Task Analysis of State and
Local Air Pollution Control Agencies and
Development of Staffing Guidelines

VOLUME B
Detailed Task Data, and Staffing Guidance ENGINEERING SERVICES

UNITED STATES
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INTRODUCTION

One of the pressing problems in the air pollution control effort at Federal, state, and local levels is planning manpower requirements and developing manpower resources. Questions are being asked such as, how many people are needed, what kind of past experience and education should they have, how should their jobs be structured, what do they need to know to do their jobs, what special abilities do they need, and what kind of training should they receive to do their jobs? These questions are becoming increasingly meaningful as the control effort broadens with the creation of more and more local agencies and as existing agencies increase the scope and depth of their programs. Adequate answers are required if progress is to continue toward the goal of clean air.

In order to begin to answer questions relevant to manpower planning and development, a data base describing the tasks to be performed by control agency personnel and the skills and knowledge they must have to perform those tasks effectively must be available. Guidance concerning the use of the data base in making staffing decisions must be prepared. It is the purpose of this study to provide such a data base and the appropriate guidance.

A. Objectives

The objectives of this project were the following:

1. To identify as great a proportion as possible of the population of tasks currently being performed by air pollution control agency personnel at the state and local levels throughout the country.
2. To describe the identified tasks in terms of component behaviors and the skills and knowledge required to perform those behaviors.
3. To identify and describe categories of air pollution control agency personnel who would perform the tasks mentioned above.

continued

4. To structure and communicate the data which resulted from achieving the above objectives in a form which could be used by agency management in planning and developing manpower resources.

B. General Project Overview

The project was performed in two phases. Phase I dealt with achieving the first two project objectives, and resulted in the development of a detailed data base describing the major tasks performed by agency personnel in terms of the procedural components of the tasks and the skills and knowledge required to perform them. Phase II dealt with achieving the last two major objectives, and resulted in production of a guidance document which integrates and structures data developed in Phase I and presents it in a form designed to assist agency manpower developers.

THIS IS VOLUME B
Additional books available are:

VOLUME A: Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Introduction and Directions for Using These Guidelines

VOLUME C: Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Field Enforcement

VOLUME D: Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Laboratory Support

VOLUME E: Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Air Monitoring and Meteorological Support

VOLUME F: Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Source Testing

VOLUME G: Guidance and Supporting Information for Staffing and Training Decisions in an Air Pollution Control Agency - Agency Management, Program Development, and Public Information Support

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ENGINEERING

The task data and staffing information presented in this volume cover a group of related tasks which are typically performed within the engineering organization of a control agency. The operations are performed by the occupational categories of Engineer and Engineering Technician. The following tasks are included and are located within the volume as indicated below:

In addition to the above tasks, Table B-1 (Page B-113) lists engineering tasks which have been identified but which have not yet been submitted to detailed analysis. Occupational categories have been suggested for each task based upon current knowledge of the skills and knowledge required to perform them effectively. A brief rationale for each assignment is also included in the table.

Development and Production of an Emission Inventory

Task Overview

The development and production of an emission inventory consists of a complex sequence of activities requiring many of the basic skills and knowledge of an air pollution Engineer. For the purposes of this study, generation of an emission inventory will be described as a single task. Many of the activities listed below could be treated as tasks in themselves and could be analyzed into more minute steps. Such a molecular breakdown was deemed to be inefficient with regard to identifying skill and knowlege requirements. However, such an analysis would be necessary for the generation of detailed procedures and training.

Briefly, the objective of the emission inventory is to identify and summarize the contribution of specific categories of sources to the total of pollution for a given geographic area (whether it be a city, county, state, or other subdivision). The people involved in preparing this inventory must define the population of sources to be surveyed, survey them, summarize the data, and present it in a fashion which best meets the objectives of the emission inventory.

Occupational Category: Engineer (Senior)

Task Description

1. Identify and define the categories of emission sources to be included in the inventory. Refine the categories to a level of detail such that the inventory staff can begin to identify their data requirements. Include in the categories all relevant point and area sources subsumed under the following:

    a. Fuel combustion

    b. Process losses

    c. Solid waste disposal (including agricultural burning)

d. Transportation

e. Miscellaneous (e.g., forest fires, structural fires, and others)

2. For each source category identify the descriptive information categories about the source (either individual point sources or area sources) required to estimate the quantity and type of pollutant it is emitting over the unit time.

The required data about the source usually falls into the following general categories:

a. The identify and location of the source.

b. The quantities, identities, and composition of input materials (e.g., fuels, processing materials).

c. Information directly related to the process capability of the source (e.g., rated capacity in lbs./hr. and burner capacity in BTU/hr. for incinerators, number and rated capacity of boilers, process weight for an industrial process).

d. Production or operating schedules.

e. Emission control data (e.g., identity and efficiency of control devices, stack description, and emission estimates).

f. Type of pollutant emitted.

Identify the specific questions from the above categories which are relevant for each category of source to be covered. Also, identify the manner in which the question should be answered (i.e., level of detail, units, precision). In lieu of detailed knowledge of the source and its potential emissions, a variety of resource materials can be used as a basis for identifying the appropriate questions. These materials fall into four closely related groupings:

a. Materials currently being used by agencies with a complete or on-going emission inventory effort.

b. Emission factors handbooks.

c. Descriptions of source processes, such as manufacturing of sulfuric acid or steel.

d. Descriptions of emission control methods and devices.

It is important to note that the questions to be asked in the emission inventory data collection are frequently affected by other uses that are intended for the data, including:

a. Development of control strategies through modeling techniques.

b. Identification of sources operating without a required permit or otherwise not in compliance with regulations.

3. Develop an emission inventory data collection, verification, and processing system. In developing this system, include the following activities:

a. Develop a data collection strategy and methodology. Decide what general approaches are going to be used to collect the raw data for the inventory and which elements of the data will be collected with each method.

The basic collection methods are direct contact (e.g., telephone conversation or on-site observation) or indirect (e.g., mailed data collection forms). These two methods can be used in various combinations (e.g., initial data collection with mailed forms, followed up by a site visit). The emphasis on one method or another depends upon factors such as:

1) Degree to which agency already knows the industrial processes and the specific operations of the source (e.g., from their permit system).

2) The manpower available to make site visits.

3) The quantity of sources within each relevant category.

After determining which data collection methods will be used, construct the data collection forms to be mailed

or used in the field. These forms should convey the data collection questions, response requirements, and an adequate space for the responses. Resource materials are available to support design of such forms and surveys.

b. Identify the suppliers of raw data for the emission inventory:

   1) For point sources, identify all the members of each category of sources.

   2) For area sources, identify agencies or organizations which can supply pertinent data (e.g., the gas companies and oil distributors can identify how much fuel was consumed by residential units during the period; airport management can identify the number of landings and takeoffs which occurred at that facility).

c. Devise a method for verifying the raw data supplied during data collection. Typically, this element of the survey is performed in some combination of the following approaches:

   1) On-site observation of the source by Engineers who are knowledgeable of the process. For a description of such an inspection and the associated skills and knowledge, see Engineering Inspection (Page B-59).

   2) Telephone contacts to source management to verify questionable responses.

   3) Review of the completed data collection forms in the office by Engineers who are knowledgeable of the process or who can use source data.

d. Identify the methods to be used in processing the raw data to produce emission estimates. The procedure most typically followed is to utilize published emission factors to determine emission levels for a given category of point

sources. Other methods used when emission factors are unavailable or inadequate include:

1) Materials balance

2) Use of local source test findings

3) Industry loss estimates data

e. Develop a procedure for storage and retrieval of the raw data and emission estimates. For any substantial amount of data (depending on the number of sources) such a system may require a computer.

4. Implement the data collection verification and processing system. Published emission factors provide the primary basis for manipulating the raw data to estimate emissions. Documentation covering control device efficiencies are also available. The major contingencies the Engineer may have to face are:

a. No published emission factors available.

b. Published control device efficiencies are inadequate because the device currently on the source is operating below optimum due to age or faulty maintenance.

c. Idiosyncratic characteristics of the source process call for special attention in applying published emission factors (e.g., the effluent is used downstream in the process as a fuel rather than, as is typical, immediately vented via the stack).

Calculations required to make emission estimates are typically performed using a desk calculator or slide rule.

5. Prepare the emission inventory data for publication. This activity involves elements including:

a. Identify the information to be communicated by the emission inventory report (e.g., current levels, trends).

b. Determine the presentation mode (e.g., tables, graphs, charts).

c. Define the requirements for and prepare narrative background materials.

Skill Requirements

1. Ability to communicate effectively, orally and in writing, with technical personnel (e.g., computer operators, graphic artists, engineering assistants) and respondents contributing to emission inventory data collection.

2. Ability to identify and describe the air contaminants likely to be emitted by a unit of basic equipment. The description should be in terms such as:

    a. Temperature, volume, and velocity of the gas stream

    b. Probable particle size range and frequency distribution

    c. Odor

    d. Chemical composition

    e. Emission quantity per unit time or process weight

3. Ability to accurately apply or adapt standardized or previously used emission inventory characteristics in identifying and describing the design characteristics of a local emission inventory. The types of characteristics which will have to be developed include:

    a. Source categories to be covered

    b. Descriptive information to be collected about each source

    c. Descriptive information about the source emissions

    This ability includes skill in discriminating where and how standardized or previously used inventory characteristics should be modified to reflect local conditions and information needs.

4. Ability to interpret regulations relevant to development of an emission inventory.

5. Ability to design an emission inventory data collection verification and processing system.

6. Ability to systematically and effectively solve problems or make decisions. This general skill includes:

    a. Ability to accurately define the problem in terms of objective, desirable outcome.

    b. Ability to accurately and completely identify the elements of the situation which affect selection or development of a solution.

    c. Ability to identify and describe potential solutions or approaches for developing solutions.

    d. Ability to accurately define the relationships between these elements and the alternative solutions to the problem. This includes "trade-offs."

    e. Ability to set realistic priorities.

    f. Ability to estimate with a reasonable level of confidence the probabilities of successful solution for each alternative solution.

    g. Ability to maximize positive payoff by selecting the most effective and least costly solution.

    Tasks requiring this ability often may have to be accomplished under a high degree of time stress and under public scrutiny.

7. Ability to analyze the basic processes comprising an emission source and identify the operations which emit air contaminants which should be included or are required in an emission inventory.

8. Ability to accurately describe or judge the characteristics of basic or control equipment required for estimating emissions as determined by on-site inspection. The type of information collected and recorded can include:

    a. Source operation

        1) Number and type of source operations vented.
        2) Rate or amount of raw materials used.
        3) Rate or amount of finished product.

4) Quantity, rate, physical state, and discarge point of waste materials.

5) Identity of unit operations (e.g., drying, melting, size reduction, material movement).

6) Description of process flow with points of pollutant discharge noted.

7) Unit operating schedule.

b. Control devices

1) Type

2) Make and model

3) Design efficiency

4) Rated capacity

5) Installation date

6) Mechanical condition and maintenance

c. Stack

1) Location (within plant or geographic area)

2) Height

3) Materials

4) Type of construction (e.g., self-standing, roof, superstructure)

5) Availability of ports or openings

d. Discharge

1) Composition and physical characteristics (e.g., size, shape).

2) Daily discharge period (normal and maximum).

3) Gas discharge rate and temperature.

4) Draft or exhaust type (e.g., forced, induced, natural).

These data are used back in the office, along with the appropriate emission factors, to calculate the quantity and type of emission.

9. Ability to make and interpret a basic flow diagram which identifies and shows the relationship of the sub-processes which comprise an industrial process).

10. Ability to interpret engineering drawings (e.g., plot plans, process flow diagrams) in order to plan for an inspection or locate and identify equipment in a facility.

11. Ability to design data collection and data storage forms to be used in an emission inventory.

12. Ability to develop data collection and processing procedures to be used in an emission inventory program.

13. Ability to design "paper flow" systems to handle and store necessary documentation. The system should be responsive to the quantity of materials to be handled and the agency's ability to utilize state-of-the-art techniques and equipment (e.g., microform, computers).

14. Ability to interact with company management or use company records to secure operating information related to emissions (e.g., type of fuel used, amount consumed per unit time, type and amount of process materials).

15. Ability to locate, recognize, or describe air pollution control devices as used in industrial or commercial facilities.

16. Ability to assess the degree to which original control device efficiency ratings should be reduced or increased to accurately reflect its current condition and operating characteristics.

17. Ability to locate, recognize, or describe the basic units of industrial process equipment which are capable of or are currently producing uncontrolled or inadequately controlled emissions. Examples of such elements include:

    a. Refining processes:

        1) Pressure relief valves
        2) Pump packing glands and valves
        3) Vapor recovery systems
        4) Flares

    b. Cement plants:

        1) Rotary drier
        2) Storage bins

3) Crushing and grinding equipment

4) Conveyors

5) Loading/unloading facilities

c. Metal melting:

1) Furnaces (e.g., cupolas, induction, reverberatory)

2) Casting equipment (centrifugal, die, sand casting)

3) Charging equipment

4) Sandblasting or cleaning equipment

18. Ability to recognize component operations of industrial or commercial processes which are being suboptimally performed, thus resulting in or contributing to excessive emissions, for example:

a. Improper coking operation in a fuel burning process.

b. Unbalanced intake and draft air ratio for cookers and driers in a rendering plant.

c. Improperly enclosed or ventilated loading, unloading, or storage areas in a cement plant.

d. Sloppy housekeeping operations in a rendering plant.

e. Inadequate preventative maintenance program for air pollution control equipment.

f. Improper charge rate, fuel, or excess air in an incinerator.

19. Ability to recognize problems for which mathematical models are appropriate and cost-effective means of solution.

20. Ability to use nomographs, tables of data, special slide rules, desk calculators, and other aids in performing required calculations or data determinations.

21. Ability to use published emission factors to estimate emissions.

22. Ability to use materials balance techniques to estimate emissions.

23. Ability to estimate emission factors when no published factors are available. These estimates will be based on source test

findings and engineering assumptions from consideration of situational factors including:

a. Escape effluent potential

b. Efficiency of burning

c. Amount of exhaust gas

d. Quantities of input materials

e. Temperature of operations

24. Ability to identify and describe the general requirements for a source test required for a "permit to operate" or for acquisition of data for emission inventory. The elements of the test to be specified include:

a. Equipment to be tested.

b. General location of test points.

c. Constituents to be measured.

d. Operational conditions during which test is to be conducted.

25. Ability to perform test procedures and operate test equipment on-site during an inspection. The test procedures and equipment used may include:

a. Sensitized test papers. These materials are used to test for the following contaminants:

1) Ammonia

2) Arsine

3) Hydrogen Sulfide

4) Phosgene

b. Squeeze Bulb Type Gas Testers. This device gives colorimetric reactions to the following contaminants:

1) Benzine

2) Toluene

3) Xylene

4) Carbon Monoxide

5) Hydrogen Cyanide

6) Hydrogen Sulfide

7) Sulfur Dioxide

c. Tutweiler Apparatus. This device uses gas/liquid titrations to determine the concentrations of the following contaminants in stack gases:

1) Hydrogen Sulfide

2) Sulfur Dioxide

3) Ammonia

4) Carbon Dioxide

d. Hilo Bromine Field Test Equipment

e. Midget Impinger and Gas Adsorption Cell

f. Halide Leak Detector

g. Explosimeters or Combustion Meters

h. Sling Psychrometer

i. Sword Pyrometer

26. Ability to determine whether a control device is operating properly (e.g., reaching design efficiency) by visual inspection of situational elements, including:

a. Extent and type of emissions

b. Operational sensors and monitoring equipment (e.g., pressure gauges, rotameters)

c. Observable physical characteristics of the equipment (e.g., rust, corrosion)

27. Ability to use agency files, source process data, and other methods to develop the appropriate background data to initiate an inspection of a stationary source.

28. Ability to prepare or supervise preparation of the narrative portions of an emission inventory report.

Knowledge Requirements

1. Background knowledge of source processes complete enough to support identification of the elements of the process which are likely to emit contaminants to the atmosphere if not adequately controlled (e.g., in petroleum refining: regeneration, combustion, compression, storage, and pumping). Also, knowledge of the parameters of each of these process elements which affect the quantity and type of emissions possible. This type of knowledge is available to a useful extent in documents of the following types:

   a. Materials currently being used by agencies with a complete or on-going emission inventory effort.

   b. Emission Factors handbooks (for example, References 4, 17, 18, and 23).

   c. Descriptions of source processes, such as manufacturing of sulfuric acid or steel (for example, References 2, 3, 5, 6, 7, 11, 15, 16, 25, 26, 27, 28, and 36.

   d. Descriptions of emission control methods and devices (for example, References 19, 20, and 21).

   Another source of this type of knowledge is work experience in the process area with emphasis on process design, operation, or air pollution control.

