United States
Environmental Protection
Agency

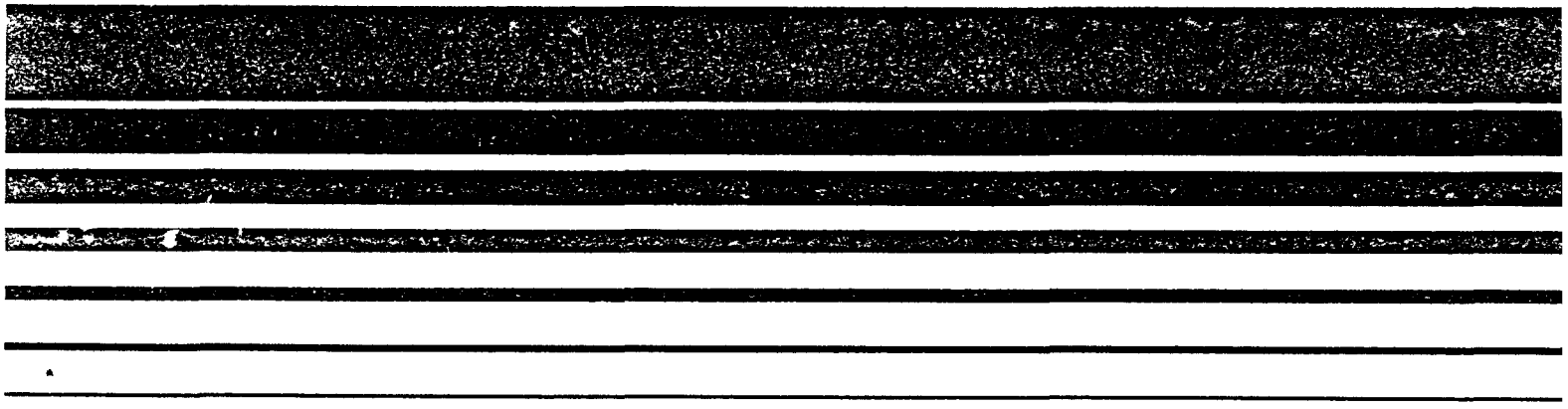
Office of Air Quality
Planning and Standards
Research Triangle Park NC 27711

EPA-450/4-86-006
May 1986

Air

EPA

Activities Of The EPA Model Clearinghouse A Summary Report: FY81 - FY85



EPA-450/4-86-006

Activities of the EPA Model Clearinghouse A Summary Report: FY81 - FY85

U.S. ENVIRONMENTAL PROTECTION AGENCY
Monitoring and Data Analysis Division
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

May 1986

This report has been reviewed by The Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, and has been approved for publication. Mention of trade names or commercial products is not intended to constitute endorsement or recommendation for use.

ACKNOWLEDGEMENTS

This report was prepared by Dean Wilson with contributions from Joseph Tikvart and James Dicke, all from the Source Receptor Analysis Branch, Monitoring and Data Analysis Division.

Appreciation is extended to Stephen Perkins, Region I; Michael Koerber, Region V; Robert Wilson, Region X; and Sharon Reinders, Control Programs Operation Branch, for their helpful comments during the review process. The patience of Linda Johnson as she typed this report is also appreciated.

SUMMARY

The activities of the EPA Model Clearinghouse during its first five years of operation are summarized. Included are a summary of the number of cases and the nature of issues reviewed by the Clearinghouse, a description of major recurring and generic issues referred to the Clearinghouse, and a series of example cases illustrating the various modes of operation of the Clearinghouse.

A total of 306 significant issues were referred to the Model Clearinghouse by the ten EPA Regional Offices during the five-year period. A majority of the referrals involved the modeling of SO_2 and TSP emissions from power plants, power boilers and other large point sources for purposes of setting emission limits. Many of the referrals involved the proposed application of nonguideline models in complex terrain. An additional 217 proposed Federal Register actions containing modeling analyses were reviewed by the Clearinghouse for completeness and adherence to policy.

Coordination of Clearinghouse issues with the ten Regional Offices was accomplished through the preparation of annual summary reports, presentations at annual meetings, visits to the Regional Offices, and the distribution of various memoranda and reports that document Clearinghouse opinions and determinations.

Major recurring or generic issues with which the Clearinghouse dealt include performance evaluations, modeling of large numbers of sources, multi-source modeling to determine net prevention of significant deterioration (PSD) increment consumption, and modeling the impacts of point sources on tall buildings. The resolution of issues dealing with generic modeling guidelines, composite wind roses, long range transport, and the effective date of modeling guidance was also undertaken.

Four case examples illustrating several procedures used by the Clearinghouse to resolve issues are described. Three of the examples involved a Regional Office asking for an advance opinion on the use of a modeling technique or data base for an impending regulatory action. The fourth example involved consideration of modeling issues inherent in a proposed regulation that was undergoing internal review before publication in the Federal Register.

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This report summarizes the operation of the EPA Model Clearinghouse during its first five years of existence, FY81-FY85. The main purpose of the report is to summarize the number of cases and the nature of issues that the Clearinghouse reviewed during this time. In addition, the report describes and illustrates, through a series of examples, how the Clearinghouse fulfills its major responsibility for review of specific proposed actions which involve interpretation of modeling guidance, deviations from such guidance, and the use of options in the guidance.

The information contained in this document regarding Clearinghouse opinions on specific problems or classes of problems should not be taken by the reader as "new guidance" or precedents for treating similar problems. Many of the issues have not yet been completely resolved within EPA; further information and policy decisions may have a bearing on final resolution of the problems. Should a user be confronted with any problem similar to the ones described, he should consult the appropriate State/Regional Office before proceeding.

1.1 Background and Responsibilities of the Model Clearinghouse

The Model Clearinghouse was established in November 1980 when the Regional Offices were notified of its general purposes, procedures and limitations. A detailed operational plan describing the functions, structure, procedures and schedule for implementation was issued in February 1981.

The "Model Clearinghouse Operational Plan" states that the primary purposes of the Clearinghouse are to provide: (1) a mechanism whereby the proposed acceptance by a Regional Office of a nonguideline model or alternative techniques may be reviewed for national consistency before final

approval by the Regional Administrator; (2) a mechanism whereby the in-depth technical evaluation and/or performance evaluation of a proposed technique may be reviewed by those EPA personnel who are most familiar with the types of techniques to be employed; and (3) a communication outlet for EPA's experience with the use of nonguideline models, data bases or other deviations from current guidance. To accomplish these purposes the Clearinghouse maintains awareness of EPA modeling policies, develops and maintains a historical record of modeling decisions, develops clarifications of existing modeling guidance for special situations, reviews proposed actions which involve interpretation of or deviation from modeling guidance and communicates the results of significant decisions to all regulatory users in the Agency.

