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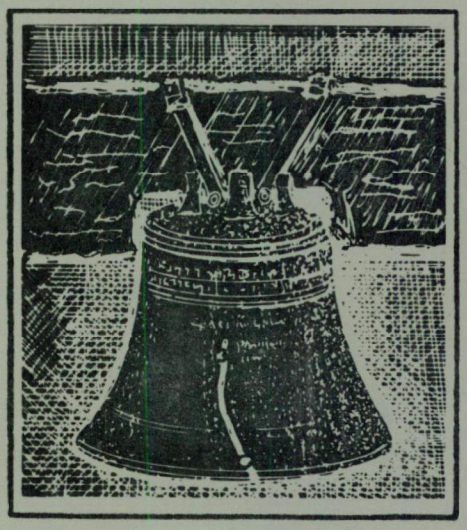
AIR POLLUTION CONTROL IN PHILADELPHIA, PENNSYLVANIA

AN EVALUATION REPORT WITH RECOMMENDATIONS FOR PROGRAM IMPROVEMENTS



U. S. ENVIRONMENTAL PROTECTION AGENCY
Air Pollution Control Office

AIR POLLUTION CONTROL

IN THE

CITY OF PHILADELPHIA

An Evaluation Report With

Recommendations for Program Improvements

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ENVIRONMENTAL PROTECTION AGENCY

Air Pollution Control Office

Division of Applied Technology

February 1971

CITY OF PHILADELPHIA

DEPARTMENT OF PUBLIC HEALTH
Room 540, Municipal Services Building
Philadelphia, Pa. 19107

NORMAN R. INGRAHAM, M.D.
Commissioner

WALTER J. LEAR, M.D.
Deputy Commissioner

February 3, 1970

Mr. Kenneth Johnson
Regional Air Pollution Control Director
National Air Pollution Control Administration
Public Health Service
U.S. Department Health, Education and Welfare
26 Federal Plaza (Foley Square)
New York, N.Y. 10007

Dear Mr. Johnson:

In accordance with discussion in our meeting at the Regional Office in New York City on January 15 and as offered in Mr. Charles D. Yaffe's letter of last June, I should like to formally request technical assistance in the form of an on-site review of the Philadelphia air management program, as an additional aid in the definition of the project undertakings which will lead to development of a maintenance level program to be considered for appropriate Federal funding.

The recent conference in which Mr. Edward F. Wilson and I participated was very useful and constructive. I am happy to know that funding under the present air pollution improvement project grant will continue during the period when the Philadelphia air management program, with the consultation and advice of you and your staff, will be further defined. We are most appreciative of this type of assistance.

Incidentally, my fiscal officer informs me that, since the initiation of the first Federal air pollution improvement grant to the Philadelphia program several years ago, there has never been a Federal fiscal audit of this

program. It was our understanding that this would be requested and, from the management standpoint, this would certainly be useful. I thought it might be appropriate to bring this up again at this time.

Thank you for your continuing consultation, advice, and financial support.

Sincerely yours,

Norman R. Ingraham, M.D.

NRI:z
cc: Mr. Goodwin

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1. INTRODUCTION

On February 3, 1970, Dr. Norman R. Ingrahm, City of Philadelphia Health Commissioner, in a letter to Mr. Kenneth Johnson, Air Pollution Control Office (formerly NAPCA), Region II Director, requested an objective evaluation of Philadelphia's resources, laws, and all program activities for air pollution control. This report has been prepared in response to that request. This study is also timely since Air Management Services, within the Department of Public Health, plans to submit an application to APCO for maintenance program support for FY 72 as authorized by the Clean Air Act as amended. With these factors in mind, this report is designed to determine program weaknesses and to focus on those program areas in need of strengthening and developing in order to qualify for maintenance support. It must be understood that recommendations contained in this report are presented as a means of reaching that goal. Certainly there are alternate methods that can be used to reach program goals and, in all probability, a few important problem areas were not detected or discussed. There is no intent to stifle program initiative and imagination in such decisions.

At the present time, several important program elements are being implemented and are only discussed briefly in this report.

There are many satisfactory, in fact excellent, program elements that are not discussed within the report. The fact they are not discussed is by design since the important objective of the report is to assist in the implementation of a comprehensive effective air pollution control program designed to protect the health and welfare of the citizens of the Philadelphia area.

Air Management Services (hereafter referred to as AMS) must operate within a city government structure that imposes many constraints on a program and makes it more difficult for the agency to achieve its goals. While these factors have been discussed in this report, APCO realizes the difficulties of altering long-standing systems. It is important, however, that these problems and their effect on AMS be discussed and understood.

The Commonwealth of Pennsylvania, according to prescribed law, has certified AMS as the exclusive agency in Philadelphia. This certification gives AMS complete responsibility for control of all air pollution originating within the City. This sole responsibility makes it all the more important for AMS to have an effective program as it is logically the body that can provide cleaner air for the City of Philadelphia.

The Commonwealth of Pennsylvania also has an active air pollution control agency. This agency is responsible for control activities in the remaining metropolitan area of Pennsylvania.

The material for this report was obtained from information provided to APCO in conjunction with the grants program, the regional office in New York City, and information gathered by a team of APCO investigators during a visit to Philadelphia, April 26-30, 1970. APCO is indeed grateful for the cooperation extended by the Air Management Services, the Health Department, and the Philadelphia Planning Commission during the fact-finding effort and for the review provided by the New York Regional Office.

2. SUMMARY

In the past few years, virtually every metropolitan center in the east coast of the United States has reached a critical point. They are faced with massive demands for power and new materials on the one hand and rapid deterioration of the urban environment on the other.

The City of Philadelphia offers a prime example of this paradox. Industrial and population figures have increased, and corresponding power needs and citizen demands for new materials have soared.

To combat this growing air menace, the City Council in October of 1969 adopted a new Air Management Code. This document provides the Air Management Services with very strong enforcement powers and penalties. If progress toward comprehensive program development and, more important, the improvement of air quality is to be accomplished, it remains for AMS to assume the kind of aggressive effort required for enforcement of the Air Management Code on a scheduled system of priorities. These priorities should in turn reflect long range air quality objectives.

This report has been prepared to guide AMS in developing an effective organization geared to meet the challenge. The Federal Clean Air Act of 1967, an amended, is quite explicit in placing the primary responsibility for air pollution control at the State and local levels. In this regard, the State of Pennsylvania and the Philadelphia program must develop definitive agreements on responsibilities and authority; thus insuring complimentary rather than duplicative programs, and further defining areas of responsibility.

It is hoped AMS will consider the points and recommendations of this report and take immediate corrective action.

The program will be able to operate more effectively if: (1) legal administrative procedures are improved upon; (2) better internal and external communications are developed; (3) personnel conditions are improved; (4) specific plans and procedures for abatement and prevention are developed in line with the development of a comprehensive program, to effectively control all sources of air pollution; (5) a comprehensive information activity is developed; (6) AMS begins detailed planning for information systems to process, store, and utilize all types of data.

To attempt to meet all objectives and carry out all recommendations at one time is not sound for program balance or comprehensive program development. Therefore, recommendations should be implemented in terms of priority based on existing limited resources and desire by the agency to attain Federal maintenance levels of support, implying an effective program. By no means are the recommendations as stated the only solution for corrective action of a problem. There may be many solutions to the problem. In the short time for the on-site review, it could not be expected that all the agency's problems would be uncovered,

although, it is felt that major program deficiencies were revealed. Further, interpretation and definition of a problem by the APCO reviewers may not in all cases be complete. This study does not intend to lay blame on any individuals or organizations but encourages as its objective that all program entities in the city work together for the common goal of controlling air pollution in Philadelphia.

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ay blame on any individuals
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SUMMARY OF RECOMMENDATIONS

mmendations presented herein can be classified into the
(1) legal, (2) organization, (3) manpower,
) program planning and evaluation, (6) land use planning,
., (8) engineering, (9) enforcement, (10) technical
logy, and (12) data handling.

ons relative to legal:

ENDATION 1. Amend Section 3-103 (5) to increase
m fines to $1,000, at least for the first offense.

ENDATION 2. Reconstitute the Air Pollution Control
so that it is an objective and impartial representative of
tire community. Board Representatives having substantial
ial interests tend to disregard public interest and welfare.

ENDATION 3. Modify Item (2) of Section 3-302 by
ng "to establish areas where objectives are applicable"
t air quality goals for the entire city will be uniformly
cial. Reasonable time schedules for achieving the uniform
ives should be set in those parts of the city rather than
ng less strict objectives at the sacrifice to air quality.
ition, such objectives must be consistent with the
ions of the Implementation Plan for the Philadelphia AQCR.

ENDATION 4. Express emission limitations in this regu-
... in terms of pounds/hour or pounds/million Btu of heat in-
In addition, modify or replace the emission standard for
ting equipment, subsection (2), by a standard that varies with
size of the installation.

MMENDATION 5. Express the limitations on emission of
ur dioxide in Section IA (2), Non-Commercial Fuel, in terms
ounds/hour or pounds/million Btu of heat input. The comments
with reference to Regulation II, Section V, also apply here.

MMENDATION 6. Specify standard test methods for testing
incinerator designs for compliance with the regulation.

MMENDATION 7. Develop regulations for control of
ocarbons, carbon monoxide, and odors. Federal criteria
ments for hydrocarbons and carbon monoxide are currently
lable, and should be utilized in developing regulations.

RECOMMENDATION 8. Work with the State to develop plans for the State to control emissions from sources outside of Philadelphia that contribute to air pollution within the City.

RECOMMENDATION 9. Obtain additional legal support. The agency needs an experienced attorney who is familiar with air pollution problems. In addition, a close working relationship with the Counseling Division should be developed.

RECOMMENDATION 10. Use the enforcement method through seeking conviction and fines in Municipal Court only for minor and infrequent violations. This is because the procedure makes no provision for long-term compliance with regulations or abatement of air pollution.

Specific recommendations relative to organization:

RECOMMENDATION 11. Allow the Assistant Commissioner more time to work with organizations outside AMS, both inside and outside City government. To accomplish this, three alternatives are proposed.

1. Establish and fill the position of Deputy Assistant Commissioner; he should be responsive to the needs of AMS and chosen by the Assistant Commissioner.

2. Delegate most responsibilities to the Division Director and choose someone to act in the capacity of Assistant Commissioner when he is out of the office.

3. Hire a chief administrative assistant to coordinate all staff functions as well as line functions and problems. However, at all times there should be sufficient access to the Assistant Commissioner by the Division Directors to express grievances.

RECOMMENDATION 12. Update the Engineering Division's functional description to include functional categories, staffing, goals, objectives, and time schedules to meet program objectives.

Specific recommendations relative to manpower:

RECOMMENDATION 13. Make a major effort to fill existing vacancies before planning and implementing further program activities.

RECOMMENDATION 14. Create the category of Air Pollution Control Engineer. Persons having this classification would deal specifically with air pollution, and would advance according to their proficiency in that field.

RECOMMENDATION 15. Require that chemists be knowledgeable primarily in air pollution aspects.

RECOMMENDATION 16. Utilize Chemist III and IV positions. Such positions, based on degree and experience, would help adjust chemists' salaries more in line with those of other agency personnel.

RECOMMENDATION 17. Create a second step within each of the technician positions. This will provide incentive and a corresponding pay increase for more qualified persons. In addition, the position of lab helper should be eliminated and such duties assumed by technicians.

RECOMMENDATION 18. Establish the position of Applied Scientist. This could serve as a "catch-all" type of position and enable the agency to obtain needed specialized scientific and technical talent without having applicants wait for new positions to be created.

RECOMMENDATION 19. Create an Air Pollution Control Public Information Specialist classification. This is discussed in more detail in the Public Information Section of this report. This position would enable the agency to reject public information applicants who did not have the necessary background in air pollution control.

RECOMMENDATION 20. Increase salaries for professional personnel and have studies made to eliminate problems of the limited pay step increase and the pay differential of professionals and non-professionals.

RECOMMENDATION 21. Adopt a formal training program in AMS for orientation of new employees, training professional employees, and training non-professional technical employees by disignating someone as training officer with responsibility for the criteria analysis of training needs. (NOTE: This is one area where an AMS task force would be extremely beneficial in studying the problems and coming up with recommendations based on program needs.)

RECOMMENDATION 22. Review the 2-year training commitment to reduce its severely restrictive influence for training personnel in the dynamic air pollution control field.

RECOMMENDATION 23. Develop better working relations and communications with the Health Department's personnel office and Central Personnel.

RECOMMENDATION 24. Hire a personnel clerk to prepare and follow up the necessary paperwork for creating job descriptions and hiring people. This clerk should be able to relieve existing AMS administrative staff of the burden of such work.

Specific recommendations relative to communications:

RECOMMENDATION 25. Develop and implement a uniform reporting system.

RECOMMENDATION 26. Hold frequent and regular staff meetings within AMS.

RECOMMENDATION 27. Work out a set of guidelines with the State defining responsibilities in these areas. This is necessary to aviod duplication of effort.

Specific recommendations relative to program planning and evaluation:

RECOMMENDATION 28. Develop formal procedures for quantifying problems, examining alternatives, identifying resources, setting priorities, and evaluation effectiveness.

RECOMMENDATION 29. Assign a trained and competent person the responsibility of implementing the appropriate concepts of PPBS. This, by necessity, includes proper attention to planning long and short-term activities.

Specific recommendations relative to land-use planning:

RECOMMENDATION 30. Develop environmental criteria for air pollution as measures for providing effective land-use planning and thereby prevent or minimize air pollution and its effects. All responsibilities delegated to the APC Board should be carried out.

RECOMMENDATION 31. Develop formal procedures for cooperation between AMS and the Planning Commission as a first step in introducing environmental criteria into land-use planning. AMS should have routine advisory powers and responsibilities on a sign-off basis in the work of the Planning Commission involving potential air pollution.

Specific recommendations relative to public information:

RECOMMENDATION 32. Clarify control over the public information specialist position. Ideally, the position should be permanently assigned to the Health Department and placed under the Assistant Commissioner. However, if City policy makes this impossible, a written agreement should be developed between AMS and the City Representative's office. The agreement should state the position's responsibilities, term of assignment (recommended indefinite), duties, and obligations.

RECOMMENDATION 33. Develop a comprehensive public information program. It is essential that the goals, objectives, strategies, and procedures be planned before the program actually gets underway.

RECOMMENDATION 34. Make the Assistant Commissioner for AMS more visible to the public and allow him to take a larger role in influencing community opinion through the public information program. Creating and filling the position of Deputy Assistant Commissioner discussed in the Administration Section of this report should give the Assistant Commissioner more time to devote to such activities.

RECOMMENDATION 35. Have the public information specialist receive extensive air pollution training. This should include knowledge of local, State, and Federal regulations; air quality criteria; and the state of the art in technology.

RECOMMENDATION 36. Locate and utilize personnel and materials outside AMS that can aid in developing a public information program. A large amount of such help could be provided by APCO and the State of Pennsylvania.

RECOMMENDATION 37. Involve the public information specialist in the formulation of AMS policy. This will enable him to be knowledgeable in his dealings with the public. Also, it will lead to consideration of public opinion in developing policy.

RECOMMENDATION 38. Develop lines of communications and programs between AMS and local universities and between the public information specialist and voluntary agencies. The need for a technical editor for reports and public information should be considered.

Specific recommendations relative to engineering:

RECOMMENDATION 39. Develop specific procedures to follow up questionnaires and data requests not returned to the agency. This would include personal contact, plant surveys, and stack testing.

RECOMMENDATION 40. Develop formalized and effective lines of communication that allow for input from the other city agencies regarding the nature of data requested and methods of data utilization.

RECOMMENDATION 41. Reassess data needs and develop data-gathering forms that will request all needed information regardless of whether there is existing control equipment or not.

RECOMMENDATION 42. Develop a data storage and retrieval system that will properly assist the staff in emission inventory analysis and reporting. This information system should be coordinated with other AMS systems as discussed in the Data Handling Section of this report.

RECOMMENDATION 43. Familarize the entire staff in the operation and use of the filing system, in order to increase the general availability of this information.

RECOMMENDATION 44. Develop systems and procedures to keep emission figures constantly up to date. This is discussed further in the Enforcement Section of this report.

RECOMMENDATION 45. Develop and publish a permit manual that stipulates the type and amount of information required and processing procedures employed.

RECOMMENDATION 46. Standardize the evaluation procedure for reviewing plans.

RECOMMENDATION 47. Increase the number of qualified personnel available for plan review.

RECOMMENDATION 48. Require that all engineers in the Division gain experience in evaluating plans and specifications. The reviewing engineer, in conjunction with enforcement, should conduct final inspection and make recommendations for approval or denial.

RECOMMENDATION 49. Develop a specific schedule based on an appropriate priority system for the submittal or improvement plans that will include all the major sources in the City on a staged basis.

Specific recommendations relative to enforcement:

RECOMMENDATION 50. Require that inspectors receive periodic training in reading visible emissions on at least an annual basis.

RECOMMENDATION 51. Acquire a communications system for the exclusive use of the AMS.

RECOMMENDATION 52. Purchase additional appropriate simple pollutant-detection equipment for all inspectors to use routinely.

RECOMMENDATION 53. Make arrangements for inspectors to receive and investigate complaints expediently beyond the normal working day.

RECOMMENDATION 54. Assign specific objectives and priorities for the control of particular pollutants. Having chosen the desired pollutant levels, the agency's enforcement procedures should be structured accordingly. The AMS should, therefore, develop a formal enforcement plan to achieve the levels, through a systematic and scheduled control effort.

RECOMMENDATION 55. Develop a manual for the administration of the licensing system. (See Appendix E).

RECOMMENDATION 56. Make emission estimates part of plan review and licensing of existing equipment. This will serve as a means to constantly update the emission inventory.

RECOMMENDATION 57. Develop administrative procedures for implementing air pollution warning, alert, and emergency procedures. All persons affected by these plans should be notified in advance of their responsibilities in emergency situations.

Specific recommendations relative to technical services:

RECOMMENDATION 58. To coordinate efforts, develop program goals, and improve communications, set up scheduled staff meetings on a reasonable frequency to include heads of the Laboratory and other divisions and the Assistant Commissioner for AMS. Refer to Section on Communication.

RECOMMENDATION 59. Recruit and assign additional manpower to program functions as shown in the Technical Services portion of Table 8-2. This table is a summary of estimated future manpower needs for the agency.

RECOMMENDATION 60. Increase the number of intermittent sampling stations consisting of high-volumes and 24-hour gas bubblers to more closely correspond with APCO's guidelines in accordance with data needs.

RECOMMENDATION 61. Limit the telemetered continuous monitoring network to the ten stations for which money has already been committed. The proposed additional six stations should not be considered or added at this time.

RECOMMENDATION 62. Re-design station locations to take into account population and emission patterns. Statistical techniques should be used to locate the stations.

RECOMMENDATION 63. Perform additional analyses on some high-volume filters. The more common ones are benzene solubles or combustible carbon content, nitrates, chlorides, polynuclear aeromatic hydrocarbons (carcinogens), and metals.

RECOMMENDATION 64. Write formal laboratory procedures so that any competent chemist could duplicate the analysis. These procedures should reflect the latest work by APCO in the development of standardized laboratory procedures.

RECOMMENDATION 65. Recruit a chemist with experience or provide training in the use of a gas chromatography to make use of the existing laboratory equipment.

RECOMMENDATION 66. Implement sampling and analysis procedures to obtain background data on pollutants for which criteria documents are forthcoming. Table 5.1 provides a listing of these pollutants.

RECOMMENDATION 67. Establish source-testing teams whose prime responsibility is to support information and enforcement needs.

RECOMMENDATION 68. Initiate a program of scheduled source tests by industrial categories on a priority basis.

RECOMMENDATION 69. Develop written standard procedures for conducting source tests.

RECOMMENDATION 70. Purchase enough source-testing equipment to allow duplicate samples to be obtained without intermittent cleaning of equipment.

RECOMMENDATION 71. Give consideration to reorganizing the placement of this function and assigning source testing to the Engineering rather than the Laboratory Division.

Specific recommendations relative to meteorology:

RECOMMENDATION 72. Investigate and evaluate the need versus the cost for meteorological data as required by the Air Quality Display Model and hold data collection to a minimum.

RECOMMENDATION 73. Bring a full-time meteorologist and one or two technicians on board to implement the meteorological aspects of the AMS.

RECOMMENDATION 74. Make some provisions for the Meteorology Section to give meteorological advice on weekends or at night during periods of high pollution potential.

RECOMMENDATION 75. Start the modeling portion of the meteorology program slowly and develop expertise in proven methodologies before attempting more sophisticated, costly, and unproven methods of air quality modeling.

Specific recommendations relative to data handling:

RECOMMENDATION 76. Begin detailed planning for information systems to process, store, and utilize all types of data immediately.

RECOMMENDATION 77. Assign one person within AMS with the responsibility for planning, coordinating, developing, and implementing all AMS information systems. This should be his only job, and other staff members should be assigned to him as necessary.

RECOMMENDATION 78. Double the core memory capacity of the computer. The additional core capacity is necessary to simultaneously accommodate the two data systems. Magnetic-type-handling capability should be added to the computer system.

RECOMMENDATION 79. Contract with IBM or another competent computer programming firm to reprogram the computer's operating system so it can simultaneously accept real-time data from both the hospital and the air-monitoring systems. This could be accomplished through the Health Department. Better computer access as indicated should be a major effort of AMS in improving its data-handling system.

RECOMMENDATION 80. Review air quality data needs carefully with the goal of justifying storage of historical daily averages only.

RECOMMENDATION 81. Keep historical air quality data in machine-readable form on either disc or magnetic tape. Historical data should not be stored on cards. The amount of data involved would make cards cumbersome, prone to loss or damage, and space consuming.

RECOMMENDATION 82. Begin detailed planning for the data-analysis programs at once. In planning the data-analysis programs and reports, careful study should be made to determine the needs of data analysis. Often these will differ from what users say they would like. Only a minimum amount of data should be printed.

RECOMMENDATION 83. Begin work on writing the specifications and actual programs for data analysis. The Water Department has an IBM 1130 Computer that uses the same programming language as the 1800. This computer can be used to test programs until the 1800 is ready to begin processing air pollution data.

RECOMMENDATION 84. Add a computer programmer to the AMS staff. During initial development of the air quality system, he can be assigned to writing some of the data-retrieval and data-analysis programs. This will leave existing staff with more time to plan and coordinate the entire project. Later he would devote much of his time to writing programs for special data-analysis studies. Availability of data for such studies was one of the reasons for development of this system in the first place.

RECOMMENDATION 85. Begin planning now for development of information systems for emission inventory and permit and license data. This is necessary to facilitate storage and use of the data when it starts to be received in the near future.

RECOMMENDATION 86. Design a storage and retrieval system for emission inventory data so that a complete emission inventory for the City can be calculated and periodically updated.

RECOMMENDATION 87. Develop a filing system to coordinate data from:

1. Complaints
2. Emission inventory
3. Enforcement actions
4. Permits and license

4. AIR POLLUTION PROBLEMS

Air pollution in the City of Philadelphia is a result of heavy concentrations of people and industry within the City. About two million people live in an area of 127 square miles. The density of automobiles is correspondingly high.

About 4,600 manufacturing establishments, over 300 of them with more than 100 employees, are located in Philadelphia. This is about 25 percent of the number of manufacturing plants in the entire State of Pennsylvania. A large portion of this manufacturing is heavy industry.

Sampling data reveal pollutant levels to be quite high. The annual mean levels for suspended particulates and sulfur dioxide during 1969 were 118 micrograms per cubic meter (u/m^3) and 0.07 parts per million (ppm) respectively.

A detailed emission inventory is currently underway and is discussed elsewhere in this report. Present data are based on a rapid survey emission inventory performed in 1969 for the Philadelphia Air Quality Control Region Consultation Report. Another emission inventory, also primarily a rapid survey, was compiled by the City of Philadelphia in 1966. These results are summarized in Table 4-1.

Sulfur dioxide emissions amount to about 375,000 tons per year. Philadelphia Electric Company's power plants contribute about 1/3 of this amount. Fuel combustion from stationary sources and process emissions is the source of most of the rest.

About 70,000 to 80,000 tons of particulates is emitted annually. Most of the total comes from industrial processes and stationary sources. An estimated 10 percent of the particulates (20 percent in the 1966 City study) comes from Philadelphia Electric Company's power plants.

