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ADEQUACY ANALYSIS OF AIR QUALITY MONITORING ACTIVITIES RELEVANT TO CALIFORNIA THERMAL ENHANCED OIL RECOVERY FIELDS

Final Report

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Arlington, Virginia

U. S. DEPARTMENT OF ENERGY

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1. INTRODUCTION AND SUMMARY

1.1 INTRODUCTION

1.1.1 Report Overview

This draft document analyzes the adequacy of air quality monitoring activity in the areas of California where thermal Enhanced Oil Recovery (TEOR) is occurring or is anticipated to occur. The primary purpose of this project is to assess the ability of present air monitoring networks in these regions to provide data suitable for an air impact analysis under new source permitting programs. Accordingly, the report is organized as follows:

- Section 1--Summarizes the purpose of the report, describes briefly EOR activities in California, and presents the conclusions and recommendations derived from this analysis.
- Section 2--Describes the general purpose and requirements behind ambient air monitoring, particularly with regard to State and Federal regulations. In addition, this section discusses ambient air quality monitoring in California and highlights specific monitoring requirements for new source permit regulations.
- Section 3--Discusses the inventory of California EOR air quality monitoring activity contained in Appendix A; the inventory is a key element of this report.
- Section 4--Discusses the present and future adequacy of air monitoring activity in the California EOR fields with regard to several criteria.

It is hoped that this document will provide EOR operators and other interested parties with information on the ability of ambient air quality monitoring networks in the EOR fields to collect data useful in predicting the potential air quality impacts associated with further EOR growth. It should be noted that while this report provides specific recommenda-

tions based on an overall inventory of air monitoring activity, evaluating the site selection of individual networks or stations is beyond the scope of this study.

1.1.2 Enhanced Oil Recovery in California

Most TEOR activity in the United States occurs in southern California. As shown in Table 1-1, almost all current TEOR production occurs in Kern County. Based on the Department of Energy's (DOE) projections of potential TEOR production in California, Kern County will continue to produce the greatest amount of oil by this method in 1985.

Crude oil is recovered via enhanced methods when both natural pressure (primary recovery) and induced water pressure (secondary recovery) no longer are sufficient. Tertiary oil recovery employs thermal, chemical, and physical means to cause crude oils (which may be heavy and viscous) to move through sand and rock strata more easily. In California, most tertiary oil recovery occurs via thermal methods. Enhanced oil recovery techniques include steam injection, in-situ underground combustion (fire flooding), and chemical injections to decrease the oil's viscosity. Steam injection is the most popular method; TEOR operators employ small packaged boilers (usually less than 250 MM Btu/hr input) to inject steam into the wells at pressures ranging from 600 to 1400 psia.*

In Kern County alone, approximately 9400 steam injection wells are being operated. As of December, 1978, approximately 640 steam generators had permits to operate in that area. In Kern and most other areas, the steam generators produce steam from water recovered with the crude oil and use the recovered oil as a fuel. These crude oil-fired generators emit

* For further information on the technology of Enhanced Oil Recovery, see, for example, Enhanced Oil Recovery, Secondary and Tertiary Methods, edited by M. M. Schumacher, Noyes Data Corporation, Park Ridge, New Jersey, 1978.

TABLE 1-1

THERMAL EOR PRODUCTION IN CALIFORNIA

Field	County	Current Gross Production (B/D)	1985-1990 Production Rate: Base Case Net Production W/O Constraints (B/D)[1]	1985-1990 Production Rate: Total Potential Gross Production Under Advanced Case (B/D)[2]
Midway-Sunset	Kern	55,000	133,000	189,000
Kern River	Kern	73,000	123,000	187,000
Coalinga	Fresno	4,000	24,000	125,000
San Ardo	Monterey	31,000	41,000	66,000
Mt. Poso	Kern	11,000	19,000	33,000
S. Belridge	Kern	small	small	31,000
Wilmington	Los Angeles	--	1,000	26,000
Cymric	Kern	1,000	11,000	20,000
Huntington Beach	Orange	2,000	--	20,000
Yorba Linda	Orange	small	4,000	20,000
Long Beach	Los Angeles	--	--	13,000
Richfield	Orange	--	--	5,000
Inglewood	Los Angeles	--	2,000	4,000
Montebello	Los Angeles	--	--	4,000
Cat Canyon	Santa Barbara	8,000	--	4,000
Lost Hills	Kern	small	small	3,000
McKittrick	Kern	5,000	1,000	3,000
Kern Front	Kern	3,000	--	2,000
Dominquez	Orange	--	--	1,000
Other	--	69,000	71,000	173,000

1/ The Base Case assumes that marketing and emissions problems can be overcome.

2/ The Advanced Case assumes certain technological advances in thermal EOR.

SOURCE: Adapted from Lewin and Associates, Inc., "Discussion of Thermal Oil Recovery Opportunities in California," April 10, 1978.

sulfur oxides (SO_x), nitrogen oxides (NO_x), and particulates. In addition, oilfield wellheads can emit hydrocarbons (HC), depending on the degree of control employed.

In the past, most steam generators were operated without specific add-on control devices. Recently, however, environmental regulations and continued growth have required air pollution control devices to be employed in many TEOR fields. Such control measures have focused on SO_2 and HC. SO_2 has been reduced from new steam generators primarily through the use of flue gas desulfurization (FGD) equipment (mostly scrubbers). One FGD unit often serves a commonly manifolded group of 10 to 20 steam generators. HC controls, on the other hand, are directed at the crude oil recovery wellheads, pipeline, and storage system; vapor recovery equipment and floating roof tanks are the common control methods employed.

Although air pollution controls are being instituted in many California TEOR fields, air quality in these areas often is substandard with respect to one or more air pollutants. In some cases--primarily concerning oxidant and sometimes particulate concentrations--substandard air quality may be due to "pollution import" from outlying regions. However, SO_2, $SO_4^=$, and NO_2 concentrations may be partly if not predominately attributable to EOR activity within the immediate TEOR region. Consequently, improving or maintaining air quality within these areas focuses on emissions from EOR operations.

In California, TEOR operators (and operators of similar major emitting facilities) are subject to the regulations of three institutions: the Region IX U.S. EPA Office, the California Air Resources Board (CARB), and the local Air Pollution Control District (APCD). Each of these agencies separately promulgates regulations which affect allowable air pollution emissions and the degree of new source growth permitted. In recent years, Federal and State laws governing air quality have grown

increasingly comprehensive and stringent, requiring TEOR operators to attain and maintain ambient air quality standards (AAQS) established by Federal and State agencies. One of the newer and more far-reaching requirements has been the institution of stricter permit programs for new sources. For example, all operators of a new source must conduct a thorough analysis of the source's air quality impact. Uniquely, in California, some operators may even be required to monitor emissions to prove compliance with the AAQS. These monitoring programs enable regulating agencies to review the effect a new source may have in a given area. Accordingly, ambient air quality monitoring is expected to play an increasingly important role in new source permit programs.

1.2 SUMMARY AND CONCLUSIONS

In California, the status of ambient air quality is a critical factor influencing the level of potential growth in each TEOR area. Nevertheless, existing monitoring networks in TEOR regions generally are not uniform; each network is subject to the particular regulatory demands of a specific area. Consequently, the quality and usefulness of data collected in different TEOR fields varies widely, making a comparative assessment of monitoring networks difficult. The approach used in this report was to survey the adequacy of monitoring networks according to specific screening criteria shown in Table 1-2. The results of this survey are highlighted as follows:

- Ambient air quality monitoring has not played a critical role in past siting of TEOR facilities. Siting often was based on air quality information derived from air dispersion modeling. To date, no permits have been denied due to the absence of air quality data. However, several air quality issues in Kern County are affecting recent permitting actions.

- Some standing networks may have trouble meeting current permit requirements. To date, the amount and quality of ambient monitoring required by regulatory agencies has varied and most EOR production areas have not developed monitoring networks which are consistent between regions. Also, municipal economic

TABLE 1-2

SCREENING CRITERIA USED IN ANALYSIS
OF TEOR MONITORING

- Have Any Permits Been Denied Due to the Absence of Suitable Air Quality Monitoring Data
- Are Standing Monitoring Networks Capable of Supplying All Data to Meet Current Permit Requirements
- Are Monitoring Networks, Both Planned and Operating, Capable of Meeting Anticipated Permit Requirements, Including Possible New Standards
- Are Standing Monitoring Networks Capable of Supplying Data that Allow Air Quality Trends Predictions in Support of TEOR Expansion Plans
- Are Standing Monitoring Networks Recording Air Quality Data Accurately According to Established Guidelines

constraints have influenced the extent to which some public networks have developed. Specifically, at least one county--Monterey--does not have an adequate monitoring network to meet present permit requirements.

- Most monitoring networks do not measure pollutants which presently are not regulated but which may have standards proposed in the future. This may be a shortcoming only in cases in which a possible standard may affect TEOR growth. For example, most monitoring networks in the TEOR regions are not prepared to measure respirable particulate concentrations in anticipation of a tentative standard for these pollutants. For this reason, issues regarding this possible standard in the TEOR fields cannot be addressed prior to possible proposal.

- Most monitoring networks in the TEOR regions do not allow comprehensive air quality trend predictions. Thus, most present monitoring networks in the TEOR regions are not sufficient to effectively determine the air pollution carrying capacity of the production fields; only areas already experiencing moderate to high growth are being monitored.

- Many monitoring networks are ambient air quality monitoring networks and therefore are not sufficient to accurately measure source-receptor relationships; for this reason, the sources of many TSP violations are difficult to determine.

- Most monitoring networks accurately record air quality data. However, controversy exists concerning the ability of sulfate monitors to accurately measure sulfate concentrations. Many of the older sulfate monitors (i.e., glass fiber filters) employ filter mediums which may misrepresent actual ambient sulfate concentrations. These filters have been found to cause a catalytic reaction of SO_2 and particulates to form $SO_4^=$ on the filter medium itself. Accurate filter mediums are available (e.g., teflon and other mediums) but are not yet employed at many stations.

Several factors will contribute to the increasing importance of monitoring: (1) the degree and importance of growth in TEOR regions; (2) the increasing regulatory reliance placed on monitoring, particularly in regard to recent State ambient standards ($SO_4^=$ and short-term NO_2) and possible future Federal regulations (new PSD standards, possible short-term NO_2 standards); and (3) the changing status of air quality within

TEOR regions.* Each of these factors will encourage regulatory agencies and TEOR producers to increase network size in growing EOR regions. Moreover, the amount of public agency involvement--whether funding a large or small network--will determine the relative contribution (in terms of monitors) needed by the private TEOR producers.

Although TEOR producers desire to keep costs to a minimum, several improvements to the existing monitoring networks may be needed over the near-term. Table 1-3 provides a summary of suggested improvements to existing monitoring networks. Section 4.3 discusses these recommendations in more detail. In addition to these specific recommendations, the following improvements also are suggested:

- Monitoring personnel sould consider employing non-reactive filter mediums (e.g., teflon filters instead of conventional glass filters) in sulfate monitors to mitigate inaccuracies in sulfate measurements.

- TEOR operators should establish at least one dichotomous sampler (to measure respirable particulates) in the high-growth TEOR regions to address issues relative to this tentative standard.

- Regulatory agencies should establish sound quality assurance programs to ensure that monitoring networks consisting of private and public stations measure pollutant data in a consistent manner.

- All regulatory agencies involved in new source permit review programs should establish clear guidelines on the amount and quality of monitoring data needed. Furthermore, such agencies should offer information on the amount and quality of monitoring data needed to determine the pollution carrying-capacity of a field.

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* A recent U.S. District Court ruling may place even greater importance on monitoring (Alabama Power Company vs. Douglas M. Costle, No. 78-1006, U.S. Court of Appeals for the District of Columbia, June 18, 1979). In that decision, the court charged that the regulations for use of monitoring data fall short of Clean Air Act requirements. The PSD regulation requires monitoring only to determine whether an applicable NAAQS will be exceeded. The Court ruled that Section 165(e)(2) of the Clean Air Act requires monitoring data for determining actual or potential violations of the allowable increments. New PSD regulations being proposed by EPA will reflect that decision.

TABLE 1-3

SUMMARY OF RECOMMENDED IMPROVEMENTS TO EXISTING MONITORING NETWORKS

NEW FIELD OR COUNTY	RECOMMENDATION
Western Kern County	• 1-2 SO_2 and TSP monitors should be added to Midway-Sunset Field. 1 NO_2 and 1 MET (Metallurgical Monitoring) station also should be established. • 1 $SO_4^=$ monitor should be established to service the North and South Belridge Oil Fields. • 1 NO_2, $SO_4^=$, and TSP monitor should be established in Cymric Field, if production increases as predicted. 1 O_x monitor should be established to service Cymric and McKittrick Fields.
Kern River Area	• 1 additional SO_2, TSP, and $SO_4^=$ monitor should be placed in Kern River Field. • 1 TSP, $SO_4^=$, and NO_2 monitor should be placed in Mt. Poso area to aid anticipated growth.
Monterey County	• 1-2 SO_2, 1 $SO_4^=$, 1 TSP, and 1 MET monitor should be established in the San Ardo Field to aid anticipated growth. • 1 O_x monitor should be established to service San Ardo and southern Monterey
Los Angeles County/ Orange County	• Further enhancement of present and planned network is unnecessary.
Santa Barbara County	• If growth does not occur, no new monitoring sites need to be established. If growth occurs, a minimal network of TSP, SO_2, $SO_4^=$, and MET stations is needed.
Fresno County	• 1 SO_2, TSP, and MET monitor should be established in Coalinga Fields to augment present network.

The recommendations presented reflect a belief that ambient air quality monitoring will serve as an increasingly important factor in determining new source growth. However, it must be pointed out that the degree of monitoring required of TEOR producers ultimately is determined by the local regulatory agency. In general, new source permit monitoring is voluntary, although several operators (Getty, Shell, and many of the Cat Canyon producers) are required to prove compliance with State and Federal AAQS through monitoring. Rarely does the regulatory agency (EPA or APCD) require pre-construction monitoring if preliminary modeling or other data indicate the new source would not pose a threat to AAQS. Primarily, new sources rely on data obtained from existing networks, the majority of which are publicly funded by regulatory agencies. However, because the purposes of the agency conducting monitoring and that of the EOR producer often do not coincide, public networks may not always suit the needs of the EOR producer. In these cases and, as TEOR growth occurs and air quality issues become more sensitive and crucial to expansion, the need for privately conducted TEOR monitoring networks may increase.

2. AMBIENT AIR QUALITY MONITORING: GENERAL PURPOSE AND REQUIREMENTS RELATED TO FEDERAL AND STATE REGULATIONS

2.1 INTRODUCTION

Ambient air quality monitoring is a data gathering function. The essential use of ambient monitoring is to characterize the quality of air with respect to one or more pollutants at specific locations. Within the regulatory structure of the Clean Air Act (CAA), ambient monitoring is used in two fundamental areas: 1) to assess existing air quality in support of developing appropriate air pollution control strategies on a regional basis, and 2) to aid in determining the impact of new sources on air quality within a given region.

This section discusses the purposes and requirements of ambient air monitoring with respect to the above two functional areas. Although this report primarily deals with the use of ambient monitoring as an element of new source permitting, it also is helpful to understand the role of monitoring as a tool for the EPA and states to develop appropriate air pollution control strategies. Thus, this section discusses ambient monitoring with respect to both new source permit requirements and the Federal and state monitoring network established by the CAA and subsequent regulations.

The first part of this section reviews EPA's proposed ambient air quality monitoring program to be established as an element of individual State Implementation Plans (SIP's). The review focuses on two aspects of the regulations: 1) the rationale behind the newly proposed Federal and state air quality network and 2) the responsibility for reporting ambient air quality data.

The latter subsections of Section 2 provide: 1) an overview of the Federal and State permitting process for new or modified stationary sources and 2) a description of the criteria for pre-construction ambient monitoring for new or modified stationary sources.

2.2 THE AMBIENT AIR MONITORING SURVEILLANCE SYSTEM

2.2.1 Background

The CAA mandates that a Federal and State ambient air quality monitoring program be initiated as part of each state's SIP. The function of this monitoring program is to aid the development of air pollution control strategies and to characterize the quality of air with regard to national and local ambient air quality standards. The regulations proposed by EPA establish both State and Local Air Monitoring Stations (SLAMS) and National Air Monitoring Stations (NAMS).*

The rationale behind the establishment of the SLAMS network is as follows:

- To provide EPA with the necessary data to develop air pollution control strategies for the attainment and maintenance of National Ambient Air Quality Standards (NAAQS)
- To provide each state with enough flexibility within the system to conduct special purpose monitoring studies (SPM)
- To provide a network that is more responsive to data needs and resource constraints
- To ensure a uniform framework for the submission of the air quality data
- To provide EPA with data of high quality through the imposition of a uniform sampling procedure.

* 43 Fed. Reg., 34892 (August 7, 1978).

The NAMS, on the other hand, are proposed specifically to meet the requirements of section 319 of the CAA. In brief, this section institutes a uniform approach to all aspects of air quality monitoring and establishes a national monitoring system to provide EPA with timely data upon which to base national assessments and trends analyses.

2.2.2 State and Local Air Monitoring Stations (SLAMS)

As mentioned, the purpose of the SLAMS network is to improve the overall efficiency of the existing ambient air quality system and improve cost-effectiveness. It therefore is intended that the SLAMS network 1) be evaluated on an annual basis; 2) be modified easily to meet changing data needs via the addition, deletion, or relocation of monitoring stations; and 3) reduce the number of stations from the existing network, thereby rendering the SLAMS network more efficient and cost-effective. In addition, reducing in the number of stations will free stations for use by states in Special Purpose Monitoring (SPM) studies (see Section 2.2.4).

The general objectives of the SLAMS network are summarized below:

- To determine the highest pollution concentration expected to occur within areas covered by the network
- To determine representative pollution concentrations in areas of high population density
- To determine the impact on ambient pollution levels of significant sources or source categories
- To determine general background (baseline) levels for criteria pollutants.

The proposed regulations require that an annual SLAMS summary report be submitted to the National Network Air Data Bank (NADB) by July of the

following calendar year. The specific information required in the annual report corresponds to the general objectives of the system.*

The compliance date for the submittal of an annual report, as opposed to the interim and current quarterly report, applies to data collected during the 1981 period. The proposed regulations recognize the different data that may be needed by each of the EPA Regional Offices. Accordingly, the proposed regulations provide the EPA regional offices with the authority to obtain individual data values or summaries as deemed necessary.

The proposed compliance date for the submittal of the SIP revision providing for a SLAMS network is January 1, 1980. Final completion of the SLAMS network, however, is not necessary until January 1, 1983. Since NAMS will contain the more important stations in the SLAMS network, the NAMS are required to be in operation sooner than the other stations in the SLAMS network (the deadline for completion of the NAMS network is January 1, 1981). For the interim period, the proposed regulations require that all monitoring stations currently described in each SIP be kept in operation until the respective SIP revision is submitted on January 1, 1980, and subsequently approved.

