Lesson 2

Introduction to Air Quality Modeling and Modeling Guidance

Goal

To familiarize you with the process called air quality modeling—from determining the need to model to obtaining concentration estimates.

Objectives

After completing this lesson, you should be able to:

- Recognize whether a factory should model under New Source Review procedures given stack emissions data.
- Name the two kinds of data required for air quality modeling.
- Name the three ways that estimates from an air quality model can be used.
- Name and describe the two types of air quality model analyses.
- Identify one screening model and one refined model.
- Define background concentration.

Reading Assignment

EPA 450/2-78-027(R), *Guideline on Air Quality Models (Revised)*, Section 2.0 Overview of Model Use and Section 3.0 Recommended Air Quality Models, pp. 10-27 of this guidebook.

The previous lesson introduced the 1990 Clean Air Act Amendments. The Amendments led to the issuance of federal regulations that require air quality modeling in several air quality programs. The three programs discussed were New Source Review, Prevention of Significant Deterioration, and SIP Control Strategy Demonstrations. To introduce air quality modeling, let's look at the process called modeling. This process involves taking source and meteorological data and analyzing them.

Consider this example. An existing power plant that is a major source will be modified by adding a new coal-fired unit and a new smokestack. Modifying the power plant will result in an additional release of 120 tons per year of sulfur dioxide. Under New Source Review, this power plant must analyze source and meteorological data if its potential emissions will increase by a significant amount. The additional 120 tons of sulfur dioxide emissions exceeds the significance threshold value of 40 tons per year for sulfur dioxide, so modeling and a PSD analysis will be required. There are different significance threshold values for each criteria pollutant. For particulate matter, an increase of only 25 tons per year is defined as significant.

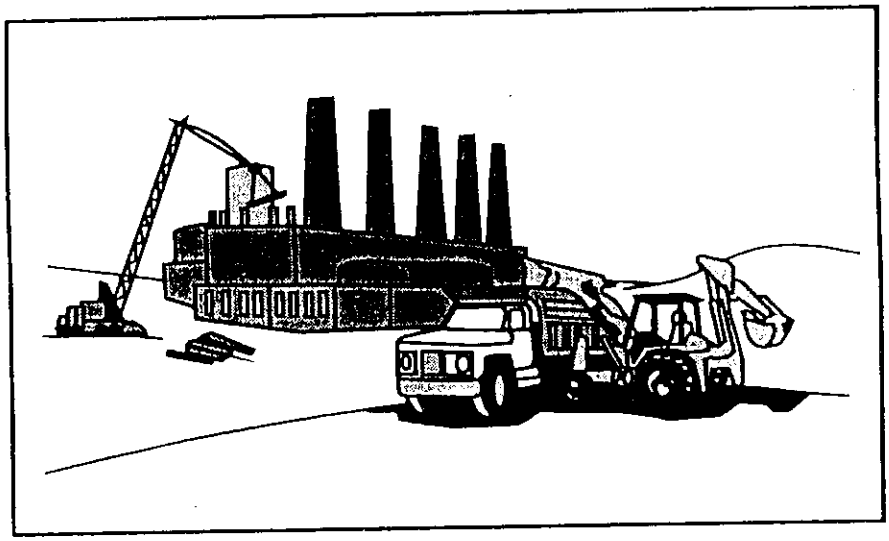

Figure 2-1. Additions to a major source may trigger new source review

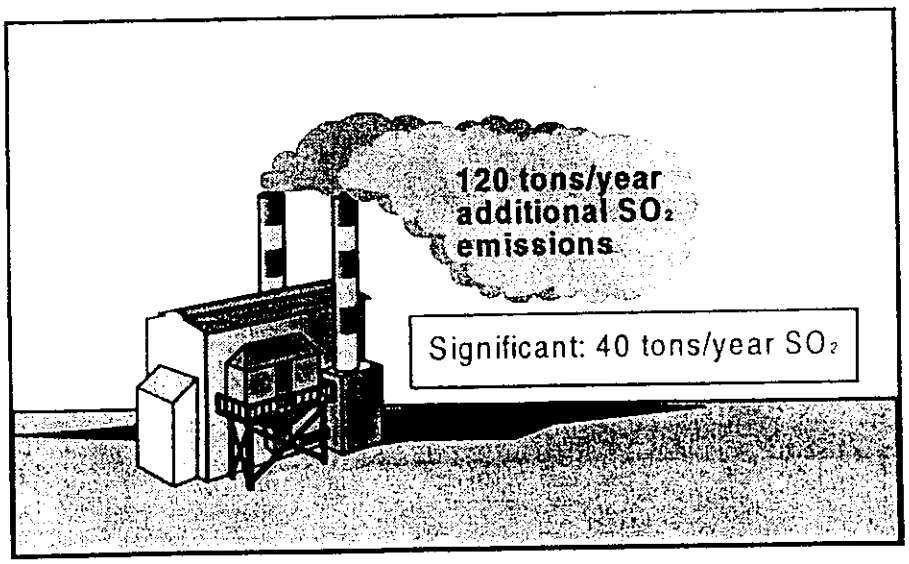

Figure 2-2. Compare additional emissions to appropriate signficance threshold

Source data are collected in the first step in the modeling process. These data would include the plant's geographic location, stack data such as height (h) and diameter (d), the effluent's temperature (T_s) and velocity (v_s), and the pollutant emission rate (Q). Meteorological data from the surrounding area are also collected. These data include wind speed (u) and direction, air temperature (T_a), atmosphere stability class, mixing height (L), and the height and location of any obstacles around the plant site. The meteorological data must be measured at a location representative of the plant's surroundings. A representative location chosen for sampling of meteorological or other data is called a monitoring site. A location where model predictions of pollutant concentrations are made is called a receptor site.

