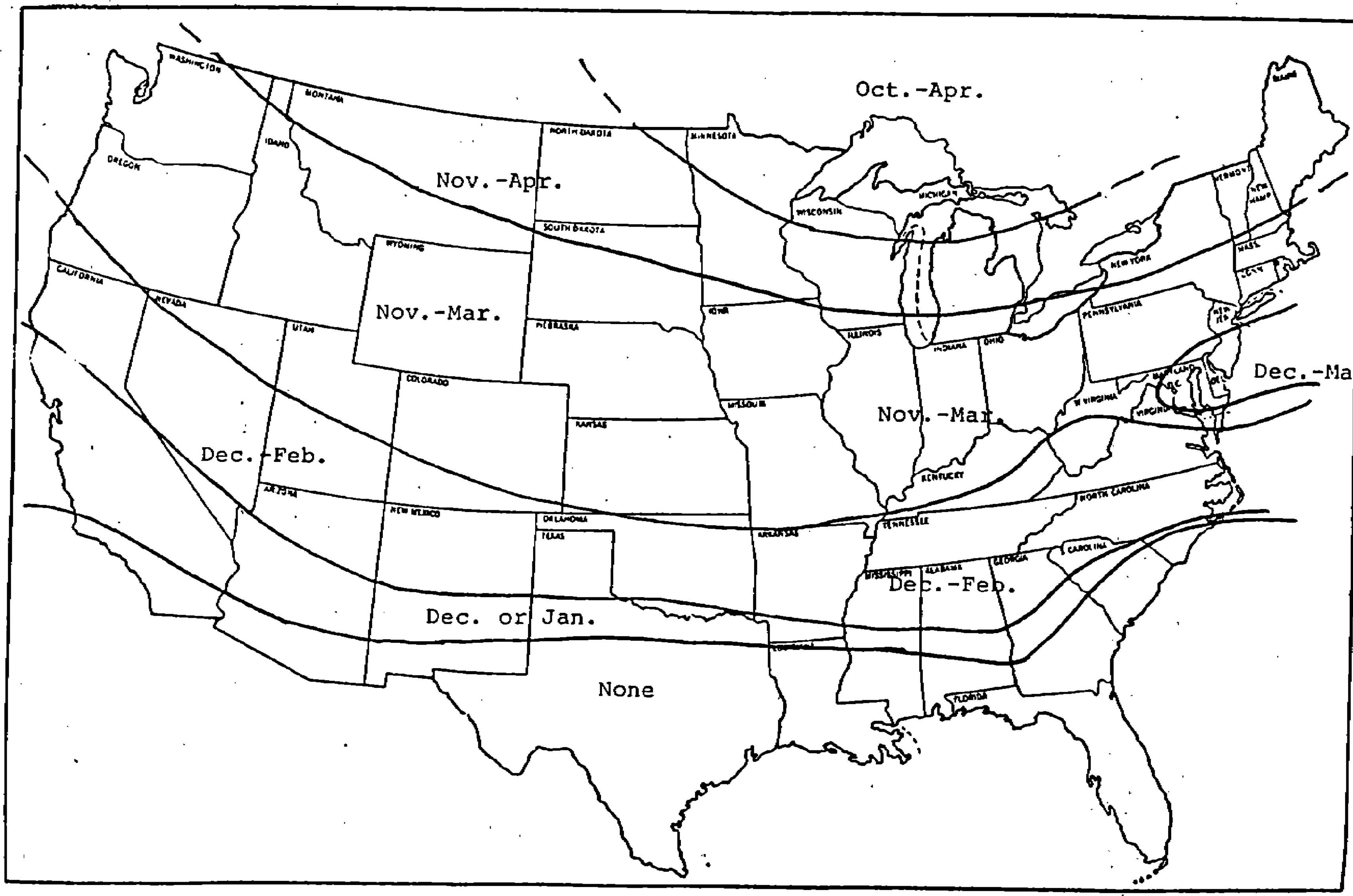


FIGURE A-1 - OZONE CONCENTRATION (PPM) VS TEMPERATURE (DEG F)
SITE 4 (INDIANAPOLIS, IN - SUMMER 1974)[9]