2. Knowledge of the relevant state-of-the-art in design of basic equipment for air pollution control (e.g., controlled air incinerators).

3. Knowledge of the jargon and terminology used by operators or management of the basic or control equipment being inspected or reviewed. This type of knowledge enables the inspector or reviewer to adequately describe his findings and to communicate with other knowledgeable individuals. For relevant References, see Knowledge 9.

4. Knowledge of the specific practices and processes of the type of industry being inspected or reviewed which may contribute to air pollution, for example:

   a. In a refinery, rattling and blowing coke from cracking tubes.

   b. In metal melting, the air pollution effects of efforts to remove metal impurities during the melt process.

   c. In a rendering plant, housekeeping problems which produce odor, such as fat accumulation inside hoods.

   For relevant References, see Knowledge 9.

5. Knowledge of the sub-processes within the plant being inspected or reviewed which have the highest potential pollution effects. For example, in a refinery:

   a. Fluid Catalytic Cracking

   b. Isomerization

   c. Crude Distillation

   For relevant References, see Knowledge 9.

6. Knowledge of the operating principles of air pollution control equipment used at the facility to be included in the emission inventory. The types of devices used can be specialized according to the process they are controlling. Examples of such specialized devices are:

   a. Flares

   b. Loading rack separators

   c. Sulfur recovery plants

   Examples of less process-specific control devices include:

   a. Baghouses

   b. Scrubbers

   c. Cyclone separators

   d. Electrostatic precipitators

For relevant References, see Knowledge 9.

7. Knowledge of the methods used to determine if pollution control devices are operating properly. In addition to visual emission evaluation, the Engineer should know how to read and evaluate data relevant to pollution control from devices such as:

   a. Chart recorders

   b. Manometers

   c. Pressure gauges

   d. Rotameters

   e. Flowmeters

   f. Ohmmeters

   g. Voltmeters

   Also, the Engineer should know what physical characteristics of deterioration indicate that the control device is operating below maximum capability. These characteristics include:

   a. Leaking or missing bags in a baghouse.

   b. Corroded metal plates, baffles, and spray heads in a scrubber.

   c. Heavily-coated grids and plates in a precipitator.

   For relevant References, see Knowledge 9.

8. Knowledge of the operating principles and uses of specific equipment within an industrial or commercial process (e.g., fractionating towers and bubble trays in a refinery). For relevant References, see Knowledge 9.

9. Knowledge of the chemical and physical properties of materials used in the process being inspected or reviewed which have an effect on emissions and possible air pollution. Basic resource information is available from publications of the following types:

   a. Emission factors handbooks - see References in Knowledge 1b.

b. Descriptions of source processes with emphasis on their pollution potential - see References in Knowledge 1c.

c. Air pollution engineering guidelines - Reference 7.

d. Air pollution control technology - References 8, 14, 19, 20, and 21.

e. Local recommended codes of practice - References 29, 30, 31, 32, 33, 34, and 40.

10. Knowledge of systematic approaches which are useful for problem solving and planning of work activities (e.g., the "systems" approach to design).

11. Knowledge of agency regulations and enabling legislation, particularly those sections which provide a legal basis for conduct of the emission inventory. This knowledge will be useful in coping with uncooperative or otherwise troublesome respondents.

12. Knowledge of the uses of data which can be collected as part of an emission inventory and which are required or useful for other areas of agency activity, such as enforcement, plan review, and regulation development.

13. Knowledge of the resource documentation available which recommends or illustrates the format and content of an emission inventory (e.g., References 1, 10, 22, and 23).

14. Knowledge of the criteria for an effective and complete emission inventory.

15. Knowledge of representative data collection, verification, and processing systems that have been used or are currently being used in emission inventory projects. Also, knowledge of each system's relative merits, weaknesses, and the reasons for these conditions.

16. Knowledge of the basic procedures used in estimating source emissions from information describing the process, its production rates, production schedules, types of contaminants

emitted, or the emission control devices currently in service or proposed. These procedures should include use of emission factors, materials balance, and source test findings. For relevant References, see Knowledge 1b.

17. Knowledge of materials balance procedures for estimating emissions.

18. Knowledge of source testing procedures at a level of detail which enables the Engineer to establish the requirements for, participate in, and evaluate the findings of the tests. References 9, 12, 13, 35, 37, and 38 have been used in this area.

19. Knowledge of the recommended methods for soliciting cooperation, assistance, and operating information from the operators or managers of units to be included in an emission inventory.

20. Knowledge of the procedures for preparation of flow diagrams of industrial processes.

21. Knowledge of the types of errors that are made by respondents in completing the emission inventory data collection forms and the appropriate techniques for correcting these errors. Typical types of errors include:

    a. Data expressed in incorrect units

    b. Omissions

    c. Respondent thinks item does not apply to him when it does

    d. Underestimates or overestimates of data, such as process weight, productivity

    e. Inconsistencies between necessarily related items (e.g., quantity of input materials and exhaust volume)

    Some of the above errors can be corrected using resource documents (e.g., Reference 11) while others require direct contact with the operator of the source.

22. Knowledge of the techniques for the design of data collection forms to be mailed to sources or used in the field by agency personnel (see Reference 24).

23. Knowledge of "systems design" methods to be used in development of "paper flow" systems.

24. Knowledge of the suppliers of general information required for estimating the emissions of area sources (e.g., fuel suppliers, relevant census records) and point sources (e.g., industrial and trade associations).

25. Knowledge of the content of and use of specific data tables, graphs, nomographs, and specialized slide rules available to support design, calculations and evaluations of basic, control, or ventilation equipment (e.g., the Exhaust System Calculator and Fan Curve Calculator used at Los Angeles APCD and referred to in Reference 7, pages 48 and 57).

26. Knowledge of the accepted techniques for planning and presenting written or spoken communications, such as technical reports, public presentations, and formal correspondence.

References

1. Air Pollution Control District. Profile of air pollution control. Los Angeles: County of Los Angeles, 1971.

2. Air Pollution Sub-Committee. Odor control manual for the rendering industry. Des Plaines, Illinois: National Renderers Association, January 1969.

3. Committee on Industrial Hygiene. Steel mill ventilation. New York: American Iron and Steel Institute, May 1965.

4. Control Agency Directors S-8 Committee. Pacific northwest emission factors reference manual. Air Pollution Control Association, Pacific Northwest International Section, April 1971.

5. Cooperative Study Project, Manufacturing Chemists' Association and Public Health Service. Atmospheric emissions from sulfuric acid manufacturing processes. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, National Air Pollution Control Administration, 1965. PHSP #999-AP-13.

6. Cuffe, S. T., and Gerstle, R. W. Emissions from coal-fired power plants: a comprehensive summary. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, 1967. PHSP #999-AP-35.

7. Danielson, J. A. (Ed.) Air pollution engineering manual. Air Pollution Control District, County of Los Angeles. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention Environmental Control, National Center for Air Pollution Control, 1967.

8. Decker, L. D. Odor control by incinerator. Greenwich, Connecticut: UOP Air Correction Division, November 1965. (Text of a talk given before a meeting of the Middle States Section of the Air Pollution Control Assn., Wilmington, Delaware, November 1965,)

9. Duffee, R. A. Appraisal of odor-measurement techniques. Journal of the Air Pollution Control Association, 7:472-474. July 1968, Vol. 18.

10. Environmental Protection Agency. Requirements for Preparation, adoption, and submittal of implementation plans. Appendices D, E, and F. Federal Register, V. 36, No. 158, Saturday, August 14, 1971.

11. Gulf Publishing Co. Hydrocarbon Processing Handbook. Houston, Texas: Box 2608, 77001.

12. Haaland, H. H. (Ed.) Methods for determination of velocity, dust and mist content of gases. Bulletin WP-50. Seventh Edition. Los Angeles: Western Precipitation Division/Joy Manufacturing Company, 1968.

13. Huey, N. A., Broering, L. C., Jutze, G. A., & Gruber, C. W. Objective odor pollution control investigations. Journal of the Air Pollution Control Association, 6:441-444. December 1960, Vol. 10.

14. Ingels, R. M. The afterburner route to pollution control. Air Engineering, June 1964.

15. Kreichelt, T. E., Kemnitz, D. A., and Cuffe, S. T. Atmospheric emissions from the manufacture of portland cement. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention and Environmental Control, 1967. PHSP #999-AP-17.

16. McGannon, H. E. (Ed.) The making, shaping and treating of steel. Eighth Edition. United States Steel Corporation.

17. McGraw, M. J., & Duprey, R. L. Compilation of air pollutant emission factors. Preliminary document. Research Triangle Park, North Carolina: Environmental Protection Agency, April 1971.

18. National Air Pollution Control Administration. Air pollutant emission factors. Washington, D. C.: Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, April 1970.

19. National Air Pollution Control Administration. Control techniques for hydrocarbon and organic solvent emissions from stationary sources. Washington, D. C. U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, March 1970. No. AP-68.

20. National Air Pollution Control Administration. Control techniques for particulate air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, January 1969.

21. National Air Pollution Control Administration. Control techniques for sulfur oxide air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, January 1969.

22. National Air Pollution Control Administration. Nationwide inventory of air pollutant emissions, 1968. Raleigh, North Carolina: U. S. Department of Health, Education,

and Welfare; Public Health Service, Environmental Health Service, August 1970.

23. Ozolins, Guntis, & Smith, Raymond. A rapid survey technique for estimating community air pollution emissions. PHSP #999-AP-29, October 1966.

24. Payne, S. L. The art of asking questions. Princeton, New Jersey: Princeton University Press, 1951.

25. Schueneman, J. J., High, M. D., & Bye, W. E. Air pollution aspects of the iron and steel industry. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, June 1963.

26. Smith, W. S. Atmospheric emissions from fuel oil combustion. An inventory guide. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, November 1962. PHSP #999-AP-2.

27. Swearingen, J. S., and Levin, H. Hydrocarbon losses from the petroleum industry in L. A. County. San Antonio, Texas: Southwest Research Institute.

28. Technical Advisory Board. Code of recommended practices. Asphalt mixing plants. Chicago: City of Chicago, Department of Environmental Control, April 1971.

29. Technical Advisory Board. Code of recommended practices. Fuel burning equipment for heating, steam and hot water generation, absorption refrigeration. Chicago: City of Chicago, Department of Environmental Control, October 1968.

30. Technical Advisory Board. Code of recommended practices. Grain handling and storage. Chicago: City of Chicago, Department of Environmental Control, April 1971.

31. Technical Advisory Board. Code of recommended practices. Refuse burning equipment for domestic and non-domestic use. Chicago: City of Chicago. Department of Environmental Control, April 1971.

32. Technical Advisory Board. Code of recommended practices. Rendering processes. Chicago: City of Chicago, Department of Environmental Control, April 1971.

33. Technical Advisory Board. Code of recommended practices. Spray booths. Chicago: City of Chicago, Department of Air Pollution Control, August 1968.

34. U. S. Department of Health, Education, and Welfare. Interim guide of good practice for incineration at federal facilities. Raleigh, North Carolina: Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, November 1969. No. AP-46.

35. U. S. Department of Health, Education, and Welfare. Specifications for incinerator testing at federal facilities. Durham, North Carolina: Public Health Service, Bureau of Disease Prevention and Environmental Control, National Center for Air Pollution Control, Abatement Program, October 1967.

36. U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution. Atmospheric emissions from petroleum refineries. A guide for measurement and control. PHSP #763, 1960.

37. Ward, F. R. Odor measurement with the Scentometer. Norfolk, Virginia: Odor Control Subcommittee, Industrial Standards Committee, National Renderers Association.

38. Wohlers, H. C. Recommended procedures for measuring odorous contaminants in the field. Journal of the Air Pollution Control Association, 9:609-612. September 1967, Vol. 17.

Special Staffing Guidance

The Engineer assigned to developing the emission inventory should have at least five years' experience working in air pollution control engineering areas, including:

1. Engineering inspections
2. Plan review, permit processing
3. Emission estimation

The assignee should have detailed knowledge of the types of commercial, industrial, and public pollution sources within the geographic area to be covered by the inventory.

Reception and Preliminary Screening of Plan Review/ Permit System Applications and Supporting Materials

Task Overview

Most agencies operating a permit system require applicants to submit completed forms and specific types of materials (e.g., plans, specifications) which will support evaluation of the planned equipment. In processing these data, it is necessary to assure that the preliminary materials submitted by the applicant are complete and accurate enough to support plan review operations. Also, someone must be available to describe and explain the plan review function to applicants or potential applicants and to answer their questions.

Occupational Category: Engineering Technician

Task Description

1. Receive application for permit to construct/install. Receiving the application entails the following activities:
    a. Interpret the agency regulations with regard to areas such as who should apply, how to apply, what equipment or equipment changes require a permit, the conditions of acceptability or denial, and the recourse in cases of denial.
    b. Administer and explain the fee system.
    c. Distribute required application forms.
2. Review input data (i.e., forms, plans, drawings) to determine if they are complete and adequate for the evaluation. In the case of forms, see that all blanks are filled in as required. Assure that the required plans and drawings are provided and that the level of detail is appropriate.
3. Contact the applicant and request all missing input data required for the evaluation.

4. When application file is complete and accurate enough to support the initial elements of the plan review operation, route the materials to the appropriate engineering personnel for further processing.

Skill Requirements

1. Ability to interpret regulations regarding administration of the plan review/permit system including:
    a. Discriminating which types of equipment must apply and which are exempt.
    b. Accurately applying emission standards, equipment design criteria, and other control regulations.
    c. Establishing the appropriate fee for both simple and complex configurations of basic or control equipment.
2. Ability to answer applicant's questions and present information to them concerning the technical and administrative requirements of the plan review/permit system.
3. Ability to accurately and quickly make calculations required to compute plan review/permit application fees.
4. Ability to make an initial determination of the completeness and adequacy of the application forms, plans, and drawings submitted by an applicant to plan review/permit processing. This includes ability to identify what additional data are required.

Knowledge Requirements

1. General knowledge of the goals and procedures of the plan review/permit system.
2. Knowledge of the general administrative and technical requirements for initially processing applications and supporting material in a plan review system. This would include knowledge of the types of equipment requiring a permit, requirements for supporting descriptive information, fees, and procedures and guidelines for communication with applicants. The information to support this

knowledge is typically agency-specific and is provided to a limited extent in the agency's regulations. References 1 and 2 provide useful background information in this area.

3. Specific knowledge of the types of supporting information required to be submitted by a permit applicant to fully process a particular class of basic equipment, control equipment, or ventilation system.

4. Knowledge of the local regulations which directly or indirectly relate to administration of a plan review system. Specifically, knowledge of all the prohibitions and controls provided for in the agency's regulations. These typically include:

   a. Limitations on visible emissions (opacity and density).

   b. Limitations on the quantity of particulates, dusts and fumes, specific gaseous compounds, combustion contaminants, and organic compounds.

   c. Rules specifying control requirements for petroleum products, storage tanks, and rendering equipment.

   d. Specifications of sulfur content of fuels, photochemical reactivity, status of organic solvents.

   e. Prohibitions on public nuisances, open burning, and single-chamber incinerators.

5. Knowledge of the procedures for routing completed files to plan review personnel for further processing.

References

1. Lunche, R. G., Lemke, E. E., & Verssen, J. A. Administration of a permit system. Paper 68-112 presented at the 61st Annual Meeting of the Air Pollution Control Association. Los Angeles: Los Angeles Air Pollution Control District, June 1968.

2. Lunche, R. G., Lemke, E. E., Weimer, R. L., Dorsey, J. R., & Verssen, J. A. (Ed.) Administration of the permit system. Fourth Edition. Los Angeles: Air Pollution Control District, County of Los Angeles, January 1968.

Special Staffing Guidance

The assignee for this task can be a junior level individual; however, his training should emphasize effective response to applicants' questions.

Review of Plans and Application Forms in a Plan Review/Permit System

Task Overview

The Engineer's task in reviewing plans and a permit application is to determine whether the proposed equipment (controlled or uncontrolled) will be in compliance with local source emission standards or other regulations designed to control ambient air quality. Separate permits are usually required to construct or install equipment and to operate it. The Engineer's judgments are based upon technical data supplied on and with the permit application forms, as a result of on-site observations, from resource documentation, and from direct contact with applicants, contractors, or vendors.

Generally, the equipment submitted for evaluation in plan review comprises a system containing the following elements:

- the basic equipment - a single unit or a complex of equipment capable of emitting contaminants into the atmosphere.
- an exhaust system typically containing a hood, ducts, and an exhaust fan.
- an air pollution control device suggested as a means of bringing the basic equipment into compliance with relevant local regulations.

The objective of the review is to systematically evaluate the proposed system or any of the elements within it with regard to effective pollution control.