Carbon monoxide is the pollutant emitted in the largest quantity, some 800,000 to 900,000 tons per year. About 2/3 comes from motor vehicles. Much of the remainder is from industrial processes, primarily refineries and chemical plants.

Emissions of nitrogen oxides and organics (hydrocarbons) have also been estimated. About 100,000 tons per year of nitrogen oxides is emitted, 1/3 from motor vehicles and 1/3 from power plants. Of the estimated 200,000 tons per year of organics, about 2/3 is emitted from motor vehicles and the rest from the refineries and chemical plants.

Odors are also a singificant problem. The refineries, chemical plants, and rendering plants are the major contributors.

Table 4-1. EMISSIONS BY SOURCE CLASSIFICATION

Pollutant	Total Tons/Year	Fuel Combustion Stationary Sources, %	Power Plants, %	Process Losses, %	Waste Disposal, %	Mobile Sources, %
Sulfur dioxide [a]	375,000	28	33	33	-	5
Particulates [a]	80,000	30	11	44	4	10
Carbon Monoxide [a]	830,000	2	-	33	1	64
Nitrogen oxides [b]	110,000	30	30	11	1	27
Organics [b]	200,000	3	-	26	6	64

a - Consultation Report
b - 1966 Philadelphia Emission Inventory

5. LEGAL

5.1 Legal Authority

Philadelphia's Air Management Code, adopted on October 20, 1969, is a modern up-to-date ordinance. It contains very strong enforcement powers and penalties. The section on legislative findings is well written and contains strong language in policy regarding non-degradation of air quality. The definitions of air pollution nuisance and the restrictions on open burning are also good.

Section 3-103 Item (5) specifies penalities for violation of the Code or Regulations. The maximum fine is $300. The State has recently amended its law to increase the maximum fine to $1,000.

RECOMMENDATION 1. Amend Section 3-103 (5) to increase maximum fines to $1,000, at least for the first offense.

Section 3-301 Item (22) requires that the Health Commissioner, or his designee, shall administratively hear appeals to orders of the Department. This meeting should serve as an office conference or review. In practice, this means that the Assistant Commissioner for AMS hears and decides on appeals from orders issued by his organization with his approval. The recipient of the order does have an ultimate appeal to the License and Inspection Review Board, which is independent from Air Management Services.

While such a perfunctory review procedure is not the best arrangement and can lead to unnecessary delays; it has some advantages. The administrative hearing is useful because it operates similar to a show-cause hearing. The recipient of the order is required to divulge his case and evidence at the hearing. Having access to such information should assist AMS in prosecuting its own case before the License and Inspection Review Board.

Section 3-302 of the Code defines the powers and duties of the Air Pollution Control Board. While many of these duties are advisory in nature, the Board does have considerable power in promulgating regulations both to control emissions and adopt air quality standards. In practice, the Board has been asked to approve regulations after they have been drafted rather than to actually write the regulations. It is conceivable, however, that the Board could delay or not approve regulations it did not find acceptable.

The composition of the Air Pollution Control board is spelled out in Section 3-902 of the City Charter. The Board consists of seven members, four of whom must be representatives of specified industries. Because of its power in adopting regulations, it is inappropriate that a majority of the Board be comprised of industry representatives.

RECOMMENDATION 2. Reconstitute the Air Pollution Control Board so that it is an objective and impartial representative of the entire community. Board Representatives having substantial

financial interests tend to disregard public interest and welfare.

Item (2) of Section 3-302 of the Code deals with the adoption of air quality objectives. The paragraph allows different air quality levels in different parts of the city.

RECOMMENDATION 3. Modify Item (2) of Section 3-302 by deleting "to establish areas where objectives are applicable" so that air quality goals for the entire city will be uniformly beneficial. Reasonable time schedules for achieving the uniform objectives should be set in those parts of the city rather than allowing less strict objectives at the sacrifice to air quality. In addition, such objectives must be consistent with the provisions of the Implementation Plan for the Philadelphia AQCR.

Under provisions of Section 3-304 concerning inspections, AMS may allow a private agency or industry to make its own inspections and determine its own compliance. AMS retains the right to make its own inspections. This provision can be useful, but care must be taken to insure that it is properly administered.

Regulations I, II, and III dealing with General Provisions, Particulates, and Sulfur Oxides became effective on April 29, 1970. A regulation governing incinerators also exists. These regulations are adequate to control the pollutants they concern.

Regulation II, Section V, governs emission of particulates from fuel-burning equipment. The limitations are expressed in terms of pounds of particulate per thousand pounds of stack gas. This approach is indirect and can contribute to confusion in its application.

RECOMMENDATION 4. Express emission limitations in this regulation in terms of pounds/hour or pounds/million Btu of heat input. In addition, modify or replace the emission standard for existing equipment, subsection (2), by a standard that varies with the size of the installation.

Regulation III limits sulfur oxide emissions. The sulfur levels ultimately allowed in fuels are the same as those allowed by New Jersey. Philadelphia's time schedule for implementing these limitations is behind that of New Jersey.

RECOMMENDATION 5. Express the limitations on emission of sulfur dioxide in Section IA (2), Non-Commercial Fuel, in terms of pounds/hour or pounds/million Btu of heat input. The comments made with reference to Regulation II, Section V, also apply here.

The incinerator regulation is good. It includes design standards as well as emission limitations. Testing procedures, however, have not been standardized.

> RECOMMENDATION 6. Specify standard test methods for testing new incinerator designs for compliance with the regulation.

Maintenance support requires that the agency have legal authority to control emissions within its jurisdiction. This means all pollutants as well as all sources. As mentioned in the discussion of Philadelphia's air pollution problems elsewhere in this report, hydrocarbon, carbon monoxide, and odor emissions are significant.

> RECOMMENDATION 7. Develop regulations for control of hydrocarbons, carbon monoxide, and odors. Federal criteria documents for hydrocarbons and carbon monoxide are currently available, and should be utilized in developing regulations.

CFR 56.31 (2)(1) for maintenance requires that sources contributing to air pollution within a jurisdiction be controlled even though they are located outside that jurisdiction but in the same state. In this case, such sources, if any exist, must be adequately controlled by the State of Pennsylvania before Philadelphia can receive maintenance support.

> RECOMMENDATION 8. Work with the State to develop plans for the State to control emissions from sources outside of Philadelphia that contribute to air pollution within the City.

5.2 Legal Operations

Air Management Services and the Health Department have no legal staff. The Law Department supplies necessary legal services to all other agencies of City government. AMS works with the Counseling and Enforcement Divisions of the Legal Department. The Counseling Division provides general legal advice to the Enforcement Division, which prosecutes all air pollution violators.

Enforcement activities involving legal prosecution is one of the key areas in carrying out AMS' program to obtain compliance with emission regulations. To date, however, the agency has had inadequate legal service.

> RECOMMENDATION 9. Obtain additional legal support. The agency needs an experienced attorney who is familiar with air pollution problems. In addition, a close working relationship with the Counseling Division should be developed.

This experience can best be gained by having the individual work within the program for a while. In addition to preparing and prosecuting cases, this attorney should work with AMS staff to teach them proper procedures to testify in court and maintain records.

There are two ways this recommendation could be achieved:

1. AMS could hire a lawyer as a member of its own staff.
2. The Law Department could assign an attorney exclusively to AMS.

The second alternative, having the Law Department assign an attorney to AMS, seems preferable for several reasons. There is a City policy prohibiting operating programs from having their own attorneys. While a similar policy for Public Information Personnel was waived for air pollution (Section 12 of this report on Public Information), such an achievement would be difficult to repeat and could cause resentment within other areas of the City government. Secondly, the Law Department would probably be more agreeable to having one of their attorneys assigned to AMS. Also, this alternative would not tend to isolate the attorney from his professional group.

The Counseling Division of the Legal Department is responsible for providing general legal assistance with contracts, procedures, regulations, and other matters. This does not include aid in preparing legislation, however.

AMS has received only a limited amount of help from the Counseling Division, largely because the Division is understaffed. One man has been assigned to the entire Health Department, and he is only able to spend 1 to 2 hours per week on air pollution control activities. Because of his workload, he is unable to work actively with AMS during the development of legal documents. He sometimes reviews them after the fact, which is far less effective.

AMS should have far more help from the Counseling Division in developing enforcement procedures, writing contracts, extending regulations, and so forth. The Counseling Division may need to expand its staff in order to provide such help. This would also be helpful in providing backup support because, at present, there is only one person within the Division who is at all knowledgeable about air pollution. AMS should also work to brief the staff of the Counseling Division on the health and technical aspects of air pollution control. One man should be assigned full time from AMS to work with the Counseling and Enforcement Divisions of the Law Department.

The Counseling Division is presently very concerned about the need to develop expert testimony on the health effects of air pollution control. They feel it is necessary to base cases on danger to health in order to establish precedents for prosecution of future cases. While this approach may be useful, it differs from the traditional air pollution enforcement patterns and may tend to slow down or limit the prosecution of violators.

The Enforcement Division of the Legal Department is responsible for prosecuting all violations of air pollution regulations. In the past, few cases were prosecuted. Table 5-1 summarizes cases actually prosecuted during 1968

and 1969. The number of prosecutions was small (222 in 1968 and only 104 in 1969), and more than one-third were either dismissed or fined court costs only. Cases that were prosecuted were handled poorly. This was most noticeable in the case against George Sall Metals Co. This seems to have been largely the result of prosecution personnel changes and inexperience in air pollution control.

There appears to be a serious problem of cooperation between AMS and the Enforcement Division. The AMS staff says that the Enforcement Division is reluctant to prosecute, and that the legal staff is not eagerly pushing cases, is unfamiliar with air pollution control, and is generally less skilled than legal counsel representing the defendents. They also say that the Enforcement Division complains about the lack of good medical testimony and wants to base all cases on the health hazard issue. AMS should work with the Counceling Division to move away from proving probable health hazards as a primary requirement for prosecution. Other lines of evidence, based on proving violation of the regulation, merely by showing emission of pollutants, should be developed. Health damage is difficult to prove and should be used only as supporting proof. The APCO Air Quality criteria should be used to help establish proof of health damage.

The point of view expressed by the Law Department is somewhat different. A new Deputy City Solicitor has recently been appointed, and he seems sympathetic toward AMS' problems. The Enforcement Division says it is willing and wants to prosecute all air pollution cases, whether or not they involve health hazards, but that AMS is not sending the cases to be prosecuted. One attorney, a half-time employee, is currently assigned exclusively to air pollution control. The Division says it will hire as much staff as is necessary to prosecute all air pollution cases..

This report does not attempt to reconcile these two points of view. It appears that a communication problem exists, and it is important that it be worked out. AMS should come to an understanding with the Law Department and develop operating procedures for prosecution of cases. An aggressive enforcement effort should be launched. All available legal assistance in the city, including the District Attorney's office, should be utilized, and a formal plan of cooperation should be developed.

As discussed above, one of AMS' problems is the City Attorney's lack of knowledge about air pollution control. APCO has issued criteria documents for various pollutants and other literature that would provide information to help solve this problem.

AMS should be sure City Attorneys concerned with air pollution have APCO criteria documents and other publications and are aware of the information contained in them. The attorneys should be kept up to date as new documents are issued. This should be one of the responsibilities of an AMS man assigned to liaison with the Legal Department.

The Code provides three methods of enforcement:

1. Convictions resulting in fines of up to $300 can be sought in Municipal Court.
2. Administrative abatement orders can be issued.
3. Injunctions can be sought in courts of equity.

Table 5-1
COURT CASES 1968 AND 1969

Disposition	Year	1st qtr.	2nd qtr.	3rd qtr.	4th qtr.	Total
Costs only	1968	12	6	5	24	47
	1969	0	0	0	0	0
$ 10 + costs	1968	0	0	0	0	0
	1969	0	0	0	4	4
$ 25 + costs	1968	13	27	15	21	76
	1969	0	0	1	6	7
$ 50 + costs	1968	13	7	28	12	60
	1969	0	0	15	2	17
$ 75 + costs	1968	0	0	0	0	0
	1969	0	0	0	1	1
$ 100 + costs	1968	0	1	18	6	25
	1969	0	0	0	11	11
$ 300 + costs	1968	0	0	0	0	0
	1969	0	0	0	11	11
Discharged	1968	0	0	0	0	0
	1969	0	0	10	9	19
No service	1968	0	2	8	1	11
	1969	0	0	4	1	5
Withdrawn	1968	3	0	0	0	3
	1969	0	0	1	1	2
Total	1968	41	43	74	64	222
	1969	0	0	31	73	104

Prosecution in Municipal Court and the seeking of injunctions require the services of the City Law Department. The administrative order procedure does not; it was created specifically so the Law Department would not be needed.

Occasional or minor violators can be prosecuted in Municipal Court. A complaint, based on a violation observed by an inspector, is signed by the Director of the Compliance and Enforcement Division, approved by the Assistant Commissioner for Air Management Services, and sent to the Law Department for prosecution.

The judicial system in Philadelphia has not been provided with sufficient information regarding air pollution control. As a result, prosecution has not been too successful. In the past, small fines were levied if convictions were obtained at all. Recently, however, this situation has improved, and some significant fines have been levied.

> RECOMMENDATION 10. Use the enforcement method through seeking conviction and fines in Municipal Court only for minor and infrequent violations. This is because the procedure makes no provision for long-term compliance with regulations or abatement of air pollution.

Administrative abatement orders are a second method of enforcement. AMS favors this approach because the Legal Department does not become involved. The procedure is somewhat cumbersome, however. The order is prepared by the Director of the Division of Compliance and Enforcement, with approval of the Assistant Commissioner for Air Management Services, and the Health Commissioner is notified. A schedule for compliance with regulations is spelled out in the order. As discussed in the review of the Code, the recipient can request an administrative hearing for review of the order.

If the order or the compliance schedule is disregarded, steps may be taken to revoke the offender's license for operating the polluting equipment. The Director of the Division of Compliance and Enforcement notifies the Assistant Commissioner of the non-compliance. The Assistant Commissioner in turn can recommend to the Department of Licenses and Inspections that the license be revoked.

Any license revocation may be appealed to the Board of License and Inspection Review. This is an independent agency specified by the City Charter. The existence of this independent board to ultimately hear appeals from air pollution abatement orders removes some of the previously mentioned objectives to having the Assistant Commissioner first hear those appeals to his own orders.

As specified in the Charter, the Board of License and Inspection Review is composed of between three and six members. The Board hears appeals to all types of license problems, not merely those for air pollution. As a result, the

Board has no particular expertise in air pollution control. Creation of a separate Air Pollution review board would be desirable, but would require amending the City Charter. This would be difficult at best. While the present procedure for appealing air pollution abatement orders has some disadvantages, it appears to be satisfactory.

These enforcement procedures have been worked out by AMS. However, they are still in draft form and are, at present, untried.

If the Abatement Order procedure discussed above fails to achieve compliance, another enforcement tool is available. This is to seek an injunction in Common Pleas Court. This is undertaken by the Law Department upon the request of the Assistant Commissioner with the approval of the Health Commissioner. Injunctions should be sought immediately against the major polluters instead of trying to achieve compliance first with administrative abatement orders. A court order carries greater respect than an administrative order. Furthermore, if compliance is not achieved, the administrative order procedure leads, after much delay, to the seeking of a court order anyway.

A final point to be considered in discussing legal operations is State certification. Pennsylvania State law grants exclusive jurisdiction to a local air pollution control agency only if that agency has been certified by the State. Lack of certification means that the local agency and the State would both have concurrent jurisdiction over sources within the local jurisdiction. Such an arrangement can only lead to confusion. The Philadelphia agency has recently been certified by the State.

While the State has granted AMS exclusive jurisdiction in the City of Philadelphia, this relationship is complicated by Federal legislation. The Clean Air Act of 1967 defines the Air Quality Control Region Concept and makes the states ultimately responsible for air pollution control within Regions. The State is required to prepare an Implementation Plan defining the means to be used to actually control air pollution. This plan may call for the local agency to contribute significantly to the control effort, but the State is ultimately held responsible for the results.

The City of Philadelphia is, of course, a part of the Philadelphia AQCR. The State law that grants control responsibility to AMS by means of certification is inconsistent with the Clean Air Act. Because of this overlapping authority, the State and AMS must have effective communications and a good working relationship. During this study, it appeared that neither agency relied to any great deal on assistance from the other or had information on what the other program was doing in Philadelphia. The Communication Section of this report recommends more effective communications between the two agencies.

6. ORGANIZATION

6.1 Prior Study by United States Public Health Service (USPHS)

In July, 1967, a study was made by James Williams of the USPHS entitled "Philadelphia Air Resource Management Program Suggested Organization." It is appropriate to discuss that study at this time because many of the existing program characteristics and the present organizational structure of AMS were recommended by Williams.

Not all of Williams' recommendations have been carried out. However, a discussion of those earlier recommendations can provide a benchmark from which to begin the present study of the organization of AMS program. It is possible to review the progress made in the past 3 years and recommend further improvements in line with the purpose of this report discussed in the introductory section.

It was recommended that the basic organization consist of a director and three divisions. The program director was to become an Assistant Commissioner with ability to influence City decision-making bodies. Further support to the organization would be provided by a staff type group. Task forces were to be created and assigned to study and reslove internal problems. The organizational re-alignment has been carried out, but the task force concept has not.

The 1967 report indicated that budget, fiscal, and other administrative services centralized within the Health Department should be responsive to air resource program goals and needs. The present study has found that this is not always the case.

The program suggested by Williams was goal-oriented and management-directed. At that time, the City of Philadelphia was instituting a Planning, Programming, and Budgeting System. The PPB System was to provide the principal management tool needed. However, to use the tool, management skills had to be developed in the organization. Neither the system nor the skills have been developed by AMS.

Further utilization of educational institutions for research, training, contracts, and special projects was recommended. The Air Pollution Control Board was to be directed toward policy matters to ensure (a) establishment of air quality goals, (b) enunciation of those goals, (c) program implementation, and (d) provision of clear understanding and smooth implementation. Continual examination to provide new initiative and action to reach program objectives was also a recommended function.

6.2 Present Organization

In 1968, AMS was reconstituted as a separate organization, one of three services within the Department of Public Health. AMS consists of three divisions and a staff support group, and is headed by an Assistant Commissioner. Additional support for AMS is provided by the Office of Administration and Community Health Services within the Health Department, the Law Department, and the City Representative's office.

It was evident that the Commissioner of Health strongly supports AMS. However, there is concern that the Assistant Commissioner for AMS does not have sufficient departmental responsibility and ability to influence City decision-making bodies. Such power was recommended in the 1967 PHS report. The Health Commissioner wants to delegate more responsibility to AMS, and appears to be working in that direction.

The Assistant Commissioner for AMS has a huge job. In addition to working with City decision-making bodies as discussed above, he is responsible for numerous other functions, both inside and outside of AMS. Elsewhere in the report it is recommended that he take a more active role in the public information program. Obviously, all of this is too much for one man.

RECOMMENDATION 11. Allow the Assistant Commissioner more time to work with organizations outside AMS, both inside and outside City government. To accomplish this, three alternatives are proposed.

1. Establish and fill the position of Deputy Assistant Commissioner; he should be responsive to the needs of AMS and chosen by the Assistant Commissioner.

2. Delegate most responsibilities to the Division Director and choose someone to act in the capacity of Assistant Commissioner when he is out of the office.

3. Hire a chief administrative assistant to coordinate all staff functions as well as line functions and problems. However, at all times there should be sufficient access to the Assistant Commissioner by the Division Directors to express grievances.

The Assistant Commissioner's Staff support group includes specialized technical and administrative people whose specific responsibilities cover broad areas. These include administration, project management, planning, information management, training, and public information. The specific functions and the personnel assigned to each for the staff support group and the three divisions of AMS are listed in detail in Appendix D.

The three operating divisions are Engineering, Compliance and Enforcement, and Laboratory. The Engineering Division is composed of two sections according to the approved AMS organization chart, Figure 6-1. The Division actually operates on the basis of three sections. This discrepancy is unsatisfactory for purposes of program planning and division of functional area of responsibility. The three sections are Emission Inventory, Permit Approval, and Industrial Improvement. The first two are combined on the organization chart. The functional descriptions for the Division were outlined in a 1969 report. A similar description for the Compliance and Enforcement Division was written in 1970 and contained considerably more detail.

Figure 6-1
ORGANIZATIONAL CHART
FOR CITY OF PHILADELPHIA
DEPARTMENT OF PUBLIC HEALTH
AIR MANAGEMENT SERVICES

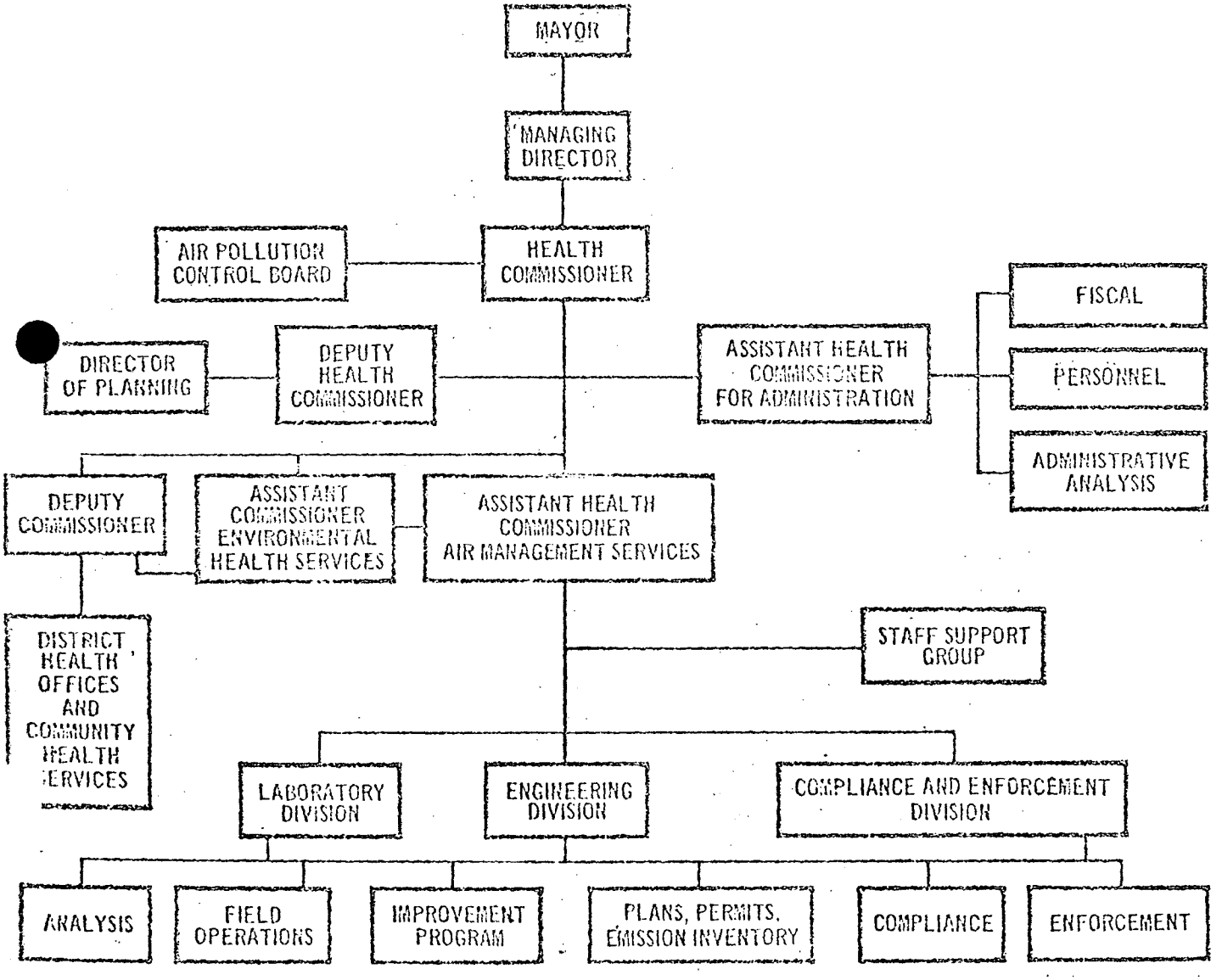


Figure 6-1. Organizational chart for city of Philadelphia, Department of Public Health, Air Management Services.