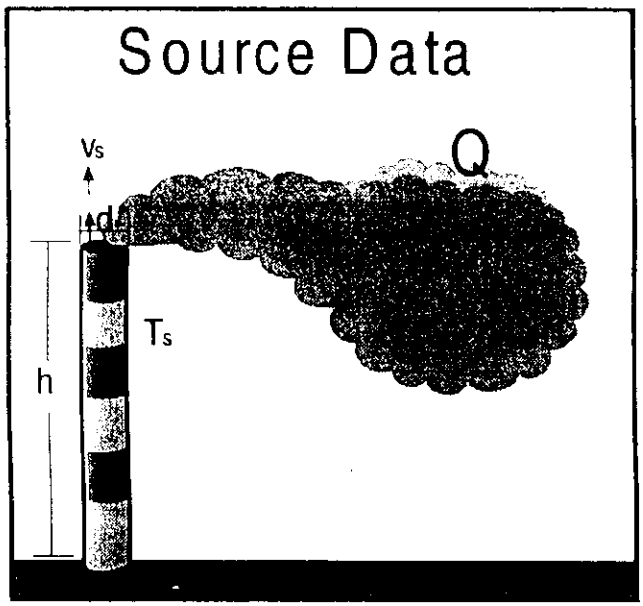

Figure 2-3. Collect source data for modeling

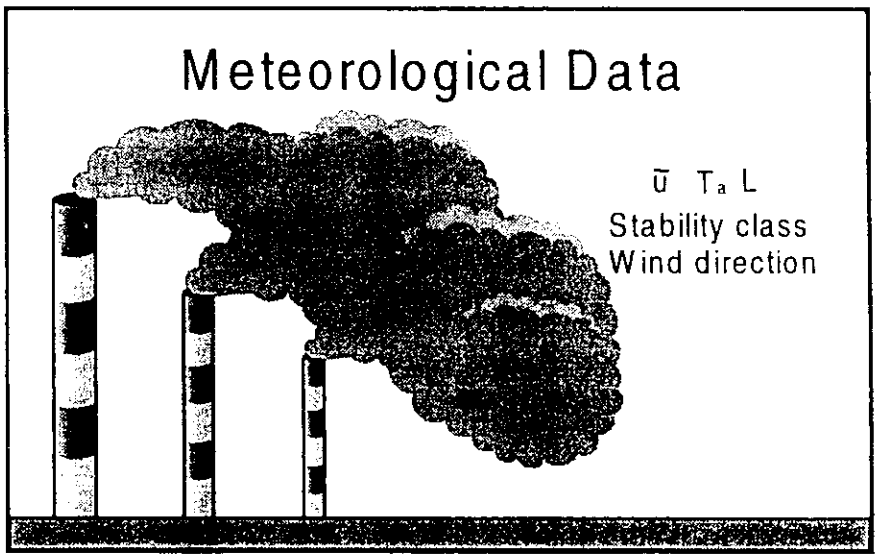

Figure 2-4. Collect meteorological data such as wind speed and direction, ambient temperature and stability class

After the data have been collected, the next step is to choose a model for the specific situation at the plant. A model contains a set of mathematical equations. The model relates the source emissions to pollutant concentrations in the ambient air at specific receptor sites and for certain time averages.

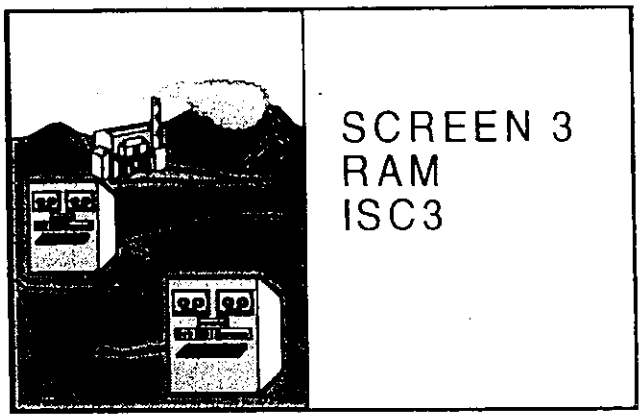

Figure 2-5. Choose an appropriate air quality model

The parameters that make up individual models can be programmed into mainframe computers, personal computers, and pocket calculators. The source data are entered into the computer or calculator, and the model is run. The run produces output, especially concentration estimates noted by the Greek letter "chi" (χ). The model gives the user a picture of what happens to pollution as it leaves the stack and is transported and dispersed by the atmosphere.

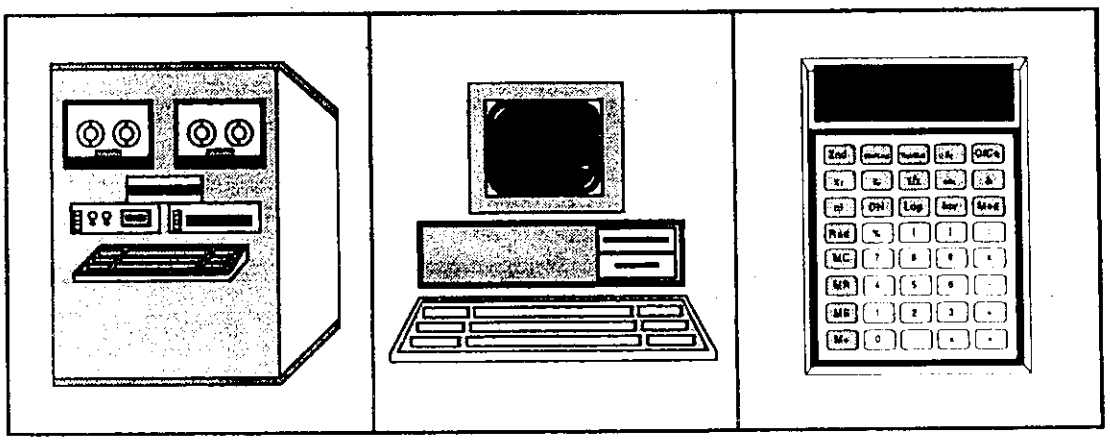

Figure 2-6. Different models can be run using a mainframe computer, a personal computer, or a pocket calculator

Now that you know what's involved in the modeling process—that is, identifying the need for modeling, collecting the data, choosing the model, and running the model—let's look at air quality models in greater detail.