2.2.3 National Air Monitoring Stations (NAMS)

To provide EPA with timely data upon which to base national assessments and trends analyses, the proposed regulations establish a National Monitoring Network. The NAMS are to be operated by the states and will consist of certain select stations of the SLAMS network from which data would be reported on a quarterly basis. The stations selected as NAMS will be based on urbanized population and pollutant concentration levels.

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* Appendix F to 40 CFR, Part 58, specifies the information to be included in the annual summary report.

The procedures for submittal of the NAMS data will be developed between the state and the appropriate EPA regional office.

The proposed regulations stipulate that a description of the NAMS network be submitted by January 1, 1980. The description will not be part of the SIP revision even though the two submittal deadlines coincide.

2.2.4 Other Monitoring

EPA has the perogative to operate ambient air monitors in instances in which states have failed to locate and operate a monitor. This perogative may be exercised if a state fails to locate SLAMS in areas where the EPA regional office deems it necessary and/or fails to locate NAMS in areas from which data is necessary to meet EPA's national data needs. In addition, the new requirements are intended to provide flexibility in the SLAMS program to meet changing stations.

Reducing the number of stations in the SLAMS network to only those that are truly necessary for SIP purposes should free some stations which the state could use for special studies (special purpose monitoring SPM). SPM stations will not be subject to any EPA requirements unless data are to be used for SIP purposes.

2.2.5 Procedures and Network Design For Surveillance Monitoring

As discussed, NAMS are comprised of an established network of SLAMS (Sec. 2.2.3). The primary objective of NAMS is to measure pollutant concentrations affecting population and to assess nationwide pollution trends. Generally a larger number of NAMS stations are needed in more polluted urban and multisource areas. SLAMS data, on the other hand, are used primarily for nonattainment decisions/analysis in specific geographical areas. The actual number of monitors depends on local factors such as meteorological topography, urban and regional air quality

gradients, and the potential for significant air quality improvement or degradation. Both NAMS and SLAMS employ similar siting criteria; selection is based on population and ambient pollutant levels. Tables 2-1 and 2-2 give examples of the approximate number of surveillance monitors needed to characterize national and regional SO_2 and TSP pollution levels and trends, based on EPA criteria.

Generally, air surveillance monitoring is governed by somewhat different criteria than monitoring designed for "new source" permitting. Monitoring under Prevention of Significant Deterioration (PSD) guidelines (see Sec. 2.3.1) is performed specifically to provide a baseline against which to model a source's impact. Specific site location is a crucial element of PSD monitoring. (This is more fully discussed in Sec. 2.3.3.1.) On the other hand, surveillance monitoring under SLAMS and NAMS is designed to evaluate impacts from a large number of sources in a region.

It should be noted that although the importance of NAMS/SLAMS surveillence monitoring should be understood, its purpose and practice is not the focus of this report. For further information on NAMS/SLAMS surveillence monitoring, EPA's Proposed Regulatory Revisions on Air Quality Surveillence should be consulted (43 FR 34892, August 7, 1978).

2.3 FEDERAL AND STATE MONITORING PROGRAMS REQUIRED IN SUPPORT OF PERMITS FOR NEW OR MODIFIED SOURCES

2.3.1 Background

The CAA stipulates that each state establish a permitting program (in their SIP) for new or modified stationary sources. The purpose of such a program is to ensure that new or modified sources do not prevent the attainment or maintenance of ambient air quality standards as a result of emissions from the facility. The New Source permit procedures as required by the CAA is summarized in Figure 2-1. The figure illustrates the role PSD monitoring is designed to play in procuring permits.

TABLE 2-1

SO_2 NATIONAL AIR MONITORING STATION CRITERIA
(Approximate Number of Stations Per Area)[a/]

Population Category	High Concentration[b/]	Medium Concentration[c/]	Low Concentration[d/]
High Population >500,000	6-8	4-6	0-2
Medium Population 100,000-500,000	4-6	2-4	0-2
Low Population <50,000-100,000	2-4	1-2	0

a/ Selection of urban areas and actual number of stations per area will be jointly determined by EPA and the State agency.

b/ High concentration -- violating primary NAAQS.

c/ Medium concentration -- violating 60 percent of secondary NAAQS.

d/ Low concentration -- less than 60 percent of primary or secondary NAAQS.

SOURCE: "Proposed Regulatory Revisions on Air Quality Surveillance," 43 FR 34892, August 7, 1978.

TABLE 2-2

TSP NATIONAL AIR MONITORING STATION CRITERIA
(Approximate Number of Stations Per Area)[a/]

Population Category	High Concentration[b/]	Medium Concentration[c/]	Low Concentration[d]
High Population >500,000	6-8	4-6	0-2
Medium Population 100,000-500,000	4-6	2-4	0-2
Low Population <50,000-100,000	2-4	1-2	0

a/ Selection of urban areas and actual number of stations per area will be jointly determined by EPA and the State agency.

b/ High concentration -- violating primary NAAQS by 20 percent or more.

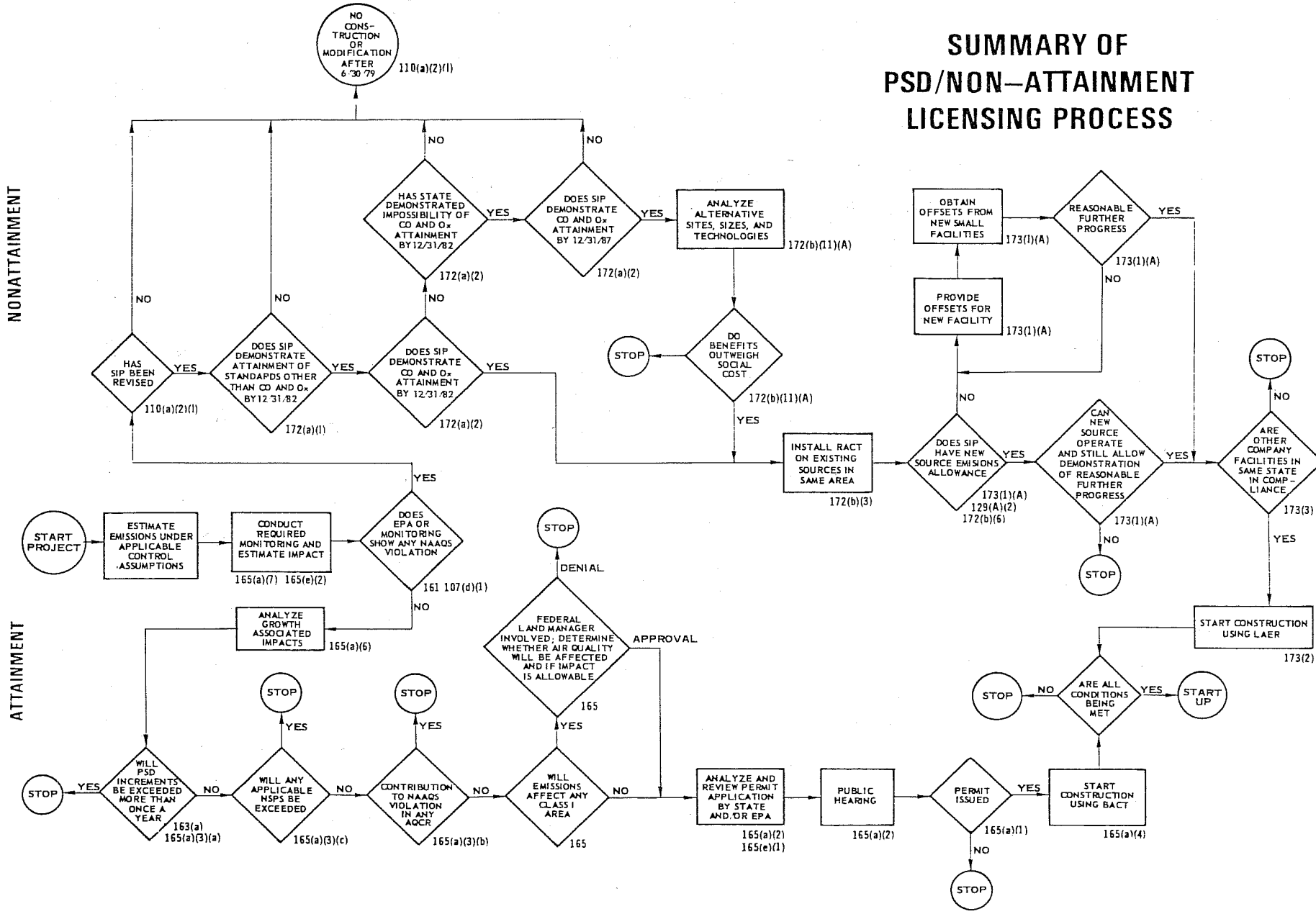
c/ Medium concentration -- violating 60 percent of secondary NAAQS.

d/ Low concentration -- less than secondary NAAQS.

SOURCE: "Proposed Regulatory Revisions on Air Quality Surveillance," 43 FR 34892, August 7, 1978.

FIGURE 2–1

SUMMARY OF PSD/NON–ATTAINMENT LICENSING PROCESS



SOURCE: CONDENSED FROM P.E. JONKER, ENVIRONMENTAL SCIENCES DEPARTMENT UNION OIL COMPANY OF CALIFORNIA 2/13/78

As an element of the permitting process, monitoring is designed to be used as an aid in determining source compliance with air pollution standards. The permitting process essentially is comprised of three elements. First, baseline monitoring is conducted to determine the status of air quality prior to the facility's construction or operation which, in turn, serves to determine the stringency of emission regulations governing sources. In addition, such monitoring may be employed with dispersion modeling to determine the source's anticipated impact. Note that new monitoring is not always required; instead, the most current monitoring data obtained from ambient air quality networks may be used as a substitute if shown to be adequate and representative of an area expected to be impacted. This policy is discussed in Sec. 2.3.4. Second, the operator must prove compliance with all applicable Federal and state emission limitations for any other facilities owned by the same operator. Third, an air quality impact analysis must be conducted to prove that the proposed facility will not adversely affect the attainment or maintenance of regional air quality. In California only, a fourth element exists in the permit procedure; operators may be required to conduct post construction monitoring to ascertain the facility's compliance with all applicable ambient air pollution regulations.

While reviewing the general monitoring criteria stipulated by Federal and State new source permitting requirements, it is important to note that while overall monitoring program concepts are similar--regardless of source and regional air quality--parameters such as source type, regional air quality, and local requirements affect the design of specific monitoring networks on a case-by-case basis.

2.3.2 General Permit Monitoring Procedures

CAA requires the owner/operator of a major new source (defined by the act as any of the facilities listed in Table 2-3 or modified existing sources) to gather and analyze air quality data for the area surrounding

TABLE 2-3

MAJOR EMITTING FACILITY DEFINED UNDER CAA PSD REGULATIONS

A "Major Emitting Facility" is any one of the following 28 stationary sources of air pollutants which emits or has the potential to emit 100 tons/yr or more of any air pollutant:

- Fossil-Fuel Fired Steam Generators
- Coal Cleaning Plants
- Portland Cement Plants
- Kraft Pulp Mills
- Primary Zinc Smelters
- Iron Mill Plants
- Steel Mill Plants
- Primary Aluminum Ore Reduction Plants
- Primary Copper Smelters
- Municipal Incinerators
- Hydrofluoric Acid Plants
- Sulfuric Acid Plants
- Nitric Acid Plants
- Petroleum Refineries
- Lime Plants
- Phosphate Rock Processing Plants
- Secondary Metal Production Facilities
- Chemical Process Plants
- Fossil-Fuel Boilers
- Petroleum Storage and Transfer Facilities
- Glass Fiber Processing Plants
- Charcoal Production Facilities
- Coke Oven Batteries
- Sulfur Recovery Plants
- Carbon Black Smelters
- Primary Lead Smelters
- Fuel Conversion Plants
- Sintering Plants

The term "Major Emitting Facility" also indicates all sources other than those listed above, with the potential to emit 250 tons/yr or more of any air pollutant.

the proposed facility. Existing data may be used if approved by the reviewing agency or monitoring may be required both prior to and after source construction. Should preliminary modeling indicate that the proposed source may impact AAQS, monitoring data to show actual baseline air quality concentrations may be desirable.

The air quality data and analysis are to be submitted to the appropriate state or local office responsible for "new source" permitting, as designated in the respective SIP. Presently, the appropriate EPA regional office is responsible for reviewing sources under PSD and nonattainment regulations. However, states may assume this responsibility once revised SIP's are approved.

The purpose of PSD monitoring is to provide adequate information on air quality for the area surrounding the proposed facility. The Federal guidelines require analysis of all pollutants for which a NAAQS exist (except hydrocarbons): total suspended particulates (TSP), sulfur dioxide (SO_2), carbon monoxide (CO), photochemical oxidants (O_x), nitrogen dioxide (NO_2), and lead (Pb). Other pollutants regulated by a state also may require analysis and/or monitoring.

2.3.3 Network Design of Monitoring Programs

2.3.3.1 General Network Design

The number and location of monitors are based on a case-by-case determination by the owner or operator and should be reviewed by the permit granting authority prior to implementing the network. When reviewing the overall design of the PSD/nonattainment monitoring network for permit requirements, characteristics of the emission source, the surrounding terrain, meteorological conditions, and other such factors must be considered. The number of sites will be directly related to the expected spatial variability of the pollutants in the areas of study and will be agreed upon by the applicant and by the local permitting agency.

To determine the location of each monitoring station, it is suggested that the owner of the source first consult with the local permit granting authority to discuss use of appropriate dispersion modeling techniques and to estimate the air quality impact of the proposed source (and any existing sources within the impact range of the proposed source) for each pollutant averaging time. The modeled pollutant contribution of the proposed source should be analyzed in conjunction with contributions from existing sources to determine the location of maximum pollutant concentrations. Monitoring then should be conducted in or as close to these areas as possible.

In general, the network design--including the number and location of monitoring sites--will depend upon the area being studied (i.e., urban or remote). Table 2-4 presents examples of some monitoring networks commonly used or suggested under PSD guidelines. For urban or near-urban areas close to existing sources of pollutants, more monitors generally are needed because of the variability in emissions and the resulting variability in air quality concentrations. The existing sources in these areas and their impacts on the population must be considered along with the averaging times for each pollutant.

For remote areas in which the permit granting authority has determined no significant sources exist, a minimum number of monitors usually are used (e.g., one or two at most). Also, some concessions may be made on the location of these monitors. Since the maximum impact from remote sources would occur in remote areas, the monitors may be located based on convenience or accessibility near the source rather than near the maximum impact area. However, the maximum impact area is the preferred location.

With regard to the type of monitoring equipment used, all ambient air quality monitoring must employ continuous Reference or Equivalent Methods,

TABLE 2-4

EXAMPLE PSD MONITORING NETWORKS

Source	Pollutant	Number of Sites[a/]	Length of Monitoring	Monitoring Site Location[b/]	Frequency of Sampling
Remote Powerplant (coal- or oil-fired)	SO_2	1	4 mos-1 yr	on site	continuous
	TSP	1	4 mos-1 yr	on site	1/6[c/]-1/1[d/]
	CO	0	--	--	--
	NO_2	1	4 mos-1 yr	on site	continuous
	O_3	0-1	4 mos-8 yr	on site	continuous
Powerplant (with existing sources)	SO_2	1-4	4 mos-1 yr	max impact/ max conc	continuous
	TSP	1-4	4 mos-1 yr	max impact/ max conc	1/1
	CO	0	--	--	--
	NO_2	1-2	4 mos-1 yr	max impact/ max conc	continuous
	O_3	0-1	4 mos-8 mos	on site	continuous
Oil Refinery	SO_2	1-4	4 mos-1 yr	max impact/ max conc	continuous
	TSP	1-4	4 mos-1 yr	max impact/ max conc	1/6 - 1/1
	CO	0-1	4 mos-1 yr	max impact	continuous
	NO_2	1	4 mos-1 yr	max impact	continuous
	O_3	1	4 mos-8 mos	max impact	continuous

TABLE 2-4 (Continuous)

Source	Pollutant	Number of Sites[a/]	Length of Monitoring	Monitoring Site Location[b/]	Frequency of Sampling
Pulp & Paper	SO_2	1-4	4 mos-1 yr	max impact/ max conc	continuous
	TSP	1-4	4 mos-1 yr	max impact/ max conc	continuous
	CO	0-1	4 mos-1 yr	max impact	continuous
Hydrocarbon Emissions					
remote	O_3	1	4 mos-8 mos	on site	continuous
multisource	O_3	1	4 mos-8 mos	downwind	continuous
Fugitive Particulate Matter Process Emissions	TSP	1	4 mos-1 yr	on site	1/6 - 1/1
Stack Particulate Matter					
rural	TSP	1	4 mos-1 yr	on site	1/6 - 1/1
urban	TSP	1-4	4 mos-1 yr	max impact/ max conc	1/6 - 1/1

a/ In remote areas, generally one site is sufficient. In multisource situations or modifications to existing sources, more sites may be necessary.

b/ In remote areas, on site monitoring generally is satisfactory. In multisource situations or modifications to existing sources, areas of maximum impact or maximum concentrations should be monitored.

c/ 1/6 means one 24-hour sample every 6 days.

d/ 1/1 means one 24-hour sample each day.

with the exception of TSP for which continuous Reference or Equivalent Methods do not exist. For TSP, samples must be taken in accordance with the Reference Method.* Appendix D lists the accepted Reference and Equivalent monitoring methods published by EPA.

With respect to frequency of sampling, continuous analyzers must be used for SO_2, CO, NO_2, O_3, and meteorological parameters. Thus, continuous sampling (over the time period determined necessary) is required. For TSP, daily sampling (i.e., one sample every 24 hours) is needed except in areas where the applicant can demonstrate that significant pollutant variability is not expected. In these situations, a less frequent sampling schedule may be allowed. However, a minimum of one sample every six days will be required for these areas.

2.3.3.2 Meteorological Monitoring

At least one year of meteorological data should be available for input to dispersion models used in analyzing the impact of the proposed new source on ambient air quality. In some cases, representative data are available from sources such as the National Weather Service. However, in many situations, on-site data collection may be necessary. Meteorological monitoring, as in the case of ambient air quality monitoring, must adhere to the EPA procedures in effect at the time of the monitoring and must conform to all quality assurance practices.

2.3.3.3 Quality Assurance

The owner or operator of the new source, in performing the required monitoring, must adhere to EPA's quality assurance program to ensure data precision and quality.** The quality assurance program basically requires the operator of the monitoring system to: 1) demonstrate, upon

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* 40 CFR 50, August 7, 1978.

** This program is fully described in Appendix B, 40 CFR 58.

the reporting of the data, that all measurements were made within acceptable control conditions, and 2) provide, via an independent auditor, an assessment of the resulting data for precision and accuracy.

2.3.3.4 Data Reporting

The recorded air quality and meteorological data must be reported to the permit granting authority at the time of the permit application but can be reported every three months during the monitoring program. However, the actual reporting frequency should be based on an agreement between the applicant and the permit granting authority.