RECOMMENDATION 12. Update the Engineering Division's functional description to include functional categories, staffing, goals, objectives, and time schedules to meet program objectives.

The Compliance and Enforcement Division is composed of two sections: (1) Compliance and Surveillance and (2) Enforcement. The Compliance and Surveillance Section, which supervises AMS' staff of inspectors, has divided the city into three districts for field work purposes. The rest of the Health Department uses a ten-district basis. As a result, AMS has staff located in only three of the Health Department district offices.

The Laboratory Division has two sections: Analysis and Field Operations. There was no program plan information available from the Division with defined areas of responsibility for each section. This is a very unsatisfactory situation. It has been recommended elsewhere in this report (see Technical Services) that consideration be given to transferring the Laboratory Division's stack-testing function to the Engineering Division.

The Office of Administration of the Health Department provides fiscal, personnel, and analytical program support to AMS. In the fiscal area, the Office of Administration audits, manages accounts, and administers the budget. It appeared that Administration exerts too much control over budget affairs as they affect program activities.

In the personnel area, the Office of Administration serves as a link between AMS and Central Personnel. There have often been extensive delays in receiving job descriptions, creating job classifications, and hiring people. This is particularly true in non-professional areas. The Office of Administration has been, at times, almost a line function over AMS setting its staffing priorities rather than acting as a staff support group, which would help push through paperwork necessary for AMS to hire the people it wants. However, Central Personnel has also been responsible for many of the delays in processing AMS' personnel actions. These and other personnel problems are discussed in more detail in the Manpower Section of this report.

The Office of Administration is also responsible for maintenance, duplicating, and petty cash. These services have been generally unsatisfactory. AMS has experienced serious delays having lights replaced, windows fixed, cleaning, and other maintenance services. Delays of several days in duplication of documents are common. As there is no petty cash fund, even small items must be ordered through formal purchasing channels.

Environmental Health Services also provides some support to AMS. However, the relationship is unclear. The organization chart dated 12/31/68 (see Figure 6-1) reveals a solid line direct relationship between AMS and EHS. An earlier chart dated 9/6/67 showed a dotted line indirect relationship. The district health offices, three of which are used by AMS Compliance and Enforcement field staff, are EHS facilities. With the exception of using office space in EHS facilities and doing some radiological analysis and high-volume samples, AMS seems to have little contact with EHS. This relationship should be clarified.

6.3 AMS As A Separate Department

It has been suggested that AMS would be more effective in its efforts to control air pollution if it was reorganized as a separate Department of the City government. In discussing this question with various people, both advantages and disadvantages of such a change were mentioned. Any decision would require a comprehensive evaluation of cost and benefit factors, available resources, and the public and private impact of the move. Such an evaluation is beyond the scope of this study and, without it, the only reasonable approach is to merely list the advantages and disadvantages of the change:

ADVANTAGES

1. There is considerable prestige in being a separate department and being able to negotiate at department level.

2. Air pollution control would be the sole activity of the new department. It would not have to compete for priority with other programs within the Health Department.

3. As Commissioner of Air Pollution Control, the head of AMS would have full responsibility for all control activities.

4. Air pollution can be treated as a legal and an engineering problem and not be clouded by "health hazard" connotation.

5. Air Pollution Control could exert more control over personnel and fiscal functions.

6. Positions can be upgraded as necessary to give better salaries and promotion potential. This would facilitate the acquisition of special disciplines used in air pollution control programs.

7. The air pollution control program would have increased visibility to the public and could be more responsive to public opinion.

8. Many air pollution control activities are not common to other health-related activities. Examples include review of engineering plans, monitoring of contaminants, source testing, inspection of technical processes, and code enforcement by injunction or other legal means. A separate department would allow AMS to set up its own programs and methodologies for its activities.

9. Air Pollution Control Agencies must be more enforcement-oriented than Health Departments are by basic policy and philosophy.

DISADVANTAGES

1. The smaller department or organization would have less influence and receive less administrative support from the City bureaucracy.

2. Results are frequently achieved within a City structure through a system of trade offers. A new department would have no stock of such goodwill with which to bargain.

3. Overhead operations in functional areas of personnel specialists and fiscal officers can be overly burdensome to a small organization.

4. There is an element of safety in budget support as part of a larger Department or organization available to AMS through the Health Department.

5. The actual process of revising the City Charter and creating the new agency could be quite time-consuming and may delay or disrupt abatement of air pollution for sometime.

Another trend in organizing pollution control efforts is emerging around the county. This is a creation of combined environmental control agencies with responsibility for air, water, and land conservation. Such a possibility for Philadelphia was not evaluated by this study for the same reasons that no recommendation was made about creating a separate air pollution control department.

7. BUDGET

Since 1965, the City of Philadelphia has received grant support for its air pollution control program. The agency is now completing its second 3-year improvement project. A summary of AMS grant support is shown in Table 7-1. In 6 years, the total project annual budget (Federal + non-Federal funds) has grown from $142,000 to almost $1 million. These figures do not include funds that are not eligible for Federal matching. These "Program Exclusive of Project" funds add another $240,000 to the agency's budget during the present fiscal year.

Table 7-2 shows a breakdown of the budget by functional activity. The allocation shows heavy emphasis on engineering and enforcement. Engineering utilizes 43 percent of the budget. This percentage is high because air monitoring, laboratory, and technical services have been included in this category. Enforcement consumes 38 percent of the budget while only 19 percent is devoted to administration.

Future staffing and calculated budget needs were projected for AMS. This estimate is discussed in the Manpower Section of this report. It was estimated that a total of 125.5 people are needed by FY 1974. Table 8-2 projects the progressive buildup of the staff and the allocation of manpower to various program functions.

The effects of this size staff on the agency's budget are estimated in Table 7-3. The total required budget for FY 1974 would be about $1.5 million. AMS' present budget (project grant for FY 71 plus program exclusive of project funds) is about $1.25 million. This is about what the projection forecasts will be required by FY 1972. A budget expansion of about 20 percent will be required by FY 1974 to reach the required manpower and activity levels projected by APCO.

Table 7-1.
PHILADELPHIA FINANCIAL RESUME:
FEDERAL GRANT PROJECT FUNDS

Date	Type	Non-Federal	Federal	Total	Remarks
1/1/65-12/31/66	Imp. [a]	47,540	95,079	142,619	Expended
1/1/66-12/31/67	Imp. [a]	62,654	125,307	187,961	Expended
1/1/67-6/30/68	Imp. [a]	121,667	243,334	365,001	Expended
7/1/68-6/30/70	Imp. [b]	164,578	392,115	556,733	Expended
7/1/69-6/30/70	Imp. [b]	298,572	597,143	895,715	Budgeted
7/1/70-6/30/71	Imp. [b]	332,988	655,975	998,963	Budgeted

a - 42-month Improvement Grant 6/1/66-6/30/68.
b - 36-month Improvement Grant 7/1/68-6/30/71.

Table 7-2.
PERCENTAGE OF TOTAL PROGRAM
BUDGET RELATING TO ELEMENTS
IN THE AIR POLLUTION CONTROL ACTIVITY

Air pollution activities	Fiscal year 1970	Fiscal year 1971
I. General enforcement	xxxx	xxxx
1. Complaint processing	2	2
2. Inspection	20	18
3. Prosecution	5	5
4. Stack sampling	1	5
5. Clerical	4	3
6. Administration	6	3
7. Other		
	38	36
II. General engineering and analysis	xxxx	xxxx
1. Plan review	2	3
2. Permits	2	2
3. Source survey or registration	4	2
4. Emission inventory	4	3
5. Code preparation	1	1
6. Public technical assistance	-	-
7. Planning	1	1
8. Air monitoring	10	10
9. Laboratory	10	9
10. Data processing	4	9
11. Meteorology	1	3
12. Administration	3	2
13. Clerical	1	1
14. Other		
	43	46
III. General administration	xxxx	xxxx
1. Management and planning	8	6
2. Local assistance	-	-
3. Public information	3	3
4. Accounting	1	1
5. Clerical	4	4
6. Training	1	2
7. Legal	1	2
8. Other		
	19	18
Total	100%	100%

Table 7-3.
MATED COST OF RECOMMENDATIONS
CITY OF PHILADELPHIA

	FY 1970	FY 1971	FY 1972	FY 1973	FY 1974
	196,000	276,000	336,000	378,200	417,600
	49,000	69,000	84,000	94,550	104,400
	1,500	1,500	1,500	1,500	1,500
	323,400	323,400	323,400	327,320	327,320
	80,850	80,850	80,850	81,830	81,830
	2,000	2,000	4,000	2,000	2,000
	159,600	172,900	199,500	239,400	269,990
	39,900	43,225	49,875	59,850	67,498
	5,000	1,000	1,000	1,000	1,000
	105,500	125,500	150,500	163,500	178,000
	26,375	31,375	37,625	40,875	44,400
	15,000	10,000	5,000	5,000	5,000
	1,004,125	1,136,750	1,273,250	1,395,025	1,500,638

8. MANPOWER

Manpower is the most important resource of any organization. While AMS has experienced considerable growth in the past 2 years, additional manpower is still required to enable the agency to do its job effectively. This section of the report discusses the following facets of AMS' manpower problems:

1. Staffing requirements
2. Job descriptions
3. Salaries
4. Training
5. External constraints

8.1 Staffing Requirements

Table 8-1 shows the present number of positions on the AMS staff and their distribution by function. Table 8-3 shows a further breakdown of the functions performed by each staff member during fiscal year 1970. The figures in Table 8-1 reflect a fairly well-balanced control effort. Of a total of 54 people, 32 percent are involved in management operations, 28 percent in enforcement, 17 percent in engineering, and 23 percent in lab and technical operations. While these percentages reflect good manpower distribution, the agency has an unusually high vacancy rate, about 33 percent.

> RECOMMENDATION 13. Make a major effort to fill existing vacancies before planning and implementing futher program activities.

AMS has projected its future manpower needs as shown in columns 2 and 3 of Table 8-1. A total staff of 117 is forecast by 1972. APCO has also developed a projection of manpower needs for the agency which is shown in Table 8-2. The discrepancies in present manpower levels between the two tables were due to differences in charts received from AMS. APCO's projection is based on population, number of manufacturing establishments, land area, and industrial capital expenditures. The calculations are shown in Appendix C. APCO's figures indicate a need for a staff of 124.5 by 1974. The two figures are in close agreement on the agency's ultimate total personnel needs. There is, however, some disagreement in the allocation of personnel to source testing, permit plan review, public relations, and legal preparation.

The AMS allocates one man each to the stack sampling and permit operations. This allocation is not sufficient. Rather, 2.5 man-years should be the minimum assigned to stack sampling, while efficient operation of the permit system would require about 12 men.

The AMS predicts a decline in activity in the area of both public information and legal preparation. These operations will become increasingly important in the future and thus AMS should be geared up to meet this responsibility.

Table 8-1

PRESENT AND PROJECTED MANPOWER NEEDS
CITY OF PHILADELPHIA
PREPARED BY AMS

	Fiscal Year		
	1970	1971	1972
Management Operations			
Policy, publications, strategy, recruitment, etc.	4	5	7
Staff Training	0	0	1
Administrative & Clerical	13	19	24
Subtotal Management	17	24	32
Enforcement Operations			
Scheduled Inspections - fuel and refuse	1	1	5
Scheduled Inspections - industry	7	10	12
Complaints and Field Patrol Source Identification and Registration	7	8	8
Subtotal Enforcement	15	19	25
Engineering Operations			
Permit System	1	1	1
Source Testing	½	1	1
Emission Estimates	1½	2	2
Engineering Reports, New Regulations	7	12	18
Subtotal Engineering	9	16	22
Technical Operations			
Air Quality Monitoring	3	5	7
Special Studies	1	3	6
Data Processing	1	3	5
Instrument Calibration	5	9	12
Lab. Operations	2	5	8
Subtotal Technical	12	25	38
Total Manpower	54	84	117

Table 8-2

PROJECTED MANPOWER NEEDS
CITY OF PHILADELPHIA - AS PREPARED BY DCAD, APCO

	1969[a]	1970	1971	1972	1973	1974
Man-years/100,000 Population	4.2	4.3	4.9	5.5	6.0	6.3
Management Operations						
Policy, P/R, Strategy, Recruitment	4.0	6.0	8.0	9.0	10.0	11.9
Staff Training	0	1.0	3.0	5.0	6.0	6.5
Administrative, Clerical	17.0	15.0	18.0	20.0	22.0	22.0
Subtotal Management[a]	21.0	22.0	29.0	34.0	38.0	40.4
Enforcement Operations						
Scheduled Inspections - fuel and refuse	2.0	2.0	3.0	3.0	4.0	4.0
Scheduled Inspections - industry	7.0	8.0	9.0	9.0	9.0	9.0
Complaint and Field Patrol	21.0	21.0	21.0	21.0	21.4	21.4
Source Identification and Registration	3.0	2.0	1.0	0	0	0
Subtotal Enforcement[a]	33.0	33.0	34.0	34.0	34.4	34.4
Engineering Operations						
Permit System	2.0	3.0	5.0	7.0	10.0	11.8
Source Testing	0.5	1.0	1.0	2.0	2.0	2.5
Emission Estimates	1.5	2.0	2.0	2.7	2.7	2.7
Reports, New Regulations	8.0	6.0	5.0	3.3	3.3	3.3
Subtotal Engineering	12.0	12.0	13.0	15.0	18.0	20.3
hnical Operations						
Air Quality Monitoring	5.0	5.0	6.0	7.0	8.0	9.0
Special Studies	1.0	2.0	2.0	3.0	3.3	3.3
Data Processing	2.0	2.0	3.0	4.0	4.9	4.9
Instrument Calibration	5.0	6.1	6.1	6.1	6.1	8.0
Laboratory Operations	2.0	3.0	4.0	5.0	5.2	5.2
Subtotal Technical	15.0	18.1	21.1	25.1	27.5	30.4
Total Manpower, Philadelphia	81.0	85.1	91.1	107.1	117.9	125.5

a - Budgeted (there are presently 27 vacancies).

Table 8-3
Fiscal Year 1970 Manpower Survey Sheet

(Total should equal 100% of time and effort in each function)

STAFF	Percent Assigned to Program	Administrative	Engineering	Enforcement	Sampling	Analysis	Clerical	Accounting	Administrative	Permits and Plan Review	Complaints	Emission Inven.	Program Planning	Inspection	Intergovernment	Air Monitoring	Stack Sampling	Code Preparation	Public Information	Hearings	Legal	Data Processing	Accounting	Laboratory
1 Asst. Health Commissioner	100	x							90				10											
1 Administrative Asst.	100	x							40				10		30								20	
1 Administrative Intern	100	x							80				20											
1 Information Officer II	100	x									10		10						80					
1 Draftsman	100		x																					
2 Public-Health Eng. II	100		x						10				50		10		20					10		
1 Public-Health Eng. I	100		x																			100		
1 APC Eng.	100	x							40				30		10					20				
1 Public-Health Eng.III	100			x						70											30			
1 PHS I	100			x						80										20				
4 AOC Insp. Supvr.	100			x					70		15		15											
17 APC Insp.	100			x					8		46			46										
1 APC Eng.	75	x							70						5	10	5							10
1 Chem. II	50				x																			100
2 Chem. I	50				x																			100
4 Chem. Tech.	25			x																				100
4 Inst. Tech.	100			x																				100
1 APC Eng.	100	x							70		5			5	5					10	5			
2 PHE III	100		x								50			30	20									
1 PHE II	100		x											70								30		
6 PHE I	100		x								75					10	15							

One final area that needs clarification is that of instrument calibration. The unusually high number in that category reflects the manpower needed to service the ten-station telemetery network in addition to those required for routine calibration of lab and technical equipment.

In addition to these general personnel recommendations, several specific staffing recommendations have been made in discussions of various functional activities throughout this report. These recommendations are summarized below:

1. Allow the Assistant Commissioner more time to work with organizations outside AMS by one of the methods listed in the Organizational Section of this report.

2. Have a full-time attorney assigned from the Law Department to AMS.

3. Assign one man the responsibility of working with the legal staff in briefing lawyers, preparing cases, etc.

4. Hire an assistant or clerk for personnel matters to relieve the administrative assistant and thus allow him more time for program planning.

5. Hire a chemist with experience in the use of the gas chromatograph.

6. Hire a full-time meteorologist.

7. Assign one or two technicians to serve and maintain the automatic sampling network.

8. Assign one person full-time to be in charge of data processing and information systems and provide him with support in routine data handling (key punch, etc.).

9. Secure full-time services of one man to serve as a training officer.

8.2 Job Description

AMS is limited in its choice of personnel to those positions for which a job description and classification have been approved by the Philadelphia Civil Service Commission. Should specialized personnel be necessary, AMS must go through the lengthy process of drafting, submitting, negotiating, and obtaining approval for the proposed position. This process can take as long as eight months, and qualified people often find other jobs in the meantime. The Philadelphia Civil Service Commission is reluctant to create new classifications or allow flexibility in using existing ones.

Job classifications are difficult since a precise description of the duties for a hypothetical and probably unobtainable person is required. This is particularly true for engineers where it is extremely difficult to satisfy procedural requirements for any except a qualified environmental engineer. Such a person is neither available or entirely suitable for AMS' needs.

Engineering personnel are currently classified as Public Health Engineers. This designation enables the agency to draw from a wide spectrum of engineering disciplines including chemical, mechanical, civil, sanitary, and electrical engineering. While this arrangement enables the agency to attract qualified personnel, it may tend to be a disadvantage to these people when they seek advancement. Despite the fact that they deal exclusively with problems of air pollution, examinations for advancement between grades require a knowledge of all facets of environmental engineering.

> RECOMMENDATION 14. Create the category of Air Pollution Control Engineer. Persons having this classification would deal specifically with air pollution, and would advance according to their proficiency in that field.

Engineering position levels are assigned as follows:

> Apprentice = Engineer I
> Journeyman = Engineer II
> Deputy Division Director = Engineer III
> Division Director = Engineer IV

This system of evaluating jobs rather than people limits promotion potential. Since there are a limited number of jobs at the III and IV level, a person could be blocked at the top step of a II level even though he was qualified for a III or a IV. The only way to achieve a higher classification is to fill a position at that level.

A similar situation is present in the series of chemist positions. Applicants for Chemist I and II positions are required to have extensive knowledge of fields not related to air pollution.

> RECOMMENDATION 15. Require that chemists be knowledgeable primarily in air pollution aspects.

AMS currently uses only Chemist I and II positions. Both the qualifications and salaries for these positions are low.

> RECOMMENDATION 16. Utilize Chemist III and IV positions. Such positions, based on degree and experience, would help adjust chemists' salaries more in line with those of other agency personnel.

For less professional activities, the agency makes use of both an Instrumentation Technician and a Chemical Technician. The Civil Service System severely limits career opportunities in these positions. They provide for only one step, and a technician reaches his maximum salary after 4 years. This situation can stifle initiative, incentive, and lead to rapid turnover.

RECOMMENDATION 17. Create a second step within each of the technician positions. This will provide incentive and a corresponding pay increase for more qualified persons. In addition, the position of lab helper should be eliminated and such duties assumed by technicians.

Several other classifications would be helpful to AMS.

RECOMMENDATION 18. Establish the position of Applied Scientist. This could serve as a "catch-all" type of position and enable the agency to obtain needed specialized scientific and technical talent without having applicants wait for new positions to be created.

RECOMMENDATION 19. Create an Air Pollution Control Public Information Specialist classification. This is discussed in more detail in the Public Information Section of this report. This position would enable the agency to reject public information applicants who did not have the necessary background in air pollution control.

Availability of applicants does not seem to be a problem. Substantial numbers of applications are being received for positions with salary levels appropriate to the background of the applicants. Requirements for non-degree personnel are being met more easily than those for people with degrees, however. In the past, through advertising and at conventions AMS has attracted applicants, but external contraints have reduced their ability to hire the people. Certainly, the 33 percent vacancy rate bears this out. The average vacancy period for an engineer in AMS is 6 to 8 months.

Recruiting has been done by both AMS and the Administration Office in the Health Department. Since AMS has no restraints on recruiting, it may be beneficial for a man to be assigned from the AMS staff group to handle and coordinate recruiting efforts.

8.3 Salaries

The rigidity and limitations of government salary schedules frequently present difficulties in the recruitment and retention of qualified air pollution control agency staff. This is further complicated by the fact that government salaries have not risen as fast as those of private industry. Table 8-4 gives a comparison between existing salary schedules of similar job functions for government in Philadelphia, the Federal government, private industry, and medians for other local and state air pollution control agencies. Supporting information is found in Appendices F and G for 1966 and 1967 personnel salaries. However, professional salaries since that time have risen 30 percent, or an average of 10 percent per year and are reflected in Table 8-4. Federal salaries reflect actual raise increments since 1966.

Table 8-4 SALARY COMPARISON

TLE	GRADES	Philadelphia Civil Services Pay Ranges Applicable to Air Management Services SALARY RANGE				Approximate Federal Rating GRADES	Approximate Federal Rating SALARY RANGE	Approximate Industrial Rating GRADES	Approximate Industrial Rating SALARY RANGE	Other Local & State Agencies (Median)
ministrative Assistant	I	8,815	9,159	9,501	9,843					
	II	10,883	11,320	11,756	12,189	9-12	9,881-			
	III	13,275	13,818	14,361	14,906		18,449			
dministrative Intern		-	-	9,205	9,535					
gineering Aide	I	6,618	6,853	7,087	7,320	5-7	6,548-			
	II	7,385	7,654	7,923	8,190		10,528			
ir Pollution Control Engineers		-	16,604	17,267	17,931					
ublic Health Engineer	I	-	-	9,798	10,152					
	II	10,883	11,320	11,756	12,189	9-13	9,881-		10,000-	16,000
	III	13,275	13,818	14,361	14,906		21,791	I-VII	27,000	
	IV	15,942	16,604	17,267	17,391					
hemist	I	-	8,396	8,698	9,011					
	II	9,088	9,443	9,798	10,152	9-12	9,881-	I-VI	9,500-	
	III	9,713	10,095	10,477	10,963		18,449		20,000	12,100
Chemical Technican		7,621	7,899	8,178	8,459	7	8,089-			
							10,528			
Air Pollution Control Inspector		9,088	9,443	9,798	10,152					
Inspector Supervisor		10,883	11,320	11,756	12,180					

A summary of Table 8.4 reveals:

1. Top salaries for most positions are considerably less than salaries in other governmental agencies and industry.

2. Salary ranges are limited to only four steps that can be attained in 4 years. With so few steps in a category, salary ranges are extremely limited.

3. Salary ranges are attained by reviewing comparable agencies and situations, and using the middle pay scale. It is regrettable that Philadelphia is not in a position to compete for the best personnel available. Further, when this scale was established, salaries may have been attractive at those starting levels. In fact they still are according to Table 8-4. Philadelphia's raises over the past few years have been based on a common numerical value for all positions, not on a percentage increase. The results have created attractive salaries for new, unskilled employees, non-professionals and professionals. The beginning salaries for clerks is $5,325, while a Clerk IV can receive $9,257. A stenographer begins at $5,694, while and engineer starts at only $4,100 more. A Chemist III can earn only $10,863, only $1,600 more than the upper range of a Clerk IV. This differential will continue to remain the same with numerical raises, although the percentage difference will continue to diminish. Turnover will be low for non-professional and increase in key program areas.

4. Regardless of training and experience that any one individual has, he must begin at the first pay step of that grade. This seriously hampers the recruitment of trained and qualified personnel.

5. Job descriptions are often set for "avenues of least pay." Critical positions are frequently open to unqualified individuals as position descriptions often omit degree or license requirements. Little regard is given to professional requirements. Formerly, the chemist position did not require a degree. In many cases, particularly in this essential APC field and in the AMS program, experienced and qualified people are needed. Restrictions in hiring the most qualified can only injure the program. Descriptions for positions should be based on the agency's needs and on program objectives.

RECOMMENDATION 20. Increase salaries for professional personnel and have studies made to eliminate problems of the limited pay step increase and the pay differential of professionals and non-professionals.