development based upon the above relationship. For this purpose, the relationship between monthly maximum oxidant/ozone concentration (1-hour) and monthly mean daily maximum temperature was tested. The monthly mean daily maximum temperature parameter was chosen because it is readily available from National Weather Service stations across the country.[8] Also, this statistic is more stable than daily maximum temperature on a year-by-year basis; it also better reflects climatological conditions over broad geographical regions. The relationship of monthly mean daily maximum temperature to monthly maximum ozone was tested in four Air Quality Control Regions (AQCRs) that included Philadelphia, New York, Washington, DC and Milwaukee. Temperature and ozone monitoring data for 1974 were used in this analysis. The correlation between monthly mean daily maximum temperature and monthly maximum ozone at any site in 1974 ranged from 0.7 to 0.9.[8] "The breakpoint for monthly maximum ozone concentrations above 200 $\mu g/m^3$ (0.10 ppm) was a monthly mean daily maximum temperature of approximately 55 degrees."[8] From this analysis, it was determined that monthly mean daily maximum temperature is a useful indicator of ozone formation potential.

To protect this relationship nationwide, extrapolations of monthy mean daily maximum temperature patterns were made across the U.S. showing the range of months when mean daily maximum temperatures were not expected to exceed 55 degrees (Figure A-2). The patterns shown in Figure A-2 are based on a 30-year mean and are not appreciably different than those for 1974.[8]

FIGURE A-2 Months During Which the Mean Daily Monthly Maximum Temperature is 55°F or Less (30-year Mean)[8]



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The reader is urged to review Reference 8 for a complete description of the assumptions and procedures used in deriving this relationship of monthly mean daily maximum temperature to ozone formation potential on a State-by-State basis.

Ozone and monthly mean daily maximum temperature data were next evaluated to determine for which States - and monthly ranges - relaxation of selective (afterburner) hydrocarbon control could be considered.[8] In determining these States and monthly ranges, some "subjective judgment needed to be applied in arriving at definitive recommendations." These judgments were based on "the number of sites, quantity of data, number of technical violations (i.e., greater than 0.08 ppm), and the number of significant violations (greater than 0.10 ppm)." Based on the air quality data, temperature data and "subjective judgments", the States and monthly ranges which were considered to have "an insignificant oxidant/ozone problem relative to the existing (0.08 ppm) standard" were identified.[8] These monthly ranges served as the basis for initially proposing ozone monitoring seasons for each State to be used in estimating the expected exceedances of the ozone standard on an annual basis.[2] These proposed seasons are depicted in Figure A-3. The proposed seasons were communicated to the U. S. EPA Regional Offices for review.[3] Comments were received from all Regional Offices as well as some States. Within some Regions, individual States conducted additional analyses of State ozone monitoring data and in some cases proposed alternative seasons. The responses from the Regional Offices and States yielded alternative monitoring seasons shown in Figure A-4. Figure A-4 shows some inconsistencies between EPA Regions and States. Based on these Regional Office/State

FIGURE A-3 OZONE SEASON - INITIAL PROPOSAL[10]