An air quality model contains a set of mathematical equations. The equations try to explain the atmospheric interactions taking place as the pollution is released and as it travels to a receptor. The equation shown on this slide is for a Gaussian plume model.

$$\chi = \frac{Q}{\pi u \sigma_y \sigma_z} \exp - \frac{1}{2}\left(\frac{H}{\sigma_z}\right)^2 \qquad \text{Eq. 1}$$

The model then provides a way of estimating what the pollution concentrations from new or existing sources will be in areas downwind. These estimates can be used three ways: in developing air pollution control plans, in assessing environmental impact, and in projecting future air quality trends.

Air Quality Model Estimates

1. Developing air pollution control plans
2. Assessing environmental impact
3. Projecting future air quality trends

Let's look at these three uses in greater detail. The first use is in developing air pollution control plans. For example, high pollution concentrations are measured in an area downwind from a source. Air quality modeling can be used to identify the specific source that contributed to the excessive concentrations. Once identified, pollution control engineers can take action to solve the problem.

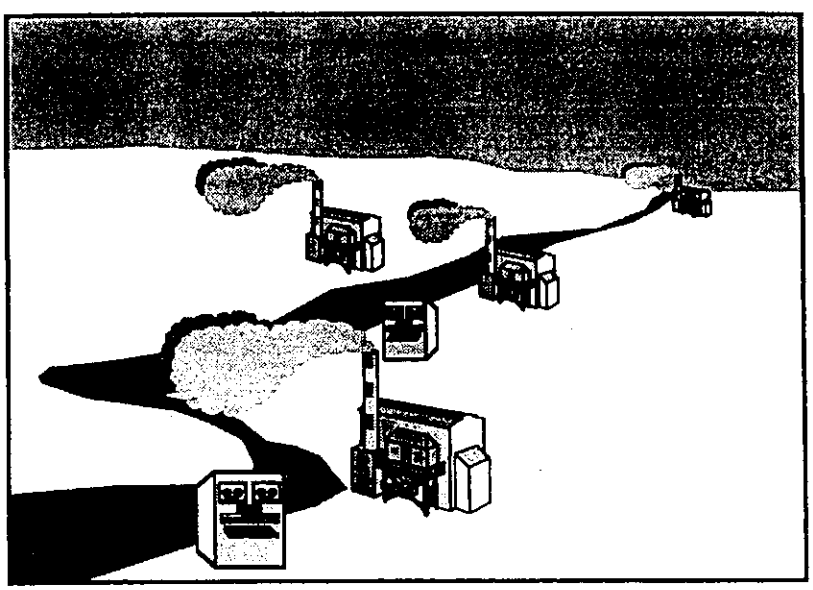

Figure 2-7. Model estimates are used to develop air pollution control plans

Second, air quality models can be used to assess environmental impacts. For example, a new factory will be constructed near an urban area. Modeling must be used by industry consultants to predict how emissions from the factory will affect ambient air quality. Permission to build will be given only if air quality will be maintained after the factory is in operation.

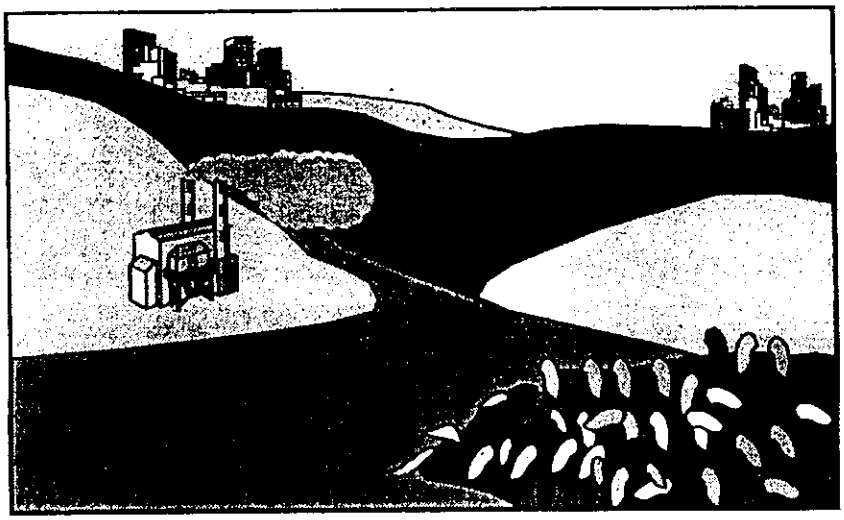

Figure 2-8. Model estimates are used to assess environmental impact

Third and last, air quality models can be used to project future air quality trends. For example, a regional planning agency has several options for industrial expansion in a rural county. The impact of each option can be assessed with an air quality model. The model results can be used with other information to rank each option. In this way, environmental factors, like a new industry's effect on air quality, can be weighed and considered in the planning process.