8.4 Manpower Training

Training within the AMS has been a particularly unique problem. The program does not have a training officer, nor does it have a training program established for new personnel in the air pollution control field. Only one AMS staff member

has attended a APCO training course given outside Philadelphia in the past year. At present, training is limited to in-house activities such as having the person work with several program components. Often this training program is interrupted by other program priorities needs as a crisis develops. For new professional personnel, training requirements should range from 3 to 10 weeks during the first 2 years of employment, depending upon an individual's background in college or technical school, and his assigned role in the program.

Training requirements for middle-level technical personnel (2 to 5 years in air pollution control) should range from 3 to 10 man-days per year of employment. Smoke readers especially should receive scheduled refresher courses in plume evaluation on at least an annual basis.

Upper-level technical personnel working in the field over 6 years should receive at least one week per year of formal training to maintain competence.

Management, administrative, and supervisory personnel should receive from 3 to 10 man-days per year in areas of management, supervision, program planning, and specialized technical areas.

AMS has no career development programs using rotational assignments and formal training to advance personnel through the existing system of career ladders to positions of increased responsibility.

Training has received a rather low priority in agency planning. Training needs have not been determined, a formal training program has not been planned, nor do individuals receive sufficient orientation in AMS as well as air pollution control. Agency resources available for training are minimal, although a library is located at headquarters for staff use. The public information program should develop visual aides, training materials, and programmed instructions as needed. Assistance in these areas as well as in technical areas is available from State and Federal officials.

One external AMS element severely handicapping the program's potential in training is the following condition contained in an Administrative Board Ruling.

Instructions for Filling out a Request for
Philadelphia Personnel Manual
Education/Training Leave
(Form 73-S-122, Rev. 8/68)

If the cost to the City for tuition, salary, travel and other related expenses will be $250.00 or more, the arrangement on the reverse side of the Request for Education/Training Leave must be executed by the employee. An employee requesting City aid of $250.00 or more must agree to remain in City employ for at least two (2) years following the termination of the training leave.

This condition undoubtedly limits the number of employees requesting training because of the obligation required by the City. Some employees have refused to sign the condition for training, thereby causing their elimination from highly desirable program training. The condition is unnecessarily severe for short-term training. A 1-week course outside the city would undoubtedly exceed the $250.00.

RECOMMENDATION 21. Adopt a formal training program in AMS for orientation of new employees, training professional employees, and training non-professional technical employees by disignating someone as training officer with responsibility for the criteria analysis of training needs. (NOTE: This is one area where an AMS task force would be extremely beneficial in studying the problems and coming up with recommendations based on program needs.)

RECOMMENDATION 22. Review the 2-year training commitment to reduce its severely restrictive influence for training personnel in the dynamic air pollution control field.

8.5 External Constraints

Many AMS manpower problems are at least partly a fault of factors external to the agency, as already discussed. The Philadelphia Civil Service system is the worst of these problems. The system is, in general, unresponsive to new functions such as air pollution control. The delays and inflexibility in creating job descriptions, the low salary levels, and the lack of advancement potential inherent in the system have been discussed in the appropriate sections of this report.

Central Personnel has tried to prescribe the type of manpower needed by AMS without receiving input from AMS. A recent example of this was a report indicating that engineers were not needed within certain segments of AMS. This type of program problem should be discussed with AMS and resolved by that agency.

The study team's review indicated that most engineering personnel are almost exclusively involved in engineering functions. Supervisory engineers, as well as those engineers assigned to the Staff of the Assistant Commissioner, are involved in program planning. In such areas as data processing, fewer engineer types would be warranted, but the agency has been unable to fill these positions with qualified personnel who are not engineers. The whole problem is a result of insufficient staff and using existing personnel in understaffed areas. This particular personnel report seems to indicate a lack of understanding of the AMS program on the part of Central Personnel.

Personnel administration is one of the functions handled centrally by the Health Department for all agencies within the Department, including AMS. This function includes processing the paperwork to create job classifications, developing position descriptions, obtaining positions, actually hiring people, and dealing in general with Central Personnel. Because of AMS' great need for new staff and new job descriptions, it is important that AMS administrative staff

cooperate closely with the Health Department's personnel office. Some lack of communication and understanding between the two was evident during this study.

RECOMMENDATION 23. Develop better working relations and communications with the Health Department's personnel office and Central Personnel.

RECOMMENDATION 24. Hire a personnel clerk to prepare and follow up the necessary paperwork for creating job descriptions and hiring people. This clerk should be able to relieve existing AMS administrative staff of the burden of such work.

Residency rules create an additional difficulty in hiring people. Policy requires that all city employees live within the city.

9. COMMUNICATIONS

Communication appears to be a problem at several levels. Difficulties exist within the AMS organization, between AMS and other city government agencies, and between AMS and the State of Pennsylvania.

Within AMS, both vertical and lateral communication seems to be a problem. Communication between the Assistant Commissioner and his staff and both the Compliance and Enforcement and the Engineering Division was generally fair. Contact with the Laboratory Division, however, was extremely poor. Although an important part of the total air pollution control effort, the laboratory seems aloof from the rest of AMS. Reporting between the three divisions and the Assistant Commissioner is not uniform or adequate. The staff seems to lack knowledge about program goals and direction; therefore, they do not relate their activities to the goals and objectives of AMS. Although some program planning has been done, it has not been effectively carried out. This is at least partly because of poor communication.

RECOMMENDATION 25. Develop and implement a uniform reporting system.

Lateral communication between the divisions also were not good. This problem was not as evident between sections within the same division, however. Staff meetings for exchange of information have been too infrequent.

RECOMMENDATION 26. Hold frequent and regular staff meetings with AMS.

Proper communication in a large organization cannot be left to chance. Formal information systems are important to ensure that necessary information is available to the proper persons when needed. The details of such systems are discussed in the Information Handling Section of this report.

Communication between AMS and other City government agencies was also strained. This is particularly true of the Office of Administration within the Health Department. This office provides AMS with such vital services as personnel, financial management, and budgeting. Lack of good communication has decreased the amount and quality of such services AMS receives, and has handicapped AMS in getting its own job done. AMS should work to establish better communications and relations with the Health Department's Office of Administration.

An active enforcement policy requires close cooperation and communication between AMS and the Legal Department. This relationship is discussed in more detail in the Legal Section of this report. However, communication between the two departments needs to be improved. Communication to the general public has also been ineffective. This situation is discussed in more detail in this report's Public Information Section.

Communication between AMS and the State of Pennsylvania is limited. To date, it has mainly involved joint studies such as the emission inventory. The State provides little input to AMS program planning. The State could provide useful assistance to AMS in areas such as training, inspection of exhaust control devices, legislative assistance at the State level, specialized laboratory and engineering support, and planning and implementation of control efforts throughout the Philadelphia Air Quality Control Region.

> RECOMMENDATION 27. Work out a set of guidelines with the State defining responsibilities in these areas. This is necessary to avoid duplication of effort.

This problem cannot be solved by AMS alone, but requires a spirit of cooperation by both agencies.

10. PROGRAM PLANNING AND EVALUATION

The City of Philadelphia, through the City Planning Commission, has developed a Planning-Programming-Budgeting System (PPBS). The primary purpose of this system is to obtain the greatest possible effectiveness from the available resources while also providing a means of program evaluation. This program calls for identifying activities and problems, identifying capital and operating expenditures, analyzing problems, setting long- and short-term objectives, and developing a comprehensive program plan along with alternate methods of operation. At present, AMS becomes involved only to the extent of planning the capital budget for municipal incinerators.

AMS does not operate under a PPB System and has not developed an integrated comprehensive package of objectives, plans, programs, budgets, performance actions, evaluation reviews, and modifications. The agency also has not worked out alternatives to reach program objectives or drawn up a list of program priorities. Even the new Code, which is an implicit statement of goals and objectives, was developed by a consultant with relatively little input from AMS. AMS only recently, and after a formal request from APCO through the grants program, developed a clear statement of program goals and objectives.

> RECOMMENDATION 28. Develop formal procedures for quantifying problems, examining alternatives, identifying resources, setting priorities, and evaluation effectiveness.

Lack of staff has generally prevented AMS from doing formal planning. The planning and evaluation that does take place is done at the division operating level, but is not uniform or coordinated.

> RECOMMENDATION 29. Assign a trained and competent person the responsibility of implementing the appropriate concepts of PPBS. This, by necessity, includes proper attention to planning long- and short-term activities.

Operating memorandum No. 3 describes the only method currently utilized by AMS to measure progress. The goals stated are: (1) reduction and abatement of air pollution and (2) control of nuisances and air pollution hazards. The first goal is measured in "tons of pollution abated," as determined from the Philadelphia emission inventory. The goal for FY '70 is 10 percent abatement of air pollution. There are several reasons why this is a poor evaluation tool to measure program effectiveness:

1. The 10 percent is a blanket figure applied to all pollutants. It does not reflect the relative threat of various pollutants present in the air, the severity of localized pollution problems, the specific sources, or the availability of regulations and technology to control various sources. A more meaningful approach would be to set different goals for each pollutant in terms of air quality requirements. Elimination or reduction of certain

localized problems should also be specific goals with long- and short-term objectives.

2. All abatement actions are reported regardless of plant shutdowns or elimination of sources through urban renewal. This measures a decrease in pollution as a result of external factors rather than program effectiveness. Other changes in source emission brought about by plant expansions, plant relocations, or process changes can produce situations wherein AMS takes credit for results not due its actions.

3. There is no indication that new sources are computed and added to the inventory to show pollution increases.

4. Using sampling data to indicate pollution decreases is inappropriate because results may be affected by variations in weather, sampling and analytical procedures, cyclic source operations, etc.

5. Effectiveness on a month-to-month basis cannot be fairly evaluated. One plant controlled may bias results in any one month.

6. The 10 percent reduction goal does not assist AMS in determining what program elements are ineffective, and in what areas additional resources are needed.

AMS' recent workable program discussed long-range planning and a 10-year air management plan using something like Program Evaluation and Review Technique (PERT) or Critical Path programming techniques. However, personnel shortages have prevented this development. A man responsible for planning, as recommended, should devote part of his time to long-range planning activities.

11. LAND USE PLANNING

Section 3-302 of the Air Management Code gives the Air Pollution Control Board power to set ambient air quality objectives. The Board may promulgate regulations that, among other things, restrict uses of land and establish zoning.

The City Planning Commissioner is responsible for subdivision control, zoning, capital improvement budgeting, and urban renewal. In some of these areas, the Planning Commission and the Air Pollution Control Board have overlapping responsibilities. However, neither body has introduced any environmental criteria into its planning activities.

> RECOMMENDATION 30. Develop environmental criteria for air pollution as measures for providing effective land-use planning and thereby prevent or minimize air pollution and its effects. All responsibilities delegated to the APC Board should be carried out.

It was quite apparent that little or no coordination exists between AMS and the Planning Commission, even though both agencies have some similar responsibilities.

> RECOMMENDATION 31. Develop formal procedures for cooperation between AMS and the Planning Commission as a first step in introducing environmental criteria into land-use planning. AMS should have routine advisory powers and responsibilities on a sign-off basis in the work of the Planning Commission involving potential air pollution.

Planning for the vacant land still left in Philadelphia is an important preventive measure. All such vacant land has the potential of supporting an air pollution source. Preventing such sources is a much easier way of limiting air pollution than controlling them after they are built.

The Air Pollution Control Board has other significant responsibilities that have been neglected. Long-range planning for air pollution control must anticipate social and technological changes as well as the future growth potential of Philadelphia and its regional influences. This includes studies of energy utilization, transportation, waste products, and other materials that substantially affect the air in Philadelphia. These factors should also be taken into account in the development of air quality objectives.

A brief review of the overall regional planning concept revealed that there is no air pollution component on the Delaware Regional Valley Planning Commission. In light of the air quality control region concept, it may be highly desirable for air pollution control agencies to be represented on this Commission.

12. PUBLIC INFORMATION

The goal of the public information program should be to provide a basis for dialogue between AMS and the broadest possible spectrum of the public. Functions of the program should include a transmission of facts, definition of issues, and delineation of actions that AMS will take. Public involvement in key issues such as legislation, regulations, program budgets, and variance hearings is essential. Only a well-informed public will make such involvement beneficial to AMS.

The existing public information program includes:

1. A daily air pollution index.
2. Bi-monthly publications of progress.
3. Meetings with local groups.
4. Public hearings on regulations.

The existing public information program in Philadelphia can be evaluated by determining the attitude of the general public. Recent public outcries concerning air pollution control in the city indicate that there is a lack of information available to the public. Review of the AMS program verifies that the public information program has not been a dynamic, effective part of program operations. Papers have been issued and talks have been given by AMS staff, but this was not truly a public information program designed to effectively inform the public.

The existence of an effective public information program is a necessary part of a comprehensive program operation that qualifies for maintenance support. Over a year ago, Air Management Services issued Operating Memorandum No. 1, which included the development of a public information program. However, a City policy has required that all public information staff work within the City Representative's office. This arrangement did not satisfy the needs of the AMS program, and, finally in April, 1970, an agreement was assigned to the Health Commissioner for Air Management purposes.

While this agreement has given AMS the needed public information specialist to develop a public information program, it has also caused some confusion. It is not clear whether the public information specialist is only on temporary assignment from the City Representative's office or whether the position is permanent within the Health Department. If the public information specialist has only been temporarily assigned to AMS, he could well become confused by orders from both AMS and the City Representative's office, and divided loyalties could result.

RECOMMENDATION 32. Clarify control over the public information specialist position. Ideally, the position should be permanently assigned to the Health Department and placed under the Assistant Commissioner. However, if City policy makes this impossible, a written agreement should be developed between AMS and the City Representative's office. The agreement should state the position's

responsibilities, term of assignment (recommended indefinite), duties, and obligations.

At the present time, a formal public education program does not exist. Activities are being undertaken in piece-meal random fashion.

RECOMMENDATION 33. Develop a comprehensive public information program. It is essential that the goals, objectives, strategies, and procedures be planned before the program actually gets underway.

RECOMMENDATION 34. Make the Assistant Commissioner for AMS more visible to the public and allow him to take a larger role in influencing community opinion through the public information program. Creating and filling the position of Deputy Assistant Commissioner discussed in the Administration Section of this report should give the Assistant Commissioner more time to devote to such activities.

In order for AMS' public information program to be successful, the public information specialist must be knowledgeable in both air pollution control and public relations. While titles are generally not important to positions, in this case it would be helpful to create a special title so personnel without appropriate training in air pollution could be excluded. The title of "Air Pollution Public Information Specialist" should be created for the person employed to do public information work for AMS. This will enable the agency to exclude persons who do not have suitable backgrounds in air pollution control.

The individual presently occupying the public information specialist position has need for general training in the field of air pollution control.

RECOMMENDATION 35. Have the public information specialist receive extensive air pollution training. This should include knowledge of local, State, and Federal regulations; air quality criteria; and the state of the art in technology.

RECOMMENDATION 36. Locate and utilize personnel and materials outside AMS that can aid in developing a public information program. A large amount of such help could be provided by APCO and the State of Pennsylvania.

The public information specialist should be continually aware of AMS policy on all major matters and able to communicate directly with key citizens as well as the mass public.

RECOMMENDATION 37. Involve the public information specialist in the formulation of AMS policy. This will enable him to be knowledgeable in his dealings with the public. Also, it will lead to consideration of public opinion in developing policy.

The need for a technical editor will continue to grow as the demands for public hearings and implementation plans increase. Community participation by the public information specialist is needed now in Philadelphia just to maintain liaison with the many public organizations expressing interest in the air pollution problem. Many of the people could provide valuable advice to the program on a voluntary basis if there was an adequate mechanism, such as an advisory council, established for their participation. There is obviously a great number of non-technical people also who would be willing to contribute time and talent to assist AMS. However, to maintain the interest of such volunteers and to assure them that their efforts are needed and appreciated, direct their efforts and ensure that their comments are considered by the policy makers within the program. Such programs are thus needed to ensure that information flows from the public to the program policy makers as well as from the agency to the public.

RECOMMENDATION 38. Develop lines of communications and programs between AMS and local universities and between the public information specialist and voluntary agencies. The need for a technical editor for reports and public information should be considered.

At present, only 80 percent of the public information specialist's time is spent on this program. Since this is a relatively new program area, and a weak one, it may be advisable to assign an additional full-time person.

The public information program should further be responsible for organizing technical training programs for AMS. Programs to be considered should be for the AMS personnel, legislators, judicial people, boiler operators, and so forth. This will require the information specialist to become aware of training and educational needs throughout Philadelphia by coordination of AMS personnel and researching public opinion. Programs of this nature would assist in furthering the goals and objectives of AMS.

13. ENGINEERING

The first step toward any air pollution control effort must be to identify the air pollution problems that exist, determine the causes and effects, assess the amount of emissions, investigate means of control, and evaluate control efforts. This is fundamentally the mission of the engineering segment of the program.

The engineering operation is established as a division-level activity as are enforcement and laboratory services. The Engineering Division operates autonomously as described in the portion of this report dealing with organization. It is organized into three sections: emission inventory, permit approval, and industrial improvement. Each of the sections is discussed separately with specific recommendations addressed to each.

13.1 Emission Inventory

The emission inventory is a basic air pollution control activity. In conjunction with air quality data, it indicates the degree of emission control needed to achieve air quality goals and helps to establish the priority schedule for abatement action. It should, therefore, be a thoroughly planned, routine, systematic activity.

The first attempt to establish a reasonable estimate of pollutant emissions in Philadelphia was undertaken in 1958. Subsequent inventories were made during the years 1965 through 1969 by the National Air Pollution Control Administration, the Regional Conference of Elected Officials, and the City of Philadelphia. Basically, five pollutant parameters were considered: oxides of sulfur, oxides of nitrogen, organics, carbon monoxide, and particulates. The information required to calculate the emissions was obtained by the following methods: personal contact and surveys, published data, special census data, and questionnaires mailed to industrial and commercial locations in the City.

The latest inventory of industrial emissions is presently being conducted by the City of Philadelphia in conjunction with the State of Pennsylvania. This project is in the preliminary stages, with only the mailing phase completed. In order that the operation be as informative and credible as possible, the agency should develop and formalize procedures for follow-up, including plant surveys and stack tests, while also creating a system to constantly update emission estimates.

RECOMMENDATION 39. Develop specific procedures to follow up questionnaires and data requests not returned to the agency. This would include personal contact, plant surveys, and stack testing.

RECOMMENDATION 40. Develop formalized and effective lines of communication that allow for input from the other city agencies regarding the nature of data requested and methods of data utilization.

One of the uses of the emission inventory data will be in models to develop control strategies. This is required as a part of the Air Quality Control Region implementation plan. The present emission inventory forms will not supply all the necessary information. Specific problems are:

1. The basic forms (process, boiler, and incinerator) do not request any indication of associated control equipment.

2. Process, boiler, and incinerator information forms do not include a request for stack information. This stack information is listed on the collector and emission forms, but this form would probably not be completed unless there is control equipment.

3. An estimate will have to be made by the agency regarding emission from basic equipment. This information could be specifically requested.

RECOMMENDATION 41. Reassess data needs and develop data-gathering forms that will request all needed information regardless of whether there is existing control equipment or not.

Data from an emission inventory should be available for use on a convenient basis. Presently, all emission data are handled manually. The filing system is cumbersome, and updating procedures have not been formalized.

RECOMMENDATION 42. Develop a data storage and retrieval system that will properly assist the staff in emission inventory analysis and reporting. This information system should be coordinated with other AMS systems as discussed in the Data Handling Section of this report.

RECOMMENDATION 43. Familarize the entire staff in the operation and use of the filing system, in order to increase the general availability of this information.

RECOMMENDATION 44. Develop systems and procedures to keep emission figures constantly up to date. This is discussed further in the Enforcement Section of this report.

13.2 Permit Approval

A permit system provides a key mechanism for managing the control operation because the agency must approve construction and operation of new or modified sources of pollution. In this manner, the agency may prevent potential pollution sources or require more stringent controls before a plant is built rather than face the more difficult and expensive task of trying to control a source after it is operating.

The Air Management Code specifies that "no person shall build, erect, install, alter, or replace any article, machine, equipment device," which may be a source of air pollution, "until an air management permit has been obtained for such installation or construction."

AMS requires a potential polluter to have both a permit to construct new equipment and a license to operate an existing source. The approval of construction permits is an established activity, but the agency has only recently begun to issue operating licenses. Both permits and licenses are administered by the Compliance and Enforcement Division.

As part of the permit review procedure, the Engineering Division is called upon by Compliance and Enforcement to review and approve the technical details of plans submitted with the application. If Engineering decides the proposed controls are adequate, the permits will be approved. If not, the application will be returned with recommendations for improvement.

RECOMMENDATION 45. Develop and publish a permit manual that stipulates the type and amount of information required and processing procedures employed.

RECOMMENDATION 46. Standardize the evaluation procedure for reviewing plans.

Engineering's role in the process of granting operating licenses is much less formal. The Division relies upon field inspections by enforcement personnel to inform it about any new installations or alternations. Building permits are another source of such information. Compliance and Enforcement may call upon Engineering when necessary to review any such changes, recommended improvements, and help decide whether or not to grant an operating license. With the recent implementation of the licensing system, the work load in this area will undoubtedly increase

RECOMMENDATION 47. Increase the number of qualified personnel available for plan review.

In addition to serving as a valid control activity, the review of various operations increases the knowledge and expertise of the reviewing engineer.

RECOMMENDATION 48. Require that all engineers in the Division gain experience in evaluating plans and specifications. The reviewing engineer, in conjunction with enforcement, should conduct final inspection and make recommendations for approval or denial.

13.3 Industrial Improvement

The compliance procedures that are developed and implemented by the division are most instrumental in determining the effectiveness of the agency in handling pollution violations. To accomplish this end, the agency has established the Improvement Program Section. Their task is essentially to conduct engineering surveys of industrial operations, define the nature and extent of all air pollution emission, and specify the degree of improvement required to meet acceptable standards. Compliance schedules with target dates for the accomplishment of the needed improvements are then developed with the offenders.

To date, surveys of 15 major polluters in the city have been completed. Acceptable compliance programs have been obtained from 4. The Code establishes timetables and procedures to be followed for the submittal and formalization of improvement programs.

> RECOMMENDATION 49. Develop a specific schedule based on an appropriate priority system for the submittal of improvement plans that will include all the major sources in the City on a staged basis.

This section of the Engineering Division is also responsible for preparation of special technical studies. These studies are undertaken as necessary. One example is development of control procedures for asbestos in both the construction and demolition of buildings.

14. ENFORCEMENT

The fundamental goal of any air pollution control agency is the abatement of air pollution. Although the entire agency is involved in this activity, AMS has given prime responsibility to the Compliance and Enforcement Division. The Division is composed of the Compliance and Surveillance Section and the Enforcement Section. Each section is discussed separately in this report and specific recommendations are addressed to each.

14.1 Compliance and Surveillance Section

For field enforcement purposes, the division has sectioned the City along previously established health department boundaries. Each inspector is responsible for his designated area. These inspectors initially spend 3 days at a Rutgers University-sponsored course to learn the basic elements of smoke reading and the Ringelmann concept. There has been no provision for periodic training or recertification of these inspectors. Such recertification would not only keep the inspector informed of the latest concepts and practices, but also would help him maintain expert qualifications in instances of legal action.

> RECOMMENDATION 50. Require that inspectors receive periodic training in reading visible emissions on at least an annual basis.

Each inspector has at his disposal an automobile with a two-way radio. Communications are handled through the City dispatcher. This system has proved inoperable. The City dispatcher handles all city agencies with the exception of the police and fire departments. The system of referring complaints, sometimes of a technical nature, from the main AMS office to the field inspector through the dispatcher is cumbersome and inefficient.

> RECOMMENDATION 51. Acquire a communications system for the exclusive use of the AMS.

Air pollution detective and enforcement aids such as cameras, binoculars, and hydrocarbon detection devices are not readily available to each inspector. The agency has only four Polaroid camers for inspection use.

> RECOMMENDATION 52. Purchase additional appropriate simple pollutant-detection equipment for all inspectors to use routinely.

All complaints are received at the main AMS office. Questions are answered directly or, if of a more technical nature, referred to a qualified member of the staff. All complaints are recorded immediately. (Filing aspects are treated in the Data Handling Section of this report). This system, except for the communication difficulty mentioned above, appears to operate well. In addition, there is some provision for off-hours complaint-handling and enforcement, but this operation does not seem to be formalized.