The Clearinghouse formally operates in the Source Receptor Analysis Branch (SRAB) and in the Control Programs Operations Branch (CPOB) of the Office of Air Quality Planning and Standards (OAQPS). Regional Office requests for review of nonguideline models are sent directly to SRAB. CPOB maintains responsibility for review/approval of proposed Federal Register actions submitted from the Regions. These packages often contain modeling issues. Close coordination is maintained between the two branches on all Regional Office modeling issues that come to their attention.

Activities of the Model Clearinghouse during the FY81-FY85 period included:

1. Responding to Regional Office requests for review of nonguideline models proposed for use.

2. Responding to Regional Office requests for interpretation of modeling guidance.

3. Reviewing Federal Register submittals.

4. Documenting Clearinghouse decisions and discussions.

5. Summarizing Clearinghouse activities at various internal EPA meetings.

6. Issuing, internally, annual summary reports of activities.

7. Developing and issuing a report summarizing the Clearinghouse experience in dealing with nonguideline model evaluations.

8. Acquiring historical information on the application of models in EPA.

1.2 Scope of Report

The remainder of this report is divided into three sections. Section 2 summarizes the number and nature of the Clearinghouse reviews during the five-year period. Section 2 also summarizes the various programs of the Clearinghouse that are designed to keep EPA users informed of its activities, referrals and opinions. Section 3 describes the Clearinghouse responses to several common or recurring technical/consistency issues. Section 4 illustrates, through a series of case examples, the nature of and mode of Clearinghouse operation. Section 5 contains the conclusions.

2.0 FY81-FY85 MODEL CLEARINGHOUSE ACTIVITIES

This section summarizes each of the eight activities of the Model Clearinghouse listed at the end of Section 1.1.

2.1 Summary of the Number and Nature of Clearinghouse Reviews

The number of reviews conducted by the Clearinghouse during FY81-FY85 is summarized in Table 1. The data in the table only include those issues where a coordinated clarification of policy was required or an investigation had to be undertaken by the Clearinghouse. In addition, there were numerous telephone inquiries to the Clearinghouse regarding procedures, technical considerations and policies which were readily resolved or referred elsewhere.

Note from the table that there were a total of 65 modeling issues referred to the SRAB function in the Clearinghouse which required a written response and 241 issues which were resolved orally. In addition, CPOB directly reviewed another 217 regulatory action packages which contained modeling analyses that followed guidance and required no further technical review by SRAB. Although there is some variation from year to year, on average the Model Clearinghouse handles slightly over 100 cases per year.

Table 1. Clearinghouse Responses by Year

	FY81	FY82	FY83	FY84	FY85	Total
Written Responses(1)	12	12	19	11	11	65
Telephone/Oral Responses(1)	18	24	46	82	71	241
Federal Register Actions(2)	65	43	71	26	12	217
Total	95	79	136	119	94	523

(1) Cases containing modeling issues requiring a technical review and coordination between CPOB and SRAB

(2) Cases that followed current guidance; reviewed directly by CPOB

Table 2 shows the distribution of the Clearinghouse reviews over the five-year period by Region of origin. Note that requests for assistance, either written or by telephone, came from all the Regional Offices. This suggests that there is an awareness and a desire for Clearinghouse support throughout the Agency. The majority of the referrals came from the five Eastern Regions. These referrals most often were associated with State Implementation Plans (SIP's) and SIP revisions. The referrals from the Western Regions were most often associated with new sources and Prevention of Significant Deterioration (PSD) permits.

Table 2. FY81-FY85 Clearinghouse Reviews by Region

Region	Written Response(1)	Telephone/Oral Response(1)	Federal Register Actions(2)	Total
I	6	25	40	71
II	8	29	22	59
III	9	43	30	82
IV	16	36	25	77
V	8	28	87	123
VI	2	12	3	17
VII	3	15	1	19
VIII	4	19	3	26
IX	3	19	6	28
X	6	15	0	21
Total	65	241	217	523

(1) Cases containing modeling issues requiring a technical review and coordination between CPOB and SRAB

(2) Cases that followed current guidance; reviewed directly by CPOB

Table 3 contains a summary, by subject area, of the nature of the referrals and requests for assistance that came to the Clearinghouse.

Table 3. Summary of Common Issues Associated With 306 Model Clearinghouse Referrals and Actions During FY81-FY85.

Subject Area	Number of Referrals FY81	FY82	FY83	FY84	FY85	Total
1. By Pollutant						
SO_2	24	24	43	47	40	178
TSP	1	2	3	10	16	32
CO	1	3	2	4	2	12
Pb	1	0	3	12	3	19
NO_x	0	2	0	3	4	9
O_3	0	0	0	1	0	1
More Than One Pollutant	1	0	2	12	6	21
Noncriteria	1	0	0	0	2	3
Not Relevant(1)	1	5	12	4	9	31
2. By Source Type						
Power Plant(2)	16	9	16	21	18	80
Industrial Boiler	4	3	6	7	6	26
Smelter	0	1	4	14	5	24
Steel Facility	0	3	2	2	3	10
Paper Mill	1	2	4	0	6	13
Aluminum Plant	0	0	4	2	0	6
Refinery	0	0	1	2	1	4
Roadway	1	2	2	4	1	10
Other Sources	2	8	3	3	16	32
Multiple/Mixed	0	0	7	15	14	36
Generic(3)	6	8	15	8	6	43
Not Relevant(1)	0	0	1	15	6	22
3. Urban vs. Rural						
Urban Only	2	4	11	19	12	48
Rural Only	23	24	46	47	61	201
Both Urban and Rural	5	3	4	16	4	32
Not Relevant(1)	0	5	4	11	5	25
4. Type of Response						
Written	12	12	19	11	11	65
Oral	18	24	46	82	71	241

Table 3. (Continued)

	Number of Referrals					
	FY81	FY82	FY83	FY84	FY85	Total
5. By Regulation						
New SIP	5	4	10	26	16	61
SIP Revision	13	12	26	22	15	88
PSD	4	11	11	21	26	73
Bubble	0	2	4	2	7	15
EIS	2	1	0	3	3	9
Others	4	0	2	2	9	17
Generic(3)	2	4	12	14	6	38
Not Relevant(1)	0	2	0	3	0	5
6. By Terrain Setting						
High Terrain (Above Stack Height)	5	12	17	21	22	77
Low Terrain (Below Stack Height)	15	3	25	8	8	59
Both High and Low Terrain	6	9	9	17	21	62
Essentially Flat Terrain	2	9	14	27	20	72
Not Relevant(1)	2	3	0	20	11	36
7. Nonguideline vs. Guideline Model						
Nonguideline	16	23	34	27	36	136
Appropriate Use of a Guideline Model	14	11	30	66	46	167
Not Relevant(1)	0	2	1	0	0	3
8. On-site vs. Off-site Data Used in Model						
On-site	7	16	21	30	18	92
Off-site	21	12	32	57	52	174
Not Relevant(1)	2	8	12	6	12	40

Footnotes

(1) The issue referred to the Clearinghouse was independent of this specific subject area.