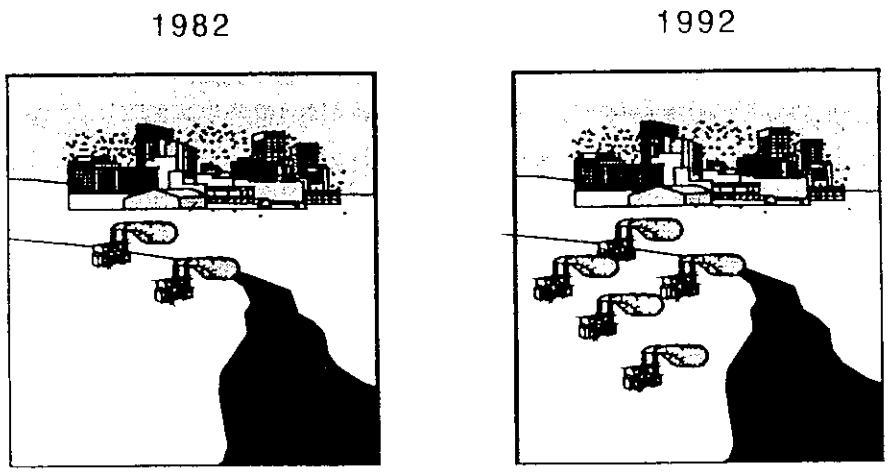

Figure 2-9. Model estimates are used to project future air quality trends

As we have seen, modeling lets us logically connect the emission rate (Q) from air pollution sources to ambient air quality concentrations (χ) at specific receptor sites for various averaging times.

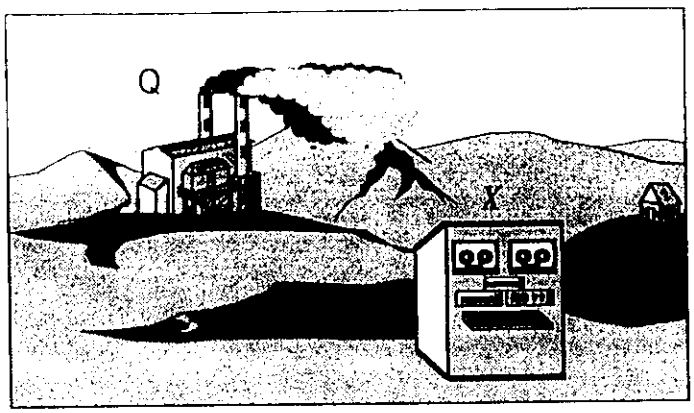

Figure 2-10. Models are used to relate source emission rates to air pollutant concentrations at specific receptors

Selecting which model to apply to a source would be based on two factors: specific use and data requirements. Ask, "How will the specific model be used?" and "What data are necessary to run this model?" First, a specific model can be used to *screen* the pollution source. That is, a model can be run with limited, conservative meteorological data and receptor sites. For example, meteorological data can consist of a small number of possible wind speed and atmospheric stability combinations. The conservative screening method allows a quick estimate of whether the source could cause the National Ambient Air Quality Standards or PSD increments to be exceeded. The models used for the estimate are not expensive to run, and the mathematical equations are simple to solve. The SCREEN2 model, which will be discussed later, produces conservative estimates of pollution concentrations; that is, concentration estimates are unlikely to be lower than measured/monitored concentrations. EPA recommends using a screening model first in the modeling process. If the screening model indicates that the source could cause the National Ambient Air Quality Standards or the PSD increments to be exceeded, then a refined analysis must be made.

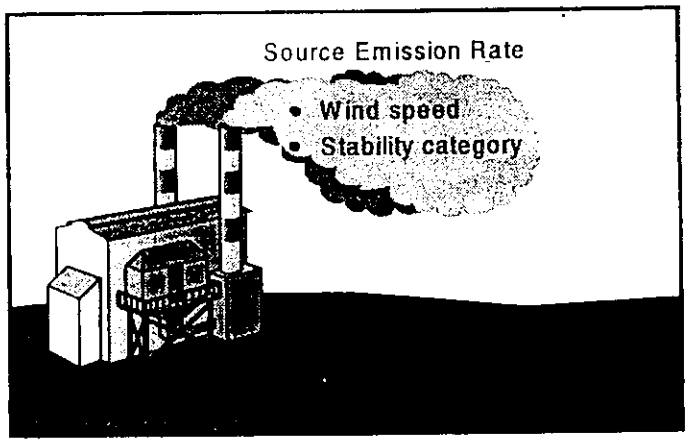

Figure 2-11. Simple, conservative models are used to initially assess, or screen, a source's impact on air quality

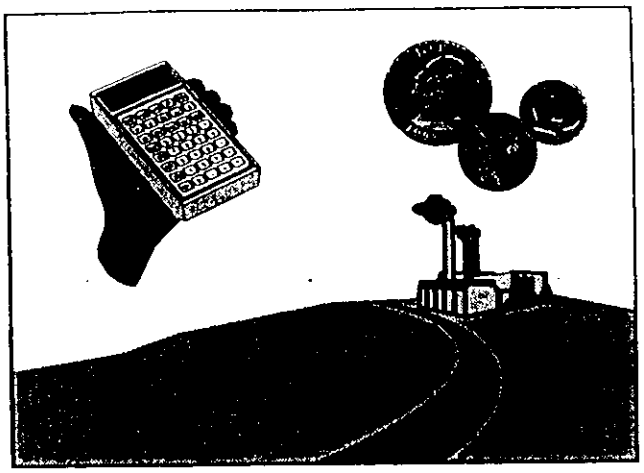

Figure 2-12. Screening models are inexpensive to run and may only require a pocket calculator