U.S. Environmental Protection Agency

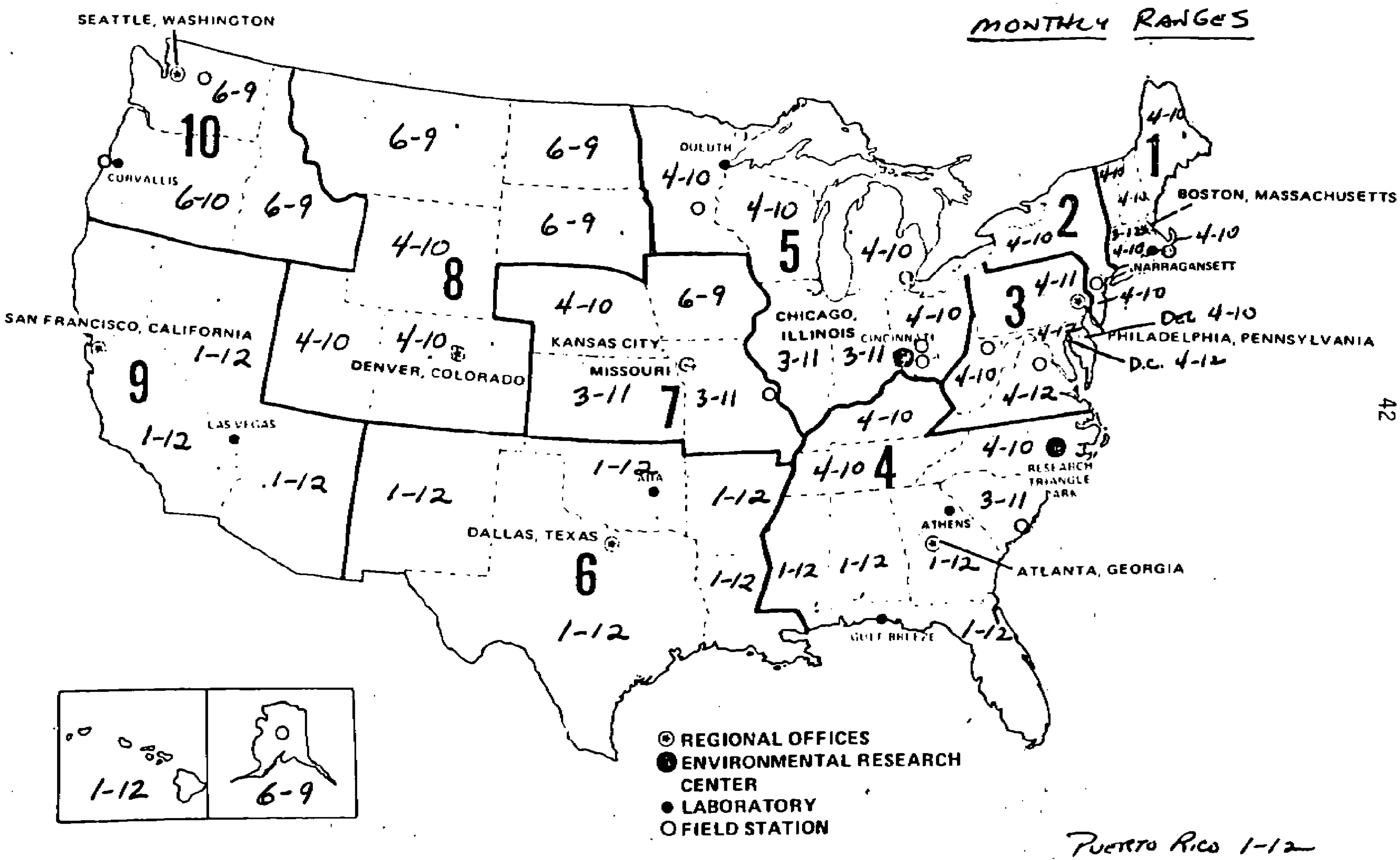