The applicant should submit summaries of the air quality and meteorological data in a form compatible with the applicable averaging times of the increments and NAAQS. As an example, the following format is considered adequate for reporting recorded SO_2 data: a frequency distribution of three-hour and 24-hour values, monthly arithmetic means, and the arithmetic mean for the entire sampling period, along with the number of one-hour observations recorded. In addition, all raw air quality data (e.g., one-hour values for continuous analyzers, 24-hour values for TSP) should be submitted in hard copy. The quality assurance data, including precision and accuracy calculations, should be submitted for each site along with the summarized air quality data.

2.3.4 Use of Existing Air Quality Data or Meteorological Data

If existing monitoring data are shown to represent the area under consideration and concur with appropriate criteria, the data can be used to meet the pre-construction monitoring requirements. Such data may comprise the following.

1. Data collected by a state or local air pollution control agency.

2. Air quality data collected by a source under PSD requirements provided the data are no older than two years at the time of permit application and are considered representative of current conditions. However, data older than two years may be used if it is updated by the use of models.

3. TSP data being collected by a state agency or local agency may be used if it is supplemented when necessary by new monitoring if sufficient sampling is not being conducted.

4. Meteorological data collected by the National Weather Service or by a source under PSD requirements.

Existing data used in these instances do not have to meet the quality assurance requirements previously discussed. Nevertheless, until the SLAMS and NAMS networks are in operation, the permit granting authority must decide if "historical" data are valid for determining the air quality status of a particular area.

2.4 AMBIENT AIR MONITORING IN CALIFORNIA

2.4.1 Public and Private Agencies Involved in Ambient Air Monitoring

Federal, state, and private agencies all are involved in ambient air monitoring in California. Government agencies concerned with the protection and monitoring of ambient air quality standards are the Region IX EPA Office, the California Air Resources Board (CARB), and the local Air Pollution Control Districts (APCD's). Private companies concerned with local ambient air quality include the various oil companies involved in EOR operations and/or their contractors involved in monitoring.

The regional EPA office is responsible for reviewing programs designed to protect NAAQS. The regional EPA office is not directly in charge of any monitoring activity. EPA receives quarterly data reports from key SLAMS also serving as NAMS for use in trends analyses.

The CARB overviews the maintenance of Federal and State Air Quality Regulations. CARB's functions include promulgating state standards, reviewing air programs and expenditures, coordinating APCD activities, and implementing certain monitoring programs. The monitoring network implemented by CARB is designed to assess statewide air quality status with respect to Federal and State AAQS. In addition to directly-run monitors, CARB also receives data from APCD-run networks. Based on data received from the available monitoring network, the agency may assess trends in statewide air quality and may propose model rules and regulations.

The local APCD's adopt and enforce rules and regulations promulgated by the local agency or CARB. In California, the APCD's are the key agencies responsible for insuring attainment/maintenance of all AAQS. Individual APCD's operate and maintain separate monitoring networks to establish the air quality status for their respective region and to satisfy SLAMS requirements. In general, each APCD encompasses a county within California. Table 2-5 lists the APCD's and their regional offices.

Finally, certain private groups operate air monitoring equipment in California, primarily in support of new source permit information. Such groups include the various oil companies involved in EOR activities (e.g., Belridge Oil and Getty Oil) and/or their contractors (e.g., Science Applications, Inc.).

2.4.2 California New Source Permit Requirements

The intent behind New Source permitting is to provide responsible regulating agencies sufficient information to: 1) determine whether the applicable facility will significantly affect ambient air quality, and 2) to demonstrate that sufficient controls will be employed at the facility in order to insure the attainment/maintenance of all state and Federal ambient air quality standards. Ambient air quality data is a

TABLE 2-5

LIST OF CALIFORNIA APCD'S

- Great Basin Valley Air Basin
  - Great Basin Unified APCD
- Lake County Air Basin
  - Lake County APCD
- Lake Tahoe Air Basin
  - El Dorado County APCD
  - Placer County APCD
- Mountain Counties Air Basin
  - Amador County APCD
  - Calveras County APCD
  - El Dorado County APCD
  - Mariposa County APCD
  - Nevada County APCD
  - Placer County APCD
  - Plumas County APCD
  - Sierra County APCD
  - Tuclumne County APCD
- North Central Coast Air Basin
  - Monterey Bay Unified APCD
- North Coast Air Basin
  - Del Norte County APCD
  - Humboldt County APCD
  - Mendocino County APCD
  - Northern Sonoma County APCD
  - Trinity County APCD
- Northeast Plateau Air Basin
  - Lassen County APCD
  - Modoc County APCD

Northeast Plateau Air Basin (Cont.)

  - Shasta County APCD
  - Siskiyou County APCD
- Sacramento Valley Air Basin
  - Butte County APCD
  - Colusa County APCD
  - Glenn County APCD
  - Sacramento County APCD
  - Shasta County APCD
  - Sutter County APCD
  - Tehama County APCD
  - Yolo-Solano County APCD
  - Yuba County APCD
- San Diego Air Basin
  - San Diego County APCD
- San Francisco Bay Area Air Basin
  - Bay Area APCD
- San Joaquin Valley Air Basn
  - Fresno County APCD
  - Kern County APCD
  - Kings County APCD
  - Madera County APCD
  - Merced County APCD
  - San Joaquin County APCD
  - Stanislaus County APCD
  - Tulare County APCD
- South Central Coast Air Basin
  - San Luis Obispo County APCD

TABLE 2-5 (Continued)

South Central Coast Air Basin (Cont.)

- Santa Barbara County APCD
- Ventura County APCD

- South Coast Air Basin
  - South Coast AQMD
- Southeast Desert Air Basin
  - Imperial County APCD
  - Kern County APCD
  - Los Angeles County APCD
  - Riverside County APCD
  - San Bernardino County APCD

critical component of the first item, i.e., the air quality impact analysis.

Air quality impact analysis is composed of two elements: 1) monitoring data to provide information on current (baseline) air quality; and 2) atmospheric dispersion modeling utilizing baseline monitoring data to predict maximum plant impact on ambient air quality. Atmospheric dispersion models usually are computer-run and may be selected from several "agency-approved" models (prior to using such models in an impact analysis, the applicant should consult appropriate reviewing agencies on the model's suitibility.) Ambient air quality data, including meteorological data, may be obtained from existing monitoring sites (if suitable) or a new monitoring network (see Sec. 2.3.4 for a list of acceptable data).

Monitoring requirements ultimately are determined by the permit granting authority. Presently the EPA reviews permits, but the local APCD will become the permit review agency upon revision of the California SIP. Monitoring data for Federal and/or State promulgated pollutants may be required by a reviewing agency. In addition to the seven criteria pollutants assigned NAAQS, California has promulgated ambient standards for sulfates ($SO_4^{=}$), hydrogen sulfide (H_2S), and ethylene (C_2H_4). The National and California AAQS and their averaging times are given in Appendix B.

2.4.2.1 Sources Covered, Agencies Involved

An owner/operator of a new or modified facility must apply for a construction (and/or operation) permit from the Region IX EPA Office. EPA will continue to issue permits until the California SIP is revised, making the local APCD the sole permit granting authority. Presently the EPA tries to cooperate as closely as possible with local APCD's when determining an applicant's eligibility.

All sources are covered by local permit regulations and must submit an application, regardless of size. So-called major emitting facilities, however, must submit substantial additional permit information in their applications under New Source Review (NSR) procedures. Table 2-6 lists local APCD criteria defining major emitting facilities subject to NSR for the major EOR producing counties.

2.4.2.2 Information Required

Appendix B enumerates the information required under both regional EPA and local APCD permit processes. The Region IX EPA permit process is based on PSD procedures outlined in the CAA and subsequent rules. The local APCD permit information is based on CARB's "List and Criteria". Major emitting facilities must submit additional information over that required from non-major sources.

Pre-application meetings should be held with each responsible agency to clarify authority, information responsibility, data requirements, and procedures to prevent permit delays.

2.4.2.3 Monitoring Requirements Affecting EOR Development

An owner/operator of a new EOR facility is subject to all permit requirements previously discussed. The applicant must file an application with the Federal and local permitting agency and assess the potential impact of source on existing air quality. Federal regulations (40 CFR, August 1978) stipulate that an adequate impact analysis should contain monitoring data for at least one full year; however, in special cases, (usually interpreted as a minimum of four months) data gathered over a representative portion of the year may be judged sufficient.* It is the

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* Data should be collected for monitoring programs conducted for at least one year prior to the submission of the application to construct. However, under some circumstances, less than one year of air quality data may be acceptable. This will vary (continued on 2-25)

TABLE 2-6

POLLUTANT LIMITATIONS TO DETERMINE APPLICANTS SUBJECT TO NSR IN CALIFORNIA*

	Pollutant				
	TSP, SO_2, NO_x, HC, Pb, H_2S, C_2H_4		CO		
County	lbs/hr	lbs/day	lbs/hr	lbs/yr	Comments
Kern	15	--	150	--	
Monterey	25	250	250	2500	
Fresno	20.2	202.0	202	2204.6	Precursors to pollutants limited to 20.2 lb/hr or 202 lb/day
Orange	25	250	150	1500	
Los Angeles	25	250	150	1500	
Santa Barbara	10	--	100	--	

* Unless it can be determined that the new source will not interfere with Federal or State ambient air quality standards for that contaminant.

responsibility of the applicant to provide adequate monitoring data and perform an impact analysis. To do this, the applicant may monitor or choose to use existing monitoring data and model the expected impact the source will have after commencing operation.

Thermal TEOR recovery operations are a significant potential source of sulfur dioxide (SO_2), nitrogen oxides (NO_2), and particulates (assuming clustering of boilers). Most pollutants are emitted from the crude oil-fired steam generators; only trace amounts of hydrocarbons and carbon monoxide are emitted from this source, however. Additional particulate emissions and some hydrocarbons evolve from respective fugitive sources, such as unpaved roadways and uncontrolled oil pipeline vents. In most cases, except for NO_x emissions, control strategies are available to significantly reduce pollutant emissions. For NO_x, control strategies exist but are not yet commonly employed.

When applying for a construction/operation permit, new source applicants traditionally supply monitoring and/or modeling data on SO_2, particulates, and meteorology. Depending on the attainment status of the area and/or on the prevailing regulatory posture on oxidant control, new source applicants may also collect monitoring data on HC and NO_x. In most cases, the responsible regulatory agency attempts to use existing data, often that which is recorded by stations run by the agency itself. When

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according to the pollutant being studied. For TSP, SO_2, CO, and NO_2 monitoring, less than a full year will be acceptable if the applicant demonstrates through historical data that the data are obtained during a time period where maximum air quality levels can be expected. A minimum of four months will be required. Monitoring for ozone will be required for those months in which the average daily maximum temperatures exceed 20°C (68°F) in the area under study, or for the four months of the year with the warmest average maximum temperatures for areas where there are not at least four months with average maximum temperatures greater than 20°C (68°F).

new monitoring data may be needed, it is the responsibility of the permit applicant to establish the network and collect the data.

Information regarding existing monitoring data usefulness and sponsorship of networks is discussed in the following two major sections. It is the intent of these sections (i.e., the inventory of existing networks and their adequacy) to present a more complete picture of monitoring activity in the various TEOR operation areas.

2.0 GENERAL REFERENCE SOURCES

- Environmental Protection Agency, "1977 Clean Air Act, Prevention of Significant Air Quality Deterioration," Rules and Regulations, Federal Register, Vol. 43, No. 118, June 19, 1978.
- Bureau of National Affairs, "EPA's Proposed Regulatory Revisions for Air Quality Surveillance," Data Reporting, Environmental Reporter, 43 FR 34892, August 7, 1978.
- Environmental Protection Agency, Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), EPA-450/2-78-019, May, 1978.
- California Air Resources Board, Public Hearing to Consider Adoption of a Regulation Controlling Emissions of Sulfur Compound from Steam Generators in Kern County, February 21, 1979. CARB Staff Report 79-7-1.
- California Air Resources Board, Model New Source Review Rules, February 16, 1979.
- California Air Resources Board, Consideration of A Proposed Model Rule for Control Emissions of Sulfur Oxides and Oxides of Nitrogen From Steam Generators in the San Joaquin Valley Air Basin, March 24, 1978, Report Agenda No. 78-7-2.
- California Air Resources Board, Report of Applications for Additional Steam Generators in Kern County, January 24, 1978, Report No. 78-1-4.
- Monterey Bay Unified Air Pollution Control Districts, "Ambient Air Monitoring Locations in 1977," November, 1978.

2.1 TELEPHONE COMMUNICATION WITH AIR QUALITY MONITORING PERSONNEL

- Fresno Air Pollution Control District. Gordon Turl.
- Kern County Air Pollution Control District. Tom Paxson.
- Monterey Air Pollution Control District. Fred Thoits.
- Santa Barbara Air Pollution Control District. Keith Doval.
- South Coast Air Quality Management District. Bill Holland.

3. INVENTORY OF AIR QUALITY MONITORING ACTIVITIES IN CALIFORNIA

This section discusses an inventory of air quality monitoring activities for areas of California where thermal enhanced oil recovery (EOR) is either practiced or planned. Appendix A presents tables covering Kern, Monterey, Fresno, Los Angeles, Orange, and Santa Barbara Counties in California. The inventory describes the current status of respective monitoring programs in these counties. Each table indicates the operator/ sponsor of individual monitoring stations, the location of monitoring sites, the pollutants monitored, the measurement methods used, and the duration of monitoring activity.

The inventory represents all private and public agencies sponsoring relevant monitoring activities. Important temporary stations also are noted on the inventory. However, all major monitoring stations (including those discontinued after 1974 and before 1978) for the 6 counties are given in a separate table (Table XV). Most temporary satellite stations are not reported in the inventory.

3.1 PURPOSE OF THE AIR QUALITY MONITORING NETWORKS

Most air quality monitoring conducted by CARB and the County APCD's is for general air quality surveillance to satisfy State and Federal requirements.* Oil companies usually operate and sponsor air monitors to

* The regional EPA requires CARB and the local APCD to submit data reports for stations designated by EPA as NAMS. NAMS are not noted as such in this inventory.

satisfy permit conditions. Some temporary monitors are operated to investigate specific air quality questions. For example, in Santa Barbara County, the Environmental Research Foundation (ERF) is monitoring to study the air quality impact of high-sulfur fuel combustion (see Tables XIII and XIV).

3.2 AVAILABILITY OF MONITORING DATA

There are several forms of documentation of the air quality data collected at the listed monitoring sites: (1) EPA's annual reports of national ambient air monitoring systems;* (2) state and local agency reports, and (3) published reports of private operators or sponsors. Generally, the CARB quarterly reports serve as the most complete source of published monitoring data in California. The CARB also publishes an annual summary of air quality data. EPA and other private and public agencies normally publish only a fraction of the air quality data available, since their functions and scope of responsibility differ.

Because of the dynamic nature of many monitoring operations, new stations are continually being established while others are closed after their particular purpose is fulfilled; it is difficult to keep abreast of the current status of monitoring stations. Consequently, a considerable amount of communication with monitoring personnel was necessary to determine the status of stations. For the most part, the local APCD served as the most knowledgeable source on this subject, since they track private and public monitoring networks (for permitting purposes and to determine ambient air quality status, respectively) in their jurisdiction.

* See 43 Fed. Reg., 34892 (August 7, 1978) for a description of the recently proposed (revised) national air monitoring system.

Most difficulties in compiling data for the air quality monitoring inventory are related to the fact that no single personal communication or general reference source provided all the complete and current information for any one item, i.e., location, sponsor, etc. Information about the specific analytic procedures used to measure pollutants at monitoring stations was particularly difficult to obtain since many monitoring stations in southern California are being converted from conventional "wet" chemical methods to more precise chemiluminescence and chemical methods.

3.2.1 Review Process

To ensure that the data presented in the tables were correct and up to date, a preliminary inventory was prepared and sent in November 1978 for review by all parties concerned with EOR activities in California. Table 3-1 lists the companies and agencies requested to review the draft document and submit any corrections, deletions, and additions to the data in the draft. In addition, comments were solicited regarding the adequacy and format of the draft and any other pertinent data, including purpose of station and plans for future stations. The tables in the preliminary draft were structured as they appear in Appendix A. Known data gaps were clearly indicated on the draft with question marks. The review period lasted approximately 17 days.

Many helpful responses were received from CARB (Sacramento Office), the SCAQMD, the Monterey APCD, the Santa Barbara APCD, Getty Oil Co., Chevron Oil Co., Belridge Oil Co., and Shell Oil Co. (through SAI). CARB and the APCD's comments were varied. Both agencies made corrections on the draft pertaining to outdated sampling methods listed. For example, in Los Angeles and Orange Counties, many of the O_x monitoring stations previously incorporating the potassium iodide (KI) or wet chemical sampling method now monitor with ultraviolet photometric (UP) equipment. Similar corrections on method changes were given for many SO_2 and NO_x (NO_2/NO)

TABLE 3-1

COMPANIES AND AGENCIES REQUESTED TO REVIEW THE DRAFT DOCUMENT

- Oil Companies
  - Belridge Oil Co.
  - Shell Oil Co.
  - Aminoil USA, Inc.
  - Getty Oil Co.
  - Circle Oil Co.
  - Conoco
  - Chevron Oil Co.
  - Exxon Oil Co.
  - Gulf Oil Co.
  - Chanslor-Western Oil & Development
  - Arco Oil Co.
  - Occidental Petroleum
  - McCullock Oil Co.
  - Sun Oil Co.
  - Tenneco Oil Co.
  - Mobil Oil Co.
  - Texaco Oil Co.
  - Union Oil Co.
  - Husky Oil Co.
  - General Crude
  - The Western Oil and Gas Association
- Private Agencies
  - Science Applications, Inc.
  - Environmental Research Foundation
- Governmental Agencies
  - U.S. DOE, Oakland Office
  - The EPA, Regional IX Office
  - The California Air Resources Board
  - Kern County APCD
  - Fresno County APCD
  - Santa Barbara APCD
  - Monterey Bay Unified APCD
  - South Coast Air Quality Management District

Other comments received during the review are summarized below:

- The CARB noted that when particulates are man-made, the Coefficient of Haze (COH) and TSP measurements appear to correlate well enough to use the AISI tape sampler as an indicator of TSP levels. An AISI tape sampler is used to measure Coefficient of Haze (COH).

- Belridge Oil Co. informed us of the company's plans to install TSP, SO_2, NO_x, and HC monitors in Kern County to meet anticipated permitting requirements accompanying the company's planned growth in that area. (The costs for equipment, installation, and labor to operate their station are given in Appendix C.)

- The Getty Oil Company commented that they plan to install two new monitors in the Kern fields--a CO and a MET sampler to measure turbulence (TURB).

- CARB and APCD's corrected much of the data relating to new, discontinued and satellite stations, and the duration of current stations and their locations.

3.2.2 Adequacy of the Inventory

Data solicited from appropriate parties were provided or discussed. The inventory, therefore, is believed to represent a genuinely comprehensive survey of present monitoring activities in Kern, Monterey, Fresno, Orange, Los Angeles, and Santa Barbara Counties.