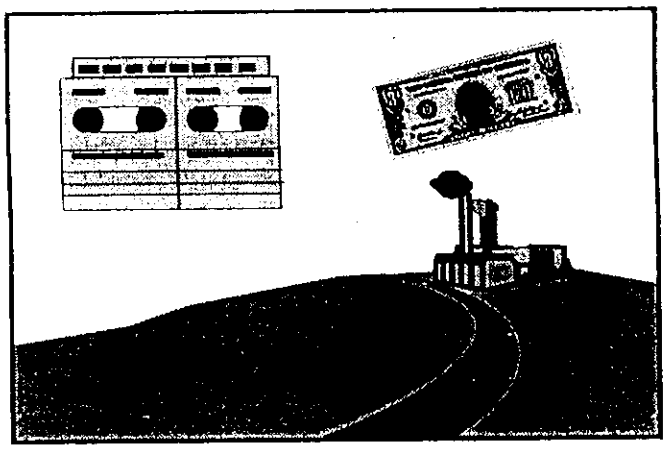

Figure 2-13. Refined models are more expensive to run and require more input

The models used in making a refined analysis are more expensive to run than are screening models. This is because refined analysis models can process large volumes of actual measured meteorological data, can consider hundreds of receptor sites, and can simulate complex situations such as downwash or particulate matter deposition. The EPA single source, or CRSTER, model that will be discussed later is a refined model. Both the screening and refined model analyses will predict air quality based on source emissions and the meteorological conditions.

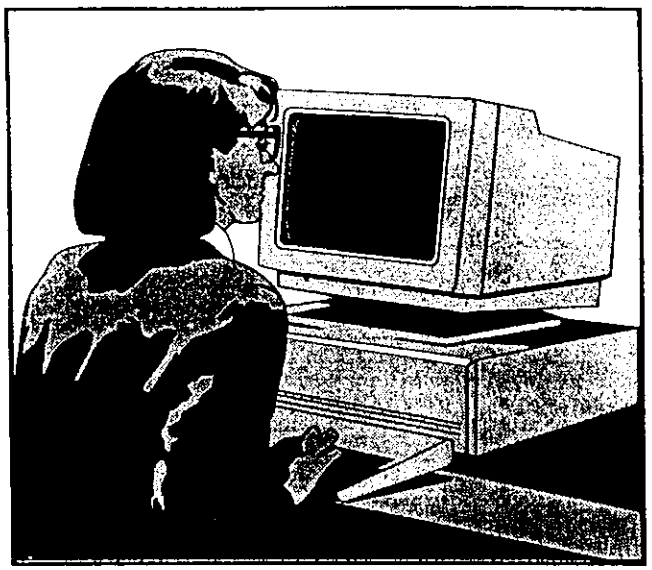

Figure 2-14. Screening model results may quickly indicate whether a NAAQS or PSD increment is exceeded

Air quality at a specific location also depends on how much pollution is in the air *before* the source adds its own pollution. The ambient pollution concentration due to (1) natural sources, (2) nearby sources other than the one(s) currently under consideration, and (3) unidentified sources is called *background* (χ_B). The model output provides concentrations (χ_p) for the source in question for time averages associated with the NAAQS; for example, the model provides 1-hour, 3-hour, and/or annual time averages. To get the total expected concentration, the background concentration is added to the model's predicted concentration. The total concentration is then compared to the National Ambient Air Quality Standards to see if violations will occur. The new source impact, without background, is compared to the PSD increments.

$$\text{Total concentrations} = \text{Background concentrations} + \text{Predicted concentrations}$$

$$\chi_T = \chi_B + \chi_p \qquad \text{Eq. 2}$$

This lesson has looked briefly at the process of modeling. The modeling process requires that a need be identified, data collected, a model chosen, and the results obtained. Air quality model estimates can be used to develop air pollution control plans, to assess environmental impacts, and to project future air quality trends. Some air quality models can be used to quickly screen air pollution sources. Also, other air quality models can be used to make a more detailed, refined analysis of source impact on their surroundings, if required. The next lesson will introduce two case studies that illustrate practical uses of air quality modeling.

Extracts from the Guideline on Air Quality Models (Revised) Appendix W of 40 CFR Part 51 July 1986.

2.0 Overview of Model Use

Before attempting to implement the guidance contained in this document, the reader should be aware of certain general information concerning air quality models and their use. Such information is provided in this section.

2.1 Suitability of Models

The extent to which a specific air quality model is suitable for the evaluation of source impact depends upon several factors. These include: (1) the meteorological and topographic complexities of the area; (2) the level of detail and accuracy needed for the analysis; (3) the technical competence of those undertaking such simulation modeling; (4) the resources available; and (5) the detail and accuracy of the data base (i.e., emissions inventory, meteorological data, and air quality data). Appropriate data should be available before any attempt is made to apply a model. A model that requires detailed, precise, input data should not be used when such data are unavailable. However, assuming the data are adequate, the greater the detail with which a model considers the spatial and temporal variations in emissions and meteorological conditions, the greater the ability to evaluate the source impact and to distinguish the effects of various control strategies.

Air quality models have been applied with the most accuracy or the least degree of uncertainty to simulations of long-term averages in areas with relatively simple topography. Areas subject to major topographic influences experience meteorological complexities that are extremely difficult to simulate. Although models are available for such circumstances, they are frequently site specific and resource intensive. In the absence of a model capable of simulating such complexities, only a preliminary approximation may be feasible until such time as better models and databases become available.

Models are highly specialized tools. Competent and experienced personnel are an essential prerequisite to the successful application of simulation models. The need for specialists is critical when the more sophisticated models are used or the area being investigated has complicated meteorological or topographic features. A model applied improperly, or with inappropriately chosen data, can lead to serious misjudgments regarding the source impact or the effectiveness of a control strategy.