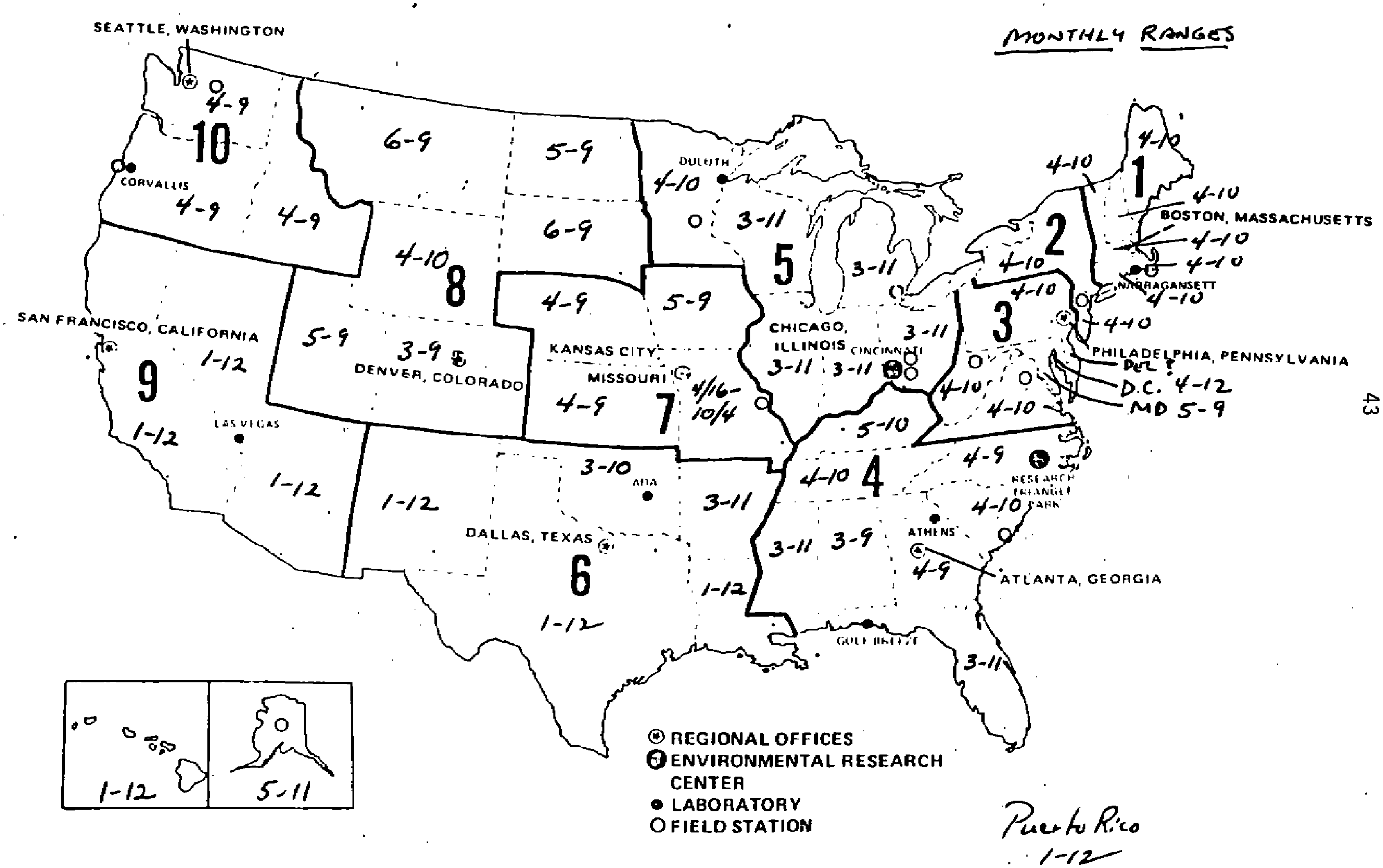