Plan review and permit systems vary in detail from agency to agency. The major differences between agencies are in details such as the scope of the program (i. e., the range of equipment covered), the content of application forms, the specific administrative procedures followed, and the scope and specificity of regulations. However, the basic task of reviewing the permit application materials presented below is indicative of the skills and knowledge required to perform the operation within most of the specific systems currently in use.

Occupational Category: Engineer

Task Description

1. Briefly scan the input data (application forms, specifications, plans) and characterize the general review problem in terms of the following factors:

   a. The type of basic equipment to be reviewed.

   b. The probable air contaminants emitted by the basic equipment.

   c. The specific regulations and requirements relevant to the equipment.

   d. The overall design of the exhaust system and its impact on the effectiveness of the pollution control device.

   e. The type of control device proposed and its general appropriateness to the basic equipment, emitted contaminants, exhaust system, and relevant regulations.

2. Using relevant design criteria, emission factors, and the descriptive data provided by the applicant, evaluate the adequacy of the proposed basic equipment. Determine whether or not an air pollution control device is required by comparing estimated emissions with the appropriate local regulations.

   In the case of certain types of basic equipment (e.g., incinerators, boilers) this step involves a detailed examination of the proposed equipment. For example, in evaluating an incinerator design, application materials (in the form of specifications and drawings) typically include the following types of information:

   a. Make, model, type.

   b. Configurational specifications (e.g., interior and exterior dimensions, construction materials, chamber design, and descriptions of the dampers, sensors, burners, and stack).

   c. Intended use (e.g., type of waste, amounts to burned, intended schedule of use).

To evaluate the adequacy of the incinerator, compare the information given in the above categories with the relevant local standards and requirements. In addition, use the above data to derive (or verify, if already provided by the applicant) specific performance characteristics and compare them with requirements. The characteristics typically include:

a. Calculate heat release in primary chamber from volume of chamber and total BTU input to chamber.

b. Determine whether the BTU/hr/ft^3 capacity is great enough that the gases in the primary and secondary chambers will reach criterion values.

c. Determine burning rate per square foot of grate area.

d. Compute velocity of combustion gases through selected cross-sectional areas assuming given levels of excess air.

e. Determine retention time.

f. Determine adequacy of barometric damper free area.

g. Determine adequacy of burning area in terms of hearth size, hours per day burning, service requirements.

h. Predict emission characteristics (e.g., smoke density, opacity, odor).

i. Calculate retention time.

3. Evaluate the effectiveness of the process exhaust or ventilation system. The objective of this system is to capture contaminants (e.g., dusts and fumes) at their source, move them to the pollution control device, and then expel the cleansed gas stream into the atmosphere via the stack. The ventilation system usually consists of the following elements:

a. The hood

b. The duct network

c. The exhaust fan

To evaluate the ventilation system review each of the above elements with regard to the source process and its associated contaminants.

a. Use standardized ventilation design principles, procedures, and resource data to determine hood requirements, including:

   1) Hood configuration (i.e., location, shape, size)

   2) Hood construction materials (consider the need to resist high temperature or corrosive effluent)

   3) Capture velocity

   4) Face velocity

   5) Slot velocity (if a slot hood is suggested)

   6) Plenum velocity

   7) Duct velocity

   8) Transport velocity

   Compare findings with prescribed hood design and determine whether differences are acceptable.

b. Use standardized ventilation design principles, procedures, and resource data to determine duct design characteristics, including:

   1) Desired air volume.

   2) Minimum duct velocity.

   3) Duct network configuration (lengths, special fittings, elbows).

   4) Pressure losses due to the components of the system including the pollution control devices (i.e., the system's static pressure).

   5) Construction materials requirements.

   Compare findings to suggested design and evaluate adequacy of the differences.

c. Use standardized principles, procedures, and resource

data to specify the operating point of the ventilation system. Consider factors such as:

1) Fan type (e.g., axial flow, centrifugal, air injector).

2) Fan size, speed, horsepower requirements (use Fan Rating Tables), and system operating characteristic curves.

3) System operating volume and static pressure.

4. Identify and describe the specific contaminants to be collected by the control device. The description should be specific enough that the relative advantages and disadvantages of particular types of control devices can be determined and weighed. Attend to descriptive dimensions including:

   a. Temperature, volume, and velocity of the gas stream

   b. Probable particle size range and frequency distribution

   c. Odor

   d. Chemical composition of the effluent

   e. Emission quantity per unit time

5. Decide whether or not the general type of control device(s) (e.g., baghouse, wet scrubber) selected by the applicant is well-suited to the characteristics of the contaminants described in the previous step. If the applicant's choice is inferior to some other type of device, make note of the more desirable selection and the rationale for that judgment. In making the judgment consider factors including:

   a. Efficiency as a function of particle size and weight.

   b. Possible physical or chemical attack by the contaminant on the device (including impairment of function due to moisture, poisoning of catalysts).

   c. Possibility of transforming the pollution problem rather than solving it completely (e.g., creating a water pollution problem as a result of treating an air contaminant, or creating an odor problem with the collection device).

d. Only partially eliminating the pollution problem (e.g., cleaning the particulate element of the effluent without treating the odorous element).

6. In the case where the suggested type of control device(s) is a type suited to the problem, identify the key parameters of the device's design which are relevant to its efficiency and effectiveness. For example:

   a. Afterburners

      1) Type (thermal vs. catalytic).

      2) Products of combustion. That is, what will the effluent of the afterburner be? Will it be odorous?

      3) Retention time in combustion chamber.

      4) Turbulence (thoroughness of mixing).

      5) Temperature required to oxidize contaminant.

      6) Catalyst/contaminant interaction.

      7) Pressure drop.

      8) Fuel requirements.

   b. Baghouses

      1) Air-to-cloth ratio

      2) Inlet temperature

      3) Dew point temperature

      4) Type of filtering media (particularly its susceptibility to chemical attack)

      5) Sensors to detect changes in pressure drop

      6) Bag cleaning method and cleaning cycle

      7) Construction characteristics (e.g., hopper size)

      8) Particle size frequency distribution

   c. Adsorption equipment

      1) Suggested adsorbent

2) Saturation rate of the adsorbent

3) Retentivity of adsorbent

4) Regeneration characteristics of the adsorbent

5) Number of adsorbent beds

7. Evaluate the suggested cleaning device on each of the key parameters identified in the preceding step. This is done by a variety of methods, including:

   a. In the case of some parameters (e.g., retention time in an afterburner), calculate the value required for acceptable efficiency and compare it with the value given for that parameter in the suggested device. If the parameter value is not defined by the applicant, determine it by contacting the manufacturer, vendor, or contractor.

   b. Directly compare the stated characteristic of the suggested device with accepted design criteria (e.g., air-to-cloth ratio in a baghouse, temperature in the combustion chamber of an afterburner).

   c. Use historical data (e.g., results of source tests) to predict the suggested device's effectiveness.

8. Where relevant (i.e., the issue is in doubt) estimate the level of emissions with the suggested control device installed. Use process descriptive data filed by the applicant, documented efficiency data, and emission factors. Compare the results with relevant local regulations.

9. Identify any process or control device operating conditions which should be modified or maintained in order to sustain maximum control device effectiveness. Such conditions include:

   a. Minimum afterburner temperature.

   b. Minimum water quantity per unit time within a given pressure range to be supplied to a scrubber.

   c. Limit on the amount of fines (per unit time) used in a drying process.

10. If the suggested control device is acceptable in terms of its design and effectiveness, grant a permit to construct. Incorporate any conditions deemed relevant to initial or continuing effectiveness of the device(s).

11. If the suggested device is found to be unacceptable follow the procedure for permit denial. This usually entails contacting the applicant, communicating the reasons for the denial, and informing him of the appeal procedure.

12. If a permit denial is contested, prepare a presentation justifying the denial action and testify before the hearing body.

13. In the case of an acceptable application, make a visual inspection of the completed installation to assure that the equipment installed matches that for which the permit was granted. Prepare any required reports of findings. See Page B-59 for a complete description of the Engineering Inspection (used in Plan Review) task and the associated skills and knowledge.

14. Identify source test requirements, assist in test administration, and evaluate source test findings prior to granting a permit to operate the new equipment.

    a. In determining source test requirements identify items such as:

        1) Basic equipment and control equipment to be tested.

        2) Points to be tested (e.g., afterburner inlet and outlet).

           If possible, locate test ports on relevant drawing. Assure that ports are the proper size.

        3) Constituents to be measured (e.g., total carbon analysis).

        4) Operational conditions during which test should be conducted. Tests should be run during periods in the process in which emissions are the greatest (e.g., during the oxygen blow on an electric furnace).

5) Assure that "safe access" is provided.

b. In assisting the source test team:

1) Assure that the operation performed during the test is specifically the one selected for observation (i.e., when emissions are expected to be greatest). This could include verifying operating conditions such as charging rates, composition of input materials, and level of dilution air used.

2) Evaluate visible emissions (opacity and density).

3) Suggest operational modifications which might improve operation of basic equipment or control equipment. For example, in testing a smoking incinerator, adjustments to the charge rate, fuel, and air might be suggested in order to reduce emissions. These adjustments could then become "conditions" of operation required for the permit.

c. In evaluating the source test findings, consider items such as the following:

1) Were the proper operating conditions observed?

2) Is a materials balance indicated?

3) Were the parameters of control device design and performance as expected (e.g., pressure drop, retention time, filter velocity, efficiency)?

4) Is level of emission in compliance with relevant regulations?

15. If source test results show full compliance, grant a permit to operate the new equipment. Incorporate all standard and special purpose conditions required to assure continued acceptable performance.

16. In the case of a denial, follow the appropriate procedure for informing the applicant of the situation and his recourse.

17. Prepare a statement of the fees required. Fees are typically calculated on the basis of energy, power, or capacity associated with the equipment to which the permit applies.

Skill Requirements

1. Ability to answer applicant's questions and present information to them concerning the technical and administrative requirements of the plan review/permit system.
2. Ability to interpret regulations regarding administration of the plan review/permit system including:
    a. Discriminating which types of equipment must apply and which are exempt.
    b. Accurately applying emission standards, equipment design criteria, and other control regulations.
    c. Establishing the appropriate fee for both simple and complex configurations of basic or control equipment.
3. Ability to accurately and quickly make calculations required to compute plan review/permit application fees.
4. Ability to interpret engineering drawings for detailed evaluation of basic equipment, ventilation systems, or control systems. The types of drawings reviewed include:
    a. Assembly drawings (in plan and elevation)
    b. Equipment location drawings
    c. Plot plans
    d. Process flow diagrams
5. Ability to briefly scan the plan review/permit process input data (application forms, drawings, etc.) and to initially characterize the general review problem in terms of the following factors:
    a. The type of basic equipment to be reviewed.

b. The probable air contaminants emitted by the basic equipment.

c. The specific regulations and requirements relevant to the equipment.

d. The overall design of the exhaust system and its impact on the effectiveness of the pollution control device.

e. The type of control device proposed and its general appropriateness to the basic equipment, emitted contaminants, exhaust system, and relevant regulations.

6. Ability to recognize the component operations of industrial or commercial processes which are being suboptimally performed, thus resulting in or contributing to excessive emissions, for example:

   a. Improper coking operation in a fuel burning process.

   b. Unbalanced intake and draft air ratio for cookers and driers in a rendering plant.

   c. Improperly enclosed or ventilated loading, unloading, or storage areas in a cement plant.

   d. Sloppy housekeeping operations in a rendering plant.

   e. Inadequate preventative maintenance program for air pollution control equipment.

   f. Improper charge rate, fuel, or excess air in an incinerator.

7. Ability to apply the appropriate standard engineering analyses, principles, and resource data to the evaluation of the proposed basic equipment, ventilation system, or control device using the agency's plan review/permit processing procedures.

8. Ability to predict how the load requirements on a control device will change with time, so that designs can be selected which have the greatest productive longevity. For example, predict how waste material likely to be consumed in a incinerator will change, such as an increase in plastics.

9. In evaluating basic, control, or ventilation equipment, the ability to recognize trade-offs. That is, the design of a piece of equipment may lack one desirable characteristic but be able to make up for it with another characteristic. For example, if agglomeration is likely in a particular baghouse installation, shaking techniques and cycle may be judged adequate to counter the caking effect of the effluent. Also, in an incinerator, if velocity through the flame port is too great (causing excessive turbulence), this can possibly be compensated for with increased downpass velocity.

10. Ability to use published emission factors to estimate emissions.

11. Ability to use materials balance techniques to estimate emissions.

12. Ability to estimate emission factors when no published factors are available. These estimates will be based on source test findings and engineering assumptions from consideration of situational factors such as:

    a. Escape effluent potential

    b. Efficiency of burning

    c. Amount of exhaust gas

    d. Quantities of input materials

    e. Temperature of operations

13. Ability to use nomographs, tables of data, special slide rules, desk calculators, and other aids in performing required calculations or data determinations.

14. Ability to identify and describe the air contaminants likely to be emitted by a unit of basic equipment. The description should be in terms such as:

    a. Temperature, volume, and velocity of the gas stream

    b. Probable particle size range and frequency distribution

    c. Odor

    d. Chemical composition

e. Emission quantity per unit time or process weight

15. Ability to accurately judge whether or not the general type of control device(s) (e.g., baghouse, wet scrubber) selected by the applicant in a permit application is well-suited to the characteristics of the contaminants likely to go through it. If the applicant's choice is inferior to some other type of device, the reviewer should be able to make note of the more desirable selection and the rationale for that judgment. In making the judgment consider factors including:

    a. Efficiency as a function of particle size and weight.

    b. Possible physical or chemical attack by the contaminant on the device (including impairment of function due to moisture, poisoning of catalysts).

    c. Possibility of transforming the pollution problem rather than solving it completely (e.g., creating a water pollution problem as a result of treating an air contaminant, or creating an odor problem with the collection device).

    d. Only partially eliminating the pollution problem (e.g., cleaning the particulate element of the effluent without treating the odorous element).

16. Ability to estimate control equipment costs on an air volume basis.

17. Ability to communicate effectively in writing, over the telephone, and in face-to-face contact with applicants, vendors, contractors, attorneys, and other individuals related to the activities of the plan review process.

18. Ability to prepare and rehearse a presentation to be made before a court, hearing board, or other legal or quasi-legal body.

19. Ability to present testimony effectively in court. Effective testimony can be characterized as:

    a. Confidently presented

    b. Truthful

    c. Brief

d. Responsive to the questions asked

e. Responsive only to questions asked

f. Unbiased

g. Clearly and audibly spoken

h. Courteously presented

This ability includes responding effectively under cross-examination. Also includes skill in qualifying as a competent (therefore, valid) witness. For example, in the case where the witness has made a smoke-reading, he will often have to establish himself as a competent smoke-reader (e.g., by describing his smoke-reading training, or explaining the difference between smoke density and opacity).

20. Ability to reliably and accurately judge visible emissions from stationary sources in terms of density and opacity using accepted procedures. The precision of these judgments should be adequate to serve as acceptable evidence in a court of law.

21. Ability to recognize, describe, or judge the source of general categories of stains or deposits formed by settlement of air contaminants. Such categories of stains or deposits include:

    a. Acid stains (e.g., chromic acid, sulfuric acid, hydrofluoric acid, and phosphoric acid)

    b. Oil droplets

    c. Paint deposits

    d. Carbon spheres

22. Ability to accurately observe, describe, or estimate environmental conditions current at the time of a smoke observation, including wind speed and direction, relative humidity, temperature, and percent cloud cover.

23. Ability to reliably and accurately detect or characterize odors such that illegal concentrations can be identified and related to the responsible source. The terminology and procedure used to rate or describe odors vary from agency to agency and depend upon accepted legal requirements.

24. Ability to identify, recognize, or locate external characteristics of plants or installations where indications of pollution are most likely to be revaled (e.g., stacks, vents, loading areas).

25. Ability to determine if the operating conditions of an industrial or commercial process during a source test or inspection are representative of typical operations or are those likely to produce the greatest pollution potential. This could include verifying operating conditions such as charging rates, composition of input materials, and level of dilution air used.

26. Ability to make and interpret a basic flow diagram which identifies and shows the relationship of the sub-processes which comprise an industrial process.

27. Ability to determine whether a control device is operating properly (e.g., reaching design efficiency) by visual inspection of situational elements, including:

    a. Extent and type of emissions

    b. Operational sensors and monitoring equipment (e.g., pressure gauges, rotameters)

    c. Observable physical characteristics of the equipment (e.g., rust, corrosion)

28. Ability to prepare inspection or engineering field reports which are adequately detailed, complete, and cogent to be accepted as evidence in a court of law.

29. Ability to accurately evaluate the source test findings to determine whether or not to grant a permit to operate. Items such as the following should be considered in this decision:

    a. Were the proper operating conditions observed?

    b. Was a materials balance indicated?

    c. Were the parameters of control device design and performance as expected (e.g., pressure drop, retention time, filter velocity, efficiency)?

d. Was the level of emission in compliance with relevant regulations?