3.0 GENERAL REFERENCE SOURCES

- Environmental Protection Agency. Directory of Air Quality Monitoring Sites Active in 1976.
- California Air Resources Board. California Air Quality Data: Summary of 1977 Air Quality Data, Gaseous and Particulate Pollutants.
- California Air Resources Board. Consideration of a Proposed Model Rule for Control of Sulfur Oxides and Oxides of Nitrogen from Steam Generators in the San Joaquin Valley Air Basin. April 26, 1978.
- Fresno County Air Pollution Control Districts. "Fresno County Air Pollution Control District Stations."
- Monterey Bay Unified Air Pollution Control District. "Ambient Air Monitoring Locations in 1977."
- Santa Barbara County Air Pollution Control District. "Air Monitoring Activity in Santa Barbara County."
- South Coast Air Quality Management District. Air Quality and Meteorology: 1976 Annual Report.
- Science Applications, Inc. Air Quality Impact of Proposed Oil-Fired Equipment in the Western Kern County Oil Fields Through Year End 1978. April 1977.
- Getty Oil Company at the Kern River Oil Field. "Air Monitoring Instrumentation."

3.1 PERSONAL COMMUNICATION WITH AIR QUALITY MONITORING PERSONNEL

3.1.1 Personal Visits

- California Air Resources Board. Allan Goodley, Frank Chester, Fred Graham, Kingsley Macomber. Sacramento, CA. October 24, 1978.
- Environmental Protection Agency (Region IX). Lloyd Kostow, Dana Becker, Coe Owens. San Francisco, CA. October 23, 1978.

- Getty Oil Company. George Schwartz, Ed Webster, Bakersfield, CA. October 25, 1978.

- Kern County Air Pollution Control District. Citron Toy. Bakersfield, CA. October 25, 1978.

- Science Applications, Inc. Ruth Sheridan. La Jolla, CA. October 26, 1978.

- Western Oil and Gas Association. Brett Braden (Chanslor Western Oil and Development Co.), Gary Walthall (Union Oil Co.), Duane Heeren (Getty Oil Co.), Don Shoemberger (Texaco, Inc.), J.D. Worsham II (Sun Oil Co.), Les Clark (Belridge Oil Co.), and representatives from several other oil companies. Santa Fe Springs, CA. October 27, 1978.

3.1.2 Telephone Communication

- Aerovironment (representing Circle Oil Co.). Mike Chan. Pasadena, CA.

- California Air Resources Board. Dick Lenquist. Sacramento, CA.

- Chevron Oil Co. Bruce Beyart. San Francisco, CA.

- Getty. Ed Webster and Craig Jackson. Bakersfield, CA.

- Kern County Air Pollution Control District. Larry Landis. Bakersfield, CA.

- Monterey Bay Unified Air Pollution Control District. Harold Hillman. Salinas, CA.

- Santa Barbara Air Pollution Control District. Ted Stathackis. Santa Barbara, CA.

- South Coast Air Quality Management District. Bill Holland, Julian Toon. Los Angeles, CA.

- Science Applications, Inc. Dave Ferriera. La Jolla, CA.

- Shell Oil Co. Daryl Gunderson.

- Texaco, Inc. Unidentified operator at San Ardo oil field.

- Mobil Oil Co. Bill Ditman, Mr. Abshier. Pasa Robles, CA.

4. PRESENT AND FUTURE ADEQUACY OF EOR MONITORING ACTIVITY

4.1 DETERMINANTS BEHIND IMPLEMENTING A MONITORING NETWORK

EOR operators in California are confronted by several factors that may influence the decision to sponsor a private monitoring network; in addition to regulatory demands, these include: (1) the presence and suitability of existing monitoring data collected by state and Federal agencies; (2) the air quality status of the region in question; (3) the ability of an existing monitoring network to provide data useful in predicting trends in the region, and (4) a motivation to resolve questions on the quality or implications of data collected by an existing monitoring network.

With respect to an existing monitoring network, its suitability for air impact analyses is influenced by such items as the method employed, i.e., continuous methods are only useful only in permit application information; the extensiveness of the network, i.e., whether it monitors all pollutants in key areas; and the purpose of the existing network, i.e., the network may focus on population areas rather than on oil production fields. For the state or Federal agency monitoring in an EOR production area, the size of the network is limited by cost and its own regulatory priorities.* In certain cases, these priorities do not include collecting data the EOR operators need for obtaining permits. Nevertheless, EPA and the local APCD's recognize that monitoring is costly; consequently, these agencies consistently allow use of existing data as much as possible for determining ambient impact analyses. Only when absolutely necessary is new monitoring required for permitting purposes.

* It has been noted that Proposition 13 may have some effect on the size of monitoring networks run by state agencies.

The second key factor influencing a monitoring decision is the status of ambient air quality in the region. If a given region is complying with one or more ambient pollutant standards (for all averaging times) then the EOR producer anticipating expansion is interested in the so-called pollution "carrying capacity" of the field (i.e., the margin of ambient pollution available before ambient standards are violated). Conversely, if a given region is considered "nonattainment" with respect to one or more standards, the EOR producer may be interested in determining areas where violations are not occurring (so-called "clean" pockets). In both cases, an existing public agency-sponsored network may not be adequate for addressing these questions and the EOR producer may desire to implement a limited network.

The third key factor influencing a monitoring decision is the ability to predict air quality trends. Monitoring for trends analysis is quite similar to monitoring to determine air quality status; trends analysis, however, requires greater station permanence, since it is important to collect data over several years. In most cases, only state or Federal agencies implement long-standing networks, although such networks may not extend over the areas of interest to EOR producers.

Finally, the EOR producer may be interested in resolving air quality issues posed by local regulatory agencies. Such issues rarely are clear-cut and, in most cases, the resolutions are sought jointly by the producers and agencies. An example of such an issue is a question concerning the ambient air quality of a particular region. In this case, the CARB may declare a region nonattainment based on modeling or data from monitoring stations outside, but nearby, the region in question. The affected EOR producer may feel that such data are nonrepresentative and thus implement a small network (perhaps one monitor) to ascertain or dispute this determination. (Siting of this station likely would receive guidance from the local APCD and CARB.) In a similar situation, the EOR

producer may feel that recorded violations in a particular region are not attributable to his sources and may thus establish a network to determine the origin of the violations. As mentioned, resolutions of these and similar issues usually are sought through cooperation of both parties.

The above-mentioned issues summarize the key considerations which should influence implementing a privately-sponsored network. Traditionally, however, the EOR producer in California has been sensitive to only one factor--the authority of the local regulatory agency to require additional monitoring. If that agency does not request monitoring by the source applicant, then no further monitoring is implemented. Rarely have other issues influenced a decision to sponsor a private network.

The following sections assess the existing EOR monitoring networks in terms of their present (and recent past) usefulness and future needs. The section on present assessment concentrates on the ability of the existing networks to supply suitable air quality data for permit impact analyses. The section on future needs similarly assesses the networks' ability to supply new source permit data and also considers their adequacy in terms of the other issues mentioned in this section.

4.2 PRESENT ASSESSMENT

Table 4-1 summarizes the number and status of air quality monitoring stations in the major EOR producing counties in California. This table is based on the monitoring inventory tables contained in Appendix A and represents all publicly and privately owned stations. However, it should be noted that this table indicates more than just the monitors present in the production fields themselves, since county-wide monitoring has been included if applicable.

TABLE 4-1

TOTAL MAJOR MONITORING STATIONS IN CALIFORNIA FOR COUNTIES RELEVANT TO EOR PRODUCTION

POLLUTANTS	LOS ANGELES	KERN	SANTA BARBARA	ORANGE	FRESNO	MONTEREY	TOTAL
SO_2	15(7)[c]	17(1)[a]	8(4)[b](1)[c]	6	2	(1)[a]	48(2)[a](4)[b](8)[c]
TSP	10(4)[c]	11(1)[a]	8(2)[b]	7(1)[c]	5(1)[c]	2	43(1)[a](2)[b](6)[c]
O_x	15(7)[c]	3(1)[a]	5(1)[b]	7(1)[c]	9(2)[c]	3(1)[c]	42(1)[a](1)[b](11)[c]
NO_x	15(7)[c]	3(1)[a]	3(1)[b]	3	3	2	29(1)[a](1)[b](7)[c]
CO	15(7)[c]	1(1)[a]	2	6(1)[c]	7(1)[c]	2	33(1)[a](9)[c]
HC	15(7)[c]	3(1)[a]	3(1)[b]	2	2	2(1)[c]	27(1)[a](1)[b](8)[c]
MET	15(7)[c]	10(1)[a]	11(4)[b]	7(1)[c]	1	2	46(1)[a](4)[b](8)[c]
COH	13(7)[c]	1	2	3	7(1)[c]	2	28(8)[c]
SO_4	-	8	5(1)[b]	-	-	1	14(1)[b]
H_2S	-	-	1(1)[b]	-	-	-	1(1)[b]
TOTAL	113(53)[c]	57(7)[a]	49(15)[b](1)[c]	41	36(5)[c]	16(1)[a](2)[c]	311(8)[a](15)[b](65)[c]

( )[a] Number of stations in planning phase.
( )[b] Number of temporary stations, included in total.
( )[c] Number of discontinued stations, included in total.

* Refer to inventory for further information.

** Total permanent monitoring stations - 223.

The adequacy of these existing monitoring networks was judged chiefly on their ability to provide sufficient data for pre-construction permit needs. In many areas, a comprehensive long-standing (2 years or more) network has been suitably located to provide EOR producers with the necessary information. Less commonly, the adequacy of a particular monitoring network has become a moot issue in cases where there is sufficient data showing that air quality is so substandard that further growth effectively is prohibited.

4.2.1 Kern County

Thermal EOR operations in Kern County accounted for approximately 79 percent (167 x 10^3 barrels/day) of California's total EOR production in 1977 (CARB Staff Report 79-7-1). Many of the major crude oil fields in Kern County currently employ thermal EOR techniques. These major fields include Midway-Sunset, Kern River, Mt. Poso, South Belridge, Kern Front, McKittrick, and Cymric. The Midway-Sunset field is the largest producing in Kern County and the fourth largest producing in the U.S. Applications for 300 EOR sources were received by the Kern County APCD last year; one hundred-fifty applications have been approved and the remaining one hundred-fifty are pending.

CARB reports indicate that Kern County's air is the state's most polluted with regard to sulfur dioxide and sulfate concentrations (Carb Staff Report 79-7-1). Recent concerns have been raised over the status of NO_2 in the Kern River Fields. Modeling efforts conducted by SAI for Getty Oil Company (1977) and other West Side Operators indicate NO_2 standards may be in jeopardy in the Midway-Sunset area; monitoring data collected by Getty Oil Company indicate that NO_2 standards are near violation in the Kern River area (CARB, March 24, 1978). Kern County also is classified as nonattainment with respect to total suspended particulates (TSP) and oxidants (O_x). Portions of the county are exceeding the Federal guidelines for HC (APCD Staff, 1979).

In light of the air quality status within Kern County, the CARB operates two monitoring facilities in the Bakersfield, or central area of the county, and two facilities in western Kern County (from 1976-1978, CARB operated 11 temporary stations in the area). Getty Oil company measures TSP, SO_2, $SO_4^=$, NO_x, HC, and MET in its McKittrick fields. In Bakersfield, Getty monitors TSP, SO_2, $SO_4^=$, NO_x, HC, and MET. North of Bakersfield, Getty monitors MET in Kern River and SO_2 in Kern Front. Northeast of Bakersfield, Getty monitors SO_2 at Kern Bluff. Chancelor-Western Oil and Development sponsors an SO_2 monitor in the Cymric oil field. In the Midway-Sunset fields, CWOD sponsors an O_x monitor in Taft and a MET and SO_2 station in Fellows. Shell measures SO_2 and MET at Mt. Poso. Belridge monitors MET and plans to establish a monitoring system at the Belridge field to record TSP, SO_2, NO_2, and O_x data. Other oil companies involved in SO_2 monitoring in the county include the Circle Oil Company (in McKittrick), Chevron Oil Company, and Teal Oil Company (in Bakersfield). Finally, the Kern County APCD operates one TSP and one $SO_4^=$ monitor in Bakersfield, and a TSP and $SO_4^=$ monitor in Taft. The Kern County APCD also operates three monitoring stations in Eastern Kern County and one in Northeastern Kern.

In summary, all major pollutants and MET are monitored by one or more stations in the Central and Western Kern area, although coverage of specific fields varies. The present monitoring network in Kern provides the most comprehensive data on air quality in the central (Kern River and Bakersfield) and western (McKittrick) area fields. This information has been sufficient for most new permit applications and for evaluating the pollution carrying capacity of these fields. Applications for the 300 proposed new sources in the area contain air quality impact analyses based on data from the present monitoring network.

Many of the private stations present in these fields were established as a requisite to operate new facilities; now, such stations monitor to

detect violations attributable to these sources. If violations occur, the facilities responsible for the violation must shut-down. The oil companies in Kern conducting post-construction compliance monitoring to satisfy permit conditions (imposed by EPA, CARB, and the Kern County APCD) are Getty, Shell, Chevron, Teal, and Circle. Other EOR operators rely heavily on the networks described above.

Although monitoring for pre-construction permit needs historically has been met by the present network, CARB contends the Kern County APCD has not enforced regulations of the state sulfate and sulfur dioxide standards (as measured by CARB). Consequently, the adequacy of existing networks to determine the true concentrations for these two pollutants has been questioned. CARB is equally concerned over the effect NO_2 concentrations are having on the oxidant level in Kern County.

4.2.2 Monterey County

Thermal EOR production is spread throughout Monterey County, although the major EOR production sites are in the San Ardo fields (31×10^3 barrels/ day in 1977).

Monterey County is classified as nonattainment with respect to oxidants and TSP. Cursory studies by the state indicate sulfate concentrations are nearing critical levels in many of the fields (Monterey APCD staff, 1979). Violations of the state hydrogen sulfide (H_2S) standard also have occurred intermittantly (Monterey APCD staff, 1979). (The Monterey APCD is in the process of establishing regulations to control this pollutant.)

As a result of Proposition 13, the Monterey public monitoring network has been drastically reduced. In 1977, the district operated 13 monitoring stations; today, only two stations are operating. Although all major pollutants are monitored, except SO_2, the county's two stations

are located in the northern populated areas of the county, approximately 50 miles from the San Ardo fields.

No monitors exist in southern Monterey County where the major EOR fields are located. Current producers obtained their operating permits before the District's rule (requiring an air quality impact analysis) was implemented in 1976. Since that date, no permits have been issued, but this situation is expected to change. Until February of this year, the District's stringent NSR rule effectively discouraged sources from locating in Monterey; operators simply could not meet the required hydrocarbon tradeoffs and strict NO_x emission limitations. Although no NO_2 violations have occurred in the county, the regulations controlling this pollutant were implemented to decrease O_x levels. However, CARB's newly proposed NSR modifications allow facilities that emit both NO_x and HC to control HC rather than NO_x as an oxidant abatement strategy. Consequently, if EOR producers agree to perform HC offsets, they may be able to locate new sources in Monterey.

4.2.3 Los Angeles and Orange Counties

Los Angeles and Orange Counties comprise the fourth largest EOR-yielding area in California (about 13×10^3 barrels/day). The major fields in these counties are Inglewood and Wilmington (in Los Angeles County), and Brea-Olinda (in Orange County).

All state and most Federal AAQS have been violated in this region. Only the 24-hour SO_2 NAAQS has not been exceeded. The poor air quality within the district is due largely to the geography, the weather and climate, the many stationary sources, and the innumerable mobile sources.

The South Coast Air Quality Management District (SCAQMD) operates an extensive ambient monitoring network in Los Angeles and Orange Counties. Since 1951, ambient monitoring has been conducted. The present network meets all State and Federal monitoring needs for the area.

Due to the poor regional air quality, the adequacy of the monitoring network in terms of NSR permitting is a moot issue. Because all AAQS have been exceeded in the area, no pollutant increments are available to new sources and permits to construct are difficult to obtain--an applicant must meet strict emission limitations and obtain pollutant "trade-offs." The high cost of stringent emission control and the scarcity of available trade-offs have effectively prevented most new applicants from locating in Los Angeles or Orange County. Since adoption of the District's NSR rule in 1976, no major facility has been granted a permit to construct.*

4.2.4 Santa Barbara County

Santa Barbara County has a current gross production of approximately 8 x 10^3 barrels/day (1977). The major active EOR area in Santa Barbara is the Cat Canyon Field with some sites in the Santa Maria Fields.

Santa Barbara County is divided into three air quality regions. In the southern half of the county, violations of the Federal and state CO and TSP standard have occurred. In the northeast portion of the county, where most EOR production facilties are located, oxidants and the Federal TSP standards are being violated and the available HC ambient pollution capacity near exhaustion. In this area, intermittent violations of the state H_2S standard also have been recorded, although this pollutant can be controlled easily and therefore is not generally considered a problem. Finally, in the northwest portion of the county, TSP and oxidant violations have been recorded.

The major EOR fields in Santa Barbara County are located about 10 miles southeast of the Santa Maria Valley. Monitoring stations currently servicing these fields include one APCD station measuring TSP and $SO_4^=$ in

* The recent exception is the Atlantic Richfield-Shell proposed oil tanker berth at Long Beach Harbor. This permit was approved by the South Coast AQMD.

Santa Maria Valley (S. Broadway); one CARB station measuring SO_2, O_2, and MET in Santa Maria, and three stations in Santa Maria measuring SO_2 and MET which are co-sponsored with CARB, APCD and the Environmental Monitoring Company (EMC) of Santa Maria, which represents a group of EOR operators. In addition, EMC sponsors a station in Orcott and 2 stations in Lompoc. (The Environmental Research Foundation (ERF) previously monitored at these stations.)

NO_2 monitors are nonexistant in the Santa Maria Valley. With the exception of NO_2, other major pollutants are being measured in regions close to the Cat Canyon fields (the town of Santa Maria is approximately 10 miles away). However, no monitors are located right in the Cat Canyon fields, or in proximal areas. Although Santa Barbara's monitoring networks are extensive, the majority of stations are located in the southern, populated areas, far from the Cat Canyon. However, to date these networks have been used to supply air quality information to operators seeking pre-construction permits.

In Santa Barbara, the type of oil burned in a facility may determine the need for any post-construction monitoring. In the Santa Maria Fields, operators must use less than one percent sulfur fuel to operate steam generators or be subject to special monitoring requirements. For operators required to monitor, one continuous year of SO_2 data must be collected during operation to determine the impact of the facility in question. If monitoring shows SO_2 standards are not being threatened, monitoring may be discontinued. ERF network sponsors were shown to be threatening the state SO_2 standard and, therefore, must continue to conduct monitoring. The ERF stations are temporarily closed; EMC will resume operation of these stations.