FIGURE A-4 OZONE SEASON - BASED ON RESPONSES BY REGIONAL OFFICES/STATES[10]

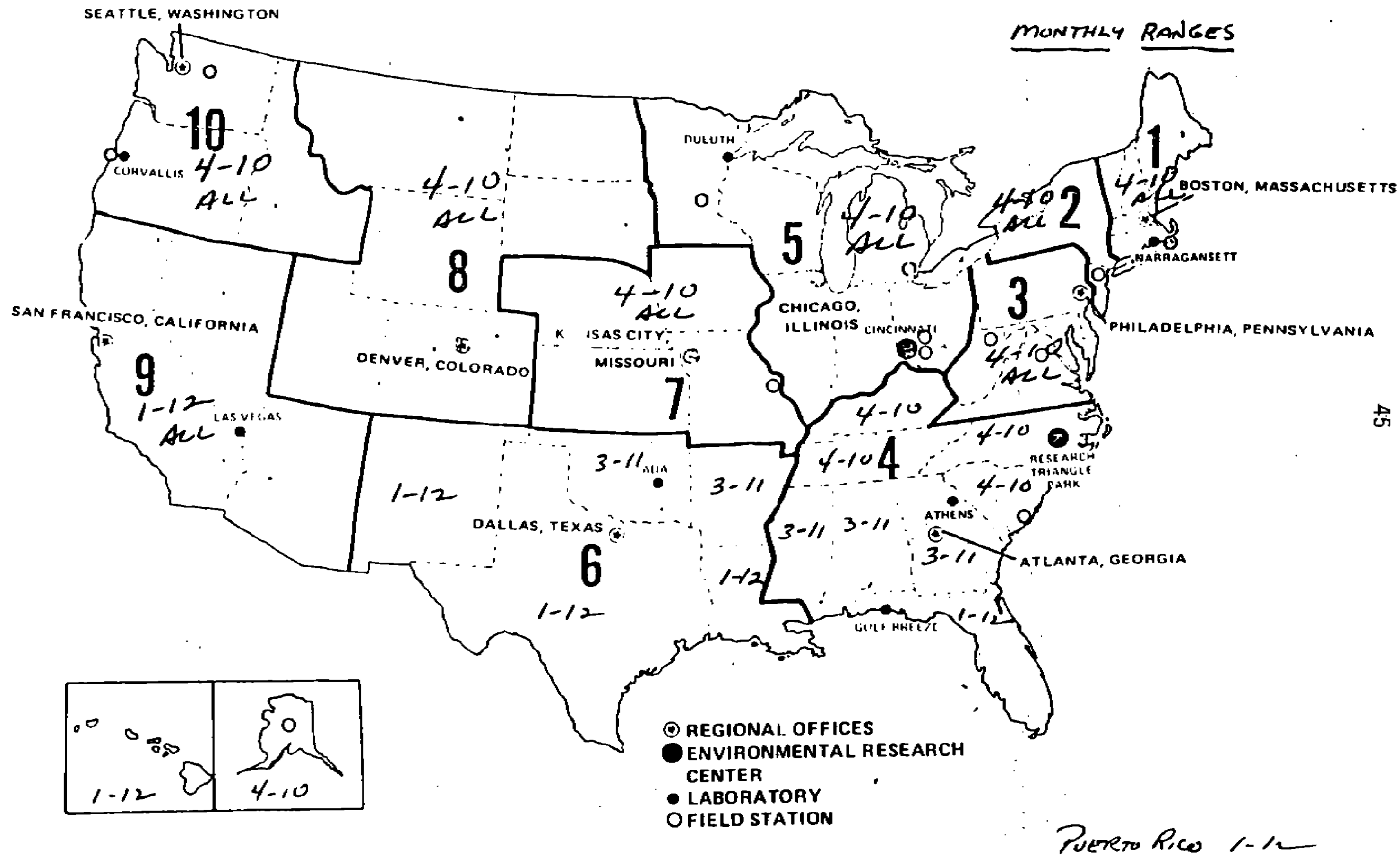
U.S. Environmental Protection Agency



responses, another version of the State monitoring seasons was developed[19] as depicted in Figure A-5. As shown, these seasons are uniform within all but two Regions. These seasons were derived to "smooth out the inconsistencies, yet consider much of the technical data reviewed and practical concerns of the Regional Offices/States."[19] The Regional Offices were informed that the seasons depicted in Figure A-5 would be implemented to calculate the estimated number of exceedances of the ozone standard on an annual basis.[20] All Regions accepted this version except for Region VIII. Region VIII requested that the monitoring seasons as depicted in Figure A-4 be implemented to reduce resource requirements for their States.[21] This change was incorporated into the final proposal and the seasons shown in Figure A-4 are the current monitoring seasons for Region VIII States.

FIGURE A-5 OZONE SEASON - RECOMMENDED VERSION[10]

U.S. Environmental Protection Agency



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MEMORANDUM

SUBJECT: Guideline on Modification to Monitoring Seasons for Ozone

FROM: William G. Laxton, Director
Technical Support Division (MD-14)

TO: Director, Environmental Services Division, Regions I-VIII and X
Director, Office of Policy and Management, Region IX

The attached guideline can be used as the basis for approving regional changes to published monitoring seasons for ozone. The document reviews the derivation of the 1986 promulgated seasons, provides background on season selection from monitoring and meteorological perspectives, presents criteria for judging revisions and discusses administrative procedures for making formal changes. Any questions relating to the implementation of these guidelines can be directed to Ogden Gerald, Chief of the Monitoring Section, at FTS 629-5652.

Attachment

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