(2) Includes resource recovery facilities and gas turbines.

(3) Applicable to classes of sources or types of regulations.

Briefly some highlights of the table are:

1. Pollutants. The majority of the cases involved SO_2 and TSP as the pollutants. When more than one pollutant had to be considered the combination was most often TSP and SO_2. Because of the emphasis on developing lead SIP's during FY84 and the complicated modeling problems associated with primary and secondary lead smelters, there were a number of referrals for that pollutant in that year.

2. Source Types. Many problems referred to the Clearinghouse involved power plants/power boilers but there were also numerous other modeling problems associated with area-wide problems including State-wide SIP's and SIP revisions, generic modeling guidelines and other generic issues. The significant number of smelter cases during FY84 was primarily due to lead SIP development issues.

3. Urban/Rural. Most modeling analyses referred to the Clearinghouse were either clearly urban or clearly rural such that the choice of urban or rural dispersion coefficients was not in question. However there were also a variety of problems, especially during FY84, where sources and/or receptors were located in both urban and rural areas. Most of these problems were resolved by citing the current guidance.

4. Type of Regulation. Most regulatory actions referred to the Clearinghouse were for SIP relaxations (primarily SO_2) and PSD. The significant number of cases associated with new SIP's during FY84 is primarily associated with the development of lead SIP's; however, there were also several cases where a State began development of a SIP in areas where no SIP currently existed. The significant number of generic modeling problems during FY83 and FY84 were most often associated with States developing/adopting their own modeling guidelines for PSD and bubble (emissions trading) analyses.

5. Terrain Setting. Since the Guideline on Air Quality Models[1] does not recommend any refined models for use in complex terrain, a large percentage of the referrals to the Model Clearinghouse involved proposals for new complex terrain models/analysis techniques for use on specific sources. Many applications involved receptors both above and below stack height, sometimes requiring the use of more than one model.

6. Use of Nonguideline Models. A large percentage of the Model Clearinghouse referrals proposed the use of nonguideline models, often for complex terrain situations. However, the majority of the issues involved appropriate choices among guideline models and/or associated data bases.

7. Use of On-site Data. The majority of the model applications referred to the Clearinghouse utilized off-site meteorological data (usually National Weather Service data). Those that utilized on-site data often were in complex terrain. The "not relevant" category was most often associated with screening techniques where no local meteorological data input was required.

2.2 Coordination with Regional Offices

During the five-year period the Clearinghouse conducted or participated in a number of activities that can be categorized as coordination and information exchanges with the Regional Offices. One such activity was to prepare and distribute to the Regional Offices in October of each year, a Clearinghouse report; this report served as a "newsletter" informing Clearinghouse users about the issues and responses which occurred during the year. The report included statistical summaries of Clearinghouse activities, similar to Tables 1-3, summaries of major responses by the Clearinghouse to Regional Offices, descriptions of recurring consistency issues that were common to more than one Region, and a summary of issues by pollutant, source type, etc.

Another periodic activity of the Clearinghouse was to discuss the activities of and issues referred to the Clearinghouse at the annual Regional Office modeling workshop held in April/May of each year. At such workshops recent significant issues referred to the Clearinghouse were presented. Several of the particularly complex and controversial issues were discussed in some detail at these workshops.

As another communication function, beginning in FY83, the Clearinghouse sent copies of all of its written responses (along with the incoming requests) to all the Regional Offices. In this way the Regional Offices were made aware, in a timely fashion, of decisions made that may affect some of their modeling activities.

A related activity that began in FY83 was to solicit advance opinions from all the Regional Offices on particularly sensitive issues with national implications. When such cases arose, the proposed Clearinghouse response, containing a detailed description of the issue and its risks, was sent to all the Regions for comment before the response was finalized.

As a means of communicating with the general air pollution modeling community, the Clearinghouse participated in the design and operation of the EPA booth at the 1984 and 1985 Air Pollution Control Association (APCA) national meetings. These booths included displays from the several EPA Clearinghouses, e.g. the Model Clearinghouse, the BACT Clearinghouse, etc. The APCA booth display contained brief statements about the users of the Model Clearinghouse, the information available, and the methods of disseminating that information. In addition, a one page statement that describes the

operation of the Model Clearinghouse was prepared and distributed to interested visitors at the booth. A copy of this statement is provided in the Appendix.

Pursuant to its responsibility to establish a historical record of modeling decisions, personnel from the Model Clearinghouse visited all ten Regions during FY82. The purpose of these meetings was to gather information on the historical usage of models by Regional Offices and to identify current/upcoming modeling problems which may come to the attention of the Clearinghouse. A secondary purpose was to communicate information to the Regions on the current and future operation of the Clearinghouse. As a result of these very useful meetings, the Clearinghouse was able to document precedents that have been established for the use of certain models and data base considerations and the circumstances associated with the precedents. In addition, a number of broader modeling issues were identified where the Regions have adopted specific policies in areas where national guidance is lacking or is flexible.

As noted in Section 2.1 the Model Clearinghouse was frequently involved in reviewing justifications for the use of nonguideline models. Several of the more involved and complicated justifications included technical and performance evaluations of the proposed model pursuant to guidance contained in the "Interim Procedures for Evaluating Air Quality Models (Revised)."[2] In order to share its experience in reviewing such evaluations with the Regional Offices and other users, the Model Clearinghouse prepared and issued in 1985 a report "Interim Procedures for Evaluating Air Quality Models: Experience with Implementation"[3]. This report summarizes and intercompares the details of five major regulatory cases which were reviewed by the Clearinghouse, and for which the above cited guidance was implemented as support for acceptance of the proposed nonguideline models.

3.0 MODEL CLEARINGHOUSE RESPONSES TO RECURRING AND GENERIC ISSUES

There were several Clearinghouse referrals over the five-year period that contained common modeling problems or issues. In these cases the Model Clearinghouse ensured that each recommendation was in harmony with previous recommendations involving the same or similar issues. If the recommendations were in conflict with previous determinations, then the changed position was coordinated and a consensus agreed upon by the Regions[4].

Summarized below are recommendations the Clearinghouse has made on the major recurring issues. Also included are a few issues that did not occur all that often, but which are expected to recur at a future date.

In contrast though, it should be noted that issues referred to the Model Clearinghouse were generally very narrow, i.e., highly geared to the specific aspects of the individual model application. Although the resolution of such issues may set precedents for future modeling of a like situation, such similar situations rarely occurred.

Also, it should be reemphasized here that the Clearinghouse determinations on these recurring/generic issues do not constitute national guidance. Relevant facts in a particular situation may suggest a somewhat different interpretation. However, the information in the following subsections can provide an indication of how EPA may view a particular modeling application where these issues are inherent.