4.2.5 Fresno County

Fresno County is the fifth largest EOR-yielding county in California, producing approximately 4.5×10^3 barrels/day. The Coalinga Field is the key oil production area in Fresno. Air quality within the region is substandard with respect to oxidants, TSP, and CO. Moreover, the State and Federal SO_2 standards soon may be exceeded. Accordingly, the District's NSR rule focuses on reducing the concentrations of these pollutants.

The present monitoring network run by CARB and the Fresno APCD records all the criteria pollutants as well as limited MET data. However, the majority of these stations are not located in the vicinity of the Coalinga Oil Fields. With the exception of the APCD station in Coalinga, all monitoring stations are located 25 miles or more from the fields (the Coalinga Field station monitors O_x, NO_2, and CO). The District's network meets State and Federal needs and has provided sufficient information for NSR permits for most facilities. Only one company--Shell Oil--has been required to implement new monitoring; this monitoring was directed at assessing ambient levels of SO_2 during the operational phase of the facility. Because the monitoring showed there was little chance of SO_2 violations, the company was allowed to discontinue monitoring operations last year.

Several permits for new EOR sources are pending in Fresno. Delays in approval of these permits stem from the costliness of the HC trade-offs required to meet oxidant standards, a cost the operators feel is prohibitive.

4.3 FUTURE NEEDS

Future needs of the present monitoring networks are defined by: (1) past inadequacies needing attention; (2) the need for additional pollutants to be monitored as a result of new standards, and (3) the direct result

of enforcement measures (i.e., a greater demand being placed on monitoring data by regulatory agencies).

The focus of this section is to assess the adequacy of monitoring networks to provide data necessary to obtain new source permits. Consequently, all other concerns were considered secondary, although such concerns may be useful to the EOR producer (as discussed in the previous section). Furthermore, recommendations presented here fully account for the importance of modeling in determining the pollution carrying capacity of fields. Nevertheless, in lieu of site-specific analysis, several criteria were used to assess monitoring needs. These are presented in Table 4-2. These criteria reflect an interpretation of suggested PSD monitor siting criteria and past practices of the EOR producers. Based on this criteria and the status of existing networks, recommendations are presented in the following sections.

4.3.1 Kern County

The SO_2 standards throughout EOR regions in the county are expected to be violated within several years, according to APCD personnel. One SO_2 violation already has been recorded in Getty's Kern River fields. Since production was allowed only as long as no violations occurred, the company was required to shut down those steam generators which were responsible for the violation (about 40 percent of Getty's operations). Levels for other pollutants, such as $SO_4^=$, NO_2, and HC*, also are expected to be exhausted in the near future (HC state standard violations have been recorded in the Kern River Fields; Getty, 1977).

* The Federal Primary Standard for hydrocarbons is considered a guideline. In California, many areas use this guideline as a reference for requiring further HC emission control.

TABLE 4-2

GENERAL CRITERIA USED IN ASSESSING FUTURE NEEDS
OF EOR AIR QUALITY MONITORING NETWORKS

- TSP, SO_2 - One to three monitors (for each pollutant) are needed in individual fields, depending on growth.
- $SO_4^=$ - (a) One monitor for each field if it is a high growth area and modeling data (or other monitoring data) indicate potential for violation.

  (b) One monitor per county area if available data do not indicate potential for high $SO_4^=$ concentrations in region.
- NO_2 - One monitor per field if modeling data (or other monitoring data) indicate violations of state 1-hour or Federal annual AAQS are possible.
- O_x - One monitor per county area unless greater than a 25 mile difference exists between field and existing site; in this case, one monitor may be needed in central field area.
- MET - One monitor per county area unless EOR fields being served are separated by more than 10 miles; in this case, individual monitors in separate fields may be needed.
- HC - Approximately one monitor per field if available data indicate levels are in jeopardy.

There is a degree of uncertainty about permit monitoring requirements in Kern. The CARB is charging the Kern County APCD with being lax about enforcing state and Federal standards, particularly the state sulfur oxide standards (CARB Staff Report 79-7-1). The CARB has stated that data collected from their monitors show sulfur oxide emissions from steam generators far in excess of the permissible levels. However, the Kern APCD contends that Getty Oil Co. has been the only violator of SO_2 standards to date. It likely will be some time before the two agencies resolve this debate. However, existing and future EOR operations will need to be accompanied by a precise determination of their ambient impact. CARB predicts a 70 percent increase in oil production between 1978-1982 (CARB, 1978). Lewen & Associates predicts an 84 percent increase in production between 1978-1985 (see Table 1-1). With increased production as predicted, it is expected that present networks may need to be augmented.

In Western Kern County, the following amendments to the existing networks are recommended:

- The monitoring stations in the vicinity of the Midway-Sunset field are not adequate to meet future demands. This field, the largest in Kern County, encompasses an area of approximately 94 square miles. Lewin & Associates predict an EOR production in this field can grow as much as 240 percent by 1985.* Present monitors located in the area include an APCD station in Taft (located 2-3 miles from the Midway-Sunset field) which monitors TSP and $SO_4^=$ and a CWOD station in Taft measuring O_x. In addition, CWOD monitors SO_2 and MET in Fellows about 8 miles from Midway-Sunset. It is recommended that EOR operators in the Midway-Sunset field increase current networks to include 1-2 monitors each for TSP and for SO_2 for a total of 2-3 monitors for each pollutant in the area (monitors should be located to measure high concentration areas; modeling can aid in the analysis of location). In addition, a NO_2 monitor should be established since recent air impact analysis

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* The base case prediction assumes the marketing and emissions problems can be overcome. Lewin and Associates advanced case assumes a 240 percent increase in EOR production between 1978-1985.

(SAI, 1978) indicate NO_2 standards may be in jeopardy. Finally, because Midway-Sunset is a large field, it is advisable that a MET station also be established in Midway-Sunset field itself.

- The Belridge Oil Company plans to install a monitor for SO_2, TSP, NO_2, and HC in the North and South Belridge Oil Fields, covering an area of approximately 34 square miles. It is recommended that an $SO_4^=$ monitor also be placed in this area to service these two fields. Only MET data are being recorded in this field.

- Cymric oil field has a potential to produce twenty times its current production (Lewin and Associates). If production increases as predicted, an extensive network will be needed. The Cymric field is approximately 20 square miles. Currently, only SO_2 is monitored at Cymric. It is recommended that this field include an O_x monitor to service Cymric and the nearby McKittrick field. In addition, it is recommended that one NO_2, TSP, and one $SO_4^=$ station be established (a NO_2 monitor is recommended based on the NO_2 levels measured and/or predicted in neighboring fields having similar production characteristics). As TEOR production increases, an additional SO_2 monitor may be needed.

Kern River is the largest EOR producing field in Kern County and production is expected to grow through 1985 (see Table 1-1). The Getty Oil Co. is planning to increase its EOR production in Kern by 33×10^3 barrels/day by 1981. In addition, many other companies have applied for construction permits in Kern River. The following amendments to the existing monitoring networks are recommended for Central Kern:

- Present networks servicing Kern River include those operated by Getty Oil Co., CARB, and the county APCD. In all, these concerns operate 11 stations in the area. Getty monitors two MET stations in the field itself and operates seven SO_2 stations in the area. This includes SO_2 monitors at Kern Bluff (six miles southeast of Kern River), Producers 105 (two miles southwest of Kern River), Kern Front (six miles northwest of Kern River), Bakersfield's on La Cresta St. (four miles south of Kern River), Flower St. (six miles south of Kern River), and Manor Drive (four miles south of Kern River). CARB monitors TSP, SO_2, $SO_4^=$, and O_x in Oildale (four miles southwest of Kern River). CARB also monitors TSP, SO_2, O_x, NO_2, CO, HC, and MET in Bakersfield on Chester St. (four miles from Kern River).

Lastly, the county APCD monitors TSP and $SO_4^{=}$ in Bakersfield on Flower St. (approximately six miles from Kern River). The nearest SO_2 monitor is located in Kern Front, three miles away. In addition, the TSP, SO_2, and $SO_4^{=}$ monitors in Oildale are located about four miles away. Because of the controversy regarding TSP, SO_2, and $SO_4^{=}$ concentrations in Kern River (see Section 4.2.1), it is recommended that a minimum of one additional monitor for these pollutants be established in the Kern River Field itself. Getty's NO_2 monitor at Church St. can provide NO_2 data for the field.

- Mt. Poso is a major EOR field in California. The field, approximately 24 square miles, is located approximately 25 miles north of Bakersfield and approximately 8 miles from Kern River. Shell Oil Company sponsors 2 monitors measuring SO_2 and MET data in Mt. Poso. It is recommended that operators at Mt. Poso include monitors to measure TSP (1 monitor), $SO_4^{=}$ (1 monitor), and NO_2 (1 monitor) to accommodate anticipated future high growth. An additional SO_2 monitor may also be needed as production in this field increases.

It may be advisable to establish one high-volume sampler in locations specifically designed to measure TSP loadings from up-wind farming operations from EOR fields. The purpose of such monitors is to help determine the source(s) of fugitive TSP violations in the area.

To aid cooperation and efficiency between the producers, local APCD, and CARB, a uniform quality assurance program between network sponsors should be established in accordance with the PSD Monitoring Guidelines established by EPA. Discrepancies have been noted regarding the comparability of data obtained from the privately and agency-sponsored monitors. A uniform quality assurance program is necessary so that monitors from CARB, APCD, and private networks record comparable data.

4.3.2 Monterey County

As discussed in Section 4.2.2, the present monitoring network in Monterey is of little value to EOR producers in the San Ardo and other oil fields. The sparse monitoring network measures pollutants indigenous to population

areas in the northern portion of the county. Consequently, there are no monitoring stations in southern Monterey where EOR activities are conducted.

Production rates forecasted for the San Ardo field indicate that EOR production can double by 1985. In the event that production in Monterey does increase, or the air quality with respect to AAQS becomes questionable for any reason, minimum network for SO_2 (1-2 monitors), $SO_4^=$ (1 monitor), TSP (1 monitor), and MET (1 monitor) monitors may be needed. In addition, because Monterey is nonattainment for oxidants, one O_x monitor to service San Ardo and southern Monterey should be established.

4.3.3 Los Angeles County/Orange County

Further enhancement of the monitoring network in Los Angeles County or Orange County is unnecessary at present. The SCAQMD operates an extensive and adequate network. Both counties are classified nonattainment for all applicable standards and no "clean pockets" are available for new sources to locate. Therefore, the stringency of the nonattainment policy in this region effectively precludes expansion of present EOR operations.

4.3.4 Santa Barbara County

Several networks supply monitoring data to Cat Canyon operators. The APCD monitors TSP and $SO_4^=$ in Santa Maria, 10 miles from the Cat Canyon fields. CARB monitors SO_2, O_x and MET in Santa Maria. In addition, the EMC monitors SO_2 and MET in Santa Maria.* EMC also measures MET in Orcott (seven miles from Cat Canyon and TSP, SO_2, $SO_4^=$, and MET in Lompoc). Lompoc is approximately 16 miles from Cat Canyon. The inventory of stations servicing Cat Canyon shows that virtually no stations are located within the oil field itself.

* EMC monitors are operated in conjunction with the Santa Barbara APCD and ARB.

Lewin and Associates (1978) predict a 50 percent decline in EOR production in Cat Canyon over the next 10 years. If their predictions are correct, there may be no need to establish new monitors in the oil fields. However, because of the recent energy shortage many oil producers operating free flowing wells may employ EOR techniques in the future, provided economic controls for EOR oil are lifted. In the event that oil producers employ steam recovery, a minimum network of one monitor each for TSP, SO_2, $SO_4^=$, and MET should be established. The CARB station in Santa Maria can provide O_x data to operators in Cat Canyon.

4.3.5 Fresno County

Currently, the Coalinga oil field is one of the lowest producing of the major EOR fields, but based on a prediction of oil reserves, Lewin & Associates (1978) predicts EOR production can grow six to 20 times the current rate and become the third largest EOR production field in California. If such forecasts are correct, the monitoring network in Southern Fresno must expand to meet future permitting needs.

The Coalinga monitoring station provides air quality data for the Coalinga oil field operators. TSP, O_x, NO_2, and CO are monitored at this station (approximately three miles from the oil fields). It is recommended that one monitoring station measuring SO_2, $SO_4^=$, and MET be established in the field, to augment the present network at Coalinga.

4.0 GENERAL REFERENCE SOURCES

- California Air Resources Board, Proposed New Source Review Rules, February 16, 1979.

- California Air Resources Board, Public Hearing to Consider Adoption of a Regulation Controlling Emissions of Sulfur Compounds from Steam Generators in Kern County, February 21, 1979. CARB Staff Report 79-7-1.

- California Air Resources Board, Consideration of a Proposed Model Rule for Control of Emissions of Sulfur Oxides and Oxides of Nitrogen from Steam Generators in the San Joaquin Valley Air Basin, Released: March 24, 1978. Date for Consideration: April 26, 1978. CARB Staff Report 78-7-2.

- Environmental Protection Agency, Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD). EPA 450/2-78-019, May 1978.

- Lewin and Associates, Inc., Discussion of Thermal Oil Recovery Opportunities in California. April 10, 1978.

- Oil and Gas Journal, "Growth Marks Enhanced Oil Recovery," March 27, 1978.

- Freerer, J.L. et al. (Science Applications, Inc.) Assessment of Air Quality Impact of Proposed Chanslor and Western Oil and Development Company Steam Generators in the Coalinga Oil Field. June 2, 1977.

- Sheridan, R.S., et al. (Science Applications, Inc.). Air Quality Impact of Proposed Oil-Fired Equipment in the North Midway-Sunset Area Field Steam Generators Through Year End 1978. September 1977. Submitted to Chanslor-Western Oil and Development Company.

- Sheridan, R.S., et al. Air Quality Impact of Proposed Oil-Fired Equipment in the Western Kern County Oil Fields Through Year End 1978. April 1978. Submitted to Belridge Oil Company.

4.1 TELEPHONE COMMUNICATIONS WITH AIR QUALITY MONITORING PERSONNEL

- Fresno Air Pollution Control District. Gordon Turl.
- Kern County Air Pollution Control District. Tom Paxson.
- Monterey Air Pollution Control District. Fred Thoits.
- Santa Barbara Air Pollution Control District. Keith Doval, John English.
- South Coast Air Quality Management District. Bill Holland.
- Belridge Oil Company. Les Clark.

TABLE I

KEY TO AIR QUALITY MONITORING DATA TABLES

ANALYTIC PROCEDURES:

Pollutant	Method	Abbreviation
TSP	HiVol Gravimetric	HV
SO_2	Chemiluminescence	CH
	Conductometric	CN
	Coulometric	COU
	Flame Photometric	FP
	Pulsed Flourescence	PF
$SO_4^=$	Methyl Thymol Blue (California Air and Industrial Hygene Lab. Method #61)	AIHL
O_x	Chemiluminescence	CH
	Ultraviolet Photometric	UP
	Potassium Iodide (Coulometric)	KI
NO_x	Saltzman	SLZ
	Chemiluminescence	CH
CO	Non-Dispersive Infrared Spectroscopy	NDIR
	Gas Chromatograph Flame Ionization	GCIF
HC	Flame Ionization Detection	FI
	Gas Chromatograph Flame Ionization	GCFI
MET (Meteorological Data)	Wind Speed	WS
	Wind Direction	WD
	Temperature Variance	ΔT
	Temperature	Temp.
	Turbulance	Turb.
COH (Coefficient of Haze)/Visibility	AISI Tape Sampler	AISI
H_2S	Chemiluminescence	CH
	Pulsed Flourescence	PF
Planned Stations	Analytic Method Unknown	*

OPERATOR:
- CARB - California Air Resources Board
- APCD - Air Pollution Control District
- EMC - Environmental Monitoring Company
- SEDAB- Southeast Desert Air Basin Station
- SAI - Science Applications, Inc.

NOTES:

All pollutants except TSP are monitored continuously. 24-hour samples of TSP are taken every six days.

TABLE II

AIR QUALITY MONITORING ACTIVITY

COUNTY: KERN

OPERATOR/SPONSOR: ARB

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
BAKERSFIELD:	HV	PF	-	UP	CH	NDIR	FI	WS,WD	6/71-	COH monitored with
225 Chester Avenue	-	-	AIHL	-	-	-	-	-	6/76-	AISI
OILDALE:	HV	PF	AIHL	UP	-	-	-	-	10/77-	Daily TSP readings during winter months
101 Universe Avenue										
MCKITTRICK:	-	PF	-	-	-	-	-	-	10/3/78-	
23271 2nd Street	HV	-	AIHL	-	-	-	-	-	1/21/78-	
MCKITTRICK:	-	PF	-	-	-	-	-	WS,WD,ΔT Temp.	12/14/78-	
Belridge Oil Field										

TABLE III

AIR QUALITY MONITORING ACTIVITY

COUNTY: KERN

OPERATOR/SPONSOR: APCD

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
BAKERSFIELD:	HV	-	-	-	-	-	-	-	5/4/70-	
1700 Flower St.	-	-	AIHL	-	-	-	-	-	1/78-	
BORON:	HV	-	-	-	-	-	-	-	1/29/71-	
26965 Cote St.										
CHINA LAKE NAVAL WEAPONS CENTER:	HV	-	-	-	-	-	-	-	4/29/71-	
Near Richcrest, end of Power Line Rd.										
KERN NATIONAL WILD-LIFE REFUGE:	HV	-	AIHL	-	-	-	-	-	1/28/71-	
20 mi. W. of Delano hear Cecil Ave. & Corcoran Ave.										
MOJAVE:	HV	-	-	-	-	-	-	-	5/4/70-	
1953 Highway 58										
TAFT:	HV	-	-	-	-	-	-	-	7/24/75-	
Center St. & N. 70th Street	-	-	AIHL	-	-	-	-	-	1/78-	

TABLE IV

AIR QUALITY MONITORING ACTIVITY

COUNTY: KERN

OPERATOR/SPONSOR: GETTY

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
BAKERSFIELD, KERN COUNTY COMMUNICATIONS DEPARTMENT: 2520 Church Ave.	HV	FP	AIHL	-	CH	-	FI	WS,WD	4/76-	
BAKERSFIELD, HEALTH DEPARTMENT: 1700 Flower St.	-	FP	-	-	-	-	-	-	4/76-	
BAKERSFIELD, LA CRESTA: K.C. Fire Station La Cresta & Alta Vista Streets	-	FP	-	-	-	-	-	-	4/76-	
BAKERSFIELD: Manor Drive	-	FP	-	-	-	-	-	-	4/76-	
BAKERSFIELD, KERN BLUFF: N. County Rd. #1192	-	FP	-	-	-	-	-	-	10/76-	
BAKERSFIELD, PRODUCERS 105 OIL FIELD: Highland Fire Station	-	FP	-	-	-	-	-	-	intermittent: 1971-76 continuous: 1/76-	

TABLE IV (Continued)

AIR QUALITY MONITORING ACTIVITY

COUNTY: KERN (Continued)

OPERATOR/SPONSOR: GETTY

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
BAKERSFIELD, KERN FRONT: West of Woody Rd.	-	FP	-	-	-	-	-	-	9/76-	
MCKITTRICK:	-	FP	AIHL	-	CH	*	-	-	3/77-	Planning to install
Hwy. 33, Kern County	HV	-	-	-	-	-	-	-	2/77-	NDIR method to
Fire Station	-	-	-	-	-	-	FI	-	10/77-	monitor CO
	-	-	-	-	-	-	-	WS,WD,Turb	1/77-	
BAKERSFIELD, KERN RIVER: Sec. 25, Met Tower	-	-	-	-	-	-	-	WS,WD,Turb	12/76-2/79	Discontinued Station
								ΔT	12/76-	
BAKERSFIELD, KERN RIVER: Sec. 5, Met Tower	-	-	-	-	-	-	-	WS,WD*	5/78-	Planning to install Sigma Meter to monitor Turb.