The resource demands generated by use of air quality models vary widely depending on the specific application. The resources required depend on the nature of the model and its complexity, the detail of the database, the difficulty of the application, and the amount and level of expertise required. The costs of manpower and computational facilities may also be important factors in the selection and use of a model for a specific analysis. However, it should be recognized that under some sets of physical circumstances and accuracy requirements, no present model may be appropriate. Thus, consideration of these factors should not lead to selection of an inappropriate model.

2.2 Classes of Models

The air quality modeling procedures discussed in this guide can be categorized into four generic classes: Gaussian, numerical, statistical or empirical, and physical. Within these classes, especially Gaussian and numerical models, a large number of individual "computational algorithms" may exist, each with its own specific applications. While each of the algorithms may have the same generic basis (e.g., Gaussian, it is accepted practice to refer to them individually as models). For example, the CRSTER model and the RAM model are commonly referred to as individual models. In fact, they are both variations of a basic Gaussian model. In many cases the only real difference between models within the different classes is the degree of detail considered in the input or output data.

Gaussian models are the most used techniques for estimating the impact of nonreactive pollutants. Numerical models may be more appropriate than Gaussian models for area source urban applications that involve reactive pollutants, but they require much more extensive input databases and resources and therefore are not as widely applied. Statistical or empirical techniques are frequently employed in situations where incomplete scientific understanding of the physical and chemical processes or lack of the required data bases make the use of a Gaussian or numerical model impractical. Various specific models in these three generic types are discussed in this guideline.

Physical modeling, the fourth generic type, involves the use of wind tunnel or other fluid modeling facilities. This class of modeling is a complex process requiring a high level of technical expertise, as well as access to the necessary facilities. Nevertheless, physical modeling may be useful for complex flow situations, such as building, terrain, or stack downwash conditions, plume impact on elevated terrain, diffusion in an urban environment, or diffusion in complex terrain. It is particularly applicable to such situations for a source or group of sources in a geographic area limited to a few square kilometers. If physical modeling is available and its applicability demonstrated, it may be the best technique. A discussion of physical modeling is beyond the scope of this guide. The EPA publication, *Guideline for Fluid Modeling of Atmospheric Diffusion*, provides information on fluid modeling applications and the limitations of that method.

2.3 Levels of Sophistication of Models

In addition to the various classes of models, there are two levels of sophistication. The first level consists of general, relatively simple estimation techniques that provide conservative estimates of the air quality impact of a specific source, or source category. These are screening techniques or screening models. The purpose of such techniques is to eliminate the need of further more detailed modeling for those sources that clearly will not cause or contribute to ambient concentrations in excess of either the National Ambient Air Quality Standards (NAAQS) or the allowable Prevention of Significant Deterioration (PSD) concentration increments. If a screening technique indicates that the concentration contributed by the source exceeds the PSD increment or the increment remaining to just meet the NAAQS, then the second level of more sophisticated models should be applied.

The second level consists of those analytical techniques that provide more detailed treatment of physical and chemical atmospheric processes, require more detailed and precise input data, and provide more specialized concentration estimates. As a result they provide a more refined and, at

least theoretically, a more accurate estimate of source impact and the effectiveness of control strategies. These are referred to as refined models.

The use of screening techniques followed by a more refined analysis is always desirable; however there are situations where the screening techniques are practically and technically the only viable option for estimating source impact. In such cases, an attempt should be made to acquire or improve the necessary databases and to develop appropriate analytical techniques.

3.0 Recommended Air Quality Models

This section recommends refined modeling techniques that are preferred for use in regulatory air quality programs. The status of models developed by EPA, as well as those submitted to EPA for review and possible inclusion in this guidance, is discussed. The section also addresses the selection of models for individual cases and provides recommendations for situations where the preferred models are not applicable. Two additional sources of modeling guidance, the Model Clearinghouse and periodic Regional Meteorologists' workshops are also briefly discussed here.

In all regulatory analyses, especially if other than preferred models are selected for use, early discussions among Regional Office staff, State and local control agencies, industry representatives, and, where appropriate, the Federal Land Manager are invaluable and are encouraged. Agreement on the database to be used, modeling techniques to be applied, and the overall technical approach, prior to the actual analyses, helps avoid misunderstandings concerning the final results and may reduce the later need for additional analyses. The use of an air quality checklist, such as presented in Appendix C, and the preparation of a written protocol help to keep misunderstandings at a minimum.

It should not be construed that the preferred models identified here are to be used permanently to the exclusion of all others or that they are the only models available for relating emissions to air quality. The model that most accurately estimates concentrations in the area of interest is always sought. However, designation of specific models is needed to promote consistency in model selection and application.

The 1980 solicitation of new or different models from the technical community and the program whereby these models are evaluated, established a means by which new models are identified, reviewed, and made available in the guideline. There is a pressing need for the development of models for a wide range of regulatory applications. Refined models that more realistically simulate the physical and chemical process in the atmosphere and that more reliably estimate pollutant concentrations are required. Thus, the solicitation of models is considered to be continuous.

3.1 Preferred Modeling Techniques

3.1.1 Discussion

EPA has developed approximately 10 models suitable for regulatory application. More than 20 additional models were submitted by private developers for possible inclusion in the guideline. These refined models have all been organized into eight categories of use: rural, urban, industrial complex, reactive pollutants, mobile sources, complex terrain, visibility, and

long range transport. They are undergoing an intensive evaluation by category. The evaluation exercises include statistical measures of model performance in comparison with measured air quality data as suggested by the American Meteorological Society and, where possible, peer scientific reviews.