3.1 Performance Evaluations

The most frequently recurring issue involved proposals for acceptance of nonguideline models/techniques where the primary justification for acceptance of such techniques consisted of "favorable" comparisons of model estimates with measured data. In reviewing such proposals, the Clearinghouse most

often used the guidance contained in the "Interim Procedures for Evaluating Air Quality Models (Revised)"[2] in judging whether the performance evaluation was objective and sufficiently comprehensive, given the scope and nature of the proposal.

For major problems, e.g., a large power plant located in complex terrain where a model significantly different from the recommended model was proposed, the Clearinghouse recommended full implementation of the Interim Procedures guidance. This involved a technical evaluation of the proposed model, a protocol for the performance evaluation agreed upon by the source and the regulatory agencies, and the acquisition or identification of an agreed-upon data base to be used in the evaluation. A review of five major issues of this nature that were referred to the Clearinghouse is contained in the "Interim Procedures for Evaluating Air Quality Models--Experience with Implementation."[3]

A variety of other referrals to the Model Clearinghouse for smaller sources or more narrow situations also included performance evaluations as partial justification for the use of new or alternative modeling techniques. In these cases the basic principles contained in the Interim Procedures guidance were still used to judge the adequacy of the proposal, but perhaps a complete protocol was judged to be unnecessary. However, many of the proposals still could not be accepted because of a dearth in coverage (spatial or temporal) of field data for the performance evaluation. In some cases fluid modeling in conjunction with minimal field data was accepted. In a few cases where the Guideline on Air Quality Models did not recommend a technique for the situation, a technically sound model was accepted, with minimal field justification. For example, see Section 4.3 below.

3.2 Modeling a Large Number of Sources

A number of referrals to the Model Clearinghouse during the five-year period involved proposed relaxations from strict interpretation of guidance when the guidance implied that a large number of sources would need to be modeled. In these cases the resources required to model all of the sources in harmony with the guidance would be large and sometimes prohibitively expensive.

One set of circumstances involved TSP SIP cases where it was necessary to model a large number of sources (~1200). In these cases the computer costs and logistics required to use the RAM,[5] ISC[6] and/or CDM[7] models with five years of meteorological data were prohibitive. In one case the computer costs alone were estimated to be $1 Million.

In each of these cases the respective Region wrote a protocol for modeling the area which was designed to reduce the amount of computer run time and yet still be technically defensible. Although the details of each protocol were slightly different, in general each incorporated the following procedure. For the annual estimates all sources were included in CDM or ISCLT and five individual years of meteorological data (STAR) summaries were input. Coarse grids were used; remodeling around hot spots with a finer grid would be conducted, if judged necessary.

For the short-term analysis, a judgment was first made as to which of several sources, usually the large industrial complexes, were likely to cause the largest air quality impacts. Many of the individual sources within these facilities were then combined and the appropriate model (RAM or ISC, depending on the need to consider downwash, etc.) was run with five years of hourly meteorological data. The meteorological year yielding the

highest short-term impacts was singled out, each of the large facilities then disaggregated into individual sources, and the model rerun for that year. Several (~5) "worst case" days were identified and the model(s) run for these days using the entire emissions inventory for the area.

The Clearinghouse agreed that, although these modeling procedures were somewhat less than rigorous since they involve some subjective judgments, they were technically sound in these situations and a reasonable compromise to achieve acceptable costs.*

A somewhat related set of issues that were referred to the Model Clearinghouse involved Regions and States that were often in a position of having to determine the emission limit for a single source located in the midst of many other sources. In these cases it was frequently necessary to model all of the sources over an extensive grid, using five years of meteorological data. This was often a sizeable and sometimes expensive project.

One solution to this problem proposed to the Clearinghouse by some Regions, involved first modeling only the source in question using the five years of meteorological data. Then the specific meteorological periods where the source had a "significant" impact were identified. Finally, all the sources in the area were modeled but only for the specific receptors/ time periods identified as significant.

Prior to FY85 at least two Regions had used the technique, in principle, or some variation in the technique. For example, one Region used the technique to help determine the acceptability of emission limits

---

*Application of these procedures for future modeling would also need to be shown to be technically sound prior to acceptance by EPA.

for three small TSP sources in a nonattainment area. In this case, the 24-hour Level II bubble significance level of 10 ug/m^3 was used to define the days/receptors where all sources needed to be modeled. Another Region asked the Clearinghouse to approve a variation of the technique for use in a PSD analysis. In this case the PSD significance levels were used to identify receptors where the incremental impact of "surrounding" increment consuming sources needed to be calculated. However, in this case, the technique was limited to only defining the area of significant impact and all sources were modeled using the full set of sequential meteorological data.

The Clearinghouse agreed with the Regions that the proposed method was acceptable for these applications but at the same time indicated that for future uses the technique (or variations) should continue to be accepted on a case-by-case basis only.

3.3 PSD Increment Consumption Calculation

A number of discussions were held with the EPA Regional Offices during FY83 and FY84 on the general question of how, from a modeling standpoint, short-term increment consumption should be calculated when multiple increment consuming sources (or source shutdowns which create increment) were involved. One viewpoint supported by some Regions was to model short-term increment consumption on both a spatially and temporally consistent basis, a procedure analogous to the method contained in a policy memorandum on Level II bubble analyses, dated February 17, 1983.[8] In this methodology, the maximum amount of PSD increment consumed must be determined by modeling the net changes in emissions (between the baseline and future cases) sequentially for each time period with at least a year of meteorological data. The

resulting maximum impacts of this type of analysis specify the maximum amount of increment consumption at each receptor.

Another viewpoint was that the model calculations should be performed on a spatial basis only, i.e., the second highest short-term modeled impacts of all sources at each receptor were compared to the second highest modeled baseline concentrations at those receptors to determine the increment consumption.

The Clearinghouse recommended that EPA should follow the methodology of spatial and temporal modeling to determine increment consumption.

3.4 Concentration Estimates on Tall Buildings

In recent years a number of issues surfaced regarding concentration estimates on balconies and rooftops of tall buildings. While the Model Clearinghouse was not directly involved in the issues regarding applicability of NAAQS and PSD increments on buildings, it was involved in a technical manner concerning how to make the estimates. One option was to use the MPTER,[9] ISC or Valley[10] models to make such estimates, identical to the manner in which estimates are made on elevated terrain. One problem with this technique is that the buildings are then treated as terrain features with full reflection. The Clearinghouse did not believe that buildings should be regarded as terrain features since they act more like "flagpoles" extending into the plume. Another problem with the above mentioned models was, at that time, that they did not properly account for urban dispersion applicable to most problems where tall buildings are present.

Consequently, the Clearinghouse advised Regional Offices that the appropriate concept to use when modeling receptors on tall buildings was to treat these receptors as "flagpoles." In most cases the RAM model was appropriate as it has an option that handles flagpole receptors.