TABLE V

AIR QUALITY MONITORING ACTIVITY

COUNTY: KERN

OPERATOR/SPONSOR: SAI/CWOD Belridge

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
S. BELRIDGE OIL FIELD:	-	-	-	-	-	-	-	WS,WD,ΔT	4/19/76-	Sponsor is Belridge Oil Co.
119^o 42' W. Long.										
35^o 27' N. Lat.	*	*		*	*					Planning to install stations in 1979
CYMRIC FIELD:	-	COU	-	-	-	-	-	-	2/11/76-	Sponsor is CWOD
119^o 41' 20" W. Long.										
35^o 22' 30" N. Lat.										
FELLOWS: Midway-Sunset	-	COU	-	-	-	-	-	WS,WD,ΔT	3/17/76-	Sponsor is CWOD
119^o 33' Long.										
35^o 11' 30" N. Lat.										
TAFT, KERN COUNTY FIRE STATION	-	-	-	UP	-	-	-	-	2/11/76-	Sponsor is CWOD
119^o 28' W. Lat.										
35^o 8' 30" N. Lat.										
MT. POSO FIELD: Township 265, Range 28E, Sec. 9	-	COU	-	-	-	-	-	WS,WD,ΔT	7/6/77-	Sponsor is Shell Oil Co.

TABLE VI

AIR QUALITY MONITORING ACTIVITY

COUNTY: KERN

OPERATOR/SPONSOR: AEROVIRONMENT/CIRCLE OIL CO., TEAL AND CHEVRON OIL COS.

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
MCKITTRICK: 1 mi. East, South East of McKittrick Town Center	-	FP	-	-	-	-	-	-	4/77-	Circle Oil Co.
RACETRACK: Rt. 1, Niles Rd.	-	FP	-	-	-	-	-	-	12/77	Teal and Chevron Oil Cos.

TABLE VII

AIR QUALITY MONITORING ACTIVITY

COUNTY: MONTEREY

OPERATOR/SPONSOR: APCD

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
SALINAS: 1270 Navidad Rd.	HV -	* -	AIHL -	- UP	 CH	NDIR -	FI -	WS,WD -	6/67- 7/78-	COH monitored with AISI Planning to install Equipment to monitor SO_2
MONTEREY: 351 Madison St.	- -	- -	 -	- UP	- - CH	NDIR -	- -	WS,WD -	4/68- 7/78- 9/78	
GONZALES: High School, 351 Madison St.	HV	-	-	UP	-	-	FI	-	4/67-6/78	COH monitored with AISI This was a long term satellite station

TABLE VIII

AIR QUALITY MONITORING ACTIVITY

COUNTY: ORANGE

OPERATOR/SPONSOR: SCAQMD

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
LA HABRA: 621 W. Lambert St.	HV	COU	-	UP	CH	NDIR	GCFI	WS,WD	1960-	COH monitored with AISI
SANTA ANA CANYON: 22201 Santa Ana Canyon Rd.	HV	FP	-	UP	-	-	-	WS,WD	1975-	
ANAHEIM: 1010 S. Harbor Blvd.	HV	COU	-	UP	SLZ	NDIR	FI	WS,WD	1957-	COH monitored with AISI
LOS ALAMITOS: 5660 Orangewood Ave.	HV	COU	-	UP	-	GCFI	-	WS,WD	3/74-	
COSTA MESA: 2631 Harbor Blvd.	HV	COU	-	UP	SLZ	NDIR	-	WS,WD	1/72-	COH monitored with AISI
EL TORO: 23022 Altoro Rd.	HV	FP	-	UP	-	GCFI	-	WS,WD	1/73-	
SAN JUAN CAPISTRANO: 32400 Paseo Adelanto	HV	-	-	UP	-	NDIR	-	WS,WD	8/73-8/78	discontinued station

TABLE IX

AIR QUALITY MONITORING ACTIVITY

COUNTY: LOS ANGELES

OPERATOR/SPONSOR: SCAQMD, SEDAB*

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
LOS ANGELES: 400 S. San Pedro	HV	CN	-	UP	SLZ	NDIR	FI	WS,WD	1/55-	COH monitored with AISI
W. LOS ANGELES: 2000 Westwood Blvd.	HV	CN	-	KI	SLZ	NDIR	FI	WS,WD	11/62-6/78	COH monitored with AISI Station relocated to Robertson Blvd. 12/77 Discontinued station
W. LOS ANGELES: 1535 S. Robertson Blvd.	HV	CN	-	KI	SLZ	NDIR	FI	WS,WD	4/78-	COH monitored with AISI
LENNOX: 11448 La Caienga Blvd.	HV	CN	-	UP	SLZ	NDIR	FI	WS,WD	2/65-	COH monitored with AISI
LONG BEACH: 3648 Long Beach Blvd.	-	CN	-	KI	SLZ	NDIR	FI	WS,WD	10/62-6/78	COH monitored with AISI discontinued station
WHITTIER: 14427 Leffingwell Rd.	-	CN	-	UP	SLZ	NDIR	FI	WS,WD	8/69 8/69/8/78	
RESEDA: 18330 Gault St.	HV	CN	-	KI	SLZ	NDIR	GCFI	WS,WD	3/65-6/78	COH monitored with AISI discontinued station
BURBANK: 228 W. Palm Ave.	-	CN	-	UP	SLZ	NDIR	FI	WS,WD	11/62-	
PASADENA: 1196 E. Walnut St.	HV	CN	-	UP	SLZ	NDIR	FI	WS,WD	5/72-	COH monitored with AISI

TABLE IX (Continued)

AIR QUALITY MONITORING ACTIVITY

COUNTY: LOS ANGELES (Continued)

OPERATOR/SPONSOR: SCAQMD, SEDAB*

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
AZUSA: 800 Loren St.	HV	CN	-	UP	SLZ	NDIR	FI	WS,WD	1/57-	COH monitored with AISI
POMONA: 924 N. Gary Ave.	-	CN	-	UP	SLZ	NDIR	FI	WS,WD	6/65-6/78	COH monitored with AISI discontinued station
PICO RIVERA: 3000 San Gabrial Pkwy.	HV	CN	-	UP	SLZ	NDIR	GCFI	WS,WD	6/76-6/78	COH monitored with AISI discontinued station
LYNWOOD: 11220 Long Beach Blvd.	HV	CN	-	KI	SLZ	NDIR	GCFI	WS,WD	10/73-6/78	COH monitored with AISI discontinued station
NEWHALL: 24811 San Fernando Road	-	CN	-	UP	SLZ	NDIR	FI	WS,WD	10/69-6/78	COH monitored with AISI discontinued station
LANCASTER:* 45547 N. Beech St.	HV	CN	-	KI	SLZ	NDIR	FI	WS,WD	6/70-	COH monitored with AISI SEDAB

TABLE X

AIR QUALITY MONITORING ACTIVITY

COUNTY: SANTA BARBARA

OPERATOR/SPONSOR: ARB

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
SANTA BARBARA: 4400 Cathedral Oaks Road	-	-	-	UP	-	-	-	-	10/73-	
SANTA BARBARA: 831 State Street	HV	PF	AIHL	UP	CH	NDIR	FI	WS,WD	2/72-	COH monitor with AISI SO_2 monitoring is temporary
SANTA MARIA: 705 E. Main Street	-	PF	-	UP	-	-	-	WS,WD	10/75-	COH monitor with AISI

TABLE XI

AIR QUALITY MONITORING ACTIVITY

COUNTY: SANTA BARBARA

OPERATOR/SPONSOR: APCD

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
CARPINTERIA: 911 Walnut St.	HV	-	-	-	-	-	-	-	11/30/73-	
EL CAPITAN STATE PARK:	HV	CH	-	UP	CH	-	FI	WS,WD	6/1/78-	Temporary station
GOLETA: 380 N. Fairview	HV	CH	-	UP	CH	GCFI	GCFI	WS,WD,ΔT	4/2/75-	
LOMPOC: 115 S. G St.	HV	-	-	-	-	-	-	WS,WD	11/1/73-	Operated in conjunction with ERF
SANTE YNEZ:	HV	-	AIHL	-	-	-	-	WS,WD	4/1/74-	SO_2 monitoring is recently discontinued.
SANTA MARIA: 420 S. Broadway	HV	-	AIHL	-	-	-	-	-	8/25/75-	Temporary station

TABLE XII

AIR QUALITY MONITORING ACTIVITY

COUNTY: SANTA BARBARA

OPERATOR/SPONSOR: EMC

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
LOMPOC: 115 South G St.	HV	CH	AIHL	-	-	-	-	WS,WD	11/1/73-	Operated in conjunction with APCD
LOMPOC: Jalama Road	-	CH	AIHL	-	-	-	-	WS,WD	7/78-	
SANTA MARIA: 2076 Briarwood	-	CH	-	-	-	-	-	WS,WD	8/1/78-	Temporary station
SANTA MARIA: Lake Marie Valley Club	-	CH	-	-	-	-	-	WS,WD	3/23/79-	H_2S monitored by chemiluminescence Temporary station
ORCUTT: Orcutt Hill	-	-	-	-	-	-	-	WS,WD,ΔT	3/1/79-	Temporary station

TABLE XIII

AIR QUALITY MONITORING ACTIVITY

COUNTY: FRESNO

OPERATOR/SPONSOR: APCD

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
CALIFORNIA STATE U.: N. Maple & E. Shaw Ave.	HV	-	-	UP	-	NDIR	-	-	7/78-	COH monitored with AISI
COALINGA: 3000 W. Cherry Ln.	HV	-	-	UP	CH	NDIR	-	-	4/76-	COH monitored with AISI
FRESNO: 1246 L Street	-	-	-	UP	CH	GCFI	GCFI	-	11/76-	COH monitored with AISI
FIVE-POINTS: 17299 W. Oakland	HV	COU	-	UP	-	NDIR	-	-	12/71-	COH monitored with AISI
PARLIER: 9240 S. River Bend	HV	-	-	UP	-	NDIR	-	-	12/76-7/78	COH monitored with AISI discontinued station
SHAVER LAKE: Division 11 County Maintenance Yard	-	-	-	UP	-	NDIR	-	-	12/76-	COH monitored with AISI

TABLE XIV

AIR QUALITY MONITORING ACTIVITY

COUNTY: FRESNO

OPERATOR/SPONSOR: ARB

Pollutants Monitored and the Analytic Method

LOCATION	TSP	SO_2	$SO_4^=$	O_x	NO_x	CO	HC	MET	DURATION	COMMENTS
FRESNO: Olive Street	HV	PF	-	UP	CH	NDIR	FI	WS,WD	9/19/74-	COH monitored with AISI
FRESNO: Sunnyside Country Club	-	-	-	UP	-	-	-	-	5/30/78-	
CLINGAN'S JUNCTION: 5 mi. east of Squaw Valley	-	-	-	UP	-	-	-	-	5/6/76-12/19/78	Discontinued station

TABLE XV

MAJOR MONITORING STATIONS
1974-1978
(Now Discontinued)

COUNTY	LOCATION	POLLUTANTS MONITORED							
		TSP	SO_x	O_x	NO_x	CO	HC	COH	MET
Kern	Bakersfield: Fire Station	X						X	
Los Angeles	Glendale	X	X		X				
	Laguna Beach	X				X			X
	Mt. Lee			X					
	Pasedena	X	X	X	X	X	X		
	Temple City			X					
	Torrance	X	X		X				
Monterey	Carmel Valley			X					
	Salinas				X	X	X		
Fresno	Cal State	X	X	X			X		
	Fresno: Cedar St.	X	X		X	X		X	
	Fresno: Herndon St.			X					
	Fresno: Courthouse	X	X	X	X	X	X		
Santa Barbara	Santa Barbara: State St.			X	X				

State and National AAQS and Permit Procedures Applicable to EOR Facility Siting in California

CALIFORNIA AND NATIONAL
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	AVERAGING TIME	CALIFORNIA STANDARDS[a]	NATIONAL STANDARDS[b]	
		CONCENTRATION	PRIMARY	SECONDARY
Oxidant (Ozone)	1 hour	0.10 ppm ($200\ \mu g/m^3$)	$24\ \mu g/m^3$ (0.12 ppm)	Same as Primary Std.
Carbon Monoxide	12 hour	10 ppm ($11\ \mu g/m^3$)	-	
	8 hour	-	$10\ \mu g/m^3$ (9 ppm)	Same as Primary Standards
	1 hour	40 ppm ($46\ \mu g/m^3$)	$40\ \mu g/m^3$ (35 ppm)	
Nitrogen Dioxide	Annual Average	-	$100\ \mu g/m^3$	
	1 hour	0.25 ppm ($470\ \mu g/m^3$)	-	Same as Primary Standards
Sulfur Dioxide	Annual Average	-	$80\ \mu g/m^3$ (0.03 ppm)	-
	24 hour	0.05 ppm ($131\ \mu g/m^3$)[c]	$365\ \mu g/m^3$ (0.14 ppm)	-
	3 hour	-	-	$1300\ \mu g/m^3$ (0.5 ppm)
	1 hour	0.5 ppm ($1310\ \mu g/m^3$)	-	-
Suspended Particulate Matter	Annual Geometric Mean	$60\ \mu g/m^3$	$75\ \mu g/m^3$	$60\ \mu g/m^3$[d]
	24 hour	$100\ \mu g/m^3$	$260\ \mu g/m^3$	$150\ \mu g/m^3$
Sulfates	24 hour	$25\ \mu g/m^3$	-	-
Lead	30 Day Average	$1.5\ \mu g/m^3$	$1.5\ \mu g/m^3$	-
Hydrogen Sulfide	1 hour	0.03 ppm ($42\ \mu g/m^3$)	-	-
Hydrocarbons (Corrected for Methane)	3 hour (6-9 a.m.)	-	$160\ \mu g/m^3$ (0.24 ppm)[d]	Same as Primary Standards
Ethylene	8 hour	0.1 ppm	-	-
	1 hour	0.5 ppm		
Visibility Reducing	1 observation	A sufficient amount to reduce the prevailing visibility to less than 10 miles when the relative humidity is less than 70%	-	-

a/ California standards are values that are not to be equaled or exceeded.

b/ National standards, other than those based on annual averages or annual geometric means, are not to be exceeded more than once per year.

c/ At locations where the state standards for oxidant and/or suspended particulate matter are violated. Federal standards apply elsewhere.

d/ Guideline, not a standard.

THE CALIFORNIA AIR RESOURCES BOARD "LIST AND CRITERIA":
INFORMATION REQUIRED FOR PERMIT TO CONSTRUCT/OPERATE

PART A

All applications for permits (authorities) to construct new or modified air sources are subject to the requirements of this portion of the list.

I. Name

A. Business license name
Legal owner

B. Nature of business

C. Name, address, and phone number of person to contact regarding this application.

D. Schedule of construction dates and completion dates of phases for design, purchase, construction, shakedown, and compliance testing.

II. Type of Application

A. 1. Original application
2. Revised application

B. 1. New facility
2. Modification
3. Existing facility not previously permitted

III. Description and Estimated Cost of Control Equipment (show as attachment)

IV. Location of Facility (show as attachment):

A. Location

1. Street address of facility (or location as described by section, township, and range)

NOTE: The APCD-12-Rev. A may be substituted for items I, II and IVA.1 on this page.

2. Scaled and dimensioned plot plan of facility which shows and identifies the locations of:
   a) Public and private streets
   b) Property lines
   c) Existing and proposed buildings (indicate their heights)
   d) Adjacent property owners and uses
   e) Storage areas for fuel, materials, and products
   f) Basic, control, and air monitoring equipment
   g) Piping and ducts for carrying fuels, products, and possible sources of air pollutants
   h) Identify points of emissions
   i) Baseline year of monitoring complete for new or modified sources after August 1978.

V. Description of Equipment

Detailed schematic of basic equipment and control equipment and list.

1. Electric motor driven equipment and horsepower. Also list equipment driven by other prime movers such as steam or internal or external combustion engines.
2. List of vessels with capacity, dimensions, throughput, and location specified in process training.
3. List of pumps and compressors. Give manufacturer, model, type, and type of gland seal used.
4. List of burners, manufacturer, model Btu rating, mode of atomization, mode of control (manual, high-low, etc.), firing type (tangential, opposed, front, etc.), fuel type, and volumes with temperature and excess air used. (Note on fuel: Document sulfur content or grains/100 SCF.)
5. List and drawing of air pollution control equipment showing manufacturer, control efficiency, model, and type. Document horsepower of any prime movers.
6. List of automatic process control equipment and principal instrumentation.

7. Drawing and design of continuous emissions monitoring equipment with quality assurance and calibration controls proposed.

VI. Description of Operation

A. Time

Hrs/day, days/week, days/year. State season or time when plant will not be in operation (be specific and able to document).

B. Loads

Provide tabulation showing:

1. Hourly raw material usage, fuel usage, electrical usage, rate of production, rate of emission of pollutants and stack gases at maximum design capacity and at 'normal' working level with a statement of process throughput in both cases.
2. Estimated annual totals in ton/year.
   Quantify any seasonal or cyclic operations if applicable.
3. Provide particle size distribution and other pertinent physical and chemical properties of emissions.

C. Description of Operation

1. Include pressures, temperatures, (including stack temperatures) and sequences.
2. For burners provide manufacturer and model and mention excess air, fuel preheating and atomization mode, type of fuel, and type of controls used to ensure efficient combustion. When oil tanks are used, schematic with relief valve settings and vapor pressure at storage temperature.
3. Describe and quantify normal and fugitive emissions incidental to the plant and its operation under:
   a) Normal operations
   b) Breakdown process conditions

NOTE: Attach all calculation sheets and show references used. For emission calculation, use source test data or estimates shown on EPA-42 latest edition.

PART B

Part B applies in the following cases: 1) for new sources, when total emission of any pollutant exceeds limit determined by the local APCD, and 2) for modified sources, when total of existing and new emissions exceed limit determined by local APCD (see Table 3-3 of text). When a source is subject to Air Quality Impact Analysis, an applicant shall supply the following in addition to the information required in Part A.