When a single model is found to perform better than others in a given category do, it is recommended for application in that category as a preferred model and listed in Appendix A. If no one model is found to clearly perform better through the evaluation exercise, then the preferred model listed in Appendix A is selected on the basis of other factors such as past use, public familiarity, cost or resource requirements, and availability. No further evaluation of a preferred model is required if the source follows EPA recommendations specified for the model in this guideline. The models not specifically recommended for use in a particular category are summarized in Appendix B. These models should be compared with measured air quality data when they are used for regulatory applications consistent with recommendations in Section 3.2.

The solicitation of new refined models which are based on more sound scientific principles and which more reliably estimate pollutant concentrations is considered by EPA to be continuous. Models that are submitted in accordance with the provisions outlined in the *Federal Register* notice of March 1980 (45 FR 20157) will be evaluated as submitted. These requirements are:

1. The model must be computerized and functioning in a common Fortran language suitable for use on a variety of computer systems.

2. The models must be documented in a user's guide which identifies the mathematics of the model, data requirements, and program operating characteristics at a level of detail comparable to that available for currently recommended models (e.g., the Single Source (CRSTER) Model).

3. The model must be accompanied by a complete test data set including input parameters and output results. The test data must be included in the user's guide as well as provided in computer-readable form.

4. The model must be useful to typical users (e.g., State air pollution control agencies) for specific air quality problems. Such users should be able to operate the computer program(s) from available documentation.

5. The model documentation must include a comparison with air quality data or with other well-established analytical techniques.

6. The developer must be willing to make the model available to users at reasonable cost or make it available for public access through the National Technical Information Service; the model cannot be proprietary.

The evaluation process will include a determination of technical merit, in accordance with the above six items, including the practicality of the model for use in ongoing regulatory programs. Each model will also be subjected to a performance evaluation for an appropriate database and to a peer scientific review. Models for wide use (not just an isolated case!) found to perform better, based on an evaluation for the same databases used to evaluate

models in Appendix A, will be proposed for inclusion as preferred models in future guideline revisions.

3.1.2 Recommendations

Appendix A identifies refined models that are preferred for use in regulatory applications. If a model is required for a particular application, the user should select a model from that appendix. These models may be used without a formal demonstration of applicability as long as they are used as indicated in each model summary of Appendix A. Further recommendations for the application of these models to specific source problems are found in subsequent sections of this guideline.

If changes are made to a preferred model without affecting the concentration estimates, the preferred status of the model is unchanged. Examples of modifications that do not affect concentrations are those made to enable use of a different computer or those that affect only the format or averaging time of the model results. However, when any changes are made, the Regional Administrator should require a test case example to demonstrate that the concentration estimates are not affected.

A preferred model should be operated with the options listed in Appendix A as "Recommendations for Regulatory Use." If other options are exercised, the model is no longer "preferred." Any other modifications to a preferred model that would result in a change in the concentration estimates likewise alter its status as a preferred model. Use of the model must then be justified on a case-by-case basis.

3.2 Use of Alternative Models

3.2.1 Discussion

Selection of the best techniques for each individual air quality analysis is always encouraged, but the selection should be done in a consistent manner. A simple listing of models in this guide cannot alone achieve that consistency nor can it necessarily provide the best model for all possible situations. An EPA document, "Interim Procedures for Evaluating Air Quality Models," has been prepared to assist in developing a consistent approach when justifying the use of other than the preferred modeling techniques recommended in this guide. An alternative to be considered to the performance measures contained in Chapter 3 of this document is set forth in another EPA document "Protocol for Determining the Best Performing Model." The procedures in both documents provide a general framework for objective decision-making on the acceptability of an alternative model for a given regulatory application. The documents contain procedures for conducting both the technical evaluation of the model and the field test or performance evaluation.

This section discusses the use of alternate modeling techniques and defines three situations when alternative models may be used.

3.2.2 Recommendations

Determination of acceptability of a model is a Regional Office responsibility. Where the Regional Administrator finds that an alternative model is more appropriate than a preferred model, that model may be used subject to the recommendations below. This finding will normally result from a determination that (1) a preferred air quality model is not appropriate for the particular application; or (2) a more appropriate model or analytical procedure is available and is applicable.

An alternative model should be evaluated from both a theoretical and a performance perspective before it is selected for use. There are three separate conditions under which such a model will normally be approved for use: (1) if a demonstration can be made that the model produces concentration estimates equivalent to the estimates obtained using a preferred model; (2) if a statistical performance evaluation has been conducted using measured air quality data and the results of that evaluation indicate the alternative model performs better for the application than a comparable model in Appendix A; and (3) if there is no preferred model for the specific application but a refined model is needed to satisfy regulatory requirements. Any one of these three separate conditions may warrant use of an alternative model. Some known alternative models that are applicable for selected situations are contained in Appendix B. However, inclusion there does not infer any unique status relative to other alternative models that are being or will be developed in the future.

Equivalency is established by demonstrating that the maximum or highest, second highest concentrations are within two percent of the estimates obtained from the preferred model. The option to show equivalency is intended as a simple demonstration of acceptability for an alternative model that is so nearly identical (or contains options that can make it identical) to a preferred model that it can be treated for practical purposes as the preferred model. Two percent was selected as the basis for equivalency since it is a rough approximation of the fraction that PSD Class I increments are of the NAAQS for SO_2 (i.e., the difference in concentrations that is judged to be significant). However, notwithstanding this demonstration, use of models that are not equivalent may be used when one of the two other conditions identified below are satisfied.

The procedures and techniques for determining the acceptability of a model for an individual case based on superior performance is contained in the document entitled, "Interim Procedures for Evaluating Air Quality Models," and should be followed, as appropriate[1] preparation and implementation of an evaluation protocol which is acceptable to both control agencies and regulated industry is an important element in such an evaluation.