3.5 Generic Modeling Guidelines

Over the years several States and local agencies developed/adopted their own modeling guidelines for use in evaluating the impacts of sources within their jurisdiction. In some instances these agencies proposed to EPA that the modeling guidelines be incorporated into their SIP such that EPA would not have to review new or revised emission limits for sources but that the State/local agency could issue such permits directly. The Model Clearinghouse was involved in the review of these modeling guidelines. The approvability of the modeling guidelines as part of the SIP was generally governed by two factors: (1) whether or not the regulatory program for which the guidelines apply had been or could be delegated to the agency and, (2) the degree to which they utilized technically sound techniques and were consistent with national guidance.

Regarding the first factor, it should be noted that the Clean Air Act allows for the new source review (NSR) and PSD programs to be delegated to the States. Approvability of the delegation depends in part on whether the agency had an acceptable modeling guideline or, as most agencies have done, had adopted EPA's Guideline on Air Quality Models into their own regulations. Once approved, the agencies can issue permits directly, using these techniques to demonstrate that the allowable emissions do not violate applicable ambient standards and PSD increments.

On the other hand, EPA cannot delegate the authority to issue/revise permits pursuant to Section 110 of the Clean Air Act pertaining to SIP's. These permits require a SIP revision in each case and the emission limits must be reviewed by EPA. However, EPA has taken the position that its role in review can be minimized or, in the case of generic bubble regulations

where there is no net increase in emissions, eliminated provided the agency agrees to use "replicable" techniques in determining the air quality impact of the changed emission limits. "Replicable" is intended to mean that the modeling techniques to be used on any source are restrictively defined such that the application of the techniques by any modeler would yield the same estimate.

Given these procedural restrictions, the Model Clearinghouse reviewed several proposed agency modeling guidelines for technical adequacy and national consistency. For NSR and PSD the Clearinghouse supported proposed screening techniques that were at least as conservative as those used by EPA and the use of refined EPA Guideline models. For Section 110 SIP's it was clear that only techniques that precisely defined which models, which model options and which data bases would be used for every applicable situation could be approved. For these actions the Clearinghouse supported several different replicable screening techniques that were more conservative than EPA's. The Clearinghouse also supported the use of certain EPA refined models provided that the predefined data bases to be used were representative. The applicability of the technique had to be significantly restricted since no judgments could be allowed. This precluded, for example, complex terrain situations and complex sources where source emission characterization was required.

3.6 Use of Composite Wind Roses

In reviewing Federal Register packages during the FY81-FY83 period the Clearinghouse noted that some of the annual modeling demonstrations utilized 5-year "composite" stability wind roses as input, i.e. a single

stability wind rose based on five years of meteorological data. While no specific modeling guidance on the subject existed at the time, the Clearinghouse was concerned that the associated 5-year average estimate did not technically ensure that the annual mean would never be exceeded, as required by regulation. The issue of the annual mean was primarily a procedural problem rather than a real problem for the cases reviewed since the emission limits necessary to attain short-term standards/increments generally provided for an ample margin of safety on the annual mean.

However, in FY84 the Clearinghouse began reviewing lead SIP demonstrations, some of which utilized composite quarterly stability wind roses as model input. Since the 5-year average quarterly concentration estimates clearly did not demonstrate compliance with the lead standard, the Clearinghouse recommended that these SIP's be remodeled, i.e. using 20 individual quarters. All Regions were subsequently advised that when using a long term, climatological model for pollutants for which there is a long term standard, i.e. TSP, SO_2, NO_2 and Pb, the analysis should be done for individual years/quarters.

3.7 Long Range Transport

The Clearinghouse was consulted on a number of occasions regarding the use of modeling techniques beyond the normal 50 km range of recommended refined models. These cases usually involved PSD sources where there was a question about the possible adverse impacts on a distant Class I area. In such cases the Clearinghouse recommended that an applicable screening technique such as the Valley model be used to make the requisite estimates since it was believed that such estimates would be conservative. This approach resulted, in most cases, in a showing of no adverse impact.

3.8 Effective Date of Guidance

The basic document used by the Clearinghouse to determine whether a proposed modeling technique is in harmony with national guidance is the Guideline on Air Quality Models, published in 1978. However, since 1978 EPA issued policy memoranda and reports which interpret this guidance and/or specify its applicability to new regulatory requirements, e.g. bubbles, GEP stack height regulations, lead SIP's, etc. The issuance of such interpretative guidance sometimes caught regulatory packages in the middle of development, e.g. a regulatory package containing modeling techniques that did not conform to the new guidance may have already been completed and is undergoing EPA review. In this situation it seems clear that EPA should complete its review and not require new modeling based solely on the fact that the modeling did not conform to current guidance. It was not so clear that regulatory modeling analyses that were started several years previously, perhaps revised several times, and finally submitted to EPA should be entitled to use only the guidance that was in place at the time of the initial analysis.

On several occasions the Model Clearinghouse was asked to concur on regulatory modeling analyses that did not conform to current guidance, but did conform to guidance that was in place at some point in the past. In each case the Clearinghouse tried to establish first whether it was reasonable to expect that the State/source had ample opportunity to conform with current guidance without undue resource impacts and second, whether the deviation clearly resulted in a technically deficient analysis or was only a question of consistency.

To eliminate confusion and promote consistency the Clearinghouse now judges the acceptability of a "dated" technique based on the following criteria: (1) whether there is a written protocol with a legal or regulatory basis or (2) whether the analysis is complete and regulatory action is imminent or underway.

4.0 EXAMPLES OF CLEARINGHOUSE ISSUES AND THEIR RESOLUTION

The following four examples are provided with the primary purpose to illustrate how the Model Clearinghouse operates in response to modeling issues that come to its attention. As mentioned in Section 1.1, the Clearinghouse becomes involved in modeling issues through two different mechanisms. In one set of circumstances a Region may contact the Clearinghouse prior to taking a formal position on a regulatory action to obtain an advance opinion on its approvability, from a modeling standpoint. This inquiry may come directly to SRAB or may come through the CPOB arm of the Clearinghouse if it involves procedural as well as technical issues. The other set of circumstances involves the Regional Office submittal of a regulatory package to CPOB. In this case the Regional Office position on modeling issues is established but is reviewed at the time of formal submittal by the Clearinghouse.

The first three examples described below serve to illustrate the first set of circumstances, i.e. an advance opinion is sought by a Regional Office on a modeling issue. Section 4.1 illustrates the resolution of a minor issue through a series of telephone discussions; oral resolution of issues is the most common mode of operation of the Clearinghouse. Section 4.2 involves the informal resolution of an issue involving the utilization of a data base; cases referred to the Clearinghouse that involve data base issues occur frequently. The third issue involves the choice of a nonguideline model for CO estimates from a roadway. It is provided to illustrate how issues are handled when the Model Clearinghouse does not internally have the technical expertise to evaluate the adequacy of a proposed technique and such technical support is sought from other personnel in EPA.