RECOMMENDATION 53. Make arrangements for inspectors to receive and investigate complaints expediently beyond the normal working day.

14.2 Enforcement Section

Violations recorded in the field are processed by the Enforcement Section. Three enforcement actions can result: Municipal Court, Order to Comply, and Injunction Action. These procedures are discussed in the Legal Section of this report.

Inasmuch as the initial step in the enforcement procedure is that of the inspector, reports of violations should be as extensive as possible. In this regard, cooperation between the engineering and enforcement divisions should be maintained. A stack-testing team should be available upon request to provide necessary information on source emissions. Also, logging procedures should be streamlined to allow for quick periodic evaluation of the violator's status.

In 1969, 844 violations were cited, and 11,895 investigations made. It has been the agency's goal to eliminate 10 percent of the total pollutant load per year. This goal seems unrealistic. Rather the enforcement process should work on a scheduled source-by-source priority system.

RECOMMENDATION 54. Assign specific objectives and priorities for the control of particular pollutants. Having chosen the desired pollutant levels, the agency's enforcement procedures should be structured accordingly. The AMS should, therefore, develop a formal enforcement plan to achieve the levels, through a systematic and scheduled control effort.

A major new enforcement tool being developed by the agency is the system of licensing. This operation calls for the annual review of each operating source, and a subsequent renewal or refusal of the license based on the review. In order that this activity be most effective, good operating procedures should be developed.

RECOMMENDATION 55. Develop a manual for the administration of the licensing system. (See Appendix E).

RECOMMENDATION 56. Make emission estimates part of plan review and licensing of existing equipment. This will serve as a means to constantly update the emission inventory.

The agency has initiated a program aimed at control of "smokers" on Philadelphia highways. This activity is carried on by the police department. As yet, procedures for follow-up and penalities have not been formalized, and actual abatement has been minimal. In order that this effort be effective, follow up procedures should be developed for the police to ensure compliance. In addition, the city is now studying the possibility of equipping all city-owned vehicles with air pollution control devices. This too, should be pursued and actively encouraged by the AMS.

AMS presently has no provisions for dealing with air pollution emergencies. As discussed in the Legal Section of this report, Regulation V, specifying the requirements of air pollution emergency plans, has been drafted. However, no administrative procedures for implementing this regulation have been developed.

RECOMMENDATION 57. Develop administrative procedures for implementing air pollution warning, alert, and emergency procedures. All persons affected by these plans should be notified in advance of their responsibilities in emergency situations.

15. TECHNICAL SERVICES

The technical services area of the AMS program is, on paper, a part of the Laboratory Division. The functions included are air quality monitoring, laboratory operations, source testing, and instrument calibration.

APCO uses a slightly different breakdown of the program elements included in technical services. These are air monitoring, special studies, data processing, instrument calibration and maintenance, and laboratory operations. Source testing is classified as a part of engineering operations. This breakdown is used in the projections shown in the Manpower Section of this report.

The Laboratory Division is physically located approximately 10 miles from the central office. The remote location is partly responsible for a breakdown in communications between the laboratory and the central office.

> RECOMMENDATION 58. To coordinate efforts, develop program goals, and improve communications, set up scheduled staff meetings on a reasonable frequency to include heads of the Laboratory and other divisions and the Assistant Commissioner for AMS. Refer to Section on Communication.

The physical building is 7888 square feet and includes an instrument shop, Chemical laboratory, air monitoring room, and engineering shop. This facility provides services for the Environmental Health Division of Community Health Services.

It has been difficult to obtain an estimate of manpower involved in technical services area due to conflicting information received from various sections of the agency and the fact that non-air pollution work is being done by laboratory personnel. Depending on who is contacted, the number of people in the Laboratory Division varies from 12 to 21, with no breakdown into the previously mentioned functional elements. In any event, the APCO manpower model has shown a need for 30.4 man-years in the technical services area. This model is discussed in more detail in the Manpower Section of this report.

> RECOMMENDATION 59. Recruit and assign additional manpower to program functions as shown in the Technical Services portion of Table 8-2. This table is a summary of estimated future manpower needs for the agency.

15.1 Air Monitoring

The existing air monitoring in Philadelphia is primarily of a static nature, i.e., samples yeild long-term integrated averages giving primarily annual information. This static network is comprised of 44 stations with dustfall buckets and lead candles. These stations are located to provide uniform geographic coverage of the area.

This is supplemented by an intermediate station network consisting of either three or four high-volume samplers, depending on whose description of technical services one reads.

There is also a continuous station network of four stations with continuous samplers for monitoring total oxidant, sulfur dioxide, carbon monoxide, total hydrocarbons, nitrogen dioxide, and nitrogen oxide. AMS also used three, five, or six paper tape samplers, depending again on the source of information.

AMS is proposing no addition to its static or intermediate monitoring networks. However, extensive changes have been planned for the continuous network. Data from the existing four stations will be telemetered to a central processor. This addition of six more continuous stations, also with telemetering, has been approved. The proposed expanded air monitoring network is discussed in more detail in Appendix A.

APCO has developed guidelines for determining the number of various types of stations required as a function of the size of the metropolitan area. The guidelines are included in Appendix B. They recommend that for every continuous station there should be three to five intermittent stations, and for each intermittent station, one to one and a half static stations.

AMS is already committed to a network of ten continuous stations, which, according to the guidelines, is high for an area of Philadelphia's size. However, with this number already fixed, the air monitoring network should also have 30 intermittent and 45 static stations to be well balanced.

> RECOMMENDATION 60. Increase the number of intermittent sampling stations consisting of high-volume samplers and 24-hour gas bubblers to more closely correspond with APCO's guidelines in accordance with data needs.

Without these additional intermittent stations, AMS will be trying to go directly from an essentially static to a fully automated monitoring network. Lack of a well-developed intermediate network is not the most orderly and logical way to develop an air monitoring network.

> RECOMMENDATION 61. Limit the telemetered continuous monitoring network to the ten stations for which money has already been committed. The proposed additional six stations should not be considered or added at this time.

The selection of station sites is not easy to describe in a general way. Station locations would be more meaningful if chosen on the basis of past air quality data, isopleth maps from diffusion models, emission sensity, population density, and geographic and meteorological parameters.

Uniformly placed stations are not necessarily the best way to achieve the most meaningful results. Statistical techniques are available that take physical factors into account but still place stations randomly in order to achieve statistically reliable results.

RECOMMENDATION 62. Re-design station locations to take into account population and emission patterns. Statistical techniques should be used to locate the stations.

15.2 Laboratory

Under the present system, high-volume samplers are collected from three or four stations 7 days a week and analyzed in the laboratory. The analyses performed are atomic absorption for total weight; trace metals including copper, nickel, manganese, lead, and iron; and sulfate. Since the Air Management Laboratory also provides services for the Environmental Health Division of Community Health Services, one-half of the high-volume filters are used to make radiological measurements.

This use of one-half of every filter seems to be more than enough to provide information on a background type of contaminant and could be reduced to one-half filter per station once or twice per week. That would leave some portion of the high-volume sampler available for futher air pollution related analysis.

RECOMMENDATION 63. Perform additional analyses on some high-volume filters. The more common ones are benzene solubles or combustible carbon content, nitrates, chlorides, polynuclear aeromatic hydrocarbons (carcinogens), and metals.

A network of 44 dustfall buckets is analyzed each month. In one written report it states there are two analyses performed on the dustfall samples: total weight and the weight percent of free carbon in the sample. In discussing this with the laboratory personnel, it was indicated that four analyses were being done: dissolved solids, total solids, free carbon, and sulfate.

Analysis of gaseous air pollutants is minimal with only measurements of sulfation by the lead candle technique and the gaseous monitoring of the four continuous stations being done. No manual gas sampling with the NASN bubbler or sequential sampler is being done. It was recommended earlier in the Air Monitoring Section that such sampling be initiated.

We are unable at this time to make comment as to the technical suitability of the chemical analysis procedures currently being used by the laboratory. A request was made for these procedures at the time of the on-site evaluation and several times since then by phone. The fact that they have not been forthcoming can only mean that standard procedures for laboratory analyses are non-existent or are so disorganized that they have not been able to be submitted to us as yet.

RECOMMENDATION 64. Write formal laboratory procedures so that any competent chemist could duplicate the analysis. These procedures should reflect the latest work by APCO in the development of standardized laboratory procedures.

Other laboratory analyses consist of sulfur in fuel analysis and, in conjunction with the Environmental Health Services Operations, radiological measurements of air, water, and milk samples, analysis of urine for aminolevulinic acid as being directly related to the lead exposure of the individual, lead in paint samples and pollen slides.

The laboratory appears to have adequate facilities for most air pollution analyses including atomic absorption, infrared, visible, and ultraviolet spectrophotometry and gas chromatography. The gas chromatograph is not being used currently since no one in the laboratory is an experienced operator.

RECOMMENDATION 65. Recruit a chemist with experience or provide training in the use of a gas chromatography to make use of the existing laboratory equipment.

RECOMMENDATION 66. Implement sampling and analysis procedures to obtain background data on pollutants for which criteria documents are forthcoming. Table 15.1 provides a listing of these pollutants.

15.3 Source Testing

Written information indicates that there are five engineers assigned to stack-testing activities. However, interviews with laboratory personnel indicated that only one man is assigned primarily to stack testing and no team has been designated. Staff must be borrowed from Engineering and Enforcement to run stack tests. No source tests have been run recently due to lack of personnel assigned to this activity.

RECOMMENDATION 67. Establish source-testing teams whose prime responsibility is to support information and enforcement needs.

RECOMMENDATION 68. Initiate a program of scheduled source tests by industrial categories on a priority basis.

RECOMMENDATION 69. Develop written standard procedures for conducting source tests.

RECOMMENDATION 70. Purchase enough source-testing equipment to allow duplicate samples to be obtained without intermittent cleaning of equipment.

Although source testing is usually a part of the engineering activities of an air pollution control program, AMS has assigned it to the Laboratory Division. Source tests are, however, generally requested by the Engineering and Enforcement Divisions, as the information obtained is most useful and necessary in this activity.

Table 15.1

Tentative Order of Publication of Air Quality Criteria Documents

YEAR	POLLUTANTS
*1969	Particulate matter and sulfur oxides
**1970	Carbon monoxide, hydrocarbons, and photochemical oxidants
1971	Fluorides, lead, nitrogen oxides, and polynuclear organics
1972	Asbestos, beryllium, chlorine gas, hydrogen cloride, and odors (including toxicologic and corrosion aspects of hydrogen sulfide)
1973	Arsenic, cadmium, copper, manganese, nickel, vanadium and zinc
1974	Barium, boron, chromium, mercury, selenium
1975	Pesticides and radioactive substances

* Documents are available
**Schedule is firm

RECOMMENDATION 71. Give consideration to reorganizing the placement of this function and assigning source testing to the Engineering rather than the Laboratory Division.

16. METEOROLOGY

AMS is beginning to develop a meteorological component for the program. Although meteorological activity is currently limited to part-time consulting (1 day per week), plans are underway to create a full-time meteorologist position and begin real-time modeling of the atmosphere.

Plans call for the meteorological parameters of wind speed, wind direction, and temperature to be measured in the six new remote telemetered air monitoring stations. Such equipment would be added to the four existing stations, and data from all ten stations would be telemetered every 5 minutes to a real time computer. Also, a teletype would be rented for the reception of air pollution forecasts from ESSA.

The data would be used for several purposes: application of APCO's Air Quality Display Model - AQDM, trace back analyses for source location, investigations into simplified modeling procedures, and better determination of diffusion parameters within the City of Philadelphia.

It is difficult to evaluate these generalized program goals in the absence of specifics. However, APCO meteorologists have offered some comments. One temperature measurement telemetered should be adequate for the stated purpose. Temperature data is necessary only for the calculation of effective stack height; and this value is not overly sensitive to small variations in temperature. The U.S. Weather Bureau Station could be used for this purpose. One U.S. City has found that the expenses for tabulating (no analysis) meteorological data from 8 stations telemetered at 10-minute intervals total $50,000. Philadelphia plans presently to telemeter at least twice this amount of data. This would mean some 800 plus pieces of meteorological data alone would be transmitted daily to the computer from each site.

> RECOMMENDATION 72. Investigate and evaluate the need versus the cost for meteorological data as required by the Air Quality Display Model and hold data collection to a minimum.

The recommendation for a full-time meteorologist is appropriate. However, to enable the meteorologist to spend most of his time on forcasting and the analysis of meteorological data, he should be supplemented by one or two technicians to help handle the massive amounts of data that will be generated.

> RECOMMENDATION 73. Bring a full-time meteorologist and one or two technicians on board to implement the meteorological aspects of the AMS.

> RECOMMENDATION 74. Make some provisions for the Meteorology Section to give meteorological advice on weekends or at night during periods of high pollution potential.

All projected uses for meteorological data involve modeling. The area, however, is quite complex and the problem should be approached carefully. The AQDM is time-consuming and expensive to run, and should be used judiciously with respect to the number of meteorological conditions and control strategies that might be evaluated. The AQDM is not particularly amenable to trace back analysis as it is source oriented rather than receptor oriented. Neither the employment of "simplified modeling procedures" or "better determination of diffusion parameters within the city" has been defined. The latter may prove to be quite expensive if the diffusion parameters must be more exact than those resulting from previous APCO, NOAA and university studies.

RECOMMENDATION 75. Start the modeling portion of the meteorology program slowly and develop expertise in proven methodologies before attempting more sophisticated, costly, and unproven methods of air quality modeling.

17. DATA HANDLING

Air Management Services presently has only limited data-handling activity. Air sampling data is recorded manually in notebooks at the laboratory. Brief monthly summary reports are prepared manually. Because the data are not in machine-readable form, they are not frequently utilized for further analysis. Complaints are processed manually and filed by source. As the work on the emission inventory and license and permit systems are just beginning, no information system presently exist to handle this data.

AMS needs formalized information systems. The IBM 1800 computer can be most effectively used to process the large volumes of data collected by the air monitoring network. However, manual systems may prove effecient in satisfying most other AMS information needs.

> RECOMMENDATION 76. Begin detailed planning for information systems to process, store, and utilize all types of data immediately.
>
> RECOMMENDATION 77. Assign one person within AMS with the responsibility for planning, coordinating, developing, and implementing all AMS information systems. This should be his only job, and other staff members should be assigned to him as necessary.

17.1 Computer Capabilities

An IBM 1800 Computer owned by the City Finance Department is available and will be used as a part of the new air monitoring network. However, there are several potential problems with this machine.

1. The computer must be shared with the Philadelphia General Hospital. It is physically located at the hospital and AMS has no remote access.

2. The system can only read data entered on cards or discs. It has no magnetic tape data-storage capability.

3. The computer at present has only 16,000 bits of core memory.

4. Both the hospital and the air monitoring systems operate in real time with data being received and stored continuously. As presently programmed, however, the computer cannot handle the two real-time systems simultaneously.

The following are recommendations for modifying the computer to make it more responsive to AMS's needs:

RECOMMENDATION 78. Double the core memory capacity of the computer. The additional core capacity is necessary to simultaneously accommodate the two data systems. Magnetic-type-handling capability should be added to the computer system.

RECOMMENDATION 79. Contract with IBM or another competent computer programming firm to reprogram the computer's operating system so it can simultaneously accept real-time data from both the hospital and the air-monitoring systems. This could be accomplished through the Health Department. Better computer access as indicated should be a major effort of AMS in improving its data-handling system.

The computer system lacks a method for cheap storage of large volumes of data in machine readable form. Magnetic tape is the easiest way to achieve this capability. In order to have the system changed to accommodate tape, AMS will have to work with the City Finance Department which owns the computer. Contact with the Finance Department should be made and work begun on this request and its justification as soon as possible. This will ensure that the computer is ready when the monitoring stations are installed.

Computer access is not very good at present. The computer is presently run as a closed shop. That is, programs are left by the users, accumulated and run in batches by the computer operating staff, and returned to the users. A good deal of AMS staff time could be wasted in taking programs to the hospital and waiting for them to be run or returning later to pick them up. Even minor errors will keep a program from running, and considerable time can be wasted while these errors are corrected and the process is repeated. There are several possible ways of improving computer access:

1. Acquire some type of a remote input device such as a teletype or a remote card-reader printer. Details about suitable equipment and its cost can be obtained from IBM or other hardware suppliers.

2. Establish a carrier service between AMS offices and the computer. AMS professional personnel should not waste time carrying programs back and forth to the computer.

3. Establish good relations with the computer personnel. They may be able to make minor corrections, re-run or expedite programs, and do other small favors that will reduce time lost by AMS staff.

17.2 Data Utilization

Air Management Services presently collects very few data and has no systems to make use of it. This situation will change drastically when the telemetered air sampling, network, emission inventory, and permit and license data all begin to come in the near future.

The most pressing need is to begin work on a system to utilize the telemetered air quality data. The network will telemeter air sampling data every minute to a central computer. Present plans call for the computer to receive these data, calculate hourly averages, check for alert criteria, and store the hourly averages on a disc pack. This procedure will completely fill the available space on the disc pack in about 40 days. Every 30 days the accumulated data would be punched on cards for long-term storage and purged from the disc.

RECOMMENDATION 80. Review air quality data needs carefully with the goal of justifying storage of historical daily averages only.

Present plans to store hourly averages resulted from requests from two sources:

1. The APCO SAROAD system.

2. The State of Pennsylvania Division of Air Pollution Control. Data to be sent to APCO for the SAROAD system could be punched out on cards and mailed at short intervals. The State's data needs should be evaluated in detail. It is likely that hourly averages were requested because it was mentioned that such data would be available. Every effort should be made to get the State to agree that daily averages will be sufficient.

RECOMMENDATION 81. Keep historical air quality data in machine-readable form on either disc or magnetic tape. Historical data should not be stored on cards. The amount of data involved would make cards cumbersome, prone to loss or damage, and space consuming.

Some modification to the hardware system will be necessary to implement this recommendation:

1. Disc - If disc is chosen for data storage, a second disc drive unit must be added to the one already existing on the system. A disc data storage pack mounted on the first drive unit would contain the programs and the work area to accumulate totals and do all necessary analysis. Disc packs containing only data would be mounted on the second drive unit. As many disc packs as necessary can be used to store the total volume of data. The cost of a second disc drive is about $8,000.

2. Tape - The least expensive way to store large amounts of data is on magnetic tape. The necessary hardware can be added to the existing system for about $30,000.

The exact cost and technical changes required for either of these approaches will depend on the exact configuration of the existing computer. An IBM representative should be consulted to obtain the necessary details and help decide which approach would be more economical.

Implementation of this recommendation is particularly important if it appears, after careful study, that it will be necessary to store hourly averages. The mass of data required would make card storage unworkable.

Although some thinking has been done about data collection and storage, no detailed work has yet been done on any of the programming that will be necessary to retrieve or analyze the air sampling data.

RECOMMENDATION 82. Begin detailed planning for the data-analysis program at once. In planning the data-analysis programs and reports, careful study should be made to determine the needs of data analysis. Often these will differ from what users say they would like. Only a minimum amount of data should be printed.

RECOMMENDATION 83. Begin work on writing the specifications and actual programs for data analysis. The Water Department has an IBM 1130 Computer that uses the same programming language as the 1800. This computer can be used to test programs until the 1800 is ready to begin processing air pollution data.

RECOMMENDATION 84. Add a computer programmer to the AMS staff. During initial development of the air quality system, he can be assigned to writing some of the data-retrieval and data-analysis programs. This will leave existing staff with more time to plan and coordinate the entire project. Later he would devote much of his time to writing programs for special data-analysis studies. Availability of data for such studies was one of the reasons for development of this system in the first place.

Very little work has been done on information systems for data other than air quality. Each division has been free to develop whatever systems it feels necessary. Some thought has been given to making these systems compatible so they can be incorporated into a total information system in the future. However, no planning or development has been documented.

RECOMMENDATION 85. Begin planning now for development of information systems for emission inventory and permit and license data. This is necessary to facilitate storage and use of the data when it starts to be received in the near future.

The maintenance grant application requires the agency to show actual reduction in emissions achieved each year. To satisfy this requirement, it will be necessary to annually calculate a complete emission inventory.

RECOMMENDATION 86. Design a storage and retrieval system for emission inventory data so that a complete emission inventory for the City can be calculated and periodically updated.

The system for handling complaint data is efficient. Copies of all complaints and the resulting action are filed by source. Monthly reports breaking down the nature of the complaints are their resolution are produced from this data.

RECOMMENDATION 87. Develop a filing system to coordinate data from:

1. Complaints
2. Emission inventory
3. Enforcement actions
4. Permits and license

This will make most effective use of all data collected by the agency. Planning for emission inventory and permit and license information systems recommended above should be directed toward this goal.

APPENDIX A

Proposed Expanded Aerometric Monitoring Network

The attached map illustrates the existing and proposed locations of the Air Management Services Expanded Aerometric Monitoring Network. Existing Continuous Air Monitoring Stations are represented as triangles and lettered A B C D, representing the CAMP Station, Air Management Services Laboratory, Temple University, and Mobile Lab, respectively.

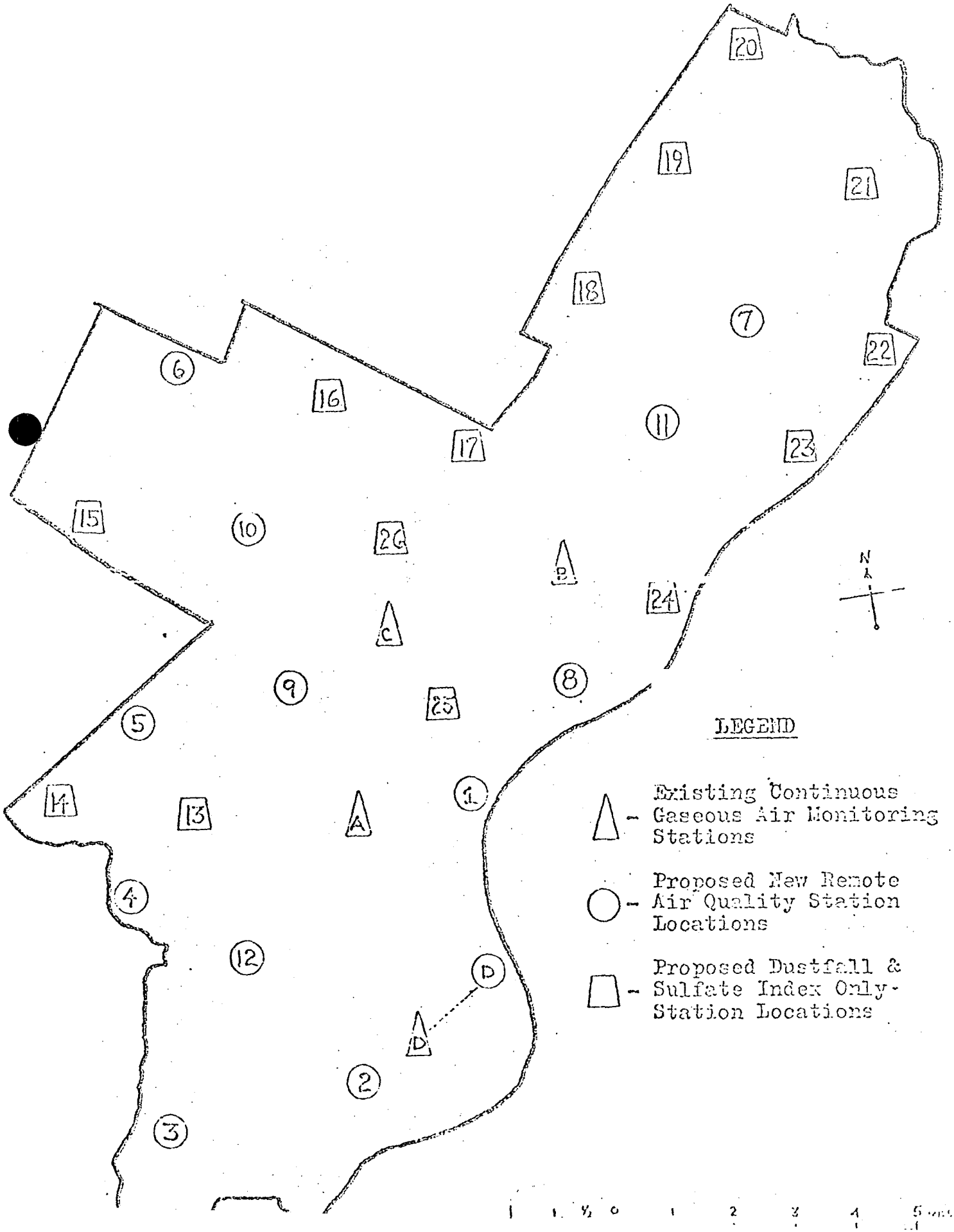
Circle configurations represent planned Continuous Air Monitoring Stations and are numbered 1 through 12, with the exception of one location numbered "D" representing a scheduled transfer location for the Mobile Lab.