When no Appendix A model is applicable to the modeling problem, an alternative refined model may be used provided that:

1. The model can be demonstrated to be applicable to the problem on a theoretical basis, and

[1] Another EPA document, "Protocol for Determining the Best Performing Model," contains advanced statistical techniques for determining which model performs better than other competing models. In many cases, this protocol should be considered by users of the "Interim Procedures for Evaluating Air Quality Models" in preference to the material currently in Chapter 3 of that document.

2. The databases which are necessary to perform the analysis are available and adequate, and

3a. Performance evaluations of the model in similar circumstances have shown that the model is not biased toward underestimates, or

3b. After consultation with the EPA Regional Office, a second model is selected as a baseline or reference point for performance and the interim procedures/protocol are then used to demonstrate that the proposed model performs better than the reference model.

3.3 Availability of Supplementary Modeling Guidance

The Regional Administrator has the authority to select models that are appropriate for use in a given situation. However, there is a need for assistance and guidance in the selection process so that fairness and consistency in modeling decisions is fostered among the various Regional Offices and the States. To satisfy that need, EPA established the Model Clearinghouse and also holds periodic workshops with headquarters, Regional Office, and State modeling representatives.

3.3.1 The Model Clearinghouse

3.3.1.1 Discussion

The Model Clearinghouse is the single EPA focal point for review of air quality simulation models proposed for use in specific regulatory applications. Details concerning the Clearinghouse and its operation are found in the document, "Model Clearinghouse: Operational Plan." Three primary functions of the Clearinghouse are:

1. Review of decisions proposed by EPA Regional Offices on the use of modeling techniques and databases.

2. Periodic visits to Regional Offices to gather information pertinent to regulatory model usage.

3. Preparation of an annual report summarizing activities of the Clearinghouse including specific determinations made during the course of the year.

3.3.1.2 Recommendations

The Regional Administration may request assistance from the Model Clearinghouse after an initial evaluation and decision has been reached concerning the application of a model, analytical technique, or database in a particular regulatory action. The Clearinghouse may also consider and evaluate the use of modeling techniques submitted in support of any regulatory action. Additional responsibilities are: (1) review proposed action for consistency with agency policy; (2) determine technical adequacy; and (3) make recommendations concerning the technique or database.

3.3.2 Regional Meteorologists Workshops

3.3.2.1 Discussion

EPA conducts an annual in-house workshop for the purpose of mutual discussion and problem resolution among Regional Office modeling specialists, EPA research modeling experts, EPA Headquarters modeling and regulatory staff, and representatives from State modeling programs. A summary of the issues resolved at previous workshops was issued in 1981 as "Regional Workshops on Air Quality Modeling: A Summary Report." That report clarified procedures not specifically defined in the 1978 guideline and was issued to ensure the consistent interpretation of model requirements from Region to Region. Similar workshops for the purpose of clarifying guideline procedures or providing detailed instructions for the use of those procedures are anticipated in the future.

3.3.2.2 Recommendations

The Regional Office should always be consulted for information and guidance concerning modeling methods and interpretations of modeling guidance, and to ensure that the air quality model user has available the latest most up-to-date policy and procedures.

Supplementary Reading List

NASA SP-322, *A Review of Methods for Predicting Air Pollution Dispersion*, pp. 1-10.

EPRI EA-1131, Appendix D: Available Air Quality Models. Electric Power Research Institute. Palo Alto, CA.

EPA 450/R-92-019, *Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, (Revised).*

The publications listed above are generally beyond the scope of this course. It is appropriate to summarize the information contained in the readings, however.

A Review of Methods for Predicting Air Pollution Dispersion gives some reasons for developing air quality models. It puts subjects such as classification of models, source inventory difficulties, meteorological data, and plume rise and dispersion techniques into proper perspective for the student. The review also points out the reason for using the Gaussian plume model instead of more-refined approaches, such as the Navier-Stokes formulation for atmospheric diffusion.

Appendix D: Available Air Quality Models aids the air quality modeler by placing the models into categories that fit into the specific needs of industry. A specific model can then be selected to fit a specific modeling situation. The appendix also discusses the underlying theory and techniques of the currently available models. The section on local plume and puff models explains why the Gaussian plume technique is so popular in air quality modeling.

Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, (Revised), was designed to be used for screening a new source when refined air quality modeling might not be necessary. This document takes the user through plume rise, mixing height, and ground-level concentrations; in effect, all factors necessary to estimate pollution concentrations, for comparison to the National Ambient Air Quality Standards, are calculated.

Review Exercises

1. True or false? An expansion of a major source must be modeled if the expansion will increase potential emissions of particulate matter by 25 tons per year or more.

2. The two kinds of data that must be collected for inclusion in a model are _____ data and _____ data.

3. A location for which model predictions are made is called a _____ site.

4. Ways that air quality model estimates can be used are:

   a. In developing air pollution control plans

   b. In assessing environmental impacts

   c. In projecting air quality trends

   d. All the above

5. True or false? Screening an industrial site with an air quality model allows a quick look at whether the site is violating NAAQS or PSD increments.

6. True or false? The SCREEN2 model is considered a refined model.

7. True or false? The EPA single source (CRSTER) model is considered a refined model.

8. Existing air quality in a specific area due to (1) natural resources, (2) nearby sources other than the one(s) under consideration, and (3) unidentified sources before a new factory is built is called the _____ concentrations.

9. True or false? Air quality model estimates are likely to be most accurate for long-term averages in areas of relatively simple topography.

10. True or false? EPA has stopped accepting new, refined models from private developers for possible regulatory use because the Agency now has enough models for its needs.

Review Answers

1. True
2. Source, meteorological
3. Receptor
4. d
5. True
6. False
7. True
8. Background
9. True
10. False