I. Information Required for Air Quality Impact Analysis

A. Any monitoring stations that may have been installed by applicant and provide data for one year.

B. Sufficient data to perform an impact analysis from all emission points and fugitive emissions:

1. Meteorological data
2. Topographical data (USGS topographical map of your area)
3. Air quality data summary and referenced to National Ambient Air Quality Standard
4. Computer modeling data, including assumptions that were made.

II. Identify all facilities by specific location on USGS topographical map within the air basin that are legally owned or operated by the applicant and the compliance status of each.

III. Power Consumption of Facility

A. Total amount of electrical power to be consumed by the new facility or the increase in the amount of electrical power to be consumed due to the modification.

B. Percentage of electrical power provided by off-site generating facilities; identify the source of power and maximum consumption contemplated.

IV. Cargo Carriers (to and from facility if applicable)

List the frequency of visits, describe types and sizes of all cargo carriers (other than motor vehicles), identify nature of cargo, and conditions under which the cargo is transferred with emissions quantified in detail.

V. If Applicant is Applying for Trade-offs from Other Existing Sources:

A. Provide documentation and legal ownership information to determine whether adequate emission reductions will be achieved to offset the air quality impacts of the applicant's source (e.g., name and location of trade-off sources and dates when the emission trade-offs will be effective).

VI. List Proposed Mitigating Measures:

A. Air pollution control equipment installed, started, and tested.

B. Other process changes or operations utilized to reduce emissions.

C. Other comments you may wish to add to support your application.

EPA, REGION IX

PREVENTION OF SIGNIFICANT DETERIORATION

PROCEDURES AND TIME REQUIREMENTS

The following is a generalized outline of EPA's procedures and time requirements for processing an application for a Prevention of Significant Deterioration Approval to Construct (see 40 CFR 52.21). After the initial contract (usually a telephone call from the applicant to EPA regarding applicability of the regulations) the following procedures are followed:

A. Application Submittal

1. Pre-application meeting. Prior to an application being filed, a meeting between the applicant and EPA staff is often suggested in order to briefly discuss the appropriate regulations, EPA's authority under those regulations, and EPA's requirements and procedures. This meeting also provides an opportunity for the applicant to briefly discuss the specifics of his proposed project.

2. Application. See "Application Requirements" summary.

B. Application Review Procedures

1. Application Completeness

a) Upon receipt of an application, a letter acknowledging receipt will be mailed to the applicant.

b) Determination of application completeness: EPA will determine whether an application or addition to an application is complete and notify the applicant of any deficiency within thirty (30) days of receipt. Upon receipt of additional information requested by EPA, the thirty day period begins new.

c. If an application is complete, the applicant will be notified within thirty days of receipt.

2. Review of Application and Preliminary Determination

After the receipt of a complete application, EPA will review the application package and make a preliminary determination concerning the approvability of the project. The preliminary determination will be supported by the Ambient Air Quality Impact Report (AAQIR).

3. Notification

a. Applicant: When the review is completed, EPA will notify the applicant of the preliminary determination by letter with a copy of the AAQIR enclosed.

b. Appropriate agencies: At the same time, copies of the letter and AAQIR will be sent to interested agencies.

c. Public: The public will be notified of the preliminary determination by means of an announcement in a local newspaper. The public will be notified of locations where the cover letter and AAQIR can be reviewed.

d. Time period: Comments will be accepted for a thirty (30) day time period, commencing on the day of publication of the newspaper Public Notice.

e. Public hearing: If significant comments are generated during the public notice time period, EPA may decide to hold a public hearing.

4. Final Action

After the close of the Public Notice period, EPA will take final action on an application, considering any public or other governmental agency comments generated by the Public Notice. The final action must be taken within one year after receipt of a completed application. The EPA will take one of three possible final actions: approve, approve with conditions, or deny. This final action takes the form of a letter with a signed permit attached to the applicant with copies to interested agencies.

EPA, REGION IX

PREVENTION OF SIGNIFICANT DETERIORATION

APPLICATION REQUIREMENTS

An applicant for a Prevention of Significant Deterioration (PSD) Approval to Construct is required to submit information sufficient to enable EPA to determine that the proposed new source 1) will meet emission limits representative of the best available control technology; 2) will not cause any applicable ambient air quality increment to be violated, and 3) will not cause any National Ambient Air Quality Standard to be violated. The three determinations above are not required if allowable emissions from the source will be less than fifty tons per year. The following outline lists the information required by EPA for a complete PSD application. The information in parts E, F, G, and H is not required for pollutants for which allowable emissions from the source are less than fifty tons per year.

PSD Application Requirements

A. Applicant Information

List the name and mailing address (by street, city, state, zip code) of the applicant and the owner/operator, if different than the applicant's.

B. Project Location

Describe the project location by address (street, city, state), appropriate Air Quality Control Region, and the current use of the project site.

C. Project Description

Provide a detailed description of all processes, process equipment, storage units, fuels to be burned, emission control systems and any

other information necessary to completely describe the proposed project and its air pollution emission sources. Include a schematic drawing of the project which identifies each air pollution emission point.

D. Emissions from the Proposed Project

Estimate potential emissions and actual emissions of the five criteria pollutants (CO, HC, NO_2, SO_x, and particulate matter) using EPA Document AP-42 emission factors, source test data for similar operations, mass balances or other approved methods. Include all calculations. Discuss potential fugitive emissions from the proposed project and the methods to be used to minimize each emissions.

E. Best Available Control Technology (BACT)

Describe the process, system or technique which will be applied to the source as BACT for each pollutant. The technology proposed as BACT must represent the maximum degree of emission reduction achievable for the specific pollutant and the specific source, taking into account energy, environmental and economic impacts, and other costs. Discuss the determination of BACT, including the rationale for not selecting alternate, more stringent systems. An EPA publication entitled "Guidelines for Determining Best Available Technology (BACT)" provides the framework for a consistent approach in determining BACT.

F. Air Quality Data

Describe the existing ambient air quality (for those air pollutants resulting from the proposed project) at the proposed site and in the Air Quality Control Region. Include such items as the source of the data presented and the number and location of monitoring stations consulted. Include a brief description of the local meteorological conditions which would affect concentration and transport of pollutants. Normally, twelve (12) months of pre-application monitoring data is required to establish existing ambient background levels. As an alternative to the twelve-month

monitoring requirement, the air quality status sources of the area may in some cases be determined by modeling existing sources or by using existing air quality and representative meteorological data. Requirements concerning ambient air quality and meteorological data collection in support of PSD applications are defined in EPA Publication EPA-450/2-78-019, Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD).

G. Air Quality Analysis

Analyze the effect of the proposed project on all applicable ambient air quality increments and on the National Ambient Air Quality Standards. Include in the analysis the impacts projected for the area of the proposed project as a result of growth associated with the project. Count against the maximum allowable increases in pollutant concentrations emissions of sulfur dioxide and particulate matter from any source in existence on August 7, 1977 and from any major source on which construction commenced after January 6, 1975. Discuss all simulation techniques used to estimate the project's ambient air quality impact and the emission and meteorological parameters associated with each. All estimates of ambient concentrations shall be based on the applicable air quality models, data bases and other requirements specified in the Guideline on Air Quality Models (OAQPS1.2-080, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, April 1978). Where an air quality impact model specified in the Guideline on Air Models is not used, the modeling will be subject to notice and opportunity for public comment and will require written approval of the Administrator of EPA.

H. Additional Impact Analyses

Analyze the impairment to visibility, to soils, and to vegetation having significant commercial or recreational value that would occur as a result of the source or modification and general commercial, residential, industrial, and other growth associated with the source or modification.

I. Environmental Documents

Submit two copies of all appropriate EIR or EIS documents.

J. Compliance with Other Regulations

Summarize the status of all other environmental permits required, applied for and/or received for the proposed project. Describe the status of compliance of all existing facilities with all applicable environmental regulations.

K. Business Confidentiality Claims

You may, if you desire, assert a business confidentiality claim covering all or part of the information you submit in your application. To make a claim, label each page that contains the information covered by the claim with a typed or stamped legend such as "trade secret," "proprietary," or "company confidential." Any material for which confidentiality is asserted should be separated from non-confidential materials. If you assert a claim, the information covered by the claim will be disclosed by the EPA only to the extent, and by means of the procedures set forth in 40 CFR Part 2, Subpart B (41 FR 36906, September 1, 1976). If you do not assert a claim at the time you submit the information, the EPA may make the information available to the public without further notice to you.

L. Additional Information

Include any additional information which you feel may be pertinent.

APPENDIX C

ESTIMATED COST OF MONITORING

Several factors contribute to the costs involved in establishing and maintaining a monitoring station. These include siting cost variances, manpower and equipment costs, and labor upkeep costs. Manpower and equipment costs have risen sharply over the recent years. EPA contractor studies indicate recent equipment costs increased at approximately 13 percent per year from 1973-1978.

With respect to establishing a monitoring station, variances in equipment costs result from price indexes established by equipment vendors. Often there are many pollutant measuring equipment models to choose from. (EPA's contractor surveyed the costs for SO_2 monitoring equipment from 6 vendors and found the costs to vary by $5,000.)

The regulatory atmosphere also influences the cost of establishing a monitoring station. Often, EPA promulgates new Reference and Equivalent Methods, thus outdating old equipment. If old equipment cannot be updated, it becomes necessary to purchase new equipment.

The tables presented in this appendix represent composite estimated and actual updated costs for establishing and maintaining monitoring stations. Included are costs for operating, replacing, and supervising a monitoring station. Three sources contributed to the data presented in the tables: EPA, Belridge Oil Co., and Booz, Allen and Hamilton.

Table C-1

Table C-1 reflects information from EPA contractor ongoing costs studies. The agency is in the process of updating its 1973 "Costs of Monitoring"

TABLE C-1

ESTIMATED COST OF MONITORING MAJOR POLLUTANTS

Pollutant	Equipment	Equipment[a/] Costs	Operation and Maintenance Costs (1st year)[b/]	Annualized[c/] Cost
TSP	Hi Vol Gravimetric	$ 430	$1,400	$ 1,550
SO_2		11,000	9,500	12,000
O_x		7,600	7,050	8,700
NO_x		8,600	7,050	8,800
CO		10,000	7,900	10,000
HC		7,080	7,050	9,000
TSP	Dichotomous Sampler	4,600	2,000	2,800
MET				
WS, WD		2,500	5,200	
TEMP (ground)		2,100	5,200	
Temp (vertical profile)		16,230		
ΔT		17,500	5,200	

a/ Cost figure represents average estimated costs for analyzer, sampling and recording equipment, shelters support equipment, and calibration costs.

b/ Cost figure represents costs for installation, site location manpower training costs, maintenance and repair, rent, insurance, utilities, supervision personnel, and quality control program.

c/ Represents a/ plus b/ annualized over a 5 year period.

SOURCE: Draft Contractor Reports for the United States Environmental Protecton Agency. (In all cases, these findings represent preliminary results from EPA contractors and do not reflect the final findings of the Agency.)

manual to reflect costs for any reference and equivalent methods promulgated since 1973.[1/] This table represents average costs for purchasing, operating, and maintaining stations for specified pollutants. The purchasing costs represent findings taken from a survey of several vendors. The operating and maintenance costs reflect average manpower costs. All costs are nonregional, based on costs throughout the U.S. (1978 dollars). Since the publication of the last document, many of the wet chemical samplers have been replaced by more advanced electric methods. The costs presented in the tables reflect the more advanced equipment.

The equipment costs presented in the first column in Table C-1 represent the composite costs for purchasing the equipment, shipping and handling charges to the site, and the composite costs of sampling, recording equipment shelter and support equipment (gases, tapes, chemicals, etc.).

The costs of calibration equipment are also included in the equipment costs column. Because the same calibrator can be used on samplers for SO_2, O_x, NO_x, CO, and HC, the price of one calibrator (approximately $8,300) is divided by a factor of 5 (or $1,660). (It is assumed an operator will have 5 monitors.) The total estimated cost of calibration equipment for MET samplers ($1,500) is incorporated into the equipment costs column for this pollutant.

Operation and maintenance costs are presented in the second column of Table C-1. These figures were derived by determining the amount of

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1/ It must be noted that reports furnished to EPA for their present monitoring cost studies (i.e., those presented herein) are in draft form and will be updated within the next two months. To date, EPA has not endorsed the results of these studies, and the results presented in this document should not be construed as representing EPA's conclusions.

manpower hours required and current labor costs needed to complete the following tasks: installation, site location, manpower training, supervision, and quality control. The agency has determined that most monitors are likely to be placed on public property (schools, firehouses, etc.) therefore, the cost values for rent and insurance were assumed to be nonexistent.

The study was based upon ambient air samplers with an average life expectancy for equipment of 5 years; some will last longer and others may become outdated earlier. Amortization costs in the tables may need to be adjusted accordingly by the purchaser.

Tables C-2a, C-2b

Table C-2a and C-2b were obtained directly from the contractor responsible for installing and maintaining monitors for Belridge Oil Company. The equipment costs represent real costs incurred by the oil company early in 1979. Estimated manpower costs to install and operate the station represent what the company and contractor have judged costs will be based on 1979 dollars.

Table C-3

The information presented in Table C-3 was obtained from a Booz, Allen and Hamilton report entitled Development of Environmental Monitoring Guidelines for EOR and EGR Processes.[1/] Methods for determining the cost values were not given in the report. Methods used to obtain survey data are presented primarily for comparison purposes. It is felt that Belridge Oil Co. estimates and draft EPA studies represent the more accurate analysis of present day costs.

1/ Booz, Allen and Hamilton, Development of Environmental Monitoring Guidelines for EOR and EGR Processes, prepared for DOE, February 17, 1978.

TABLE C-2a

CAPITAL COSTS FOR PROPOSED MONITORING STATIONS
PURCHASED BY BELRIDGE OIL COMPANY[a/]

Pollutant	Number of Monitors	Equipment (Model)	Capital Costs
SO_2	1	Pulsed Fluorescence (TECO 43)	$7,170
TSP	3	HiVol	$1,118
NO_2/NO_x	1	Chemiluminescence (TECO 14D)	$6,580
O_x	1	Ultraviolet Photometric (DAISIBI 1005)	$9,750
		Rackmount	$ 70

a/ To be installed in 1979 (see Table V, Appendix A).

TABLE C-2b

BELRIDGE OIL COMPANY'S ESTIMATED MANPOWER COSTS FOR ESTABLISHING SO_2, TSP, NO_2, O_2 MONITORS AND STATION OPERATING COSTS[a/]

Function	Task	Estimated Manpower Time	Costs
Establishing Station	Instrument Checkout	5 days	$ 850
	Equipment Installation	5 days	850
	Initial Calibration	3 days	510
Operating Station	Technical Training	5 days	850
	Weekly Maintenance	10 hrs/wk/52 wks/yr	7,800
	Quarterly Audit	16 days/yr	2,720
	Equipment Repair & Emergency	24 days/yr	4,080
	Data Reduction (2 persons)	32 wks/yr	15,360
	Filter Weighing	20 days/yr	3,400
	Quality Assurance Supervision	15 days/yr	3,000

a/ Per year.

TABLE C-3

COST OF MONITORING MAJOR POLLUTANTS USING REFERENCE OR EQUIVALENT METHODS

Pollutant	Equipment	Capital Cost	Manpower Required[a/]
TSP	Hi Vol Gravimetric	$ 550 field equip. 1,200 lab equip.	Daily visits or 1 every 6 days. Extensive lab testing required.
	Dichotomous Sampler	4,400 field equip. 12,000 lab equip.	Daily visits required by field personnel.
SO_2	Coulometric	7,000[b/]	Visits needed every 2 days.
	Flame Photometric	8,500[b/]	Field personnel visits suggested every 2 days.
	Parasaline	200 field equip. 2,500 lab equip.	Daily visits required. Extensive lab facilities required.
	Pulsed Flourescence	10,000[b/]	Weekly field visits.
NO_x	Saltzman	4,500	Daily visits required.
	Chemilumescence	9,000	Weekly visits by field personnel.
COH	AISI	8,500	Weekly field visits.

a/ Manpower costs not included in costs column and will reflect additional costs.

b/ Costs include calibration costs.

SOURCE: Booz, Allen and Hamilton, Development of Environmental Monitoring Guildelines for EOR and EGR Processes. Vol. II, Appendix D, February 17, 1978.

APPENDIX D

LIST OF DESIGNATED REFERENCE AND EQUIVALENT METHODS

The following methods for measuring ambient concentrations of specified air pollutants have been designated as "reference methods" or "equivalent methods" in accordance with 40 CFR Part 53.* Subject to any limitations (e.g., operating range) specified in the applicable designation, each method is acceptable for use in State or local air quality surveillance systems under 40 CFR Part 51.17(a) unless the applicable designation is subsequently cancelled.**

Prospective users of the methods listed should note (1) that each method must be used in strict accordance with the operation or instruction manual, and (2) that modification of a method by its vendor or user may cause the pertinent designation to be inapplicable to the method as modified.***

Further information concerning particular designations may be found in the Federal Register notice cited for each method or by writing to the Environmental Monitoring and Support Laboratory, Department E (MD-77), U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711. Technical information concerning the methods may be obtained by writing to the Environmental Monitoring and Support Laboratory at the address specified above.

NOTE: New analyzers sold as reference or equivalent methods must carry a label or sticker identifying them as designated methods. For analyzers sold prior to the designation, the model number does not necessarily identify an analyzer as a designated method. Consult the manufacturer or seller to determine if a previously sold analyzer can be considered a designated method, or if it can be upgraded to designated status.

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* Promulgated on February 18, 1975 (40 FR 7044), and amended on March 17, 1976 (40 FR 11255) and Dec. 1, 1976 (41 FR 52694).

** See 40 CFR 53.11, promulgated on February 18, 1975 (40 FR 7044, 7050-51), and 40 CFR 53.16, promulgated on March 17, 1976 (41 FR 11252, 11256-57).

*** See 40 CFR 53.14, promulgated on February 18, 1975 (40 FR 7044, 7051-52), and 40 CFR 51.17a(f), promulgated on March 17, 1976 (41 FR 11252, 11255).