30. Ability to identify and describe the general requirements for a source test required for a "permit to operate," or to acquire data for emission inventory. The elements of the test to be specified include:

    a. Equipment to be tested.

    b. General location of test points.

    c. Constituents to be measured.

    d. Operational conditions during which test is to be conducted.

31. Ability to communicate effectively with agency personnel in working on operational problems involving enforcement, engineering, or technical activities of the agency.

Knowledge Requirements

1. General knowledge of the goals and procedures of the plan review/ permit system.

2. Knowledge of the local regulations which directly or indirectly relate to administration of a plan review system. Specifically, knowledge of all the prohibitions and controls provided for in the agency's regulations. These typically include:

    a. Limitations on visible emissions (opacity and density).

    b. Limitations on the quantity of particulates, dusts and fumes, specific gaseous compounds, combustion contaminants, and organic compounds.

    c. Rules specifying control requirements for petroleum products, storage tanks, and rendering equipment.

    d. Specifications of sulfur content of fuels, photochemical reactivity, status of organic solvents.

    e. Prohibitions on public nuisances, open burning, and single-chamber incinerators.

3. Knowledge of the relevant state-of-the-art in design of basic equipment for air pollution control (e.g., controlled air incinerators).

4. Detailed knowledge of air contaminants found in emissions of basic equipment typically submitted to plans review. The Engineer should be able to identify and describe basic equipment emissions at a level of detail such that the information can be used to evaluate the proposed control equipment. Resource materials providing useful support in this area include:

    a. Emission factors handbooks - References 5, 19, 20, 28, and 30.

    b. Descriptions of source processes with emphasis on their pollution potential - References 1, 3, 6, 7, 11, 15, 18, 29, 31, 34, 35, and 43.

    c. Air pollution engineering guidelines - Reference 8.

    d. Recommended practices for design of basic equipment - References 17, 32, 35, 36, 37, 38, 39, 40, 41, 45, and 46.

    e. A specialized taxonomy of basic equipment - Reference 16.

5. Knowledge of the general types of control devices typically used and recommended for specific air contaminants. That is, knowledge of the appropriate type of control device given the form, composition, temperature, dew point, etc., of the contaminant. References 9, 14, 21, 22, 23, 24, 25, 26, and 27. are used for this information. Knowledge of the current state-of-the-art in this area is also required.

6. Knowledge of the basic procedures used in estimating source emissions from information describing the process, its production rates, production schedules, types of contaminants emitted, or the emission control devices currently in service or proposed. These procedures should include use of emission factors, materials balance, and source test findings. References 5, 19, 20, 28, and 30 are relevant in this area.

7. Knowledge of undesirable emission levels for contaminants not regulated by local regulations (e.g., documented health or nuisance effects). These levels are typically established by agency policy with regard to "general air pollution" type prohibitions written into their regulations.

8. Knowledge of the local procedure and guidelines for deciding whether or not permits to install or operate basic or control equipment should be granted, based upon the outcome of the review or testing procedures. This includes knowledge of relevant standards, criteria, priorities, and trade-off guidelines (e.g., use of conditional permits).

9. Knowledge of the chemical and physical properties of materials used in the process being inspected or reviewed which have an effect on emissions and possible air pollution. For relevant References, see Knowledge 21.

10. Knowledge of the jargon and terminology used by operators or management of the basic or control equipment being inspected or reviewed. This type of knowledge enables the inspector or reviewer to adequately describe his findings and to communicate with other knowledgeable individuals. For relevant References, see Knowledge 21.

11. Knowledge of materials balance procedures for estimating emissions.

12. Knowledge of the types of adjustments which can be made to basic equipment or control device operation which can improve emissions control (e.g., flame adjustments on an incinerator).

13. Knowledge of the content of and use of specific data tables, graphs, nomographs, and specialized slide rules available to support design calculations and evaluations of basic, control, or ventilation equipment (e.g., the Exhaust System Calculator and Fan Curve Calculator used at Los Angeles APCD and referred to in Reference 8, pages 48 and 57).

14. Knowledge of the procedures for preparation of flow diagrams of industrial processes.

15. Knowledge of the standard principles, procedures, and resource data required to evaluate the effectiveness of the proposed ventilation system (i.e., hood, duct network, exhaust fan) to collect and transport the source emissions to the control equipment. References 2, 3, and 4 provide useful support in this area.

16. Detailed knowledge of the key parameters of control device design and operation which affect its efficiency and effectiveness (e.g., retention time, turbulence, temperature and others in an afterburner). This includes knowledge of possible design shortcomings or faulty methods used in combining control devices into control systems (e.g., three wet scrubbers in series which use recycled water containing suspended particulate matter). References 8, 22, 23, and 24 are relevant to this knowledge.

17. Knowledge of the specific practices and processes of the type of industry being inspected or reviewed which may contribute to air pollution, for example:

    a. In a refinery, rattling and blowing coke from cracking tubes.

    b. In metal melting, the air pollution effects of efforts to remove metal impurities during the melt process.

    c. In a rendering plant, the housekeeping problems which produce odor, such as fat accumulations inside hoods.

    For relevant References, see Knowledge 21.

18. Knowledge of the exterior characteristics of plants and facilities inspected and the location and configuration of the elements of the facility where air pollution problems would be evident (e.g., stacks, vents, storage areas).

19. Knowledge of source testing procedures at a level of detail which enables the Engineer to establish the requirements for, participate in, and evaluate the findings of the tests. References 10, 12, 13, 42, 44, and 47 have been used in this area.

20. Knowledge of the methods used for describing and rating the intensity of odors.

21. Knowledge of the methods used to determine if pollution control devices are operating properly. In addition to visual emission evaluation, the industrial inspector should know how to read and evaluate data relevant to pollution control from devices such as:

    a. Chart recorders

    b. Manometers

    c. Pressure gauges

    d. Rotameters

    e. Flowmeters

    f. Ohmmeters

    g. Voltmeters

    Also, the inspector should know what physical characteristics of deterioration indicate that the control device is operating below maximum capability. These characteristics include:

    a. Leaking or missing bags in a baghouse.

    b. Corroded metal plates, baffles, and spray heads in a scrubber.

    c. Heavily-coated grids and plates in a precipitator.

    Basic resource information relevant to the above knowledge areas is available from publications of the following types:

    a. Emission factors handbooks - References 5, 19, 20, 28, and 30.

    b. Descriptions of source processes with emphasis on their pollution potential - References 1, 3, 6, 7, 11, 15, 18, 29, 31, 34, 35, and 43.

    c. Air pollution engineering guidelines - Reference 8.

    d. Air pollution control technology - References 9, 14, 22, 23, and 24.

    e. Local recommended codes of practice - References 36, 37, 38, 39, 40, 41, and 45.

22. Knowledge of potential hazards and related safety regulations to be followed during inspection, including:

    a. Fire hazards.

    b. Restrictions against manipulating equipment without consent of the operator or management.

    c. Requirements for protective personal equipment, including:

        1) Rubber gloves

        2) Respirator

        3) Goggles

        4) Hard hat

        5) Gas mask

        6) Safety flashlight

    d. Check-in procedures.

    e. Inspection precautions, including:

        1) Location of water showers when working in areas where acids or caustic solutions are being handled.

        2) Use of an assistant as a "safety."

        3) Not walking on building or tank roofs without appropriate supervision.

        4) Not watching welding activities directly.

23. Knowledge of the basic psychophysical and perceptual principles related to the human sense of smell. This knowledge can include:

    a. Sensory adaptation effects.

    b. Adaptation level effects.

    c. Individual differences in awareness and emotional response to odors.

    d. The concept of a sensory threshold as a statistical phenomenon which is affected by many external and internal variables (e.g., humidity and past experience).

24. Knowledge of the requirements for an accurate smoke-reading. These requirements include:

    a. Read plume against background contrasting in color to the color of the smoke.

    b. Light source (e.g., the sun) should be behind the observer during daytime.

    c. Light source (e.g., spotlight) should be behind plume at night.

    d. Wind direction should be from either right or left side of the observer.

    e. A clear view of the stack and background should be available. In some agencies a maximum observer distance has been proposed.

    f. Record smoke-readings on the proper data collection form and at the required time intervals.

    g. Read residual plumes only, not "wet plumes."

    h. Observe and record all required environmental conditions current at the time of the observation (e.g., wind speed, percent cloud cover, wind direction, temperature, relative humidity).

    Some relevant information is available in Reference 33.

25. Knowledge of the procedure and format requirements for a presentation to an appeals body justifying a permit denial decision.

26. Background knowledge of source processes complete enough to support identification of the elements of the process which are likely to emit contaminants to the atmosphere if not adequately controlled (e.g., in petroleum refining: regeneration, combustion, compression, storage, and pumping). Also, knowledge of the parameters of each of these process elements which affect the quantity and type of emissions possible. This type of knowledge is available to a useful

extent in documents of the following types:

a. Emission factors handbooks (for example, References 5, 19, 20, 28, and 30).

b. Descriptions of source processes, such as manufacturing of sulfuric acid or steel (for example, References 1, 3, 6, 7, 8, 11, 15, 18, 29, 31, 34, 35, and 43).

c. Descriptions of emission control methods and devices (for example, References 21, 22, 23, 24, 25, 26, and 27).

Another source of this type of knowledge is work experience in the process area with emphasis on process design, operation, or air pollution control.

References

1. Air Pollution Sub-Committee. Odor control manual for the rendering industry. Des Plaines, Ill.: National Renderers Assn., Jan. 1969.

2. Alden, J. L. Design of industrial exhaust systems. New York: The Industrial Press, November 1959.

3. Committee on Industrial Hygiene. Steel mill ventilation. New York: American Iron and Steel Institute, May 1965.

4. Committee on Industrial Ventilation. Industrial ventilation. A manual of recommended practice. Lansing, Michigan: American Conference of Governmental Industrial Hygienists, 1970. (11th Edition.)

5. Control Agency Directors S-8 Committee. Pacific northwest emission factors reference manual. Air Pollution Control Association, Pacific Northwest International Section, April 1971.

6. Cooperative Study Project, Manufacturing Chemists' Association and Public Health Service. Atmospheric emissions from sulfuric acid manufacturing processes. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, National Air Pollution Control Administration, 1965. PHSP #999-AP-13.

7. Cuffe, S. T., and Gerstle, R. W. Emissions from coal-fired power plants: a comprehensive summary. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, 1967. PHSP #999-AP-35.

8. Danielson, J. A. (Ed.) Air pollution engineering manual. Air Pollution Control District, County of Los Angeles. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention Environmental Control, National Center for Air Pollution Control, 1967.

9. Decker, L. D. Odor control by incinerator. Greenwich, Connecticut: UOP Air Correction Division, November 1965. (Text of a talk given before a meeting of the Middle States Section of the Air Pollution Control Assn., Wilmington, Delaware, November 1965).

10. Duffee, R. A. Appraisal of odor-measurement techniques. Journal of the Air Pollution Control Association, 7:472-474. July 1968, Vol. 18.

11. Gulf Publishing Co. Hydrocarbon processing handbook. Houston, Texas: Author, Box 2608, 77001.

12. Haaland, H. H. (Ed.) Methods for determination of velocity, dust and mist content of gases. Bulletin WP-50. Seventh Edition. Los Angeles: Western Precipitation Division/ Joy Manufacturing Company, 1968.

13. Huey, N. A., Broering, L. C., Jutze, G. A., & Gruber, C. W. Objective odor pollution control investigations. Journal of the Air Pollution Control Association, 6:441-444. December 1960, Vol. 10.

14. Ingels, R. M. The afterburner route to pollution control. Air Engineering, June 1964, p. 39-42.

15. Kreichelt, T. E., Kemnitz, D. A., and Cuffe, S. T. Atmospheric emissions from the manufacture of portland cement. Cincinnati,

Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention and Environmental Control, 1967. PHSP #999-AP-17.

16. Loquercio, Peter, & Stanley, W. J. Air pollution manual of coding...a coding system for the identification of basic equipment and control devices used in industrial processing. U. S. Department of Health, Education, and Welfare; Public Health Service Publication No. 1756, 1968.

17. MacKnight, R. J., Williamson, J. E., Sableski, J. J., & Dealy, J. A. Controlling the flue fed incinerator. Paper 59-4, presented at the 52nd Annual Meeting of the Air Pollution Control Association. Los Angeles: Los Angeles Air Pollution Control District, June 1959.

18. McGannon, H. E. (Ed.) The making, shaping and treating of steel. Eighth Edition. United States Steel Corporation.

19. McGraw, M. J., & Duprey, R. L. Compilation of air pollutant emission factors. Preliminary document. Research Triangle Park, North Carolina: Environmental Protection Agency, April 1971.

20. National Air Pollution Control Administration. Air pollutant emission factors. Washington, D. C.: Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, April 1970.

21. National Air Pollution Control Administration. Control techniques for carbon monoxide emissions from stationary sources. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, March 1970. No. AP-65.

22. National Air Pollution Control Administration. Control techniques for hydrocarbon and organic solvent emissions from stationary sources. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, March 1970. No. AP-68.

23. National Air Pollution Control Administration. Control techniques for particulate air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, January 1969.

24. National Air Pollution Control Administration. Control techniques for sulfur oxide air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, January 1969.

25. National Asphalt Pavement Association. Environmental pollution control at hot-mix asphalt plants. Information Series 27.

26. New Jersey State Department of Health, Air Sanitation Program. A guide for evaluation of solid particle emissions from asphalt paving plants. May 1966.

27. New Jersey State Department of Health, Air Sanitation Program. A guide for the evaluation of solid particle emissions from ferrous foundry operations. August 1966.

28. Ozolins, Guntis, & Smith, Raymond. A rapid survey technique for estimating community air pollution emissions. PHSP #999-AP-29. October 1966.

29. Schueneman, J. J., High, M. D., & Bye, W. E. Air pollution aspects of the iron and steel industry. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, June 1963.

30. Sheehy, J. P., Achinger, W. C., & Simon, R. A. Handbook of air pollution. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention and Environmental Control, National Center for Air Pollution Control. PHSP #999-AP-44.

31. Smith, W. S. Atmospheric emissions from fuel oil combustion. An inventory guide. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, November 1962. PHSP #999-AP-2.

32. Standards and Engineering Information - re Boilers
- Superheaters
- Stokers
- Pulverized Fuel Equipment
- Air Preheaters
- Economizers

Available from the American Boiler Manufacturers Association, 1180 Raymond Blvd., Newark, N. J.

33. Sticksel, P. R., and Staff (Ed.) Student's manual for evaluation of visible emissions for state and local air pollution inspectors. Columbus, Ohio: BATTELLE Columbus Laboratories, August 1971.

34. Swearingen, J. S., and Levin, H. Hydrocarbon losses from the petroleum industry in L. A. County. San Antonio, Texas: Southwest Research Institute.

35. Technical Advisory Board. Code of recommended practices. Asphalt mixing plants. Chicago: City of Chicago, Department of Environmental Control, April 1971.

36. Technical Advisory Board. Code of recommended practices. Fuel burning equipment for heating, steam and hot water generation, absorption refrigeration. Chicago: City of Chicago, Department of Environmental Control, October 1968.

37. Technical Advisory Board. Code of recommended practices. Grain handling and storage. Chicago: City of Chicago, Department of Environmental Control, April 1971.

38. Technical Advisory Board. Code of recommended practices. Refuse burning equipment for domestic and non-domestic use. Chicago: City of Chicago, Department of Environmental Control, April 1971.

39. Technical Advisory Board. Code of recommended practices. Rendering processes. Chicago: City of Chicago, Department of Environmental Control, April 1971.

40. Technical Advisory Board. Code of recommended practices. Spray booths. Chicago: City of Chicago, Department of Air Pollution Control, August 1968.

41. U. S. Department of Health, Education, and Welfare. Interim guide of good practice for incineration at federal facilities. Raleigh, North Carolina: Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, November 1969. AP-46.

42. U. S. Department of Health, Education, and Welfare. Specifications for incinerator testing at federal facilities. Durham, North Carolina: Public Health Service, Bureau of Disease Prevention and Environmental Control, National Center for Air Pollution Control, Abatement Program, October 1967.

43. U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution. Atmospheric emissions from petroleum refineries. A guide for measurement and control. PHSP #763, 1960.

44. Ward, F. R. Odor measurement with the Scentometer. Norfolk, Virginia: Odor Control Subcommittee, Industrial Standards Committee, National Renderers Association.

45. Williamson, J. E., and Hammond, W. F. Interim guide to good practice for direct-fed multiple-chamber incinerators. Los Angeles: L. A. County Air Pollution Control District, October 1966.

46. Williamson, J. E., MacKnight, R. J., & Chass, R. L. Multiple-chamber incinerator design standards for Los Angeles County. Los Angeles: Los Angeles County Air Pollution Control District, October 1960.