Stations 1 through 6 represent the initial six locations to be installed in accordance with the city perimeter configuration already decided upon.

Stations 7 through 10 were selected as the remaining four most desirable locations for installation in fiscal 1970. Finally, locations 11 and 12 are shown to complete the continuous sampling network.

Trapezoids on the map represent 14 static sampling locations for settled dust and sulfate index measurements only. These measurements will be made at each location throughout the entire sampling network, thus at 30 stations.

PROPOSED EXPANDED AEROMETRIC MONITORING NETWORK
CITY OF PHILADELPHIA



Expansion Schedule
Continuous Air Monitoring Locations
City of Philadelphia

Existing	A. CAMP Station - 20th.& Race B. Air Management Services Lab - Castor & Lycoming C. Temple University - Broad & Allegheny D. Mobile Lab - 10th & Pattison -- future location - Food Distribution Center, Delaware & Snyder
Fiscal 1969	1. Delaware Ave. & Spring Garden St. - City incinerator 2. Roosevelt Park - opposite Naval Base 3. George Wolf School - 81st & Brunswick 4. Add B. Anderson School - 60th & Cobbs Creek Pky. 5. Vicinity 54th & City Line 6. Germantown Ave. & Gravers Lane (Pastorius Park)
Fiscal 1970	7. Roosevelt Blvd. - near Pennypack Circle (Baptist Home) 8. Richmond & Allegheny 9. Vicinity Robin Hood Dell - Strawberry Mansion - 33rd & Cumberland 10. Vicinity Wissahickon & Walnut Lane
Fiscal 1971	11. Solis-Cohen School - Bustleton & Tyson 12. Bartram Park - near 56th & Eastwick

In order to get an indication of the requirements in terms of station numbers for a State, Regional, or Municipal Network, we propose the following scheme which is based on the experience of NAPCA and would satisfy the objectives for an average urban area:

Urban Category	Population (1000's)	Number of Stations	
		Type I	Type III
A	25 - 50	1	-
B	50 - 100	2 - 4	-
C	100 - 500	5 - 10	1
D	500 - 1000	11 - 17	1 - 3
E	1000 - 2000	18 - 25	3 - 5
F	2000 - 3000	26 - 30	4 - 6

Urban areas larger than 3 million would necessarily have special guidelines

At the present state-of-the-art there are several common samplers available for use in establishing one or more of the stations listed above. How to establish a good mixture of the various types of samplers is again based somewhat on experience and the area being monitored.

Table I gives a break-out by urban category and station type. This would apply to an average urban area.

TABLE I

Urban Category	TYPE I				TYPE III
	Hi-Vol	Gas Bubbler	Continuous SO_2 (or other)	Short Term Tape Sampler	Continuous Monitors
A	1	1	0	0	0
B	3	2	1	1	0
C	8	4	1	1	0
D	15	8	3	3	1
E	22	12	5	5	3
F	28	16	5	4	4

Type I - Stations which measure area-wide pollutants such as particulates and SO_2. Sample collectors for this type station would include such equipment as Hi-Vol samplers, gas bubbler, a continuous pollutant monitor (e.g., SO_2) and a short term continuous particulate monitor (e.g., short term paper sampler).

Type II - These stations would measure specific secondary pollutants that might be a major pollutant for a given area (e.g. H_2S, F-, HCl, Cl_2, metals, etc.) Sampling equipment for these pollutants would be selected for the specific problem and could be an instrument depending on the state-of-the-art.

Type III - These stations would measure primary "automotive pollutants" such as CO, NO_x, Hydrocarbons, etc. This sampling equipment would probably consist of continuous monitoring type of equipment.

APPENDIX B

AIR QUALITY SURVEILLANCE II

INTRODUCTION

A necessary portion of the Implementation Plan is to design and establish a monitoring program in order to determine ambient air quality within the region. Overall air pollution surveillance includes both surveillance of emissions, as well as actual air quality measurements. This outline is concerned with the design and operation of an air quality monitoring network which is necessary to demonstrate that ambient air quality is progressing toward conforming to or continuing to meet ambient air quality standards. In some of the Air Quality Control Regions a variety of monitoring or sampling networks of varying degrees of sophistication have been in existence for a number of years. These have ranged from static sampling devices, such as dustfall buckets and sulfation candles, to systems composed of continuous air monitoring stations with data being continually telemetered to a central receiving point. Similarly, the degree of coverage has varied from networks having a few stations, if any, to well designed multiple-station networks.

As a result of the requirements of the Clean Air Act as amended and the subsequent regional control of pollution, it will be necessary to rethink and modify as needed the

established objectives, as well as monitoring networks design. With the increasing availability and use of reliable diffusion models, the objectives of air quality monitoring networks, their design and operation can and must be altered to be responsive to this new approach and meet the demands placed upon us by the Clean Air Act as amended. The availability of new and improved instruments, methodology, and data handling procedures now permits a more accurate definition of ambient air quality than ever before. The following are guidelines with respect to the objectives of monitoring, the design of monitoring networks, types of instruments, sampling frequency and data handling procedures. While these guidelines are currently aimed at monitoring for SO_2 and total suspended particulates, the same principles and practices apply to the determination of ambient air quality for other pollutants.

OBJECTIVES OF MONITORING

An air monitoring network for an Air Quality Control Region must be designed and operated so that it is responsive to the following 4 objectives:

Objective 1. The network must be capable of measuring and documenting the region's progress toward meeting the adopted ambient air quality standards.

It is necessary that the existing air quality within an entire Region be known and that it can be compared to the adopted air quality standards. Because of the size of the regions and the extreme geographical variability of air pollution levels, it is not economi-

cally feasible to design a sufficiently large network to adequately characterize regional air quality levels. The practical approach is to provide a limited network supplemented by diffusion modeling for extrapolating the data so that it is possible to estimate or predict existing concentrations of a pollutant throughout a region. If the network is properly designed and operated, this information will permit year-to-year comparisons on trends and in addition provide feedback on adequacy of adopted control strategy. It is important to be able to depict the changes in air quality as a result of changes in emissions from different source types.

Objective 2. To determine the ambient air quality in nonurban areas of the region.

Most, if not all, Air Quality Control Regions contain areas that are not yet developed and where the pollution is minimal. It is an objective of the monitoring program that the air quality in these areas also be known. The measurement of air quality in nonurban areas which typically are in the periphery can provide information on the extent to which sources outside the region affect its air quality. In other words, this gives us information as to ambient air quality upwind as well as downwind from an urban area.

Objective 3. To improve the reliability of diffusion models.

As demonstrated in the preparation of implementation plans as well as the monitoring objectives, diffusion

modeling can be a very important tool in the proper management of regional air resources. Modeling can, when properly supported, adequately characterize existing overall regional air quality. More important perhaps is the use of modeling in predicting future levels of pollutants on both short-term and long-term bases, whether it be in industrial locations, residential areas, Center City, or nonurban areas. The increased dependence upon modeling requires continuing availability of ambient air quality data for validation purposes.

Objective 4. To provide air quality data during air pollution episodes.

It is necessary to provide air quality data rapidly during air pollution episodes. The primary requirement is that the data be available as rapidly as possible to permit taking action under the plan. If the episode plan involves forecasting, concurrent meteorological data will also be needed. The U. S. Weather Bureau (ESSA) can assist with necessary data for the description of local meteorology.

CRITERIA FOR LOCATING MONITORING STATIONS

The placement or location of sampling stations within this limited network must be such that ensuing data can be gainfully employed to meet the four objectives of monitoring. With this in mind, the following criteria are recommended.

Criteria 1. Monitoring stations must be pollution oriented.

It is most important that areas most heavily polluted be identified and monitored. It is in these areas that progress toward meeting ambient air quality standards is most critical..

Criteria 2. Monitoring stations must be population oriented.

A portion of the network must be located according to the population distribution. This is particularly important during times of air pollution alerts and episodes. Such data is also frequently of administrative use in demonstrating concern for the welfare or emotional well-being of the population.

Criteria 3. Sampling stations must be located to provide area-wide representation of ambient air quality.

Data must be representative of the entire Air Quality Control Region. Area-wide data is needed for validation of the model as well as to show conformity to the ambient air quality standards. This includes both developed and undeveloped areas within the region. In the nonurban areas increased consideration should be given to those areas where future land development is anticipated.

Criteria 4. Monitoring stations must be source category and/or source oriented.

The primary purpose of these stations is to provide feedback relative to the effectiveness of the adopted control strategies. For example, a control regulation limiting the emissions from domestic use of heavy fuels

would require that stations be located where the resulting change best can be appraised.

The air quality monitoring network should then be composed of stations reflecting one or more of the above criteria. It should contain stations that are situated primarily to monitor the highest levels in the region, to measure population exposure, to measure the pollution generated by specific classes of sources and to record the nonurban levels of pollution. Also, in order to allow comparisons of present and past air quality data and to permit inter-regional comparisons, a "Center City" station should be located adjacent to the NASN station. In many cases a given station location will be capable in meeting more than one of the listed criteria, i.e. a station located in a densely populated area besides measuring population exposure will also monitor the effectiveness of controls on emissions from domestic space heating if such is part of the overall control strategy.

GUIDELINES FOR DISTRIBUTION OF MONITORING STATIONS

In most Air Quality Control Regions it will take from 15 to 25 stations to furnish an adequate amount of air quality data. In unusual circumstances additional stations may be needed to fulfill the above criteria. Based upon our experience in the past, we recommend the following guidelines for the distribution of air quality stations within the region:

1. Heavily polluted or "dirty" areas - in most cases 3 to 5 stations will suffice
2. Nonurban stations - 2 to 4, depending upon the size of the hinterlands

3. Population oriented stations -- 3 to 7
4. Source oriented stations - 3 to 5
5. Comparison oriented (Center City) stations - 1
6. Remaining, or other necessary stations should be placed where concentration gradient or gradation is greatest as predicted by the diffusion model.

The development of network designs should be based on all available air quality and emissions information. Most notably this will include: (1) past air quality data (2) isopleth maps from diffusion models (3) emission density maps (4) population distribution maps (5) land development maps and (6) topographical and meteorological information.

MONITORING NETWORK

The specifics of monitoring networks are briefly outlined in the next 6 sections. A very important part of network design is the selection of averaging times, sampling frequencies, specific sampler location, as well as data handling.

1. Averaging Times

The types of samples, whether continuous or intermittent, depend upon the primary use of the data. To show compliance with, or progress toward meeting the standards, the sampling equipment must be capable of producing data consistent with the averaging times specified by the ambient air quality standards. For measuring the exposure of population, as well as for emergency episodes, continuous monitoring or data of relatively short

averaging times are required. In contrast, for instance sampling at the nonurban stations can be of a much longer duration.

More specifically, for particulate matter, the basic sampling period is 24 hours, whereas for SO_2, it can range from continuous instruments up to 24-hour integrated samples. Similarly, ambient standards for particulate matter will be in terms of 24-hour values (averages and maximums); the ambient standards for SO_2 may be specified in terms of from 5-minute values to yearly averages.

2. Sensors and Methods

The preferred methods of sampling and analysis are those most commonly in use and for which a large body of data is available (see Criteria Documents). When standard methods become available in the near future, they should be used. The recommended sampling method for suspended particulates is the Hi-Vol sampler which collects total suspended particulates on an 8" x 10" glass fiber filter at the sampling rate of 50 to 55 cfm. For sulfur dioxide, the NAPCA modification of the West-Gaeke method, the flame photometric method, and the gas chromatographic method are all adequate, because they are relatively specific and have been shown to be comparable for continuous monitoring. For 24-hour integrated samplers the modified West-Gaeke procedure is preferred.

3. Sampling Frequency

Twenty-four hour integrated samples should be collected at a frequency of at least twice weekly in order to be

able to adequately predict the maximum concentrations. Days of the week should be randomly selected so that over a period of one year each day would be equally represented.

4. Sampler locations

In the selection of sampling sites consideration should be given to source locations in the immediate vicinity and other parameters that may unduly influence the results. Sampling instruments or ports should be located from 10' to 20' above the street and at least 10' away from the nearest structure. This will result in more accurate measurements by eliminating various interferences.

5. Regional distribution of types of samplers

To meet the previous listed monitoring objectives, the following guidelines for sampler locations are recommended:

a. In the heavily polluted spots, a Hi-Vol sampler, a continuous SO_2 instrument, and an AISI sampler should be located. (The AISI data is useful in air pollution episode situations)

b. Nonurban stations should contain as a minimum a Hi-Vol sampler. In many cases, where it is anticipated that land use will change or it is recognized that a problem of SO_2 may exist, 24-hour bubblers should be utilized.

c. Inasmuch as possible, the population oriented stations should contain a Hi-Vol and a sampler capable of providing short-term averages for SO_2. In populated areas adjacent to major industrial zones, a continuous SO_2 sampler and an AISI tape sampler may be needed.

d. For source category oriented stations a Hi-Vol and bubbler is usually sufficient. Where individual large sources predominate, a continuous SO_2 monitor may be necessary.

e. The comparison oriented, or Center City, station should contain as a minimum a Hi-Vol and a gas bubbler.

f. For other stations, i.e. those to show gradation, a Hi-Vol and bubbler is usually adequate.

6. Other types of monitoring

In addition to the stationary monitoring sites, it frequently may be feasible to operate mobile monitoring stations. Mobile stations with continuous instruments can be used quite advantageously to map urban areas over a short-time period. We also envision that in the future large Air Quality Control Regions may find airborne monitoring expedient. While we are not recommending this type of monitoring, we certainly want to point out the fact that it does exist and may be useful.

DATA PROCESSING AND PRESENTATION

A most important part of the entire monitoring effort is the validation, handling, and analysis of data. It is extremely important that all data be analyzed and be made available quickly and in a standardized format. This means that values are to be expressed in uniform units (metric system) and in useful and systematic averaging periods.

To this end, NAPCA has developed an aerometric data storage and retrieval system (SAROAD). This system can easily be

instituted and modified to fit the particular regional needs. In addition, for the regions that already have their own data systems, it is relatively simple to convert their format into the SAROAD format for entrance into the National Aerometric Data Bank.

The data system and presentation should be flexible and responsive to meet a number of needs ranging from evaluation of data with respect to the standards to providing inputs for diffusion modeling. The system should be capable of producing data in terms of 5-minute, 15-minute, 1-hour, 8-hour, 24-hour, monthly, and yearly averages. In addition, the ability to extract the maximum concentration and develop geometric means for each of these averaging times should be included. The system should also indicate the availability of valid data.

2. NETWORK DESIGN:

a. Definition of a Station

In order to determine how well a network serves the objectives as outlined, it is necessary to define a pollutant sampling station in terms of the criteria standards, pollutants measured and types of collectors used.

(1) The first criteria of a station is that it produce adequate samples so that data can be analyzed.

(2) The second criteria for a station is that it sample major pollutants for which standards are available or for use in producing written standards. We have divided these into three types and are defined as follows:

Type I - Stations which measure area-wide pollutants such as particulates and SO_2 (where SO_2 problems exist). Sample collectors for this type station would include such equipment as Hi-Vol samplers, a gas bubbler, a continuous pollutant monitor (e.g. SO_2) and a short term continuous particulate monitor (e.g. short term tape sampler).

Type II - These stations would measure specific secondary pollutants that might be a major pollutant for a given area (e.g. H_2S, F^-, HCl, Cl_2, metals, etc.). Sampling equipment for these pollutants would be selected for the specific problem and could be any instrument depending on the state-of-the-art.

Type III - These stations would measure primary "automotive pollutants" such as CO, NO_x, Hydrocarbons, etc. This sampling equipment would probably consist

of continuous monitoring type of equipment.

b. Size of Network

The number of stations required and the selection of the site is not an easy plan to describe in a general way. The planning would have to take into consideration many criteria such as, 1.) the population of the area, 2.) the emission sources, and 3.) the meteorological parameters and terrain, etc.

In order to get a figure for what would be required in terms of station numbers for a State, Regional, or Municipal Network, we propose the following scheme which is based on the experience of NAPCA and would satisfy the objectives for an average urban area (See Figure 1).

Urban Category	(1000's) Population	Number of Type I	Type III
A	25 - 50	1	-
B	50 - 100	2 - 4	-
C	100 - 500	5 - 10	1
D	500 - 1000	11 - 17	1 - 3
E	1000 - 2000	18 - 25	3 - 5
F	2000 - 3000	26 - 30	4 - 6

Urban areas larger than 3 million would necessarily have special guidelines

c. Type of Network

At the present state-of-the-art there are several common samplers available for use in establishing one or more of the stations listed above. How to establish a good mixture of the various types of samplers is again based somewhat on experience and the area being monitored.

Table I gives a break-out by urban category and station type. This would apply to an average urban area.

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Urban Category	Hi-vol	Gas Bubbler	Continuous SO_2 (or other)	Short term tape Sampler	Continuous Monitors
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B	3	2	1	1	0
C	8	4	1	1	0
D	15	8	3	3	1
E	22	12	5	5	3
F	28	16	5	5	4

d. Frequency of Sampling

Sampling frequency will depend on the particular objective and applies only to the intermittent stations.

(1) To measure air quality, it is necessary to obtain a sufficient number of samples over a representative number of periods in order to draw valid statistical conclusions. A minimum number would be 103 samples per year with the same number of named days sampled per year. Increasing the frequency by the same rule would obtain a better statistical mean.

(2) To measure air quality for standards comparison would require a greater frequency of measurements and should be confined to selected small areas, (people oriented).

(3) To measure air quality for abatement action could require daily measurements at or around selected sources. This would be based on the judgment and experience of the air pollution agencies.

3. NETWORK OPERATIONAL REQUIREMENTS

a. If a network is to produce valid samples, it requires good equipment, maintenance, and frequent station inspection. This is particularly true for large networks (greater than 5 station). Economically a central maintenance shop with appropriate instrument spares and spare parts should be a part of any large air pollution agency. Instruments require frequent calibration for air flow and frequent inspection for any problems, leaks, etc. that might invalidate the sample. It is frequently impossible to duplicate a particular sample, therefore good performing equipment is necessary. Personnel operating the intermittent samplers must have enough training to know when equipment is not functioning properly.

b. For continuous operating instruments, particularly where data is being obtained continuously, it is mandatory that all of the above be available and more. At the present state of the art in continuous monitoring instruments, specially trained operators must be available at least as a part of every day. If nothing else, a visit should be made daily to check on the overall performance of each individual instrument. Frequent calibration and zero checks must be made. And most important is the type of maintenance service each instrument gets. Personnel servicing these instruments must be electronically oriented and should preferably have some knowledge of chemistry, since quite a few of the pollutants being measured today depend on chemical reactors. If they do not have training in chemistry, it is necessary that they understand the chemistry, physics and engineering principles involved in each measuring instrument.

c. Personnel operating a network should include several different entities and qualifications as follows:

(1) Network Supervisor - University trained in a scientific profession. Should have experience in the Air Pollution field and be able to supervise and train personnel.

(2) Intermittent field operators - Should be High School trained with on-the-job training in instrument operation and maintenance. Must be able to operate independently and in cooperation with urban community dwellers.

(3) Continuous station operators - Should have University training in a scientific field and with some background in chemistry. He should be job trained in instrument operation which would include changing individual componants within a particular instrument and in the calibration of same.

(4) Service personnel for continuous monitoring equipment - They should be University trained in electronics or be graduates of accredited electronic trade schools. They should have thorough on-the-job training in maintenance and trouble-shooting of all instruments and equipment used in the network.

(5) Service personnel, Intermittent operating equipment - Should have some shop experience, particularly in electrical and machine tools. Minimum High School trained and on-the-job training in servicing various network equipment.

(6) Support personnel - Would include shipping, receiving, supply and administrative clerks. Preferably High School trained.

4. LABORATORY SUPPORT

a. Requirements. Accomplishing the objective of lowering the pollutant load on the urban air mass must be done through various abatement procedures. The gathering of facts to support these procedures has to come from some type of analytical support. Thus, a laboratory must be a part of any sample collecting network to provide the physical and chemical data for documentation of the various pollutant concentrations. Although the sophistication of this type of support may vary in different regions of the country, there must be provided the basis equipment and supplies to complete the premise for the reason for the sampling network.

For networks with less than 25 stations, the laboratory may consist of some work space, a semi-microbalance, a small spectrophotometer and necessary chemicals and hardware for wet chemical microanalysis. With provision for a special instrument for a unique pollutant source, if necessary. Large programs within States should have their own central laboratory for making large numbers of routine determinations possible. This reduces the cost per determination to a considerable degree by making it feasible to operate automated systems. Also the central facility should have some capability for doing limited research on applied and localized problems. Some specialized instrumentation should be provided when justified on the basis of the degree of the severity of the entity being measured, its effect on the population and how prevalent the problem might become over the State or Region. Since laboratories are support groups, they should be a staff function.

b. Personnel staffing. Small laboratories may be one-man operations. If so, then a University trained person, preferably in chemistry, should be that one person. Large laboratory facilities should be supervised by a University graduate in Chemistry, preferably with Graduate training. He should be experienced not only in wet chemical techniques, but have extensive knowledge and experience in instrumentation. A degree chemist would be recommended for each 10 technicians doing routine work.

APPENDIX C

BASIC FUNCTIONAL DESCRIPTIONS AND DEFINITIONS FOR MANPOWER ESTIMATES

1. Basic Definitions

For any specific air quality region a number of possibilities exist relative to functional activities performed and combinations of state and local agencies existing or planned.

In addition, the region may be inter-state, compounding the variety of state and local combinations. As a general rule, primary estimates of manpower are made by considering one local agency for each intra-state portion of an AQC Region. Appropriate distribution between state and local agencies is made as a supplement to that estimate. The estimating procedure (Model III) considers a comprehensive control program defined to include the following functions:

A. Management Services

B. Technical Services

C. Enforcement Services

D. Engineering Services

2. Management Services

A. Policy, public relations, inter-governmental relations, and development of control strategies and plans: These functions include the variety of special activities required of an agency director and his immediate staff in order to conduct a meaningful and dynamic control program. As an agency increases in size, specialists, such as system analysts, public relations experts, and technical writers, are required. For small agencies the work is considered a part of the work of major supervisors.

B. Administrative and clerical support: This function includes budgeting, record keeping, filing, typing, and related owrk, as normally required to operate an agency. All clericl staff of the agency are included in this category for ease of tabulation.

C. Legal counsel: In smaller agencies, this function is handled by lawyers not directly included on the agency payroll, although portions of the counsels's salary may be carried on budget statements. In larger agencies, full-time counsels may be assigned to, or employed by, the agency. The man-year commitment is so small, however, that man-year estimates are not made in the model.

D. Staff training and evelopment: This function includes the activities of training officers and supervisors in providing on-the-job or formal group training. Time required for this function increases with high rates of personnel turnover, cumbersome administrative practices, improper job-entry requirements, and other similar factors. Civil service rules and regulations can create unnecessary training problems and/or limit the methods used to provide proper training.

3. Technical Services

A. Laboratory operations: This function includes all laboratory support activities necessary to the conduct of source sampling, ambient air monitoring, and special studies. In most larger agencies, it is a part of direct operations. In some smaller agencies, the function is conducted by a central laboratory in the local health department or by a state agency.

B. Operation of monitoring network: This function relates to the routine servicing and operation of air sampling and meteorological instruments deployed in the field for continuous surveillance of air

quality and diffusion characteristics. The data generated is used as input to diffusion models for prediction of future air quality and the development of control regulations; to determine the effectiveness of agency operation in reducing and/or preventing air pollution; to forecast episode conditions; and for public information and education purposes.