The last example is provided to illustrate the second set of circumstances, i.e. a SIP proposal containing modeling issues is forwarded to CPOB for concurrence and a Model Clearinghouse review/opinion is required before such concurrence can occur.

4.1 Use of the ISC Model With the Deposition Option

During FY85 the Model Clearinghouse was contacted by a Region regarding proposed modeling of particulate matter from an excavation/ drilling operation on Federal land. The site was located in complex terrain; however, significant terrain features were outside of the boundaries of the project property. Preliminary modeling with ISC indicated that allowable PSD increments would be exceeded at the boundary lines. A significant portion of the particulate material released would consist of heavier particles. It was expected that much of this material would be deposited on-site, thus reducing concentrations at the boundary line. The applicable model for handling the deposition problem would normally be the ISC model. However the ISC users' manual cautions against using the deposition option for sources located in complex terrain.

The Region, who was assisting another Federal Agency in preparation of the EIS for the project, asked the Clearinghouse if the deposition option could still be used for estimates at the boundary line, since complex terrain was beyond this distance. A check of the Clearinghouse files revealed that a similar issue had occurred before in another Region. In that case the Region had contacted the ISC model developer to discuss the possible use of the model in complex terrain. The result of this inquiry was that the deposition option is valid out to the distance where terrain is first encountered. Based on this finding the Clearinghouse informed the

Region that the deposition option would be valid for calculating TSP levels at the boundary line.

This particular case illustrates a very common mode of operation of the Clearinghouse. A call came from a Regional Office asking for an opinion on a position that may conflict with guidance. The Clearinghouse checked the guidance, in this case the ISC users' manual, then checked the Clearinghouse records for any precedents for the case. In this case a precedent was found and the details of the previous case were determined. These findings enabled the Clearinghouse to confirm that the Region's position was technically sound and nationally consistent.

4.2 Representativeness of National Weather Service Data

During FY83 The Model Clearinghouse was asked by a Regional Office to resolve an issue where a source wanted to discard certain hours of National Weather Service (NWS) meteorological data on the grounds that they were not temporally representative.

In this case a conventional set of CRSTER model runs had been made for the purpose of analyzing secondary standard attainment using six years of NWS meteorological data. The results showed a number of 3-hour ambient standard violations. Each of these violations were predicted to occur under a typical "A" stability condition. The source made the argument that these periods of predicted violation should be ignored because of the manner in which NWS makes wind direction observations. That is, rather than constructing true hourly average wind directions, the NWS observer reports instantaneous wind directions once every hour. It is the hourly average wind direction which is of interest in air dispersion modeling.

The Model Clearinghouse, in an oral response to the Region, indicated that the source had correctly summarized a deficiency in the data bases available from the NWS. However there exists no practical way to correct these data bases. This problem was well understood and carefully considered in the early 1970's when EPA developed its policy to require the use of NWS data in dispersion modeling. The issue before the EPA was whether the benefits of using these data sets to establish reasonable regulations nation-wide outweighed their inherent deficiencies. It is important to realize that all data bases have certain inherent deficiencies which may be impractical, if not impossible to resolve.

It was EPA's opinion that the ready availability, overall quality, length of historical record, and spatial coverage of the NWS data bases strongly outweigh the inherent deficiencies. Also, since the time of the institution of this policy, many major utilities throughout the country have been regulated through the use of NWS data. Therefore, in order to change the present policy, a new and compelling rationale would be necessary. Since the argument presented by the source constituted neither a new nor a compelling rationale, policy on this matter was not changed.

The mode of operation of the Model Clearinghouse in this case was similar to the case described in Section 4.1, i.e. a Regional Office sought an advance opinion on the approvability of a technique that was in conflict with guidance. However, the outcome in this case was different; the Clearinghouse indicated that the proposal could not be supported. While the proposal had some technical merits, the conflict with consistency was of such serious magnitude as to cause a disruption of national programs.

4.3 Use of the SONDEL Model

During FY83 the Clearinghouse responded to a written request from a Region to review the acceptability of the SONDEL[11] model for CO SIP analyses in deep street canyons of a major city. The model was designed for application to deep street canyons with height to width ratios greater than two. This model differed significantly from the more commonly used APRAC[12] street canyon model. The major differences stemmed from the observation that flow patterns differ for deep canyons and shallow canyons. Shallow street canyons, those with height to width ratios in the order of one, under crosswind conditions develop a vortex circulation which carries roadway emissions to the lee side of the canyon. Thus maximum concentrations occur on the upwind side of the street canyon. As the canyon aspect ratio (ratio of building height to street width) becomes larger or the Reynolds number becomes lower, the vortex no longer develops in the canyon. Under these conditions the model developer reasoned that it was not appropriate to apply the APRAC model because nonvortex flows were often observed in deep street canyons. Measurements showed a strong tendency for flow to be channeled along the street direction, especially in deeper canyons. Flow perpendicular to the street canyon was never observed.

The SONDEL model assumes channeled flow and dilution resulting solely from turbulent diffusion. This is a steady-state system where the total mass emitted from the top of the canyon equals the emissions generated on the street. The dependence on wind is implicit, as the level of the turbulence and turbulent diffusion are related directly to the wind speed. The assumptions of steady-state conditions and uniform source strength in

the canyon restricts application of the model to longer blocks where intersection factors do not seriously violate the assumptions. There are three zones defined in the street canyon: (1) the mechanical mixing cell (MMC) where concentrations are assumed to be uniform, (2) the lower canyon region (LCR) where uniform diffusivity is assumed, and (3) the upper canyon region (UCR) where the diffusivity is assumed to be exponentially increasing. The shape of the MMC is defined as the upper half of an ellipse having the semi-major axis along the ground and the semiminor axis vertical above the center of the roadway.

While the Clearinghouse understood the arguments favoring the use of the model, it did not feel that there was sufficient expertise within the Office of Air Quality Planning and Standards to review the detailed technical aspects of the model. The Clearinghouse also questioned whether it would be appropriate for the State to conduct a comparative technical and performance evaluation between SONDEL and APRAC, the model that was at that time commonly used for street canyon analyses. These questions were referred to the Meteorology and Assessment Division, Office of Research and Development, for an opinion.

Comments from the Meteorology Division indicated that the SONDEL model was an improvement over currently available models. Some of the input parameters may be difficult to define and require measurements and experience in assigning values to them. The Meteorology Division also noted that SONDEL was the only model known that is appropriate for deep street canyons. Therefore, in any verification study one would not be trying to choose the best model from a group, but rather to demonstrate that the physics of the model were an appropriate characterization of the dynamics in

the street canyon. Secondly, a study should show that the concentration estimates are reasonable.

Based on the comments from the Meteorology Division, the Clearinghouse recommended to the Region that SONDEL be accepted within its stated limitations. The approval was conditioned subject to tests that the model was performing satisfactorily and refinements were made to the input values for the turbulent diffusivity and the attenuation coefficient.