Special Staffing Guidance

To get a complete picture of the Plan Review task and its associated skill and knowledge requirements, combine the material presented above with that presented under Engineering Inspection (Page B-59).

Typically, control agencies maintain a staff of Engineers who work full-time on plan review activities, and the degrees of freedom in assigning an Engineer to process a specific application are limited. However, in

the case where specific assignments can be made to best take advantage of personnel experience and skill level, the following variables should be considered:

1. The judged difficulty or complexity of the basic or control equipment to be reviewed. Examples of relatively uncomplicated basic equipment and control equipment include:

    a. Buffing and grinding equipment

    b. Degreasers

    c. Dry cleaning equipment

    d. Laundry tumblers

    e. Oil quench tanks

    f. Dry cleaning adsorbers

    g. Spray booths

    h. Settling chambers

    Examples of more difficult basic and control equipment include:

    a. Grease solvent extraction units

    b. Muffle furnaces

    c. Open-hearth furnaces

    d. Rendered products handling systems

    e. Boilers used as an afterburner

    f. Hot air baghouses

    g. Vapor recovery units

    Under most conditions, senior level Engineers should be assigned to process applications concerning more difficult or complex equipment.

2. Unusual credibility requirements related to the application. If the assignment is likely to be a controversial one, it may be advisable to assign the job to a senior level Engineer in order to help increase the strength and acceptability of the agency's position.

Engineering Inspection

Task Overview

Frequently, agency personnel are called on to inspect complex and extensive industrial, commercial, or public facilities. These inspections are typically performed as an adjunct to engineering or enforcement activities including:

1. Complaint investigation.
2. Enforcement of the permit system (e.g., to determine if a new installation fits the description given on the installation permit; to identify operating processes which have no permits).
3. Data collection for an emission inventory.
4. Registration of equipment or processes as required by law (e.g., processes emitting sulfur compounds).
5. Investigation and documentation of violations (e.g., smoke density, open burning violation alert).
6. Inspection of progress in a compliance program (e.g., installation of control equipment or changes in processes to reduce emissions).

Engineering inspections contain many of the task elements of the less complicated Routine Inspection task covered in Volume C. Most of the inspections, regardless of who does them and what equipment they cover, have in common some general task requirements. These requirements include:

1. Visual inspection of equipment and operations which can result in air pollution.
2. Interaction with personnel who operate or manage the equipment.
3. Attention to details of equipment design or operation which may be in violation of local regulations.
4. Collection and reporting of specific information about the equipment and processes.
5. Concern for public relations and ethical considerations.

Occupational Category: Engineer

Task Description

1. Identify the objectives of the inspection and perform all required pre-inspection activities. These pre-inspection activities could include:

   a. Secure and read the background data describing the unit to be inspected. The descriptive material may be general or specific to the exact plant, equipment to be inspected, or anticipated pollution problem.

      In the case of large complex units, prepare or secure and then review basic flow diagrams, plot plans, process descriptions, or drawings before the actual inspection.

      Another area of background data to review would be relevant files describing other agency activities regarding the unit to be inspected. For example, files containing permit data, prior violations, and compliance program details may contain useful information.

   b. If more than one inspector is required, identify the type and number of required assistants and make arrangements for securing them. Define the roles of the assistants and rehearse or brief them accordingly.

   c. Identify the materials (e.g., data collection forms) and equipment required for the inspection, and secure them in the appropriate numbers.

   d. Identify the need for assistance from plant personnel. Determine the types of people (in terms of knowledge, experience, responsibility) and the numbers required.

2. On approaching the inspection site, carefully review the scene. Generally, locate and note items of interest including:

   a. Smoke stacks

b. Exhaust vents

c. Incinerators

d. Pollution control equipment

e. Materials loading and storage areas

f. Effluent water containers

g. Outdoor burning

h. Fugitive emissions

Also, maintain awareness for localized air pollution conditions including:

a. Smoke

b. Odors

c. Settled dust

d. Stains due to emission of air contaminants

3. Contact the highest ranking authority present at the plant. Inform him of the planned inspection and request permission to enter. Also, describe and request the desired assistance from plant personnel. It may be necessary to cite the relevant local regulations which define the inspector's duties and give him the right to perform them. If permission to enter is not granted follow the appropriate procedure for refused entry.

4. Locate the equipment to be inspected and make the required observations. Typically, a data collection form is used to cue the inspector to specific characteristics of the equipment. Also, collect all required data related to operation of the equipment. It may be necessary to secure information from equipment operators, management, or company records.

5. Verify that the observed equipment fits the description of the equipment for which the permit to install was granted. Identify and describe the equipment in terms of function, capacity, throughput, manufacturer, configurational characteristics, or serial number.

6. Identify and describe all discrepancies between the observed equipment and that described in the installation permit material.

Determine the pollution control effects of the modifications to the accepted plan. Discrepancies which adversely affect emmissions or violate local standards may result in denial to operate the equipment.

7. Verify that the process observed is the one described in the permit application supporting data. Verify characteristics of the process including:

    a. Overall product or function of the equipment in the process. Include capacity, throughput, etc.

    b. Sequential or parallel steps of the process and their functions (e.g., storage, size reduction, drying, materials handling).

    c. Type and quantity of materials used in the process.

    d. Batch vs. continuous process.

    e. Emission points and acceptability of emissions (visible emissions, odors, stains).

8. Prepare inspection findings and conclusions. With regard to enforcement of the permit system, the inspector can report his findings in two ways (depending upon local procedures and regulations):

    a. If the unit has been constructed or is being operated in a manner not consistent with relevant permits, file a notice of violation.

    b. If the unit has not received the appropriate permit, send a form to the source operator requesting that a permit application be completed. This form can contain information including:

        1) Firm name, address, telephone number.

        2) Description of equipment requiring the permit (make, model, general use of equipment, system, or process).

3) Deadline for application.

4) Description of emissions or odors.

5) Suspected or recorded violations.

6) Reason permit is required.

9. Prepare any additional specialized reporting forms required. In addition to or in lieu of the above types of forms, the inspector may complete additional materials including:

   a. Industry-specific inspection check sheets. Such materials contain specific checkpoints to cover for a specific type of operation. For example, a form for a foundry might contain checkpoints including:

      1) Cupolas.

      2) Charge materials (scrap metal, coke).

      3) Control equipment (e.g., venturi type).

      4) Pyro-vents.

      5) Visible emissions at stack.

      6) Operation of waste hoppers (e.g., operation of wet rings, blow-off conditions).

      7) Wind carry-off from storage piles.

      8) Odor characteristics (quality, distress effects, intensity).

   b. Solvent usage survey (depending upon agency or regulations). In the case of a solvent used prior to a heating operation, such a survey may require information including:

      1) Description of articles processed in oven.

      2) Type of process used for coating (e.g., spray booth, dip tank).

      3) Time between coating and oven process.

      4) Oven process (baking, heat curing, heat polymerization).

      5) Pollution control equipment.

10. Prepare a general field report. A general type of form is usually used to describe results of an inspection in addition to formal notices or other special forms. The form can be used to describe suspected or near violations, follow-up inspection findings, and any other objectives not directly related to violations. These forms are usually filled in with narrative statements describing the purpose and findings of the inspection and any relevant statements made by the operator or manager of the process being inspected.

Skill Requirements

1. Ability to interpret regulations regarding administration of the plan review/permit system including:
    a. Discriminating which types of equipment must apply and which are exempt.
    b. Accurately applying emission standards, equipment design criteria, and other control regulations.
    c. Establishing the appropriate fee for both simple and complex configurations of basic or control equipment.
2. Ability to answer applicant's questions and present information to them concerning the technical and administrative requirements of the plan review/permit system.
3. Ability to use nomographs, tables of data, special slide rules, desk calculators, and other aids in performing required calculations or data determinations.
4. Ability to reliably and accurately judge visible emissions from stationary sources in terms of density and opacity using accepted procedures. The precision of these judgments should be adequate to serve as acceptable evidence in a court of law.
5. Ability to interpret engineering drawings for detailed evaluation of basic equipment, ventilation systems, or control systems. The types of drawings reviewed include:
    a. Assembly drawings (in plan and elevation)

b. Equipment location drawings

c. Plot plans

d. Process flow diagrams

6. Ability to determine if the operating conditions of an industrial or commercial process during a source test or inspection are representative of typical operations or are those likely to produce the greatest pollution potential. This could include verifying operating conditions such as charging rates, composition of input materials, and level of dilution air used.

7. Ability to visually recognize discrepancies between the accepted plans and the equipment (basic or control) installed. Also, ability to determine whether the discrepancies will have a positive, negative, or neutral effect on pollution control.

8. Ability to identify and describe the general requirements for a source test required for a "permit to operate," or for acquisition of data for an emission inventory. The elements of the test to be specified include:

   a. Equipment to be tested.

   b. General location of test points.

   c. Constituents to be measured.

   d. Operational conditions during which test is to be conducted.

9. Ability to accurately observe, describe, or estimate environmental conditions current at the time of a smoke observation, including wind speed and direction, relative humidity, temperature, and percent cloud cover.

10. Ability to reliably and accurately detect or characterize odors such that illegal concentrations can be identified and related to the responsible source. The terminology and procedure used to rate or describe odors vary from agency to agency and depend upon accepted legal requirements.

11. Ability to secure cooperation and assistance from the operator or manager of the source or plant being inspected.

12. Ability to recognize the component operations of industrial or commercial processes which are being suboptimally performed, thus resulting in or contributing to excessive emissions, for example:

    a. Improper coking operation in a fuel burning process.

    b. Unbalanced intake and draft air ratio for cookers and driers in a rendering plant.

    c. Improperly enclosed or ventilated loading, unloading, or storage areas in a cement plant.

    d. Sloppy housekeeping operations in a rendering plant.

    e. Inadequate preventative maintenance program for air pollution control equipment.

    f. Improper charge rate, fuel, or excess air in an incinerator.

13. During the inspection, ability to locate, recognize, or describe the basic units of industrial process equipment which are capable of or are currently producing uncontrolled or inadequately controlled emissions. Examples of such elements include:

    a. Refining processes:

        1) Pressure relief valves

        2) Pump packing glands and valves

        3) Vapor recovery systems

        4) Flares

    b. Cement plants:

        1) Rotary drier

        2) Storage bins

        3) Crushing and grinding equipment

        4) Conveyors

        5) Loading/unloading facilities

c. Metal melting:

1) Furnaces (e.g., cupolas, induction, reverberatory)

2) Casting equipment (centrifugal, die, sand casting)

3) Charging equipment

4) Sandblasting or cleaning equipment

14. Ability to perform test procedures and operate test equipment on-site during an inspection. The test procedures and equipment used may include:

a. Sensitized test papers. These materials are used to test for the following contaminants:

1) Ammonia

2) Arsine

3) Hydrogen Sulfide

4) Phosgene

b. Squeeze Bulb Type Gas Testers. This device gives colorimetric reactions to the following contaminants:

1) Benzine

2) Toluene

3) Xylene

4) Carbon Monoxide

5) Hydrogen Cyanide

6) Hydrogen Sulfide

7) Sulfur Dioxide

c. Tutweiler Apparatus. This device uses gas/liquid titrations to determine the concentrations of the following contaminants in stack gases:

1) Hydrogen Sulfide

2) Sulfur Dioxide

3) Ammonia

4) Carbon Dioxide

d. Hilo Bromine Field Test Equipment

e. Midget Impinger and Gas Adsorption Cell

f. Halide Leak Detector

g. Explosimeters or Combustion Meters

h. Sling Psychrometer

i. Sword Pyrometer

15. Ability to determine whether a control device is operating properly (e.g., reaching design efficiency) by visual inspection of situational elements, including:

a. Extent and type of emissions

b. Operational sensors and monitoring equipment (e.g., pressure gauges, rotameters)

c. Observable physical characteristics of the equipment (e.g., rust, corrosion)

16. Ability to prepare inspection or engineering field reports which are adequately detailed, complete, and cogent to be accepted as evidence in a court of law.

17. Ability to identify, recognize, or locate external characteristics of plants or installations where indications of pollution are most likely to be revealed (e.g., stacks, vents, loading areas).

18. Ability to interact with company management or use company records to secure operating information related to emissions (e.g., type of fuel used, amount consumed per unit time, type and amount of process materials).

19. Ability to recognize, describe, or judge the source of general categories of stains or deposits formed by settlement of air contaminants. Such categories of stains or deposits include:

a. Acid stains (e.g., chromic acid, sulfuric acid, hydrofluoric acid, and phosphoric acid)

b. Oil droplets

c. Paint deposits

d. Carbon spheres

20. Ability to take acceptable photographs of the physical evidence of air contamination. Photographs should be adequately focused, framed, and exposed.

21. Ability to assess the degree to which original control device efficiency ratings should be reduced to accurately reflect its current condition and operating characteristics.

22. Ability to use agency files, source process data, and other methods to develop the appropriate background data to initiate an inspection of a stationary source.

23. Ability to interpret engineering drawings (e.g., plot plans, process flow diagrams) in order to plan for an inspection or locate and identify equipment in a facility.

24. Ability to make and interpret a basic flow diagram which identifies and shows the relationship of the sub-processes which comprise an industrial process.

25. Ability to locate, recognize, or describe air pollution control devices as used in industrial or commercial facilities.

26. Ability to accurately describe or judge the characteristics of basic or control equipment required for estimating emissions as determined by on-site inspection. The type of information collected and recorded can include:

a. Source operation

1) Number and type of source operations vented.

2) Rate or amount of raw materials used.

3) Rate or amount of finished product.

4) Quantity, rate, physical state, and discharge point of waste materials.

5) Identity of unit operations (e.g., drying, melting, size reduction, material movement).

6) Description of process flow with points of pollutant discharge noted.

7) Unit operating schedule.

b. Control devices

1) Type

2) Make and model

3) Design efficiency

4) Rated capacity

5) Installation date

6) Mechanical condition and maintenance

c. Stack

1) Location

2) Height

3) Materials

4) Type of construction (e.g., self-standing, roof, superstructure)

5) Availability of ports or openings

d. Discharge

1) Composition and physical characteristics (e.g., size, shape).

2) Daily discharge period (normal and maximum).

3) Gas discharge rate and temperature.

4) Draft or exhaust type (e.g., forced, induced, natural).

These data are used back in the office, along with the appropriate emission factors, to calculate the quantity and type of emission.

Knowledge Requirements

1. General knowledge of the goals and procedures of the plan review/ permit system.

2. Knowledge of the local regulations which directly or indirectly relate to administration of a plan review system. Specifically, knowledge of all the prohibitions and controls provided for in the agency's regulations. These typically include:

   a. Limitations on visible emissions (opacity and density).

   b. Limitations on the quantity of particulates, dusts and fumes, specific gaseous compounds, combustion contaminants, and organic compounds.

   c. Rules specifying control requirements for petroleum products, storage tanks, and rendering equipment.

   d. Specifications of sulfur content of fuels, photochemical reactivity, status of organic solvents.

   e. Prohibitions on public nuisances, open burning, and single-chamber incinerators.

3. Knowledge of the relevant state-of-the-art in design of basic equipment for air pollution control (e.g., controlled air incinerators).

4. Detailed knowledge of the key parameters of control device design and operation which affect its efficiency and effectiveness (e.g., retention time, turbulence, temperature and others in an afterburner). This includes knowledge of possible design shortcomings or faulty methods used in combining control devices into control systems (e.g., three wet scrubbers in series which use recycled water containing suspended particulate matter). References relevant to this knowledge are 6, 20, 21, and 22.

5. Detailed knowledge of air contaminants found in emissions of basic equipment typically submitted to plan review. The Engineer should be able to identify and describe basic equipment emissions at a level of detail such that the information can be used to evaluate the proposed control equipment. Resource materials used in this area include:

   a. Emission factors handbooks - References 3, 18, 19, and 23.

b. Descriptions of source processes with emphasis on their pollution potential - References 1, 2, 4, 5, 10, 14, 17, 24, 25, 28, and 37.

c. Air pollution engineering guidelines - Reference 6.

d. Recommended practices for design of basic equipment - References 16, 26, 29, 30, 31, 32, 33, 34, 35, 39, and 40.

e. A specialized taxonomy of basic equipment - Reference 15.

6. Knowledge of undesirable emission levels for contaminants not regulated by local regulations (e.g., documented health or nuisance effects). These levels are typically established by agency policy with regard to "general air pollution" type prohibitions written into their regulations.

7. Knowledge of the types of adjustments which can be made to basic equipment or control device operation which can improve emissions control (e.g., flame adjustments on an incinerator).

8. Knowledge of materials balance procedures for estimating emissions.

9. Knowledge of source testing procedures at a level of detail which enables the Engineer to establish the requirements for, participate in, and evaluate the findings of the tests. References 8, 11, 12, 36, 38 and 41 have been used in this area.