C. Data processing: This function includes data reduction, processing, and statistical treatment for air sampling, meteorology, permit processing, emission calculations, and development of inspection schedules. If automatic data processing equipment is used, the necessary manpower will generally be concentrated in one organizational unit. For estimating purposes, it is considered to be part of technical services.

D. Special studies: This function includes a variety of special studies conducted for purposes of locating sampling stations, determining contribution of specific sources to ambient air pollution levels, and determining need for new regulations. As such, it is an ongoing activity of an agency, the extent of which is determined by administrative decision and general capabilities of the technical services staff.

E. Instrument calibration and maintenance: This function includes those duties that require specialized education, training, or skills to ensure the proper operation of sampling, analytical, and meteorological instruments operated by the agency.

4. Enforcement Services

A. Scheduled inspections for permit renewal: This function relates to the activities required of an air pollution inspector to determine whether all sources of pollution, operating under a permit are in

compliance with the terms of that permit. The function includes travel time, inspection, and report preparation. For this function, an annual inspection is considered a program standard. Inspectors responsible for specific sectors as well as specialized industrial inspectors would be assigned to this function.

B. Complaint handling and field patrol: This function includes the operation of a continuous field patrol to enforce regulations on open burning, visible emissions, odors, etc. Patrol cars and radio communication is assumed; the patrol officers are assumed to be available for immediate response to complaints.

C. Enforcement of episode prevention procedures: During periods when air pollution episodes are occurring or may occur, all agency personnel would be called upon to activate and enforce any procedures that have been established for dealing with such situations. Engineering personnel would concentrate on reducing industrial emissions; field sampling personnel would increase their data-gathering operations; and patrol officers and inspectors would be in the field to insure that emission reduction preocedures were being followed. Thus, essentially all normal activities are intensified or preempted by the emergency. Man-years for this function are not considered in the model.

5. Engineering Services:

A. Source identification and registration: The purpose of this function is to record pollution-producing operations. A variety of mechanisms and degrees of coverage are practiced at present. These fall into three categories: (1) Registration of combustion equipment, often by an agency such as a building department, and general inventory of industrial establishments with air pollution potential: (2) formal registration of sources with the air pollution control agency, with or without information relative to pollutant emission rates; and (3) primary registration by a permit system, with follow-up by inspectors and patrol officers as part of their routine duties. The last approach is used in the model. For new agencies supplemental man-power should be assigned this function for a period of 2 - 3 years.

B. Calculation of emission estimates: This function relates to the work done in estimating emission rates from various sources and source categories to provide information on compliance with agencies rules and regulations, program effectiveness, potential future problems within an agency's area of jurisdiction, location of sampling stations, and need for new regulations. It is an engineering job requiring an initially high expenditure of manpower. For new equipment, the job is associated with the permit system. Estimates provided by the model are related to an on-going activity; they should be increased for the initial years of a new agency.

C. Permit System: This function covers all the work involved in reviewing plans for potential new sources of air pollution; estimating emissions by calculations; consultation with builder, owner and/or other interested parties to effect changes, where necessary; making inspections to insure that what is done conforms to the plans; and appearing before

hearing boards to substantiate findings. It is assumed that permits are issued to prevent pollution in a comprehensive manner; and that the system includes an authority to construct and a permit to operate.

D. Development of control regulations, preparation of technical reports on control and review of industrial control plan for episodes: Assignments in these areas are generally project-oriented or considered part-time responsibilities of the engineering staff.

E. Source Testing: This function relates to the determination of point source compliance with the agencies rules and regulations as well as confirmation of calculation of emission estimates.

6. Manpower Estimates:

Man years for each function are estimated by multiplying predictor and manpower factors for each function, as indicated below.

PREDICTORS AND MANPOWER FACTORS-MODEL III

		Predictor	Manpower Factor
1.	Operation of Monitoring Network		
2.	Schedule Inspection-fuel use	Original input required (see separate sheet)	
3.	Schedule Inspection-industry		
4.	Complaints and field patrol		
5.	Permit system		
6.	Policy, P/R Strategies, etc.	MY 1,2,3,4,5	0.22
7.	Staff training	MY 1,2,3,4,5	0.12
8.	Special field studies	MY 1,2,3,4,5	0.06
9.	Emission estimates	MY 1,2,3,4,5	0.05
10.	Eng. Repts; Tech. Aspects of new legislation, etc.	MY 1,2,3,4,5	0.06
11.	Admin. and clerical support	MY 1,2,3,4,5 .	See separate sheet .51
12.	Data processing	MY 1,2,3,4,5	0.09
13..	Source Testing	MY 2,3,5	0.10
14.	Lab. operations	MY 1,8,13	0.35
15.	Instr. calibration and maintenance	MY 1,8	0.25

1. Operation of Monitoring Network.

A. If monitoring network is known (actual or estimated) then estimate man-years directly.

B. If monitoring network is not known, but proposed number of stations is available the following factors can be applied.

(1) 0.5 MY per CAMP station.

(2) 0.1 MY per manual sensor in operation, neglecting static devices (dustfall, Pb candles, etc.).

C. For unknown situations use:

$$\left(\frac{\text{Area}}{1{,}000}\right)^{1/3} \times \frac{(\text{Number of manufacturing establishments})}{1{,}000} \times 0.8$$

2. Schedules Inspections - Fuel use.

A. Basic predictor is number of boilers (residual oil and coal fired) and incinerators (known or estimated). If this is known, then Man-Years =

$$0.5 \times \frac{\text{Number of boilers and incinerators}}{1{,}000}$$

3. Scheduled Inspections - Industry.

A. Obtain total number manufacturing establsihments from 1963 Census of Manufactures or other reference:

(1) Manpower Factor = 2.0 MY/1,000 establishments.

B. If number of boilers cannot be estimated for 2, above, then use:

MF = 2.8 MY/1,000 establishments

for total My to inspect boilers, refuse, and industry.

C. All of above assume annual inspection; modify as needed for other schedule.

4. Complaint handling and Field Patrol.

The predictor used Model III is $\frac{\text{Total Population.}}{100,000}$ Staff size is increased for areas requiring extensive speace heating:

(1) Less than 3,000 degree days - use 0.3 MY/ 100,000 population.

(2) From 3001 to 4991 degree days - use 0.7 MY/ 100,000

(3) Over 5,000 degree days - use 1.0 MY/ 100,000 population.

5. Permit System

A. Predictor chosen relates to "Capital expenditures for new plants," 1963 Census of Manufacturers.

B. Estimated Man-Years provides sufficient manpower to maintain an intensive system for variety of regulations and comprehensive pollution prevention.

C. For agencies in growth, a time schedule is needed for acquisition of staff.

D. Manpower factor = $\frac{9.7 \text{ MY}/\$100,000,000}{\text{Capital Exp.}}$

6 thru 10

A. Functions in this group are considered discretionary; that is Agency Director can increase or decrease effort based on his preference and/or judgement.

B. Manpower factors represent general allocations.

C. The predictor is the sum of the man-years for functions 1 thru 5. This is basically the same as assuming some percent of total agency man-years.

11. Administration and Clerical Support

A. The predictor is sum of man-years in functions 1 thru 5. The estimated man-years include portions of supervisors time.

B. For agencies doing the bulk of their own budgeting, bookkeeping, and other administrative chores, use man-power factor of 0.59 MY/MY.

C. For agencies that receive administrative support from other segments of apparent organization use man-power factor of 0.4 MY/MY.

INPUT CHARACTERISTICS USED FOR THE CITY OF PHILADELPHIA

1.	Population -	2,040,000 (1960 data)
2.	Area -	127 sq. miles
3.	Manufacturing establishments -	4,618
4.	Capital Expenditures -	$1.22 x 100,000,000

PREDICTORS AND MANPOWER FACTORS

		Predictor	Man-power Factor	Man-Year
1.	Operation of Monitoring Network -	known.		9.0
2.	Schedule Inspection - fuel use	2.8	4.614	13.0
3.	Schedule Inspection - industry			
4.	Complaints and Field patrol	1.0	20.4	11.8
				54.2
6.	Policy, P/R, Strategies, etc.	54.2	.22	11.9
7.	Staff training	54.2	.12	6.5
8.	Special field studies	54.2	.06	3.3
9.	Emission estimates	54.2	.05	2.7
10.	Eng. Reports, new legislation	54.2	.06	3.3
11.	Administrative and clerical	54.2	.59	32.0
12.	Data Processing	54.2	.09	4.9
13.	Source testing	24.8	.10	2.5
14..	Lab operations	14.8	.35	5.2
15..	Instrument calibration	12.3	.25	3.1

APPENDIX D

ADMINISTRATIVE STAFF SUPPORT

Administrative

Functions - procurement, personnel matters, reporting, contracting, annual budgeting.

Personnel - 5.0

Project Management

Functions - new projects, scheduling, other projects, surveillance.

Personnel - 4.0

Planning - Short Range and Long Range

Functions - goal accomplishment, ongoing surveillance, establishing long range goals 5-8 yrs., cost-effectiveness studies, priority setting, budget preparation, evaluation.

Personnel - 1.0

Information Management

Functions - management information, data management (automation and management), form development.

Personnel - 1.0

Training Function

Functions - continuing training programs, long range personal development.

Personnel - 0

Public Information

Functions - identify public needs, reporting program progress, position papers development, press conferences, public participation, disseminating information.

Personnel -.8

Air Quality Personnel - Technical Developments

Functions - study of new developments and agency requirements, surveillance of technical progress, program review.

Personnel - .5

Other Support Elements - added from time to time as the need develops.

ENGINEERING DIVISION

Industrial Improvement Program

Functions - a. plant improvement progress

b. sending survey teams

c. identify each individual source

d. potential contribution to pollution load

e. actual contribution

f. recommendations for reduction

g. developing compliance plans

Personnel - 3.0

Permit Approval

Functions - a. review all plans

b. recommend issuance of installation permit to Liscences and Inspection

c. keep abreast of new control methods, and recommend to appropriate sources

Personnel - 1.0

Emission Inventory

Functions - a. identify and catalogue all air pollution sources

Personnel - 1.5

COMPLIANCE AND ENFORCEMENT DIVISION

Compliance and Surveillance Section

Functions - a. inspection of all assigned emission sources

b. 24-hour surveillance of city and investigate all variations

c. answering and investigating all complaints

d. checking for compliance with installation permits

e. monitoring of all improvement programs

f. inspections for annual liscensing

g. response to emergency and disaster situations

h. 20,000 pieces of equipment will be inspected on an annual basis

i. within two years certification of 40,000 pieces of equipment is expected

Personnel - 1 PHE III, 1 PHE II, 3 APC inspection supervisors, 18 APC inspectors (23 budgeted for), 2 clerk typist I, 1 clerk steno I.

Enforcement Section

Functions - investigating and preparing all violations requiring:

office conferences

municipal court action

orders

liscense and revocation

sealing of equipment

injunctive action

Development and direction of specific projects to implement new programs for incineration upgrading of 1000 incinerators sulfur in fuel requirements.

Personnel - 1 PHE III, 1 Enforcement Specialist, 1 lawyer (consultant), 2 APC inspectors, 2 clerk typists I, 1 clerk steno I.

LABORATORY DIVISION

Analysis Section

Function - a. taking samples

b. laboratory tests

c. telemetry responsibilities

d. provide sampling data

e. provide reports

f. operation of all monitoring stations

Personnel - 2.0

Field Operations Section

Function - provide source sampling teams, conduct source samples

Personnel - 1.0

APPENDIX E

ADMINISTRATION OF A PERMIT SYSTEM

By:

Robert G. Luncheon
Eric E. Lemke
Julien A. Verssemon

Paper 68-112

Presented at the
Air Pollution Control Association
61st Annual Meeting
St. Paul Hilton Hotel, St. Paul, Minnesota

June 26, 1968

Annual Meeting
Paper #68-112

ADMINISTRATION OF A PERMIT SYSTEM

By

Robert G. Lunche
Eric E. Lemke
Julien A. Verssen

ABSTRACT

In June 1947, the California Legislature enacted into law a bill which authorized counties experiencing air pollution to activate air pollution control districts. The law provided a district with the privilege and necessary powers for administering a two-step permit system requiring first, an authorization to construct prior to installation and secondly, a permit for operation. By October 1947, the Los Angeles County Air Pollution Control District was activated and rules and procedures were adopted to ensure a satisfactory operation of its air pollution control program. These rules established: types of equipment for which permits are required; standards for granting applications; prohibitions for emissions, equipment and fuels; and procedures for appealing District decisions or petitioning for variances before the Hearing Board.

Administration of the permit system is in the hands of professionally trained engineers. They are responsible for evaluating applications for permits, making calculations necessary for determining probability of equipment compliance with air pollution laws, and making the decisions on the approval or denial of permits. Consistency of treatment for all applicants is sought and has resulted in standardized application forms, permit information forms, instruction forms and processing techniques. Rather than require a separate application and permit for each individual equipment item, a concept of "permit units" is employed which involves grouping equipment items operating as a functional unit into one application and one permit.

Administration of a permit system has been beneficial to Los Angeles County. The permit system has proved to be one of the most effective tools in reducing air pollution from stationary pollution sources. It not only prevents operation of equipment which emit air contaminants in excess of that allowed by law, but prevents the installation or construction of such equipment. This latter facet also conserves money for the applicant because he does not have to make expenditures for equipment until a fair certainty exists that a permit to operate can be obtained. Thus, the applicant is able to make needed changes on a drawing rather than more expensive changes to the physical plant. Dependence on unreliable voluntary cooperation is replaced by a more certain system which places the same requirements on all applicants.

ADMINISTRATION OF A PERMIT SYSTEM[a)]

By

R.G.Lunche[b)], E.E.Lemke[c)], J.A.Verssen[d)]

INTRODUCTION

Following the initial appearances of photochemical smog in Los Angeles during World War II and its subsequent increase in severity, an aroused public demanded abatement action. The response was a bill drafted by the County Counsel of Los Angeles and submitted to the California Legislature. Despite strong opposition by certain segments of industry, the bill was enacted into law in June 1947. The purpose of the bill was to enable any California county suffering from air pollution to establish an air pollution control district with the responsibility for cleaning the air in that county. The first California air pollution control district was activated by and for Los Angeles County in October 1947.

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a) Presented at the 61st Annual Meeting of the Air Pollution Control Association, St.Paul, Minnesota, June 1968.

b) Director of Engineering, Los Angeles County APCD.

c) Principal Engineer, Los Angeles County APCD.

d) Air Pollution Engineer, Los Angeles County APCD.

State Law

An important feature of the new State Law was the provision for administering a permit system. This provision allows a district to require permits prior to building, altering, replacing, selling, renting, or using, with some exceptions, of all contaminant emitting equipment. The State Law also delegated to a district the right to:

1) require plans to show that the building will be done, and approved equipment will be used, so as to eliminate or reduce contaminant emissions;
2) require the furnishing of such information, analyses, plans or specifications as will disclose the nature, extent, quantity or degree of contaminants discharged;
3) suspend permits where requested information is not furnished;
4) request the revocation of permits by the Hearing Board;
5) require fees for the issuance of permits; and
6) enact rules and perform acts needed to reduce air pollution and properly administer the district and the permit system.

To facilitate a district in putting a permit system on a firm, enforceable basis, the State Law declared

it a misdemeanor to fail to furnish requested information for a permit, to submit a false statement in connection with a permit, to build or operate without first obtaining a permit, to build or operate with a suspended or revoked permit, or to build or operate contrary to the provisions of a permit.

District Rules

The Los Angeles County Air Pollution Control District opted for a permit system as one of the cornerstones of its air pollution control program. Rules and procedures appropriate to that option, and in harmony with the State Law, were adopted by the District and have produced a permit system that is workable and effective in reducing air pollution. These rules and procedures have been modified over the years as found necessary through working experience.

Presently, these rules prescribe that an Authority to Construct be obtained prior to construction, alteration or replacement of any equipment capable of emitting or controlling air contaminants. Also a Permit to Operate must be obtained prior to operation or use on a full-time or permanent basis of any equipment capable of emitting or controlling air contaminants. The procedure employed with a Permit to Operate allows the equipment to be placed in operation for "debugging" and demonstration purposes before the decision to grant or deny the Permit to Operate

is made. Once granted, an Authority to Construct or Permit to Operate is not transferable from one location to another, from one person to another, or to other equipment.

Not all equipment emitting air contaminants falls within the purview of the permit system. Another rule describes equipment exempted from the permit system by the State Law, notably vehicles, or exempted by the District because the nature or amount of pollution from such equipment does not justify its inclusion under the permit system. However, this equipment must be operated in compliance with emission standards.

To facilitate the aim of consistent treatment, applicants for Authorities to Construct and Permits to Operate must file applications with the necessary information as prescribed by the District. Since plans to construct or operate may be changed or discarded, Authorities to Construct expire after 2 years and applications are canceled. In the case of an application for a Permit to Operate existing equipment, as occurs during change of ownership, the application is canceled after 2 years. The applicant may reapply for the Authority to Construct or Permit to Operate when plans to proceed are revived.

In certain installations, sampling and testing of the effluent must be conducted. One of the adopted rules requires that sampling and testing facilities be provided and maintained as specified in the Authority to Construct or Permit to Operate. When equipment is not shown to be

capable of complying with the State Law or District Rules, or when the equipment has not been constructed in accordance with the approved Authority to Construct, the standards for granting applications require that the applications be denied. Instead of denying an application, the District may specify conditions with an Authority to Construct or with a Permit to Operate which will bring the equipment into compliance with air pollution laws. These conditions may be revised upon reapplication and demonstration of complying operation under the revised conditions. When an Authority to Construct or Permit to Operate has been denied, a new application for the same equipment cannot be filed until the reasons given for denial have been corrected. Failure to supply requested information can be used as a basis for denial action.

A series of rules, known as "prohibitions", provide emission or performance standards, specify equipment or fuels for various operations and prohibit certain operations. Included are (1) rules limiting and defining permissible darkness and opacity for a visible emission plume, (2) rules limiting discharge of particulates, dusts and fumes, sulfur compounds, combustion contaminants and organic material from solvent usage, (3) rules specifying acceptable controls for petroleum products, storage tanks, oil-effluent water separators, gasoline loading into tank trucks, tank cars and service station tanks, and rendering cookers, (4) rules specifying sulfur contents of fuels, degree of unsaturation

of motor gasoline and photochemical reactivity status of organic solvents, and (5) rules prohibiting public nuisances, open fires and single chamber incinerators.

PERMIT SYSTEM

Operation of the permit system has contributed significantly to the effectiveness of the District's air pollution control program and the advancement of the "state of the art" of the control of dusts, fumes, smoke, gases and other air contaminants from stationary sources. Before the permit system could make this contribution, however, the framework of State laws and District rules had to be implemented by various administrative policies and procedures. These policies and procedures ranged from interpretations of the laws and instructions for their application, to mechanics of work flow, forms to be used, methods of processing permit applications, wording of permits and equipment to be included on one permit. The need for consistency and uniformity of treatment for all applicants has always been recognized but actual achievement of this goal did not come overnight.

Reinstatement of the fee system in 1957 focused attention particularly on the practice of issuing permits and separating equipment into individual permit applications. Thus was born the "permit unit" concept, which was reviewed for legality by the County Counsel's office and accepted by industry because it brought consistency to the issuance of

permits for similar equipment at different locations. Underlying the acceptance of the permit unit concept by the industrial community is the fact that they know that each applicant must submit the same data and information, follow the same procedures, use the same forms and comply with the same rules and ordinance.

Permit Unit Concept

The basic principle for establishing the boundaries of a permit unit is to include in a permit unit all equipment items which operate together as a functional unit. Amplification of this principle for various situations has been made in a brochure entitled "Administration of the Permit System". This brochure also outlines procedures to be followed in making applications, gives examples of various equipment groupings which comprise permit units, includes an index for equating different equipment groupings to the given examples, and includes instructions and instruction forms for frequently encountered permit units.

In Los Angeles County, "basic" emitting equipment and the "air pollution control" equipment are considered separate permit units under the permit system. Thus, there is no necessity to reprocess the basic equipment each time the control equipment is altered or modified.

Air Pollution Control Equipment

Air pollution control equipment is grouped in permit units by the same principle applied to basic equipment. For example, emissions from a gray iron cupola are passed in series through an afterburner to burn combustibles, a spray chamber to cool the hot gases, and a cloth filter to remove the aerosol emissions. There is no need to issue separate permits for the afterburner, the spray chamber, and the cloth filter when all these units must be operated in unison to control the cupola. Therefore, one permit unit includes the collection and exhaust system as well as the afterburner, water cooler and baghouse.

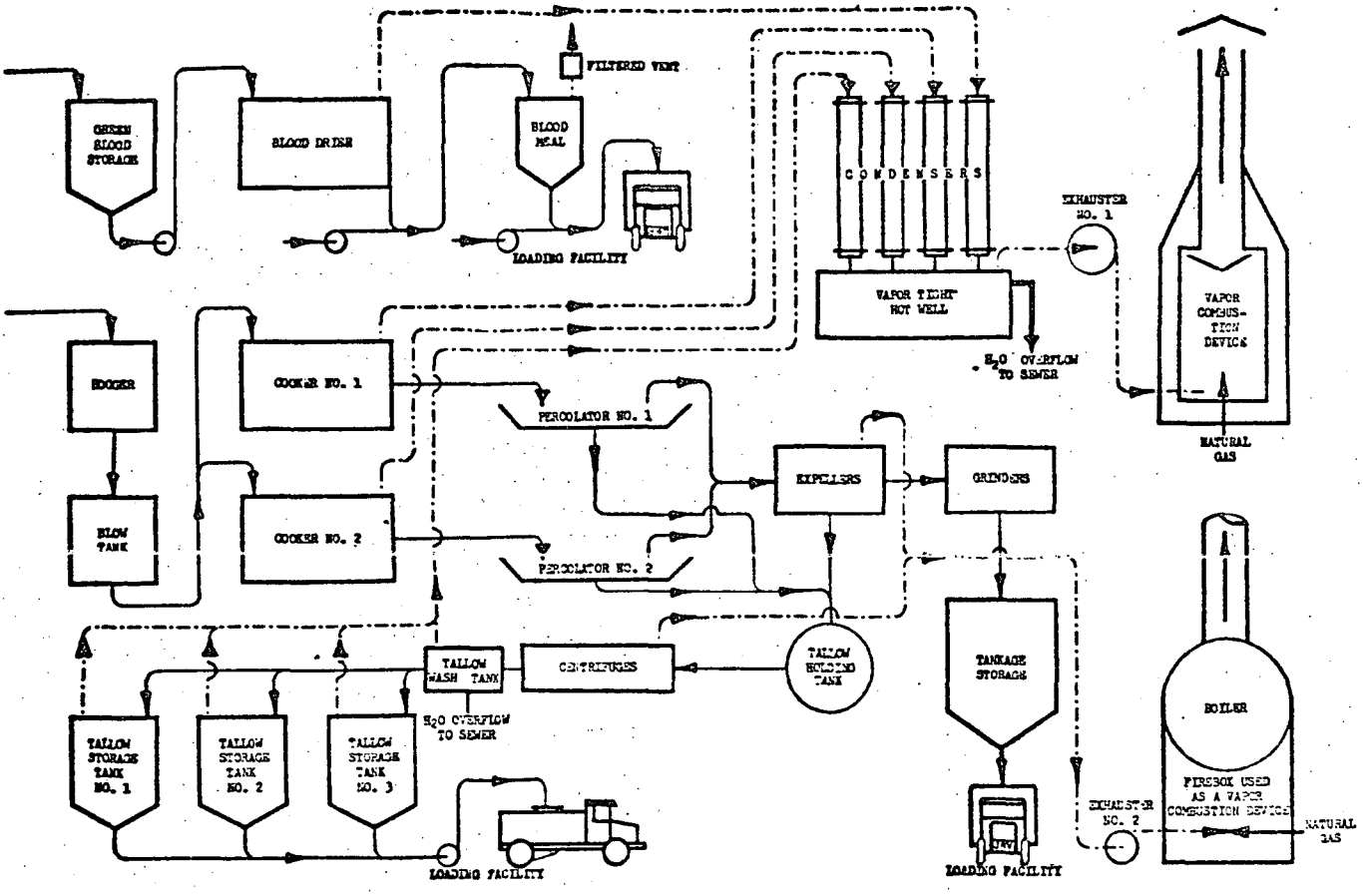
Independent Equipment

The basis for forming a permit unit of one equipment item is the ability of that equipment item to constitute a separate emission source or to operate independently from other equipment within a plant. Examples of independent equipment which can be separate permit units are boilers, metal melting furnaces, galvanizing kettles, cookers, and paint spray booths.