This case is similar to those in Section 4.1 and 4.2 in that a Regional Office requested an advance opinion on the approvability of a nonguideline technique for use in regulatory analyses. However, it differs in two important ways. First, the request was written, entailing a more complete documentation of the relevant facts and requiring a written response from the Clearinghouse. Second, the case involved technical subject matter of such a nature that the Clearinghouse needed an outside opinion on its technical adequacy. Such outside opinions do not necessarily totally govern the Clearinghouse response to the Regional Office since the Clearinghouse is also responsible for ensuring that the endorsement of the proposed technique does not create a consistency issue. In the case described above there was no consistency issue since the model addressed a unique situation for which national guidance was absent.

4.4 Modeling of a Power Plant in an Urban Area

During FY84 CPOB received from a Regional Office a proposed Federal Register action to renew a variance to allow for the burning of 2.2% sulfur content fuel oil in a boiler of a large power plant in an urban area. Model Clearinghouse personnel in CPOB reviewed the package and identified several instances where the modeling used to support the SIP

revision apparently deviated from strict interpretation of the current modeling guidance. These issues were then referred to the SRAB Model Clearinghouse function for further review.

SRAB personnel found that most of the deviations from guidance were of minor consequence, i.e., a strict application of guidance would not have resulted in a showing that the National Ambient Air Quality Standards (NAAQS) or PSD increments would have been violated as a result of the proposed action. One particular issue did entail a closer look at its technical defensibility and an examination of other Clearinghouse opinions for consistency. In this case the problem entailed a combination of modeling considerations for which there was no single recommended model available. The Regional Office made a judgment on which aspects of the problem were most important in terms of protection of the NAAQS and PSD increments and chose a model that would address those aspects. Subsequent discussions within the Clearinghouse and with the Regional Office focussed on the basis for that judgment.

A check with the Clearinghouse and Federal Register files indicated that there were other cases, similar to this power plant, where the same reasoning and choice of model has been used before. Thus the Clearinghouse deferred to the Regional Office and concurred with the modeling used to support this SIP revision; it was technically defensible and not inconsistent with similar actions. The proposed and final rules governing this SIP revision were eventually published in the Federal Register.

Several aspects of the Model Clearinghouse operation are illustrated by this example. First it shows how a proposed regulatory action containing modeling issues was reviewed and coordinated by Clearinghouse functions in both CPOB and SRAB. The regulatory package was first reviewed

by CPOB and modeling issues were identified. These issues were then addressed by SRAB and comments provided to CPOB. CPOB then used these comments as inputs to the concurrence/nonconcurrence on the regulatory package.

Second, this example shows that the Clearinghouse often defers to the Regional Office on technical judgment issues where there is not a clear indication of which technique is more appropriate. The Regional Office is "closer to the problem" and is aware of more technical facts and other considerations relevant to the problem.

Finally, this example again illustrates how the Clearinghouse checks previous determinations on like issues to make sure that there is no conflict with precedents.

5.0 CONCLUSIONS

The Model Clearinghouse was created in November of 1980 with the dual purpose of assisting the Regional Offices in their decisions on the acceptability of nonguideline models, techniques and data bases and for reviewing regulatory actions with modeling analyses as they are forwarded to CPOB. Judging by the number (523) and wide variety of issues referred to or reviewed by the Clearinghouse, the demand for its services are high.

While most cases referred to the Clearinghouse involved narrow sets of modeling issues, unique to each given application, there were also a significant number of cases where the modeling issues were interrelated and a coordinated and consistent response from the Clearinghouse was required. Most notable were cases involving the use of ambient data to substantiate a proposed technique and cases not covered by existing modeling guidance such as estimates on tall buildings and long range transport. Another class of problems resolved by the Clearinghouse involved coordination between modeling issues and broader scale air pollution control policy. These included PSD increment consumption calculation, applicability of generic modeling guidelines and the effective date of modeling guidance. A review of these major recurring or generic modeling issues indicates that the Clearinghouse can satisfactorily support Regional Office needs for technically defensible techniques for complex situations. At the same time the Clearinghouse ensures national consistency within the framework of the various regulatory policies and the Guideline on Air Quality Models.

The dual mode of Clearinghouse operation involving advance reviews of proposed regulatory modeling techniques and coordinated SRAB/CPOB reviews of proposed regulatory actions containing modeling issues has worked well.

The success of this program is primarily attributed to a continual, high level of coordination within the Clearinghouse and between the Clearinghouse and the Regional Offices.

6.0 REFERENCES

1. Environmental Protection Agency. "Guideline on Air Quality Models," EPA 450/2-78-027, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, 1978.

2. Environmental Protection Agency. "Interim Procedures for Evaluating Air Quality Models (Revised)," EPA 450/4-84-023, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, 1984.

3. Environmental Protection Agency. "Interim Procedures for Evaluating Air Quality Models: Experience with Implementation," EPA 450/4-85-006, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, 1985

4. Environmental Protection Agency. "Regional Workshops on Air Quality Modeling: A Summary Report," EPA 450/4-82-015, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711, 1981.

5. Turner, D. B., and J. H. Novak. "User's Guide for RAM," EPA 600/8-78-016 Vol a, b, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711, 1978.

6. Bowers, J. R., R. J. Bjorklund and C. S. Cheney. "Industrial Source Complex (ISC) Dispersion Model User's Guide, Volumes 1 and 2," EPA 450/4-79-030, 031, Office of Air Quality Planning and Standards, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711, 1979.

7. Busse, A. D. and J. R. Zimmerman. "User's Guide for the Climatological Dispersion Model," EPA R4-73-024, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711, 1973.

8. Meyers, S. Memorandum of February 17 to Regional Office Air Management Division Directors, "Emissions Trading Policy Technical Clarifications," Office of Air, Noise and Radiation, U. S. Environmental Protection Agency, Washington, DC 24060, 1983.

9. Pierce, T. D. and D. B. Turner. "User's Guide for MPTER," EPA 600/8-80-016, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711, 1980.

10. Burt, E. W. "Valley Model User's Guide," EPA 450/2-77-018, U. S. Environmental Protection Agency, Research Triangle Park, NC 27711, 1977.

11. Deland, R. "Final Report on Deep Canyon Model: SONDEL," Bureau of Science and Technology, New York City Department of Environmental Protection, New York, NY 10003, 1982.

12. Simmon, P. B., R. M. Patterson, F. L. Ludwig, and L. B. Jones. "The APRAC-3/Mobile 1 Emissions and Diffusion Modeling Package," EPA 909-9-81-002, Environmental Protection Agency, Region IX, San Francisco, CA 94104, 1981.

APPENDIX

EPA MODEL CLEARINGHOUSE

The Model Clearinghouse was created in November 1980 as the single EPA focal point for reviewing the use of dispersion modeling techniques in specific regulatory applications. The Clearinghouse also serves to compile and periodically report for Regional Office benefit Agency decisions concerning deviations from the requirements of the "Guideline on Air Quality Models."