10. Knowledge of the local procedure and guidelines for deciding whether or not permits to install or operate basic or control equipment should be granted, based upon the outcome of the review or testing procedures. This includes knowledge of relevant standards, criteria, priorities, and trade-off guidelines (e.g., use of conditional permits).

11. Knowledge of the local procedures for performance of inspections, obtaining entry, and dealing with refusal of entry.

12. Knowledge of the data collection form and reports required for the specific inspection objective to be accomplished and the procedures for completing them.

13. Knowledge of the ethical considerations that impact on complaint handling and inspection. These ethical considerations include:

    a. Inspectors must not interfere with the acts or decisions of the control officer.

    b. The law must be applied uniformly.

    c. Recommendations for specific control equipment manufacturers are not permitted.

    d. Information acquired about an operation or company is proprietary and must never be disclosed to competitors.

    e. Inspectors (without the appropriate engineering background) will not make engineering recommendations.

    f. No gratuities.

    g. Be aware of personal biases and try to be factual and objective.

    h. Do not promise any legal or agency actions which are not possible to carry out.

    i. Maintain a neutral stance.

14. Knowledge of the recommended methods for soliciting cooperation, assistance, and operating information from the operators or managers of units to be inspected.

15. Knowledge of the jargon and terminology used by operators or management of the basic or control equipment being inspected or reviewed. This type of knowledge enables the inspector or reviewer to adequately describe his findings and to communicate with other knowledgeable individuals. For relevant References, see Knowledge 20.

16. Knowledge of the chemical and physical properties of materials used in the process being inspected or reviewed which have an effect on emissions and possible air pollution. For relevant References, see Knowledge 20.

17. Knowledge of the specific practices and processes of the type of industry being inspected or reviewed which may contribute to air pollution, for example:

    a. In a refinery, rattling and blowing coke from cracking tubes.

    b. In metal melting, the air pollution effects of efforts to remove metal impurities during the melt process.

    c. In a rendering plant, housekeeping problems which produce odor, such as fat accumulations inside hoods.

    For relevant References, see Knowledge 20.

18. Knowledge of the operating principles and uses of specific equipment within an industrial or commercial process (e.g., fractionating towers and bubble trays in a refinery).

    For relevant References, see Knowledge 20.

19. Knowledge of the operating principles of air pollution control equipment used at the inspection site. The types of devices used can be specialized according to the process they are controlling. Examples of such specialized devices are:

    a. Flares

    b. Loading rack separators

    c. Sulfur recovery plants

    Examples of less process-specific control devices include:

    a. Baghouses

    b. Scrubbers

    c. Cyclone separators

    d. Electrostatic precipitators

    For relevant References, see Knowledge 20.

20. Knowledge of the methods used to determine if pollution control devices are operating properly. In addition to visual emission evaluation, the industrial inspector should know how to read and evaluate data relevant to pollution control from devices such as:

    a. Chart recorders

    b. Manometers

    c. Pressure gauges

    d. Rotameters

    e. Flowmeters

    f. Ohmmeters

    g. Voltmeters

    Also, the inspector should know what physical characteristics of deterioration indicate that the control device is operating below maximum capability. These characteristics include:

    a. Leaking or missing bags in a baghouse.

    b. Corroded metal plates, baffles, and spray heads in a scrubber.

    c. Heavily-coated grids and plates in a precipitator.

    Basic resource information relevant to the above knowledge areas is available from publications of the following types:

    a. Emission factors handbooks - References 3, 18, 19, and 23.

    b. Descriptions of source processes with emphasis on their pollution potential - References 1, 2, 4, 5, 10, 14, 17, 24, 25, 28, 29, and 37.

    c. Air pollution engineering guidelines - Reference 6.

    d. Air pollution control technology - References 7, 13, 20, 21, and 22.

e. Local recommended codes of practice - References 30, 31, 32, 33, 34, 35, and 39.

21. Knowledge of the potential hazards and related safety regulations to be followed during inspections, including:

    a. Fire hazards.

    b. Restrictions against manipulating equipment without consent of the operator or management.

    c. Requirements for protective personal equipment, including:

        1) Rubber gloves

        2) Respirator

        3) Goggles

        4) Hard hat

        5) Gas mask

        6) Safety flashlight

    d. Check-in procedures

    e. Inspection precautions, including:

        1) Location of water showers when working in areas where acids or caustic solutions are being handled.

        2) Use of an assistant as a "safety."

        3) Not walking on building or tank roofs without appropriate supervision.

        4) Not watching welding activities directly.

22. Knowledge of the techniques and under what conditions to use on-site test procedures and equipment during an inspection. Conditions for use of testing materials and equipment include:

    a. In a refinery inspection: use of lead acetate paper to verify pH of treated water effluent for stripping efficiency.

b. In a refinery inspection: use of the Bromine Field Test Equipment to determine if the Bromine number is below a locally required standard.

c. In a refinery inspection: use of the Explosimeter to determine if any hydrocarbon vapor leaks are present.

d. In a rendering operation inspection: use of the Sword Pyrometer to check afterburner temperature.

e. In an incinerator inspection: use of a draft gauge to measure draft or use of a Pyrometer to measure chamber temperature.

23. Knowledge of the requirements for an accurate smoke-reading. These requirements include:

a. Read plume against background contrasting in color to the color of the smoke.

b. Light source (e.g., the sun) should be behind observer during daytime.

c. Light source (e.g., spotlight) should be behind plume at night.

d. Wind direction should be from either right or left side of the observer.

e. A clear view of the stack and background should be available. In some agencies a maximum observer distance has been proposed.

f. Record smoke-readings on the proper data collection form and at the required time intervals.

g. Read residual plumes only, not "wet plumes."

h. Observe and record all required environmental conditions current at the time of the observation (e.g., wind speed, percent cloud cover, wind direction, temperature, relative humidity).

Some relevant information is available in Reference 27.

24. Detailed knowledge of local regulations relevant to the objectives, duties, and rights of the inspector. The inspector must have full knowledge of the prohibitions, required conditions, and exemptions provided in the law. The areas of the regulations the inspector needs to know include:

    a. Smoke density and opacity standards.

    b. Particulate and gaseous emission standards.

    c. "Public nuisance" or general "air pollution by definition" prohibitions.

    d. Open burning controls.

    e. Incinerator design requirements.

    f. Storage, loading, and unloading of gasoline and other petroleum products.

    g. Provisions of the permit system.

    h. Emergency control program requirements.

25. Knowledge of pre-inspection duties and agency procedures for completing pre-inspection activities (e.g., securing assistance, checkout of test equipment).

26. Knowledge of the types and appearance of property damage due to air contaminants. Such damages include:

    a. Acid stains

    b. Discoloration of paint

    c. Dust or fly ash deposits

    d. Paint deposits

    e. Vegetation damage

27. Knowledge of the methods used for describing and rating the intensity of odors.

28. Knowledge of the basic psychophysical and perceptual principles related to the human sense of smell. This knowledge can include:

    a. Sensory adaptation effects.

    b. Adaptation level effects.

c. Individual differences in awareness and emotional response to odors.

d. The concept of a sensory threshold as a statistical phenomenon which is affected by many external and internal variables (e.g., humidity and past experience).

29. Knowledge of the method for tracking odors in order to identify the likely source of the emission, including:

a. Analysis of wind patterns.

b. Area surveys.

c. Use of field test equipment (e.g., Scentometer).

30. Knowledge of the procedure for preparing a notice of violation. This includes knowledge of the rules for recording information and all coding schemes used to designate data. Also, knowledge of the appropriate wording for narrative portions of the notice.

31. Knowledge of the procedure for serving violation notices and for keeping appropriate records of such activities.

32. Knowledge of local regulations at a level of detail to enable identification or verification of violations as formally reported by enforcement personnel.

33. Knowledge of the types of data contained in agency enforcement files and their application to specific inspection, complaint handling, and other enforcement activities.

34. Knowledge of the terminology and language used in agency files of past enforcement action.

35. Knowledge of the basic procedures used in estimating source emissions from information describing the process, its production rates, production schedules, types of contaminants emitted, or the emission control devices currently in service or proposed. These procedures should include use of emission factors, materials balance, and source test findings. References 3, 18, 19, and 23 are relevant in this knowledge area.

36. Knowledge of the exterior characteristics of plants and facilities inspected and the location and configuration of the elements

of the facility where air pollution problems would be evident (e.g., stacks, vents, storage areas).

37. Knowledge of the procedures for preparation of flow diagrams of industrial processes.

References

1. Air Pollution Sub-Committee. Odor control manual for the rendering industry. Des Plaines, Illinois: National Renderers Association, January 1969.

2. Committee on Industrial Hygiene. Steel mill ventilation. New York: American Iron and Steel Institute, May 1965.

3. Control Agency Directors S-8 Committee. Pacific northwest emission factors reference manual. Air Pollution Control Association, Pacific Northwest International Section, April 1971.

4. Cooperative Study Project, Manufacturing Chemists' Association and Public Health Service. Atmospheric emissions from sulfuric acid manufacturing processes. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, National Air Pollution Control Administration, 1965. PHSP #999-AP-13.

5. Cuffe, S. T., and Gerstle, R. W. Emissions from coal-fired power plants: a comprehensive summary. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, 1967. PHSP #999-AP-35.

6. Danielson, J. A. (Ed.) Air pollution engineering manual. Air Pollution Control District, County of Los Angeles. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention Environmental Control, National Center for Air Pollution Control, 1967.

7. Decker, L. D. Odor control by incinerator. Greenwich, Connecticut: UOP Air Correction Division, November 1965. (Text of a talk given before a meeting of the Middle States Section of the Air Pollution Control Assn., Wilmington, Delaware, November 1965).

8. Duffee, R. A. Appraisal of odor-measurement techniques. Journal of the Air Pollution Control Association, 7:472-474. July 1968, Vol. 18.

9. Environmental Protection Agency, Air Pollution Control Office. Air pollution aspects of emission sources: Municipal incineration-a bibliography with abstracts. Research Triangle Park, North Carolina: Author, May 1971. No. AP-92.

10. Gulf Publishing Co. Hydrocarbon Processing Handbook. Houston, Texas: Author, Box 2608, 77001.

11. Haaland, H. H. (Ed.) Methods for determination of velocity, dust and mist content of gases. Bulletin WP-50. Seventh Edition. Los Angeles: Western Precipitation Division/ Joy Manufacturing Company, 1968.

12. Huey, N. A., Broering, L. C., Jutze, G. A., & Gruber, C. W. Objective odor pollution control investigations. Journal of the Air Pollution Control Association, 6:441-444. December 1960, Vol. 10.

13. Ingels, R. M. The afterburner route to pollution control. Air Engineering, June 1964.

14. Kreichelt, T. E., Kemnitz, D. A., and Cuffe, S. T. Atmospheric emissions from the manufacture of portland cement. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention and Environmental Control, 1967. PHSP #999-AP-17.

15. Loquercio, Peter, & Stanley, W. J. Air pollution manual of coding ...a coding system for the identification of basic equipment and control devices used in industrial processing. U. S. Department of Health, Education, and Welfare; Public Health Service Publication No. 1756, 1968.

16. MacKnight, R. J., Williamson, J. E., Sableski, J. J., & Dealy, J. A. Controlling the flue fed incinerator. Paper 59-4, presented at the 52nd Annual Meeting of the Air Pollution Control Association. Los Angeles: Los Angeles Air Pollution Control District, June 1959.

17. McGannon, H. E. (Ed.) The making, shaping and treating of steel. Eighth Edition. United States Steel Corporation.

18. McGraw, M. J., & Duprey, R. L. Compilation of air pollutant emission factors. Preliminary document. Research Triangle Park, North Carolina: Environmental Protection Agency, April 1971.

19. National Air Pollution Control Administration. Air pollutant emission factors. Washington, D. C.: Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, April 1970.

20. National Air Pollution Control Administration. Control techniques for hydrocarbon and organic solvent emissions from stationary sources. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, March 1970. No. AP-68.

21. National Air Pollution Control Administration. Control techniques for particulate air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, January 1969.

22. National Air Pollution Control Administration. Control techniques for sulfur oxide air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, January 1969.

23. Ozolins, Guntis, & Smith, Raymond. A rapid survey technique for estimating community air pollution emissions. PHSP #999-AP-29, October 1966.

24. Schueneman, J. J., High, M. D., & Bye, W. E. Air pollution aspects of the iron and steel industry. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, June 1963.

25. Smith, W. S. Atmospheric emissions from fuel oil combustion. An inventory guide. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, November 1962. PHSP #999-AP-2.

26. Standards and Engineering Information - re Boilers
- Superheaters
- Stokers
- Pulverized Fuel Equipment
- Air Preheaters
- Economizers

Available from the American Boiler Manufacturers Association, 1180 Raymond Blvd., Newark, New Jersey.

27. Sticksel, P. R., and Staff (Ed.) Student's manual for evaluation of visible emissions for state and local air pollution inspectors. Columbus, Ohio: BATTELLE Columbus Laboratories, August 1971.

28. Swearingen, J. S., and Levin, H. Hydrocarbon losses from the petroleum industry in L. A. County. San Antonio, Texas: Southwest Research Institute.

29. Technical Advisory Board. Code of recommended practices. Asphalt mixing plants. Chicago: City of Chicago, Department of Environmental Control, April 1971.

30. Technical Advisory Board. Code of recommended practices. Fuel burning equipment for heating, steam and hot water generation, absorption refrigeration. Chicago: City of Chicago, Department of Environmental Control, October 1968.

31. Technical Advisory Board. Code of recommended practiees. Grain handling and storage. Chicago: City of Chicago, Department of Environmental Control, April 1971.

32. Technical Advisory Board. Code of recommended practices. Refuse burning equipment for domestic and non-domestic use. Chicago: City of Chicago. Department of Environmental Control, April 1971.

33. Technical Advisory Board. Code of recommended practices. Rendering processes. Chicago: City of Chicago, Department of Environmental Control, April 1971.

34. Technical Advisory Board. Code of recommended practices. Spray booths. Chicago: City of Chicago, Department of Air Pollution Control, August 1968.

35. U. S. Department of Health, Education, and Welfare. Interim guide of good practice for incineration at federal facilities. Raleigh, North Carolina: Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, November 1969. No. AP-46

36. U. S. Department of Health, Education, and Welfare. Specifications for incinerator testing at federal facilities. Durham, North Carolina: Public Health Service, Bureau of Disease Prevention and Environmental Control, National Center for Air Pollution Control, Abatement Program, October 1967.

37. U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution. Atmospheric emissions from petroleum refineries. A guide for measurement and control. PHSP #763, 1960.

38. Ward, F. R. Odor measurement with the Scentometer. Norfolk, Virginia: Odor Control Subcommittee, Industrial Standards Committee, National Renderers Association.

39. Williamson, J. E., and Hammond, W. F. Interim guide to good practice for direct-fed multiple-chamber incinerators. Los Angeles: L. A. County Air Pollution Control District, October 1966.

40. Williamson, J. E., MacKnight, R. J., & Chass, R. L. Multiple-chamber incinerator design standards for Los Angeles County. Los Angeles: Los Angeles County Air Pollution Control District, October 1960.

41. Wohlers, H. C. Recommended procedures for measuring odorous contaminants in the field. Journal of the Air Pollution Control Association, 9:609-612. September 1967, Vol. 17.

Special Staffing Guidance

The level of Engineer assigned to an inspection task depends upon factors including:

1. The judged difficulty or complexity of the basic or control equipment to be inspected. Examples of relatively uncomplicated basic equipment and control equipment include:

    a. Buffing and grinding equipment

    b. Degreasers

    c. Dry cleaning equipment

    d. Laundry tumblers

    e. Oil quench tanks

    f. Dry cleaning adsorbers

    g. Spray booths

    h. Settling chambers

    Examples of more difficult basic and control equipment include:

    a. Grease solvent extraction units

    b. Muffle furnaces

    c. Open-hearth furnaces

    d. Rendered products handling systems

    e. Boilers used as an afterburner

    f. Hot air baghouses

    g. Vapor recovery units

    Under most conditions senior level Engineers should be assigned to inspect the more difficult or complex equipment. In addition, the Engineer who initially processed the permit application for which the inspection is relevant is likely to have the best background to perform the required inspection.

2. Unusual credibility requirements related to the application. If the assignment is likely to be a controversial one, it may be advisable to assign the job to a senior level Engineer in order to increase the credibility of the agency's position.

Design and Construction of an Episode Control System

Task Overview

The task described below emphasizes the Engineer's efforts in designing and developing the episode control system, rather than in operating it during an episode. Clearly, the key to an effective system is a complete and systematic plan for the program. The state-of-the-art in this area is in its infancy relative to most of the other areas of agency activity. Few agencies have developed comprehensive programs; however, many of the more advanced agencies are planning such a development for the near future. Even in agencies where a program exists there has been relatively little experience in operating it (i.e., combating episode conditions).