LIST OF DESIGNATED REFERENCE AND EQUIVALENT METHODS

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		SULFUR DIOXIDE					
EQS-0775-001	"Pararosaniline Method for the Determination of Sulfur Dioxide in the Atmosphere-Technicon I Automated Analysis System."	Environmental Monitoring and Support Laboratory Department E (MD-76) U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711	Manual	Equiv.	40	34024	8/13/7
EQS-0775-002	"Pararosaniline Method for the Determination of Sulfur Dioxide in the Atmosphere-Technicon II Automated Analysis System."	Environmental Monitoring and Support Laboratory Department E (MD-76) U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711	Manual	Equiv.	40	34024	8/13/7
EQSA-1275-005	Lear Siegler model "SM1000 SO_2 Ambient Monitor," operated on the 0-0.5 ppm range, at a wavelength of 299.5 nm, with the "slow" (300 second) response time, with or without any of the following options: SM-1, Internal zero/span SM-2, Span time card SM-3, 0-0.1 volt output SM-4, 0-5 volt output SM-5, Alternate sample pump	Lear Siegler, Inc. Environmental Technology Division 74 Inverness Drive East Englewood, Colorado 80110	Auto	Equiv.	41 42	3893 13044	1/27/7 3/08/7

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTIC DATE
		SULFUR DIOXIDE (CONTINUED)					
EQSA-1275-006	"Meloy Model SA185-2A Sulfur Dioxide Analyzer," operated on the 0-0.5 ppm range, with or without any of the following options: S-1, Linearized output S-2, Modified recorder output S-5, Teflon-coated block S-6A, Re-ignite timer circuit S-7, Press to read S-11A, Manual zero and span S-11B, Automatic zero and span S-13, Status lights S-14, Output booster amplifier S-14B, Line transmitter board S-18, Rack mount conversion S-18A, Rack mount conversion S-21, Front panel digital volt meter S-22, Remote zero/span control and status (timer) S-22A, Remote zero/span control S-23, Automatic zero adjust S-23A, Automatic/manual zero adjust S-24, Dual range linearized output S-33, Remote range control and status (signals) S-34, Remote control S-35, Front panel digital meter with BCD output S-36, Dual range log-linear output S-38, Sampling mode status; or operated on the 0-1.0 ppm range with either option S-36 or options S-1 and S-24, with or without any of the other listed options.	Meloy Laboratories, Inc. Instruments & Systems Div. 6715 Electronic Drive Springfield, Virginia 22151	Auto	Equiv.	41 43	3893 38088	1/27/ 8/25/

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		SULFUR DIOXIDE (CONTINUED)					
EQSA-0276-009	"Thermo Electron Model 43 Pulsed Fluorescent SO_2 Analyzer," equipped with an aromatic hydrocarbon cutter and operated on the 0-0.5 range, with or without any of the following options: 001 - Rack mounting for standard 19 inch relay rack 002 - Automatic actuation of zero and span solenoid valves	Thermo Electron Corporation Environmental Instruments Division 45 First Avenue Waltham, Mass. 02154	Auto	Equiv.	41 42	8531 20490	2/27/76 4/20/77
EQSA-0676-010	"Philips PW9755 SO_2 Analyzer" consisting of the following components: PW9755/o2 SO_2 Monitor with: PW9741/00 SO_2 Source PW9721/00 Filter Set SO_2 PW7911/00 Electrolyte SO_2 PW9750/00 Supply Cabinet PW9750/10 Supply Unit/Coulometric PW9731/00 Sampler, PW9731/20 Dust Filter, or vendor-approved alternate particulate filter; operated with a 0 to 0.5 ppm range and with a reference voltage setting of 760 millivolts; with or without any of the following options: PW9752/00 Air Sampler Manifold PW9753/00 Mounting Rack for Accessories PW9750/30 Frame for MTI PW9750/41 Control Clock 60 Hz PW9754/00 Air Distributor	Philips Electronic Instruments, Inc. 85 McKee Drive Mahwah, New Jersey 07430	Auto	Equiv.	41 42	26252 28571	6/25/76 6/03/77

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTIC DATE
		SULFUR DIOXIDE (CONTINUED)					
EQSA-0876-011	"Philips PW9700 SO_2 Analyzer" consisting of the following components: PW9710/00 Chemical Unit with: PW9711/00 Electrolyte SO_2 PW9720/00 Electrical Unit PW 9721/00 Filter set SO_2 PW9730/00 Sampler Unit or vendor-approved alternate particulate filter PW9740/00 SO_2 source operated with a 0 to 0.5 ppm range and with a reference voltage of 760 millivolts.	Philips Electronic Industries, Inc. 750 South Fulton Avenue Mount Vernon, NY 10550	Auto	Equiv.	41	34105	8/12/
EQSA-0876-013	"Monitor Labs Model 8450 Sulfur Monitor," operated with a 0 to 0.5 ppm range, a 5 second time constant, a model 8740 hydrogen sulfide scrubber in the sample line, with or without any of the following options: BP - Bipolar Signal Processor V - Zero/Span Valves VT - Zero/Span Valves and Timer TF - TFE Sample Particulate Filter IZS - Internal Zero/Span Module CLO - Current Loop Output DO - Status Remote Interface	Monitor Labs, Incorporated 4202 Sorrento Valley Boulevard San Diego, CA 92121	Auto	Equiv.	41	36245	8/27/7
EQSA-0877-024	"ASARCO Model 500 Sulfur Dioxide Monitor," operated on a 0-0.5 range.	ASARCO Incorporated 3422 South 700 West Salt Lake City, Utah 84119	Auto	Equiv.	42	44264	9/02/7

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		SULFUR DIOXIDE (CONTINUED)					
EQSA-0678-029	Beckman "Model 953 Fluorescent Ambient SO_2 Analyzer" operated on a range of either 0-0.5 or 0-1 ppm, with a time constant setting of 2, 2.5, or 3 minutes, with or without any of the following options: a. Remote Operation Kit, Catalog No. 641984 b. Digital Panel Meter, Catalog No. 641710 c. Rack Mount Kit, Catalog No. 641709 d. Panel Mount Kit, Catalog No. 641708	Beckman Instruments, Inc. 2500 Harbor Boulevard Fullerton, CA 92634	Auto	Equiv.	43	35995	8/14/78
EQSA-1078-030	Bendix "Model 8303 Sulfur Analyzer" operated on either 0-0.5 or 0-1.0 ppm range	The Bendix Corporation Environmental and Process Instruments Division P.O. Box 831 Lewisburg, WV 24901	Auto	Reference	43	50733	10/31/78

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		SULFUR DIOXIDE (CONTINUED)					
EQSA-1078-032	Meloy "Model SA285E Sulfur Dioxide Analyzer," operated on the following ranges and time constant switch positions: Range, ppb — Time Constant Setting 0-50* — 1 or 10 0-100* — 1 or 10 0-500 — off, 1 or 10 0-1000 — off, 1 or 10 The analyzer may be operated at temperatures between 10° and 40°C and at line voltages between 105 and 130 volts, with or without any of the following options: S-5 Teflon coated block S-14B Line transmitter board S-18 Rack mount conversion S-18A Rack mount conversion (continued on next page)	Meloy Laboratories, Inc. Instruments & Systems Div. 6715 Electronic Drive Springfield, VA 22151	Auto	Equiv.	43	50734	10/31/78

*NOTE: Users should be aware that designation of ranges less than 0.5 ppm (500 ppb) are based on meeting the same absolute performance specifications required for the 0-0.5 ppm (500 ppb) range. EPA is considering but has not yet established proportionately more restrictive performance specifications applicable to ranges less than 0-0.5 ppm (500 ppb). Thus, designation of these lower ranges does not guarantee commensurably better performance than that obtained on the 0-0.5 ppm (500 ppb) range.

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTIC DATE
		SULFUR DIOXIDE (CONTINUED)					
EQSA-1078-032 (continued)	S-21 Front panel digital meter						
	S-22 Remote zero/span control and Status (timer)						
	S-22A Remote zero/span control						
	S-22B Remote zero/span control and Status (pulse)						
	S-23 Auto zero adjust						
	S-23A Auto/manual zero adjust						
	S-25 Press to read						
	S-26 Manual zero and span						
	S-27 Auto manual zero/span						
	S-28 Auto range and status						
	S-30 Auto reignite						
	S-32 Remote range control and status						
	S-35 Front panel digital meter with BCD output						
	S-37 Temperature status lights						
	S-38 Sampling mode status						

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		PHOTOCHEMICAL OXIDANTS					
RFOA-1075-003	"Meloy Model OA 325-2R Ozone Analyzer," operated with a scale range of 0-0.5 ppm, with or without any of the following options: 0-4, Output Booster Amplifier 0-18, Rack Mount Conversion 0-18A, Rack Mount Conversion	Meloy Laboratories, Inc. Instruments & Systems Div. 6715 Electronic Drive Springfield, Virginia 22151	Auto	Reference	40	54856	11/26/75
RFOA-1075-004	"Meloy Model OA 350-2R Ozone Analyzer," operated with a scale range of 0-0.5 ppm, with or without any of the following options: 0-2, Automatic Zero and Span 0-3, Remote Control Zero and Span 0-4, Output Booster Amplifier 0-18, Rack Mount Conversion 0-18A, Rack Mount Conversion	Meloy Laboratories, Inc. Instruments & Systems Div. 6715 Electronic Drive Springfield, Virginia 22151	Auto	Reference	40	54856	11/26/75
RFOA-0176-007	"Bendix Model 8002 Ozone Analyzer," operated on the 0-0.5 ppm range and with a 40 second time constant, with or without any of the following options: A - Rack mounting with chassis slides B - Rack mounting without chassis slides C - Zero and span timer	The Bendix Corporation Process Instruments Division Post Office Drawer 831 Lewisburg, West Virginia 24901	Auto	Reference	41	5145	2/4/76

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		PHOTOCHEMICAL OXIDANTS (CONTINUED)					
RFOA-1076-014 RFOA-1076-015 RFOA-1076-016	"MEC Model 1100-1 Ozone Meter," "MEC Model 1100-2 Ozone Meter," "MEC Model 1100-3 Ozone Meter," operated on a 0-0.5 ppm range with or without any of the following options: 0011 - Rack mounting ears 0012 - Instrument bail 0016 - Chassis slide kit 0026 - Alarm set feature 0033 - Local-remote sample, zero, span kit 0040 - Ethylene/CO_2 blend feature	McMillan Electronics Corporation, subsidiary of Columbia Scientific Industries 11950 Jollyville Road P.O. Box 9908 Austin, Texas 78766	Auto	Reference	41 42	46647 30235	10/22/7 6/13/7
RFOA-1176-017	"Monitor Labs Model 8410E Ozone Analyzer," operated on a range of 0-0.5 ppm and a time constant setting of 5 seconds, with or without any of the following options: TF - TFE Sample particulate filter VT - TFE Zero/span valves and timer V - TFE Zero/span valves ER - Ethylene regulator assembly DO - Status outputs	Monitor Labs, Incorporated 4202 Sorrento Valley Boulevard San Diego, California 92121	Auto	Reference	41	53684	12/8/7

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		PHOTOCHEMICAL OXIDANTS (CONTINUED)					
EQOA-0577-019	"Dasibi Model 1003-AH or 1003-PC Ozone Analyzer," operated on a range of either 0-0.5 or 0-1 ppm, with or without any of the following options: a. Adjustable alarm b. Rack mounting ears and slides c. BCD digital output d. Integrated output e. 0-10 mV, 0-100 mV, 0-1 V, or 0-10 V analog output	Dasibi Environmental Corp. 616 E. Colorado Street Glendale, California 92105	Auto	Equiv.	42	28571	6/3/77
RFOA-0577-020	"Beckman Model 950A Ozone Analyzer," operated on a range of 0-0.5 ppm and with the "SLOW" (60 second) response time; with or without any of the following options: Internal Ozone Generator Computer Adaptor Kit	Beckman Instruments, Inc. Process Instruments Division 2500 Harbor Boulevard Fullerton, California 92634	Auto	Reference	42	28571	6/3/77

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		PHOTOCHEMICAL OXIDANTS (CONTINUED)					
EQOA-0777-023	"Philips PW9771 O_3 Analyzer," consisting of the following components: PW9771/00 O_3 monitor with PW9724/00 Disc.-set PW9750/00 Supply cabinet PW9750/20 Supply unit; operated with a 0.5 ppm range, with or without any of the following accessories: PW9733/00 Sampler PW9752/00 Air Sampler (manifold) PW9750/30 Frame for M.T.T. PW9750/41 Control Clock 60Hz PW9732/00 Sampler line heater	Philips Electronic Instruments, Inc. 85 McKee Drive Mahwah, New Jersey 07430	Auto	Equiv.	42	38931	8/1/77

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		CARBON MONOXIDE					
RFCA-0276-008	"Bendix Model 8501-5CA Infrared CO Analyzer," operated on the 0-50 ppm range and with a time constant setting between 5 and 16 seconds, with or without any of the following options: A - Rack mounting with chassis slides B - Rack mounting without chassis slides C - External sample pump	The Bendix Corporation Process Instruments Division Post Office Box 831 Lewisburg, West Virginia 24901	Auto	Reference	41	7450	2/18/7
RFCA-0876-012	"Beckman Model 866 Ambient CO Monitoring System" consisting of the following components: Pump/Sample-Handling Module Gas Control Panel Model 865-17 Analyzer Unit Automatic Zero/Span Standardizer operated with a 0 to 50 ppm range, a 13 second electronic response time, and with or without any of the following options: Current Output Feature Linearizer Circuit Bench Mounting Kit	Beckman Instruments, Incorporated Process Instruments Division 2500 Harbor Boulevard Fullerton, CA 92634	Auto	Reference	41	36245	8/27/7

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		CARBON MONOXIDE (CONTINUED)					
RFCA-0177-018	"LIRA Model 202S Air Quality Carbon Monoxide Analyzer System," consisting of a LIRA Model 202S (P/N 459839), a regenerative dryer (P/N 464084), and rack-mounted sampling system; operated on a 0-50 ppm range, with the slow response amplifier, and with or without any of the following options: Remote meter Remote zero and span controls 0-10 or 100 mV output ranges 0-1, 5, or 10 volt output 0-1, 5, 20, or 50 ma output 1-5, 4-20, or 10-50 ma output	Mine Safety Appliances Company 600 Penn Center Boulevard Pittsburgh, Pennsylvania 15208	Auto	Reference	42	5748	1/31/77

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		NITROGEN DIOXIDE					
RFNA-0677-021	"Monitor Labs Model 8440E Nitrogen Oxides Analyzer," operated on a 0-0.5 ppm range (position 2 of range switch) with a time constant setting of 20 seconds and with or without any of the following options: TF - Sample particulate filter with TFE filter element VT - Zero/span valves and timer V - Zero/span valves FM - Flowmeters DO - Status outputs R - Rack mount	Monitor Labs, Incorporated 4202 Sorrento Valley Blvd. San Diego, California 92121	Auto	Reference	42	37434	7/21/7
RFNA-0777-022	"Bendix Model 8101-C Oxides of Nitrogen Analyzer," operated on a 0-0.5 ppm range with a Teflon sample filter (Bendix (P/N 007163) installed on the sample inlet line.	The Bendix Corporation Environmental and Process Instruments Division P.O. Box 831 Lewisburg, West Virginia 24901	Auto	Reference	42	37435	7/21/7
RFNA-0977-025	"CSI Model 1600 Oxides of Nitrogen Analyzer," operated on a 0-0.5 ppm range with a Teflon sample filter (CSI P/N M951-8023) installed on the sample inlet line, with or without any of the following options: 951-3053 Rack Mounting Kit 951-3054 Chassis Slide Kit 951-3066 Tilt Stand 951-8032 Local-Remote Ambient, Zero, Span Kit M951-0007 External Pump Kit M951-0008 Diagnostic Output	Columbia Scientific Industries 11950 Jollyville Road P.O. Box 9908 Austin, Texas 78766	Auto	Reference	42	46574	9/16/7

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		NITROGEN DIOXIDE (CONTINUED)					
EQN-1277-026	"Sodium Arsenite Method for the Determination of Nitrogen Dioxide in the Atmosphere"	Environmental Monitoring and Support Laboratory Department E (MD-76) U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711	Manual	Equiv.	42	62971	12/14/77
EQN-1277-027	"Sodium Arsenite Method for the Determination of Nitrogen Dioxide in the Atmosphere--Technicon II Automated Analysis System"	Environmental Monitoring and Support Laboratory Department E (MD-76) U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711	Manual	Equiv.	42	62971	12/14/77
EQN-1277-028	"TGS-ANSA Method for the Determination of Nitrogen Dioxide in the Atmosphere"	Environmental Monitoring and Support Laboratory Department E (MD-76) U.S. Environmental Protection Agency Research Triangle Park, North Carolina 27711	Manual	Equiv.	42	62971	12/14/77

DESIGNATION NUMBER	IDENTIFICATION	SOURCE	MANUAL OR AUTO	REF. OR EQUIV.	FED. VOL.	REGISTER PAGE	NOTICE DATE
		NITROGEN DIOXIDE (CONTINUED)					
RFNA-1078-031	"Meloy Model NA530R Nitrogen Oxides Analyzer," operated on the following ranges and time constant switch positions: Range, ppm — Time constant setting 0-0.1* — 4 0-0.25* — 3 or 4 0-0.5 — 2, 3, or 4 0-1.0 — 2, 3, or 4 Operation of the analyzer requires an external vacuum pump, either Meloy Option N-10 or an equivalent pump capable of maintaining a vacuum of 200 torr (22 inches mercury vacuum) or better at the pump connection at the specified sample and ozone-air flowrates of 1200 and 200 cm^3/min, respectively. The analyzer may be operated at temperatures between 10° and 40° C and at line voltages between 105 and 130 volts, with or without any of the following options: N-1A Automatic zero and span N-2 Vacuum gauge N-4 Digital panel meter N-6 Remote control for zero and span N-6B Remote zero/span control and status (pulse) N-6C Remote zero/span control and status (timer) N-9 Manual zero/span N-10 Vacuum pump assembly (see alternate requirement above) (continued on next page)	Meloy Lboratories, Inc. Instruments & Systems Div. 6715 Electronic Drive Springfield, Virginia 22151	Auto	Reference	43	50734	10/31/78

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		NITROGEN DIOXIDE (CONTINUED)					
RFNA-1078-031	N-14B Line transmitter N-18 Rack mount conversion N-18A Rack mount conversion *Note-Users should be aware that designation of ranges less than 0.5 ppm (500 ppb) are based on meeting the same absolute performance specifications required for the 0-0.5 ppm (500 ppb) range. EPA is considering--but has not yet established--proportionately more restrictive performance specifications applicable to ranges less than 0-0.5 ppm (500 ppb). Thus, designation of these lower ranges does not guarantee commensurably better performance than that obtained on the 0-0.5 ppm (500 ppb) range.						

METHODS DESIGNATED AS OF December 21, 1978 -- QUICK REFERENCE

SO_2	1. Technicon I 2. Technicon II		1. Lear Siegler SM1000 2. Meloy SA185-2A 3. Thermo Electron 43 4. Philips PW9755 5. Philips PW9700 6. Monitor Labs 8450 7. ASARCO 500 8. Beckman 953 9. Bendix 8303 10. Meloy SA285E	12
CO	--	1. Bendix 8501-5CA 2. Beckman 866 3. MSA 202S 4. Horiba AQM-10, 11, & 12	--	4
O_3	--	1. Meloy OA325-2R 2. Meloy OA350-2R 3. Bendix 8002 4. McMillan 1100-1 5. McMillan 1100-2 6. McMillan 1100-3 7. Monitor Labs 8410E 8. Beckman 950A	1. Dasibi 1003-AH, 1003-PC 2. Philips PW9771	10
NO_2	1. Sodium Arsenite 2. Sodium Arsenite Technicon 3. TGS-ANSA	1. Monitor Labs 8440E 2. Bendix 8101-C 3. CSI 1600 4. Meloy NA530R	--	7
TOTAL	5	16	12	33

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