Need for the Model Clearinghouse

The guideline states that when a recommended model or data base is not used, the Regional Administrator may approve the use of other techniques that are demonstrated to be more appropriate. There is also a need to provide for a mechanism that promotes fairness and consistency in modeling decisions among the various Regional Offices and the States. The Model Clearinghouse was created in order to promote this fairness and uniformity and also to serve as a focal point for technical review of "nonguideline" techniques proposed for use/approval by a Regional Administrator.

Functions of the Model Clearinghouse

The major function of the Clearinghouse is to review specific proposed actions which involve interpretation of modeling guidance, deviations from strict interpretation of such guidance and the use of options in the guidance, e.g., Regional Office acceptance of nonguideline models and data bases. This is handled in two ways: (1) the Clearinghouse, on request from the Regional Office, will review the Region's position on proposed (specific case) use of a nonguideline model for technical soundness and national consistency, and (2) the Clearinghouse will screen SIP submittals for adherence to modeling policy and make recommendations for resolution of any issues identified.

A secondary purpose of the Model Clearinghouse is to communicate to regulatory model users in EPA significant decisions involving the interpretation of modeling guidance. This is accomplished through an annual newsletter or "Clearinghouse report" which itemizes the significant decisions that have been made and the circumstances involved. This report serves to improve consistency in future decisions and as a source of technical information for the Regional Offices.

Structure of the Clearinghouse

The Clearinghouse is formally located in the Source Receptor Analysis Branch (SRAB) of OAQPS. However, the Control Programs Operations Branch (CPOB) also participates in Clearinghouse matters involving SIP attainment strategies and other regulatory functions.

The primary responsibility for managing the Clearinghouse and ensuring that all of its functions are carried out is performed by a full-time person from SRAB. In addition CPOB supports the Clearinghouse with one individual who is also knowledgable in modeling policy. This individual is responsible for screening SIP submittals and related documents, referring issues to SRAB through the Clearinghouse and documenting the final (and any significant interim) decision on disposition of the issues.

Communication Chain

The Model Clearinghouse functions within the organizational structure of EPA. As such the Clearinghouse serves the EPA Regional Offices. It coordinates with and communicates decisions to the Regional Offices. Any coordination with State and local agencies and individual sources on Clearinghouse activities is a function of the EPA Regional Offices.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
EPA 450/4-86-006		

4. TITLE AND SUBTITLE	5. REPORT DATE
Activities of the EPA Model Clearinghouse, A Summary Report: FY81-FY85	May 1986
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)	8. PERFORMING ORGANIZATION REPORT NO
9. PERFORMING ORGANIZATION NAME AND ADDRESS Monitoring and Data Analysis Division Office of Air Quality Planning and Standards U.S. Environmental Protection Agency Research Triangle Park, NC 27711	10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS	13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This report summarizes the operation of the EPA Model Clearinghouse during its first five years of existence, FY81-FY85. Included are a summary of the number of cases and the nature of issues reviewed by the Clearinghouse and a description of major recurring and generic issues referred to the Clearinghouse. In addition, the report describes and illustrates, through a series of examples, how the Clearinghouse fulfills its major responsibility for review of specific proposed actions which involve interpretation of modeling guidance, deviations from such guidance, and the use of options in the guidance.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution Meteorology Mathematical Models	Model Clearinghouse	

18 DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO OF PAGES
Unlimited	Unclassified	
	20 SECURITY CLASS *(This page)*	22. PRICE
	Unclassified	

INSTRUCTIONS

1. **REPORT NUMBER**
Insert the EPA report number as it appears on the cover of the publication.

2. **LEAVE BLANK**

3. **RECIPIENTS ACCESSION NUMBER**
Reserved for use by each report recipient.

TITLE AND SUBTITLE
Title should indicate clearly and briefly the subject coverage of the report, and be displayed prominently. Set subtitle, if used, in smaller type or otherwise subordinate it to main title. When a report is prepared in more than one volume, repeat the primary title, add volume number and include subtitle for the specific title.

5. **REPORT DATE**
Each report shall carry a date indicating at least month and year. Indicate the basis on which it was selected *(e.g., date of issue, date of approval, date of preparation, etc.)*.

6. **PERFORMING ORGANIZATION CODE**
Leave blank.

7. **AUTHOR(S)**
Give name(s) in conventional order *(John R. Doe, J. Robert Doe, etc.)*. List author's affiliation if it differs from the performing organization.

8. **PERFORMING ORGANIZATION REPORT NUMBER**
Insert if performing organization wishes to assign this number.

9. **PERFORMING ORGANIZATION NAME AND ADDRESS**
Give name, street, city, state, and ZIP code. List no more than two levels of an organizational hirearchy.

10. **PROGRAM ELEMENT NUMBER**
Use the program element number under which the report was prepared. Subordinate numbers may be included in parentheses.

11. **CONTRACT/GRANT NUMBER**
Insert contract or grant number under which report was prepared.

12. **SPONSORING AGENCY NAME AND ADDRESS**
Include ZIP code.

13. **TYPE OF REPORT AND PERIOD COVERED**
Indicate interim final, etc., and if applicable, dates covered.

14. **SPONSORING AGENCY CODE**
Insert appropriate code.

15. **SUPPLEMENTARY NOTES**
Enter information not included elsewhere but useful, such as: Prepared in cooperation with, Translation of, Presented at conference of, To be published in, Supersedes, Supplements, etc.

16. **ABSTRACT**
Include a brief *(200 words or less)* factual summary of the most significant information contained in the report. If the report contains a significant bibliography or literature survey, mention it here.

17. **KEY WORDS AND DOCUMENT ANALYSIS**
(a) DESCRIPTORS - Select from the Thesaurus of Engineering and Scientific Terms the proper authorized terms that identify the major concept of the research and are sufficiently specific and precise to be used as index entries for cataloging.

(b) IDENTIFIERS AND OPEN-ENDED TERMS - Use identifiers for project names, code names, equipment designators, etc. Use open-ended terms written in descriptor form for those subjects for which no descriptor exists.

(c) COSATI FIELD GROUP - Field and group assignments are to be taken from the 1965 COSATI Subject Category List. Since the majority of documents are multidisciplinary in nature, the Primary Field/Group assignment(s) will be specific discipline, area of human endeavor, or type of physical object. The application(s) will be cross-referenced with secondary Field/Group assignments that will follow the primary posting(s).

18. **DISTRIBUTION STATEMENT**
Denote releasability to the public or limitation for reasons other than security for example "Release Unlimited." Cite any availability to the public, with address and price.

19. & 20. **SECURITY CLASSIFICATION**
DO NOT submit classified reports to the National Technical Information service.

21. **NUMBER OF PAGES**
Insert the total number of pages, including this one and unnumbered pages, but exclude distribution list, if any.

22. **PRICE**
Insert the price set by the National Technical Information Service or the Government Printing Office, if known.