The major difference between state and local programs is the number and, possibly, diversity of sources to be controlled. At the state level the episode control system designer may deal with statewide organizations of sources rather than on a one-to-one basis. The following task is representative of the operations the designer would have to accomplish to construct a viable program at most agencies.

Occupational Category: Engineer (Senior)

Task Description

1. Define the limits of the agency's authority, responsibility, and jurisdiction regarding an episode control system as established by the enabling legislation.
2. Identify the functional objectives of the episode control system. These objectives should be stated at a level of detail which permits design of the methods and policies required to accomplish them. The objectives should cover the following areas:
    a. Curtailment or elimination of source emissions
    b. Monitoring of air quality and meteorological conditions
    c. Enforcement of curtailment activities
    d. Communications

3. Identify the contaminants that the system will seek to control during periods of unusually high and potentially dangerous concentrations. Choice of pollutants will depend upon factors such as:

    a. Current emission levels as depicted in the emission inventory.

    b. Estimated number of sources of the contaminant which will have to reduce emission.

    c. Manpower and facilities available to commit to operation of the system.

    d. Anticipated problems in securing required cooperation from individual or groups of sources.

4. Prepare a detailed description of the manner in which the episode control system will operate. Attend to the following aspects of the system:

    a. Identify the stages of the episode in terms of the ambient air contaminant concentrations or meteorological conditions which define them (the episode stage criteria).

    b. Describe the means by which the agency will sense the conditions which define an episode or stage of the episode. Indicate the role of the air monitoring system in the episode control effort. Consider factors such as:

        1) Reliability and validity of measurements.

        2) The adequacy of the data acquisition and processing subsystem. For example, do current measurement units and averaging times correspond with those used for the episode control criteria?

        3) The facilities that will be used to quickly transmit monitoring system data to the agency.

    Also, indicate how critical meteorological conditions will be sensed. Will National Weather Service regional pollution

advisories be used, or will more localized forecasts be prepared? How will periodic weather forecasts be acquired and evaluated during an episode? What measurements will be taken? How will these periodic forecasts be interpreted in managing the episode control effort?

c. Establish the general emission reduction objectives for each episode stage on a source-category basis. These objectives should describe the general class of actions each type of source should take at each stage of the episode. For example, the agency may require "substantial curtailment of operations" for refineries during the first stage of an episode.

d. Describe the methods by which the specific emission reduction activities needed to satisfy the general emission objectives will be determined for each source. For example, the agency might request each source to fill out a form describing the specific actions they volunteer to take to satisfy the emission reduction objectives stated for each stage of the episode. These voluntary actions could then be compared with actions the agency feels are required and possible. Differences could then be settled through negotiation.

e. Describe the methods that will be used to identify and counter socially or economically disruptive effects of specific control actions. Particular attention will have to be paid to curtailment of vehicular traffic and refuse collection.

f. Identify the major decisions that will have to be made to operate the system, who will make them, and the methods (i.e., criteria, rules of thumb) which will be used. For example, how will the sources who must curtail their emissions at a given point in the episode be determined? Who will make the decision?

g. Define the communication requirements of the episode control

system. Consider factors such as:

1) How the agency will be informed of the onset of episode conditions.

2) Who will have to be contacted (e.g., police, news media, sources, other governmental agencies) in the event an episode occurs.

3) What information they need.

4) When in the episode they should be contacted.

5) What media should be used (e.g., special telephone line, two-way radio).

h. Describe the methods that will be used to enforce the specific reduction activities required of each source. How will violations be detected? What personnel will be committed to the enforcement operation? How will 24-hour enforcement be accomplished during the episode?

i. Identify the need for formal, written procedures and training programs. For example, describe the information to be included in an episode control procedures manual. What kind of training is needed? Should drills be held periodically?

j. Devise a plan for evaluating the entire episode control system. For example, short-term diffusion modeling could be used to evaluate the degree of ambient air quality improvement resulting from implementation of the proposed emission reductions.

k. Identify the conditions under which the episode control effort will be officially terminated.

5. Once the episode control system has been planned, identify the individual sources of the selected contaminants. Group the sources in terms of process or basic equipment similarities (e.g., refineries, bituminous concrete plants, municipal incinerators).

6. Identify the type of control actions (either staged or immediate full effect) which could be employed to significantly reduce or eliminate emissions. That is for each category of sources:

a. Identify the specific operations creating the

pollutants and the quantity emitted.

b. Identify and describe the status of all control devices currently in use on these operations:

   1) How is it being maintained?

   2) Is it being operated properly?

   3) Is it suitable for emergency use?

   4) Can it be bypassed?

   It may be decided to reduce or shut down processes with poor existing control before those processes which are already effectively controlled.

c. Identify methods of reducing pollutants (e.g., reduction in process activity, shutdown of the process, process modification such as a fuel change).

d. Identify the equipment which cannot be shut down because of danger of damaging the equipment or production of excessive emissions caused by shutdown.

e. Identify undesirable effects of shutdown including:

   1) Damage to equipment (e.g., solidification of melted material within furnaces)

   2) Power for fire protection

f. Estimate response time for each of the control techniques.

7. Select a program of control actions for each category of source which provides the greatest emission reduction at the lowest price to the industry and the people. The program should be responsive to the emission reduction objectives established for the program.

8. Solicit a control program from each source that details the control efforts they will voluntarily take to achieve the emission reduction objectives. This is an optional step. It is possible to simply present the source with the control program designed for it by the agency and convince them of its reasonableness.

9. Secure a commitment from the source to adhere to its control program if and when an episode occurs. This may require some selling.

10. Construct the supporting elements of the episode control program including:

    a. Communication arrangments and facilities.

    b. Enforcement procedures and special contingency plans.

    c. Administrative and decision-making procedures.

    d. Training.

    e. Adequate facilities and procedures for monitoring and transmitting air quality and meteorological conditions in a form which is directly useful to the episode control system.

Skill Requirements

1. Ability to recognize and incorporate into relevant planning the political and economic characteristics of the locality which will influence public and private acceptance of an episode control plan.

2. Ability to work on the operational and theoretical problems of an episode control system and communicate effectively with personnel in a variety of air pollution control technical disciplines, industry, news media, and citizen groups.

3. Ability to communicate effectively in written or spoken form with representatives of industry, citizen groups, or politicians in working on problems associated with development of an episode control system.

4. Ability to work with attorneys to interpret the relevant enabling legislation and local air pollution control regulations to define the agency's authority, responsibility, and jurisdiction in episode control.

5. Ability to integrate knowledge of agency capabilities (legal and operational) and knowledge of the state-of-the-art in

episode control to identify and define the objectives of the system to be designed.

6. Ability to systematically and effectively solve problems or make decisions. This general skill includes:

    a. Ability to accurately define the problem in terms of objective, desirable outcome.

    b. Ability to accurately and completely identify the elements of the situation which affect selection or development of a solution.

    c. Ability to identify and describe potential solutions or approaches for developing solutions.

    d. Ability to accurately define the relationships between these elements and the alternative solutions to the problem. This includes "trade-offs."

    e. Ability to set realistic priorities.

    f. Ability to estimate with a reasonable level of confidence the probabilities of successful solution for each alternative solution.

    g. Ability to maximize positive payoff by selecting the most effective and least costly solution.

    This systematic approach is necessary to effectively integrate concern for the broad range of technical areas with the sensitive personal and social issues which must be considered for the ultimate solution.

    Tasks requiring this ability often may have to be accomplished under a high degree of time stress and under public scrutiny.

7. Ability to identify the contaminants that a proposed episode control system should attempt to limit.

8. Ability to design a working episode control system. The system design should include:

    a. The stages of the episode in terms of the ambient

air contaminant concentrations or meteorological conditions which define them (the episode stage criteria).

b. The means by which the agency will sense the conditions which define an episode or stage of the episode.

c. The general emission reduction objectives for each episode stage on a source-category basis. These objectives should describe the general class of actions each type of source should take at each stage of the episode.

d. The methods by which the specific emission reduction activities needed to satisfy the general emission objectives will be determined for each source.

e. The methods that will be used to identify and counter socially or economically disruptive effects of specific control actions. Particular attention will have to be paid to curtailment of vehicular traffic and refuse collection.

f. The major decisions that will have to be made to operate the system, who will make them, and the methods (i.e., criteria, rules of thumb) which will be used.

g. The communication requirements of the episode control system.

h. The methods that will be used to enforce the specific reduction activities required of each source.

i. The need for formal, written procedures and training program.

j. A plan for evaluating the entire episode control system.

k. The conditions under which the episode control effort will be officially terminated.

9. Ability to analyze the basic processes comprising an emission source and identify those operations which can be shut down or reduced under episode conditions and those which cannot. For example, the ability to identify operations which can be postponed, such as:

   a. Asphalt blowing

   b. Chemical cleaning

   c. Slag quenching

   Also, the ability to recognize operations which should not be shut down because shutdown would create excessive emissions or equipment damages. Examples of operations that should be permitted to continue would include:

   a. Condensers and coolers

   b. Sulfur recovery systems

   c. Facilities necessary for orderly startup

   d. Power for fire protection

10. Ability to make and interpret a basic flow diagram which identifies and shows the relationship of the sub-processes which comprise an industrial process.

11. Ability to predict how the load requirements on a control device will change with time, so that designs can be selected which have the greatest productive lengevity. For example, predict how waste material likely to be consumed in an incinerator will change, such as an increase in plastics.

12. Ability to assess the degree to which original control device efficiency ratings should be reduced to accurately reflect its current condition and operating characteristics.

13. Ability to recognize the component operations of industrial or commercial processes which are being suboptimally performed, thus resulting in or contributing to excessive emissions, for example:

   a. Improper coking operation in a fuel burning process.

b. Unbalanced intake and draft air ratio for cookers and driers in a rendering plant.

c. Improperly enclosed or ventilated loading, unloading, or storage areas in a cement plant.

d. Sloppy housekeeping operations in a rendering plant.

e. Inadequate preventative maintenance program for air pollution control equipment.

f. Improper charge rate, fuel, or excess air in an incinerator.

14. Ability to accurately estimate the time required for specific industries to shut down their processes or portions of their operation (without damage or excessive emissions).

15. Ability to select an appropriate program of control actions for each type of source covered in an episode control system. The control actions should be responsive to the emission reduction objectives of the episode control system.

16. Ability to carry out task description and task analysis procedures as a precursor to personnel system developments including:

    a. Training

    b. Job specifications

    c. Personnel selection criteria

    d. Performance aid development

17. Ability to prepare training objectives. These objectives should adequately describe the behavior and knowledge to be acquired, the conditions under which these behaviors will be employed on the job, and the performance levels the trainee must achieve to demonstrate competence.

18. Ability to design and administer the training required to prepare an episode control team.

19. Ability to develop formal procedures to be followed by assigned agency personnel during emergency episodes.

Knowledge Requirements

1. Knowledge of the portions of the enabling legislation which support development and operation of an episode control system.

2. Detailed knowledge of the capabilities (operations, methods, and facilities) of the functional areas of the agency that will participate in the design development and operation of the episode control program (e.g., emissions inventory, enforcement, air monitoring, meteorology).

3. Knowledge of industrial and commercial processes which comprise the major sources of pollution to support development of an episode control system:

    a. Identification of those processes which can be shut down without damage to the equipment or excessive emissions.

    b. Solution of operational problems which may occur as a result of shutdowns, e.g., provision for storage of materials for the duration of shutdown.

    c. Approximate shutdown time requirements for categories of industries and processes.

4. Knowledge of the state-of-the-art in development and evaluation of episode control systems. References 6, 18, 19, 20, 21, 30, and 41 are relevant to this topic.

5. Knowledge of the "systems approach" to problem solving as a method for designing the episode control system.

6. Knowledge of the types of responses industry is likely to make to the imposition of a source curtailment plan, and the kinds of counter-reactions which the agency can use to solicit their cooperation.

7. Knowledge of undesirable emission levels for contaminants not regulated by local regulations (e.g., documented health or nuisance effects). These levels are typically established

by agency policy with regard to "general air pollution" type prohibitions written into their regulations.

8. Knowledge of the published or unpublished sources of information available in a variety of areas relevant to air pollution control and air quality standards. Resources typically used in this task include:

    a. The output of abstracting services (e.g., References 10, 11, 13, 14, 16, 17, 42, 43, and 44).

    b. Relevant literature reviews (References 2, 12, 32, 33, 34, 35, and 36).

    c. Journal annual indices (Reference 25).

    d. Proceedings of technical meetings (Reference 61).

    e. Agency files and publications.

9. Knowledge of the suppliers of general information required for estimating the emissions of area sources (e.g., fuel suppliers, relevant census records) and point sources (e.g., industrial and trade associations).

10. Background knowledge of source processes complete enough to support identification of the elements of the process which are likely to emit contaminants to the atmosphere if not adequately controlled (e.g., in petroleum refining: regeneration, combustion, compression, storage, and pumping). Also, knowledge of the parameters of each of these process elements which affect the quantity and type of emissions possible. This type of knowledge is available to a useful extent in documents of the following types:

    a. Emission factors handbooks (for example, References 4, 29, 31, and 45).

    b. Descriptions of source processes, such as manufacturing of sulfuric acid or steel (for example, References 1, 3, 5, 7, 8, 23, 26, 28, 48, 49, 50, 51, and 60).

c. Descriptions of emission control methods and devices (for example, References 38, 39, and 40).

Another source of this type of knowledge is work experience in the process area with emphasis on process design, operation, or air pollution control.

11. Knowledge of the basic procedures used in estimating source emissions from information describing the process, its production rates, production schedules, types of contaminants emitted, or the emission control devices currently in service or proposed. These procedures should include use of emission factors, materials balance, and source test findings. (References 4, 29, 31, and 45.)

12. Knowledge of the types of adjustments which can be made to basic equipment or control device operation which can improve emissions control (e.g., flame adjustments on an incinerator).

13. Knowledge of the jargon and terminology used by operators or management of the basic or control equipment being inspected or reviewed. This type of knowledge enables the inspector or reviewer to adequately describe his findings and to communicate with other knowledgeable individuals. For relevant References, see Knowledge 17.

14. Knowledge of the chemical and physical properties of materials used in the process bieng inspected or reviewed which have an effect on emissions and possible air pollution. For relevant References, see Knowledge 17.

15. Knowledge of the use and construction of the basic or control equipment being inspected or reviewed to estimate the effects and probability of failures which could have an effect on air pollution. For relevant References, see Knowledge 17.

16. Knowledge of the specific practices and processes of the type of industry being inspected or reviewed which may contribute to air pollution, for example:

    a. In a refinery, rattling and blowing coke from cracking tubes.

b. In metal melting, the air pollution effects of efforts to remove metal impurities during the melt process.

c. In a rendering plant, housekeeping problems which produce odor, such as fat accumulations inside hoods.

For relevant References, see Knowledge 17.

17. Knowledge of the sub-processes within the plant being inspected or reviewed which have the highest potential pollution effects. For example, in a refinery:

    a. Fluid Catalytic Cracking

    b. Isomerization

    c. Crude Distillation

    Basic resource information relevant to the above knowledge areas is available from publications of the following types:

    a. Emission factors handbooks - References 4, 29, 31, and 45.

    b. Descriptions of source processes with emphasis on their pollution potential - References 1, 3, 5, 7, 23, 26, 28, 48, 49, 50, 51, and 60.

    c. Air pollution engineering guidelines - Reference 8.

    d. Air pollution control technology - References 9, 24, 38, 39, and 40.

    e. Local recommended codes of practice - References 52, 53, 54, 55, 56, 59, and 62.

18. Knowledge of the uses, assumptions, and procedures of mathematical models of pollution diffusion. For examples of resource materials in this area see References 15, 22, 27, 37, 46, 57, and 58.

19. Knowledge of the services offered by meteorological forecasting organizations available locally. For example, knowledge of the following sources of meteorological support:

    a. Environment Meteorological Support Units (of the National Oceanographic and Atmospheric Administration, NOAA).

b. Local NOAA services.

c. Meteorological consulting companies.

d. Services available from local Air Force and Army bases and commercial airports.

20. Knowledge of the techniques for the design of data collection forms to be mailed to sources or used in the field by agency personnel (see Reference 47).

21. Knowledge of basic statistical concepts and methodology used in mathematical modeling, such as:

a. Frequency distribution (e.g., log normal)

b. Measures of central tendency and variability (e.g., arithmetic mean, geometric mean, geometric standard deviation)

c. Probability

d. Correlation

e. Regression equation

f. Statistical significance

22. Knowledge of the procedures for preparation of flow diagrams of industrial processes.

23. Knowledge of principles and procedures for identifying training requirements, preparing training objectives, and developing a program to achieve the objectives.

24. Knowledge of the methods used in designing jobs and determining the types of individuals to fill the jobs. In large agencies the individuals and teams of people working on episode control will have specific assignments. These tasks will have to be designed and assigned so that the control system can accomplish its mission speedily.

25. Knowledge of principles and procedures for organizing an operational or task oriented group.

26. Knowledge of principles and procedures for making work assignments. The procedures used will vary depending upon the assignment policy of the agency.

27. Knowledge of the techniques used in identifying the content requirements for and design of a procedures manual to be used by personnel involved in an episode control program.

References

1. Air Pollution Sub-Committee. Odor control manual for the rendering industry. Des Plaines, Illinois: National Renderers Association, January 1969.

2. California Air Resources Board. Ambient air quality standards. January 1970.

3. Committee on Industrial Hygiene. Steel mill ventilation. New York: American Iron and Steel Institute, May 1965.

4. Control Agency Directors S-8 Committee. Pacific northwest emission factors reference manual. Air Pollution Control Association, Pacific Northwest International Section, April 1971.

5. Cooperative Study Project, Manufacturing Chemists' Association and Public Health Service. Atmospheric emissions from sulfuric acid manufacturing processes. Durham, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, National Air Pollution Control Administration, 1965. PHSP #999-AP-13.

6. Croke, E. J., & Booras, S. G. The design of an air pollution incident control plan. Paper 69-99 presented during the June 1969 Annual Air Pollution Control Association Meeting in New York City.

7. Cuffe, S. T., & Gerstle, R. W. Emissions from coal-fired power plants: a comprehensive summary. Durham, N. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, 1967. PHSP #999-AP-35.

8. Danielson, J. A. (Ed.) Air pollution engineering manual. Air Pollution Control District, County of Los Angeles. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention Environmental Control, National Center for Air Pollution Control, 1967.

9. Decker, L. D. Odor control by incinerator. Greenwich, Connecticut: UOP Air Correction Division, November 1965. (Text of a talk given before a meeting of the Middle States Section of the Air Pollution Control Assn., Wilmington, Delaware, November 1965.)

10. Environmental Protection Agency, Air Pollution Control Office. Air pollution aspects of emission sources: Municipal incineration-a bibliography with abstracts. Research Triangle Park, North Carolina: Author, May 1971. No. AP-92.

11. Environmental Protection Agency, Air Pollution Control Office. Air pollution aspects of emission sources: Nitric acid manufacturing-a bibliography with abstracts. Research Triangle Park, North Carolina: Author, May 1971. No. AP-93.

12. Environmental Protection Agency, Air Pollution Control Office. Air quality criteria for nitrogen oxides. Washington, D. C.: Author, January 1971. No. AP-84.

13. Environmental Protection Agency, Air Pollution Control Office. Photochemical oxidants and air pollution: An annotated bibliography. Part I. Research Triangle Park, North Carolina: Author, March 1971. No. AP-88.

14. Environmental Protection Agency, Air Pollution Control Office. Photochemical oxidants and air pollution: An annotated bibliography. Part II. Research Triangle Park, North Carolina: Author, March 1971. No. AP-88.

15. Environmental Protection Agency. Air quality implementation planning program. Vol. 1: Operators manual. Washington, D. C.: National Air Pollution Control Administration, November 1970.

16. Environmental Protection Agency, Office of Air Programs. Air pollution aspects of emission sources: Cement manufacturing-a bibliography with abstracts. Research Triangle Park, North Carolina: Author, May 1971. No. AP-95.

17. Environmental Protection Agency, Office of Air Programs. Air pollution aspects of emission sources: Electric power production-a bibliography with abstracts. Research Triangle Park, North Carolina: Author, May 1971. No. AP-96.

18. Environmental Protection Agency. Guide for air pollution episode avoidance.. Research Triangle Park, North Carolina: Author, June 1971.

19. Environmental Protection Agency. Guide for control of air pollution episodes in medium-sized urban areas. Research Triangle Park, North Carolina: Author, June 1971.

20. Environmental Protection Agency. Guide for control of air pollution episodes in small urban areas. Research Triangle Park, North Carolina: Author, June 1971.

21. Environmental Protection Agency. Requirements for preparation, adoption, and submittal of implementation plans. Appendices D, E, and F. Federal Register, V. 36, No. 158, Saturday, August 14, 1971.

22. Gifford, F. A., Jr. Uses of routine meteorological observations for estimating atmospheric dispersion. Nuclear Safety, 2:47-51, 1961.

23. Gulf Publishing Co. Hydrocarbon processing handbook. Houston, Texas: Author, Box 2608, 77001.

24. Ingels, R. M. The afterburner route to pollution control. Air Engineering, June 1964, p. 39-42.

25. Journal of the Air Pollution Control Association, Vol. 20, Number 1, January 1970, p. i-vi. Author and title index for Volume 19 (January through December 1969).

26. Kreichelt, T. E., Kemnitz, D. A., & Cuffe, S. T. Atmospheric emissions from the manufacture of portland cement. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Bureau of Disease Prevention and Environmental Control, 1967. PHSP #999-AP-17.

27. Martin, D. O. An urban diffusion model for estimating long term average values of air quality. J.A.P.C.A., 21:16-19, January 1971.

28. McGannon, H. E. (Ed.) The making, shaping and treating of steel. Eighth Edition. United States Steel Corporation.

29. McGraw, M. J., & Duprey, R. L. Compilation of air pollutant emission factors. Preliminary document. Research Triangle Park, North Carolina: Environmental Protection Agency, April 1971.

30. Nash, Leonard, Fansmith, S. J., & Huston, J. S. Air pollution incident control guides - plans. Philadelphia: The Franklin Institute Research Laboratories, December 1970.

31. National Air Pollution Control Administration. Air pollutant emission factors. Washington, D. C.: Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, April 1970.

32. National Air Pollution Control Administration. Air quality criteria for carbon monoxide. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, March 1970. No. AP-62.

33. National Air Pollution Control Administration. Air quality criteria for hydrocarbons. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, March 1970. No. AP-64.

34. National Air Pollution Control Administration. Air quality criteria for particulate matter. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, January 1969. No. AP-49.

35. National Air Pollution Control Administration. Air quality criteria for photochemical oxidants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, March 1970. No. AP-63.

36. National Air Pollution Control Administration. Air quality criteria for sulfur oxides. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, January 1969. No. AP-50.

37. National Air Pollution Control Administration. Air quality display model. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, November 1969.

38. National Air Pollution Control Administration. Control techniques for hydrocarbon and organic solvent emissions from stationary sources. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, March 1970. No. AP-68.

39. National Air Pollution Control Administration. Control techniques for particulate air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Consumer Protection and Environmental Health Service, January 1969.

40. National Air Pollution Control Administration. Control techniques for sulfur oxide air pollutants. Washington, D. C.: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, January 1969.

41. National Air Pollution Control Administration. Guide for air pollution episode avoidance. Washington, D. C.: Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service, March 1970.

42. National Air Pollution Control Administration. Hydrocarbons and air pollution: An annotated bibliography. Part I. Raleigh, North Carolina: U. S. Department of Health,

Education, and Welfare; Public Health Service, Environmental Health Service, October 1970. No. AP-75.

43. National Air Pollution Control Administration. Hydrocarbons and air pollution: An annotated bibliography. Part II. Raleigh, North Carolina: U. S. Department of Health, Education, and Welfare, Public Health Service, Environmental Health Service, October 1970. No. AP-75.

44. National Air Pollution Control Administration. NAPCA abstract bulletin, Vol. 1, No. 9, Supplement 4. Research Triangle Park, North Carolina: U. S. Department of Health, Education, and Welfare; Public Health Service, Environmental Health Service.

45. Ozolins, Guntis, & Smith, Raymond. A rapid survey technique for estimating community air pollution emissions. PHSP #999-AP-29, October 1966.

46. Pasquill, F. The estimation of the dispersion of windborne material. The Meteorological Magazine, 90:1063, 33-49, 1961.

47. Payne, S. L. The art of asking questions. Princeton, N. J.: Princeton University Press, 1951.

48. Schueneman, J. J., High, M. D., & Bye, W. E. Air pollution aspects of the iron and steel industry. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, June 1963.

49. Smith, W. S. Atmospheric emissions from fuel oil combustion. An inventory guide. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution, November 1962. PHSP #999-AP-2.

50. Swearingen, J. S., and Levin, H. Hydrocarbon losses from the petroleum industry in L. A. county. San Antonio, Texas: Southwest Research Institute.

51. Technical Advisory Board. Code of recommended practices. Asphalt mixing plants. Chicago: City of Chicago, Department of Environmental Control, April 1971.

52. Technical Advisory Board. Code of recommended practices. Fuel burning equipment for heating, steam and hot water generation, absorption refrigeration. Chicago: City of Chicago, Department of Environmental Control, October 1968.

53. Technical Advisory Board. Code of recommended practices. Grain handling and storage. Chicago: City of Chicago, Department of Environmental Control, April 1971.

54. Technical Advisory Board. Code of recommended practices. Refuse burning equipment for domestic and non-domestic use. Chicago: City of Chicago, Department of Environmental Control, April 1971.

55. Tèchnical Advisory Board. Code of recommended practices. Rendering processes. Chicago: City of Chicago, Department of Environmental Control, April 1971.

56. Technical Advisory Board. Code of recommended practices. Spray booths. Chicago: City of Chicago, Department of Air Pollution Control, August 1968.

57. Turner, D. B. A diffusion model for an urban area. J. of Applied Meteorology, 3:83-91, February 1964.

58. Turner, D. B. Workbook of atmospheric dispersion estimates. Cincinnati, Ohio: U. S. Department of Health, Education, and Welfare, National Air Pollution Control Administration, PHSP #999-AP-26, 1967.

59. U. S. Department of Health, Education, and Welfare. Interim guide of good practice for incineration at federal facilities. Raleigh, North Carolina: Public Health Service, Consumer Protection and Environmental Health Service, National Air Pollution Control Administration, November 1969. Publication No. AP-46.

60. U. S. Department of Health, Education, and Welfare; Public Health Service, Division of Air Pollution. Atmospheric emissions from petroleum refineries. A guide for measurement and control. PHSP #763, 1960.

61. U. S. Department of Health, Education, and Welfare; Public Health Service, National Center for Air Pollution Control. Proceedings: The third national conference on air pollution, Washington, D. C., December 12-14, 1966. PHSP #1649.

62. Williamson, J. E., & Hammond, W. F. Interim guide to good practice for direct-fed multiple-chamber incinerators. Los Angeles: L. A. County Air Pollution Control District, October 1966.

Special Staffing Guidance

1. Development of an operational Episode Control Program is a task which should be assigned to a senior level Engineer. The primary reasons include:

   a. Requirements for credibility. Industrial, commercial, and public pollution sources are likely to resist imposition of curtailment plans; and negotiations at a high level will not be unusual. The individual who represents the agency should be "impressive" in terms of technical background and experience.

   b. Requirements for considerable problem-solving ability involving both abstract (e.g., socio-economic effects) and concrete concepts (e.g., selection of cost-effective source curtailment plans). The individual developing the Episode Control System requires a broad background in industrial processes, air pollution control technology, air pollution effects (on humans and plants), and control agency operations. In addition, the assignee should be able to design personnel elements of the system including: development of procedures, job assignments, and specialized training for the individuals who will operate the system routinely and in emergencies.

2. One or more Engineering Technicians should be assigned to support the Engineer designing the system. The Engineering Technicians could perform tasks including:

   a. Structuring, analyzing, or filing of responses to questionnaires

mailed to sources requesting voluntary curtailment plans and other relevant information concerning processes which may have to be shut down in an emergency.

b. Reviewing and analyzing emission inventory data to identify major sources of the contaminants to be controlled in emergencies.

c. Initial screening of source curtailment plans to assure that the requested information is complete and acceptably accurate.

Review of Application for Tax Exemption[1] on Air Pollution Control Equipment

Task Overview

In some localities, tax relief is offered to commercial or industrial facilities which install air pollution control equipment (e.g., New Jersey). In order to apply for such an exemption, the facility files an application identifying and describing its process and control equipment. Frequently, these applications are filed in conjunction with an application for a permit to install or construct the relevant equipment, and review of the exemption application is performed after the permits to install and operate the equipment have been granted.

The task of reviewing the application for tax exemption is primarily one of checking it for accuracy and completeness. The information areas to be checked can include:

1. Identification of claimant.
2. Location of facility.
3. General description of operations conducted at site.
4. Description of process to which control equipment will be applicable.
5. Description of contaminant to be controlled and the anticipated degree of control.
6. Description of control equipment including its cost (upon which exemption will be calculated).

Occupational Category: Engineering Technician (Senior) or
Engineer (under special conditions described under Special Staffing Guidance)

[1]The task data reported here is incomplete; however, it is considered to be highly indicative of the actual task characteristics and skill and knowledge requirements.

Skill Requirements (Partial)

1. Ability to identify errors of omission and factual errors in reporting the information required by the application form. This primarily requires checking the data described in the form with that recorded in the appropriate permit processing file.

   One area of data presented in the form which may not be readily found in the permit file is the cost of the equipment of concern.

2. Ability to use published guidelines to estimate the cost of air pollution control equipment.

3. Ability to communicate with the claimant to secure additional or corrected information as required.

4. Ability to determine whether or not the equipment described in the application qualifies for tax exemption. The following are reasons for rejecting an application in the State of New Jersey (Form AIR-25, September 1967):

   a. Not designed, constructed and/or used for air pollution abatement or control.

   b. A substantial part is designed or constructed for purposes other than preventing air pollution. (Reapplication may be made for that part which controls or abates pollution of the outdoor air).

   c. The prime function is other than preventing pollution of the outdoor air.

   d. Does not comply with existing State or local Codes, Regulation or Ordinances.

   e. The performance of the equipment as installed is not suitable and adequate for the primary purpose of preventing or abating air pollution.

   f. Application incomplete or incorrect.

Knowledge Requirements (Partial)

1. Knowledge of the procedures and supporting materials (e.g., cost estimation tables) used to check applications for completeness and accuracy.
2. Knowledge of air pollution control technology and industrial processes at a level suitable for review of tax exemption application forms.
3. Knowledge of the procedures used to secure missing or corrected data from claimants.

Special Staffing Guidance

The task of reviewing tax exemption applications in conjunction with a permit system could be proceduralized to the extent that it could be accomplished by a senior level Engineering Technician. The permit processing operation can automatically make most of the demanding judgments required to review the application and will provide most of the data needed to describe the equipment of concern. The need for a senior level assignee primarily results from the possible need to communicate with claimants to secure further information.

However, when tax exemption forms are to be reviewed without the equipment of concern having been previously reviewed for permits, an Engineer will be required to make judgments concerning its performance acceptability.

Table B-1

Additional Engineering Tasks, Suggested Occupational Categories, and Rationale for Suggested Category

Task Title	Suggested Occupational Category	Rationale
Review and evaluation of Environmental Impact Statements	Engineer	Broad-based knowledge required in engineering processes with pollution potential. Significant credibility requirement.
Develop and monitor progress on specific pollution control programs	Engineer (Senior)	Broad-based knowledge required in engineering processes with pollution potential. Significant credibility requirement. Critical need to communicate effectively with management of source.
Prepare codes of recommended design practices for basic equipment with air pollution potential.	Engineer	Writing capability required. General engineering skill and knowledge required.
Evaluate effectiveness of new techniques and equipment in air pollution control	Engineer	General engineering skill and knowledge required.
Conduct detailed investigation and report on the air pollution potential of major industrial, commercial, or public installation.	Engineer (Senior)	Broad-based knowledge required in engineering processes with pollution potential. Significant credibility requirement. Critical need to communicate effectively with management of source.

Table B-1 (continued)

In developing an emission inventory:		
a. compare submitted process and emission data with relevant published figures (under supervision by an Engineer)	Engineering Technician	Task capable of proceduralization. Limited technical knowledge required. Limited public credibility or communication required. Few decisions.
b. calculate emission estimates using standard published factors (under close supervision of an Engineer)	Engineering Technician	Task capable of proceduralization. Limited technical knowledge required. Limited public credibility or communication required. Few decisions.
In a plan review process, routine screening of designs for presence of specific characteristics or minimum objective criteria (under supervision of an Engineer)	Engineering Technician	Task capable of proceduralization. Limited technical knowledge required. Limited public credibility or communication required. Few decisions.
In an episode control program:		
a. organization and filing of responses from sources to industrial questionnaires	Engineering Technician	Task capable of proceduralization. Limited technical knowledge required. Limited public credibility or communication required. Few decisions.
b. routine check of ambient air conditions to determine if objective criteria have been exceeded	Engineering Technician	Task capable of proceduralization. Limited technical knowledge required. Limited public credibility or communication required. Few decisions.