Series Equipment

Real problems of maintaining consistency arise with processes employing a complex of equipment, operated in unison, between the point of feed to the process and the final storage. One need only examine the following typical flow

sheet of a rendering plant to visualize the various groupings of permits which would be possible and the problems which would be encountered.



RENDERING

Remaining consistent from one company to the next is paramount in importance and examples used in the brochure help in reaching that objective. The fundamental principle which applies in the above case is to group such equipment so as to encompass all the equipment employed from the point of initial charging or feed to the point or points where the

material proceeds to a separate process or storage (i.e., classifying to storage, cooking to grinding, etc.).

Obviously, an alternative of issuing one permit per company could have been adopted, that is, a "door-to-door" permit. This, however, would introduce the possibility that considerable numbers of complying equipment in a plant could be denied just because other equipment in the plant were in violation of air pollution laws. It's also equally obvious that two companies would receive different treatment in the event that one employed three process lines while the other employed but one or two. Therefore, the permit unit concept for operating groupings is that of a "common denominator".

Parallel Equipment

Normally, business enterprises add more productive equipment as demand for their product grows. Therefore, whether a company installs several furnaces or spray booths, etc., immediately upon entering business or adds additional units year-by-year, such "parallel" equipment is treated as separate permit units.

Storage Equipment

Grouping storage equipment into permit units is perhaps the most intricate permit unit concept, but, in general, storage equipment is grouped with the source of material it stores. Liquid storage is a major exception where each storage tank is considered a separate permit unit. There are

other exceptions which, although not as significant, are laid down in detail in the brochure on "Administration of the Permit System".

Permit Unit Examples

The various principles used in the grouping of equipment into permit units have been adapted to approximately 50 groupings of the type of equipment more frequently encountered and of more significant air pollution potential. These examples illustrating the permit unit concept indicate the number of permit units involved, the general equipment included, and the basis for fee assessments.

Specialized Instruction Forms

The type of information required by the engineers to properly evaluate the air pollution potential or air pollution control potential of equipment is detailed in specialized instruction forms which are given to every firm or person who must obtain permits. The District has prepared these specialized instruction forms to apprise permit applicants as to the type of information that will be demanded of them or any other applicant applying for similar equipment. These instruction forms cover various categories of equipment and each form is detailed as to the information which must be submitted concerning process description, operating schedules, fuels and burners used, and flow diagrams. Each form also describes how equipment catalogs may be substituted for

drawings. Copies of application forms and several instruction forms are attached as examples of the types of information required.

Mechanics of Work Flow

A Permit Application Receiving Unit has been especially established to assist persons required to submit permit applications and receives all incoming plans, drawings, etc. Here, applications are screened to determine if they are acceptable, or if they are possibly exempt under our exemption rule. Also, assistance is given to potential applicants in preparing their application forms, describing permit unit boundaries and even in providing permit fee estimates.

Now, with the advent of the electronic data processing system, the data presented with each application must be organized into a standardized pattern. The information on the application form is entered into the EDP system routinely so that many different factors may later be retrieved, such as: air contaminant measurements, costs to the community, costs to various industries, types of remedial equipment employed, and all the combinations of this information which will serve as tools to provide intelligent direction of the future air pollution control effort.

Each application is assigned a number chronologically upon receipt. This number is entered on a 3" x 5" card with the applicant's name, address, permit unit (equipment) description, processing status, processing engineer, dates, etc

These 3" x 5" cards are filed alphabetically by company name and can be used for quick answers to simple inquiries about the application or its status. Complete information, of course, is contained within each application due to the policy of thorough documentation.

Personnel Requirements and Duties

The preceding policies are indeed important for administering a permit system that is effective for reducing air pollution but capable, dedicated personnel are equally important. The District has found it essential to employ professionally trained, graduate chemical and mechanical engineers who can apply the rules and procedures along with good engineering principles. Thus, since each application for an Authority to Construct and Permit to Operate is reviewed by an engineer, there can be confidence in the evaluation as to whether the equipment involved will or does comply with all applicable air pollution laws.

The evaluation is accomplished by a review of all the plans and specifications for the equipment, and the process chemistry, process flow and operation details. The engineer calculates or estimates the types and quantities of contaminants generated, emitted and collected by control devices. The contaminant collection system is checked to insure that it is designed and sized properly to collect and transfer the contaminants to a control device. A calculation of

the control device efficiency also is a part of the evaluation. Physical inspection of equipment operation and sampling and analysis of emissions play an important part in the engineer's evaluation.

Based upon his evaluation, an engineer will recommend either approval or denial of the Authority to Construct or Permit to Operate. If the engineer's recommendation passes review of his supervisor without changes, the applicant receives either the Permit to Operate or a letter of denial. In most cases the letter of denial is given after a conference with the applicant, at which the District's action is discussed and explained.

To expedite the processing of applications for Authorities to Construct and Permits to Operate, the Engineering Division has seven application processing units (each specializing in a different variety of equipment), two source testing units, and engineering projects unit, and an application receiving unit for assisting applicants in the filing of applications. Los Angeles County, of course, has a large industrial base so the number of technical persons required to staff the program is necessarily larger than would be the case in smaller communities. Counterparts to our organization in smaller industrial base communities could certainly be scaled down and consolidated to meet the needs of their problem. Consistency in processing applications for specific equipment is maintained by the specialization of the processing units. Exchanges of personnel between processing units widens consistency in pro-

cessing applications for all equipment. Each unit consists of a senior engineer, intermediate engineer and 4 to 6 air pollution engineers so that the exchange of 1 or 2 men at a time is not harmful. The exchange program also creates a ready reserve of flexible, versatile engineers for each unit.

ADVANTAGES OF PERMIT SYSTEM

The permit system as administered under the rules of the Los Angeles County Air Pollution Control District is an example of preventive control of air pollution. As such it has a number of important advantages not only to the citizens of Los Angeles County but also to industry as well.

If the individual proposes to conduct activities likely to create air pollution, he must first obtain a permit, which is granted only after it is established that all required safeguards are present. After a permit is issued, it remains in effect only as long as its conditions are observed.

Advantages to Citizens

The citizens of Los Angeles County benefit because a permit to operate is issued only when the emissions from the equipment involved have been controlled to the standards established by law. Further, an Authority to Construct must be obtained prior to construction, alteration, or replacement of any equipment capable of emitting or controlling air contami-

nants. This safeguard prevents the installation of equipment which will not comply with air pollution laws and avoids the need for long, drawn-out legal procedures to bring existing, violating equipment into compliance.

The permit system enables the District to fulfill its obligations on the basis of information received from processing applications, to inventory the amount of pollution in the air, the sources of air pollution, the reduction that various programs have achieved, and the effect that new programs will have.

The permit system, coupled with a fee system, quite properly, shifts a portion of the cost of the air pollution control program onto the operators of the equipment emitting the air contaminants, rather than making the general county taxpayer bear the entire burden.

Advantages to Industry

Requiring approval by the Air Pollution Control District prior to construction has saved many companies the expense of installing and subsequently replacing inadequate control equipment. The District engineers are experts in the field of air pollution and their experience has qualified them to recognize errors or deficiencies in the design of control equipment. By requiring a pre-construction application for a permit, our engineers can make recommendations which enable the applicant to complete needed changes in the planning and blue-print stages rather than to make higher-priced physical changes at a later

date. District experience has shown that poorly designed or improperly operated air pollution control equipment not only does not achieve the degree of control required, but, may actually increase air pollution problems. The permit system has proved to be the most effective means to avoid such costly mistakes.

Operating under the permit system, industry has complete freedom of choice in the selection of basic equipment. The selection of control equipment, however, is limited to such equipment as has a reasonable chance of successfully eliminating, or reducing to acceptable levels, the air contaminants it is intended to control.

Some critics of the permit system claim that it stifles initiative and the development of new processes. Nothing is further from the truth. In staying at least one pace ahead of the problem, the permit system of the District has produced a great many air pollution control "firsts"(1) during the past twenty years. Far from discouraging inventiveness, the records show that necessity to meet the standards guaranteed by the permit system has fostered ingenuity within fundamentally sound engineering principles.

There is a more recent and highly important use of the permit system and its concept of consistent permit unit boundaries. The confirmation of equipment cost through which the industrial community seeks to gain the tax credit or tax relief provided by federal and state legislation for air pollution

control installations can be achieved rapidly through the permit records.

The engineer's evaluations and recommendations are made solely upon the engineering merits of an installation. As such they are not involved with any equities, or advantages, or disadvantages to the residents of the District resulting from requiring compliance or resulting from granting a variance. The State law and the District's rules, however, provide the applicant an opportunity to appeal the District's denial or conditional approval of an authority to construct, permit to operate or permit to sell or rent. A Hearing Board, completely separate from the District, composed of two lawyers and one engineer is provided whose function is to hear evidence from both the petitioner and the District. After considering the evidence and the equities, the Hearing Board renders its decision. It grants some variances to operate in violation of District rules for limited periods of time. This is only done when the petitioner proves to the Hearing Board's satisfaction that he is making diligent efforts to bring the operation into compliance with all District rules. No variance can be granted to continue a nuisance.

Emission Surveys

As mentioned earlier, the permit system provides a ready inventory source of equipment and air contaminants. The latest inventory of all types of air contaminants from stationary sources in Los Angeles County shows that we are preventing 5,560 tons

per day of air contaminants from entering the atmosphere. This means we have achieved control of slightly over 78 per cent of all emissions from stationary sources by use of the permit system. See Table I. By comparison, the control of moving sources in Los Angeles County, without a permit system, prevents only 1,680 tons per day of air contaminants from entering the atmosphere. Thus, the program for the control of moving sources achieves less than 12 per cent control of all emissions from such moving sources.

TABLE I.

INVENTORY OF AIR CONTAMINANTS FROM STATIONARY SOURCES UNDER THE PERMIT SYSTEM IN LOS ANGELES COUNTY, JANUARY 1968

CONTAMINANT	TOTAL POTENTIAL TONS/DAY	CURRENTLY BEING EMITTED TONS/DAY	PREVENTED BY CONTROLS TONS/DAY	PER CENT CONTROL ACHIEVED	MAJOR REMAINING STATIONARY SOURCES
Hydrocarbons & Other Org.Gases	2,100	760	1,340	63.8	Petroleum Industry & Organic Solvent Usag
Aerosols	530	55	475	89.6	Fuel Combustion
Nitrogen Oxides	455	330	125	27.5	Fuel Combustion
Carbon Monoxide	2,130	80	2,050	96.2	Petroleum Industry
Sulfur Dioxide	1,845	275	1,570	85.0	Chemical Industry, Fuel Combustion, Petroleum Industry
TOTAL	7,060	1,500	5,560	78.7	

CONCLUSIONS

Through the administration of the permit system in Los Angeles County, control measures have been applied to such diverse sources and operations as coffee roasters, petroleum refineries, rock crushers, and hot asphalt plants. From the smelting of metals to the painting of manufactured goods, all stationary industrial operations have been brought within the scope of the permit system of the air pollution control program.

The following statistics, illustrating the considerable experience of the District with the administration of a permit system, lend weight to the conclusion that a permit system is workable, feasible and effective in reducing air pollution. The total number of permits issued by the Air Pollution Control District of Los Angeles County since February 1, 1948 is 103,724*. This includes permits issued for new equipment, altered equipment, change of location, and transfer of ownership. The number of permits issued for new basic equipment units now amounts to 71,229*, and these basic equipment units are valued at $1,157,261,300*. The number of permits issued for new control equipment units now amounts to 14,794* and these control equipment units are valued at $141,964,900*. During this same period of time 5,815* permits were denied to both basic and control equipment units.

The following features of the administration of the permit system in Los Angeles County are worthy of emphasis:

* Through February 29, 1968.

1. The permit system prevents the installation, alteration, replacement, or operation of equipment which may emit air contaminants in excess of that allowed by law or of equipment which may not eliminate, reduce or control the issuance of air contaminants to the standards prescribed by law. The permit system accomplishes this by the application of engineering science and does not involve policeman, prosecutors, or courts.

2. The permit system incorporates a list of equipment which is exempt from making application for permit. Experience has shown this equipment to contribute little to air pollution.

3. The permit system, with its pre-construction review of applications by expert air pollution engineers, saves the applicant money by preventing the installation of equipment which cannot be operated if it does not comply with air pollution control laws.

4. The permit system, by means of the Hearing Board, provides an inexpensive legal procedure for appeals and for requests for variances.

5. The permit system, with its provision for fees, shifts some of the burden of an air pollution control district onto those directly responsible for creating the air pollution.

6. The permit system has not stopped the expansion of industry in Los Angeles County.

7. The administration of the permit system for the past twenty years has provided the technical know-how to control most air pollution emissions. In fact, much of the hardware required to control air contaminants can now be bought ready-made off the shelf.

In conclusion, with the permit system, dependence on voluntary efforts by air polluters to reduce their pollution is eliminated. A voluntary control effort is rarely satisfactory in terms of control effectiveness or time required to achieve control. In fact, it has been said that man has only approximately 30 years to establish whether he can remain on this planet or not and voluntary efforts are not likely to meet thattschedule.

Experience has shown that public statements by management proclaiming their policy of controlling pollution from their plants and complying with local air pollution laws are not always put into practice by lower echelons of the company. These lower echelons are concerned with showing a good profit and loss record and are willing to sacrifice or postpone air

pollution control expenditures for that purpose. More than once these lower echelons have made attempts to disguise the facts about an air pollution problem because of the money situation. Recently, plant personnel, less pure than the advertised product of their large corporation, were found stuffing rags into a condenser to pass a permit inspection. If this can happen at a corporation which maintains its own permanent air pollution staff and actively participates in the Air Pollution Control Association, even at this meeting, the need for a thorough review as provided by a permit system becomes evident.

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(1) Lunche, R.G., Lemke, E.E., Weimer, R.L., Verssen, J.A., "Air Pollution Engineering in Los Angeles County", Los Angeles County Air Pollution Control District, July 1966.

STAFF SALARIES
in air pollution control agencies

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Based on the author's nationwide survey of salaries in mid-1967 from 118 state and local APC agencies with 1668 positions, this paper comparatively analyzes the results with pertinent occupations in major national salary surveys by the Bureau of Labor Statistics, National Science Foundation, the National Society of Professional Engineers, and College Placement Council. This baseline comparative investigation indicates agency salaries are significantly lower than pay levels of the competition in today's labor market. These conditions are compounded by the disadvantage of comparatively small organizational size with consequent limitations on individual opportunities for growth and recognition. Salary setting recommendations for jobs unique to government, and other possibilities for coping with the poor competitive situation (for recruiting, retaining and motivating manpower) are presented.

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Are staff salaries for air pollution control agency positions realistic in today's competitive labor market; i.e., can they be expected to attract, retain, and motivate the kinds and quantities of employees needed to meet today's and tomorrow's control agency needs? If not, what are the alternative possibilities?

The questions are examined in terms of prevailing rates of pay for ten key occupations in state and local air pollution control agencies, the attraction of the better college graduates to small organizations with limited growth and promotional opportunities, and the related problem of inadequate supply versus demand for experienced personnel in a relatively new field.

The research data are based on the author's 1967 nationwide survey of regional, state, and local air pollution control agencies. The actual rates of pay received by incumbent employees are summarized and comparatively analyzed with pertinent occupations in major national salary surveys. The scope of this paper precluded in-depth analyses by specific levels of government, locale, size of population served, nature of air pollution problem, political and economic variables, organizational and division of work variables, manpower biographical and behavioral considerations, and a myriad of other related variables.

State and Local Control Agency Employment in National Perspective

The latest United States Bureau of Labor Statistics bulletin[1] provides the following big picture perspective as of 1966. The United States as a whole had almost 64 million employees on non-agricultural payrolls of which almost 11 million were government employees. Compared with major industrial divisions of employment on non-agricultural payrolls, government at all levels employed 17 per cent, well on the way to almost one out of every 5 such employees in the nation. Government ranks third in the following distribution of non-agricultural payrolls:

Manufacturing	30.1
Wholesale and retail trade	20.8
Government	17.0
Service and miscellaneous	14.7
Transportation and public utilities	6.5
Contract construction	5.1
Finance, insurance, and real estate	4.9
Mining	0.9
Total	100.0

The ever-increasing significance of governmental employment, and more particularly state and local government employment, is strikingly documented by the U. S. Bureau of Census data on public employees and payrolls from 1946 to 1966.[2]

At the time of this nationwide study, there were approximately 3000 federal, state, and local air pollution control agency filled positions, approximately two-thirds of which were at the state, regional, and local levels. "Regional" is intermittently referred to in the context of the Air Quality Act of 1967. At the time of the writing of this paper the federal level was engaged in the battle of the budget between the executive and legislative branches with the possibility of a 4 to 6 billion dollar cut in the President's requested Fiscal 1969 budget, most of the cut to be taken reportedly from agencies not involved with the Vietnam War. The immediate future could be quite unclear as to the quantity of additional positions to be filled, because of the major financial impact of federal grants-in-aid on state and local agencies as well as regional efforts called for in the 1967 Air Quality Act; the impact covers all levels of government from federal to local. At the earliest possibility, however, it is realistic to expect the need for additional positions in this relatively new field will be financed and subjected to the tests of the competition for talent: private industrial employers as well as federally financed governmental, educational, and research institutions throughout the country. A cursory look at the National Center for Air Pollution Control's request for 439 new positions for the federal agency's Direct Operations for fiscal year 1969 provides some idea of the quality desired (as reflected in the GS levels) and some of the quantity to be recruited at the earliest possibility, proportionately for the following activities[3]:

Research		161
Control Technology	77	
Criteria and Standards	84	
Abatement and Control		220
Motor Vehicle Control		17
Training		41
Total		439

Seventy of the above positions called for GS-14 and 15

Table I. Average Salaries: Nationwide Study of State and Local Air Pollution Control Agencies, Mid-Year 1967

Occupational Group	Number of Employees	Mean	Median	Middle 50% Range	
				1st Quartile	3rd Quartile
1. Chemical Engineers	73	$11,351	$10,450	$ 8,670	$13,212
2. Mechanical Engineers	24	11,794	11,256	9,950	13,212
3. Sanitary Engineers	20	12,370	12,000	10,500	13,236
4. Miscellaneous Engineers	130	11,836	11,904	10,080	13,265
5. Inspectors	235	8,403	9,120	6,624	9,838
6. Instrument Technicians	83	7,523	8,532	5,900	8,580
7. Meteorologists	6	11,570	11,904	7,800	11,904
8. Chemists	94	9,761	9,408	7,500	11,412
9. Sanitarians	70	7,379	7,800	6,060	8,055
10. Biologists	8	11,161	9,600	8,198	12,336

salaries, [illegible]
and expected salary (minimum-maximum) ranges for such key positions in the Federal Government are as follows (executive levels are GS-16, 17, and 18):

	Present	Authorized (and still expected) Increase, July 1, 1968)*
GS-14	$15,841 – 20,593	$16,946 – 22,031
GS-15	18,401 – 23,921	19,780 – 25,711

Local, State, and Regional Control Agencies Salaries in Comparison with the Competition

Are air pollution control agency salaries realistic in today's competitive labor market? Let us take a look at the results of the nationwide study of state, local, and regional agencies. The comparative analyses are based on broad occupational groups in the control agencies. This method insures promised confidentiality of specific agency and individual employee data. When the field has grown to adequate statistical size and the position classification plans and/or organizational division of work have advanced in development, it may be possible and appropriate to use the key or benchmark job methodology in future salary studies.

One hundred and eighteen local and state air pollution control agencies with 1668 budgeted positions provided compilable responses to questionnaires mailed to all listed in the *1967 Directory of Governmental Air Pollution Control Agencies*,[4] plus others discovered in an exploratory survey of state and local health agencies concerning their future/current plans relative to air pollution control. In addition, reference was made to National Center data on the status of state and local control agencies presented in Hearings before the United States Senate Subcommittee on Air and Water Pollution of the Committee on Public Works[5] in April and May 1967.

The supply of talent might readily meet the demand of unfilled positions in this comparatively small field if it existed in a vacuum; realistically, the national employment distribution and demands (outlined earlier) must be taken into account. Our expanding economy, growing governmental activities (civilian and military), and resulting "full employment" (economists' interpretation of unemployment under four (per cent)) — nationally results in a highly competitive situation. Perhaps the most competitive of all is the engineering profession. Numerically it is the largest among state and local control agencies. The 247 engineers in the author's study represents about 50% of the 1967 statistical universe. Tables I and II almost speak for themselves. Central tendency data for chemical, sanitary, mechanical, and miscellaneous engineers in state and local control agencies are less than the median salary figures provided by the Society of Professional Engineers recently released nationwide survey[6] conducted in 1967. Control agency salaries were found to lag behind the national market figures by $2000 to $5000 per year; when converted to percentages the differentials are even more striking. Control agency engineer's salaries also lag (although the differential is not so great) when compared with city, state, and federal government central tendency data from the Society for Professional Engineers 1967 Survey.

Following the engineers, the next largest state and local control agency occupational group is the inspectors. This is true not only for the writer's study but nationally in terms of total existing positions. The 235 inspectors in Table I represent approximately 50% of the universe. Comparative analyses of the salary data for air pollution control inspectors are difficult. This is true for other occupational groups which are unique to government, i.e., have no comparable counterparts in industry or [illegible]. The generalizations applies to sanitarians, in pollution control Table I) as well as inspectors. Further comments concerning salaries for jobs unique to government, are set forth following the review of salary data for other occupations.

Chemists were the third largest occupational group in this study, approximately 60% of the state and local control agency statistical universe in this occupation group. The comparison of the central tendency salary data with such data from much more extensive surveys by the United States Bureau of Labor Statistics[7] and the National Science Foundation[8] indicates that air pollution control chemists have much in the way of opportunities for higher salaries outside of government. (Tables III, IV, and V.)

Next in quantitative significance in this study was the instrument technicians group in Table I. Continuing to use the broad occupational comparative approach, it is possible to get some idea of the labor market competition by referring to the Bureau of Labor Statistics figures for engineering technicians ranging from the lowest to the highest of their various classification levels (Table III). This comparison places the air pollution control instrument technicians approximately midway in terms of central tendency data, with the exception of the federal government salary ranges going up to GS-9, potentially approaching comparability in growth and promotion possibilities; however, GS-3's starting salary obviously has not proved competitive with average 1967 – 68 industry offers of $6000 to our Associate Degree candidates in Electrical and Electronics Technology at The Pennsylvania State University.[9]

Six meteorologists (about one third of all positions at the state and local levels last year) provided individual pay data for this survey in Table I and their central tendency figures approximated the level found by the National Science Foundation

Engineers income and salary [illegible]

Engineers	Median
By Specialization:	
Chemical Engineers	$16,350
Sanitary Engineers	14,370
Mechanical Engineers	14,440
Miscellaneous Engineers	16,170
By employer:	
Consulting Firms	15,460
Industry	14,510
Public Utilities	13,610
Educational Institutions	16,600
Non-Profit Research	14,140
Federal Government	13,600
City/County Government	12,960
State Government	12,200
By Degree:	
Doctor's (Ph.D.)	19,310
Master's	15,230
All Society Members Reporting	14,310

Source: The National Society of Professional Engineers, survey conducted in 1967 and released March 1968.

* Post APCA Conf. Note: Increases have been made on July 1, 1968.

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tion in its last biennial nationwide survey in 1966 (see Table V) based on salaries of over 6000 meteorologists. The 1968 NSF survey is now in the data collection process in cooperation with various national professional societies.

Similar commentary applies to the salaries of the eight biologists in the state and local air pollution control study, with a mean annual [illegible] figure. Physicians, i.e., M.D.'s in the state and local control agency study were typically public health officers with administrative, part-of-their time responsibility for the air pollution control function within the health agency. There was an inadequate response from physicists, electronic data processing specialists, and public information specialists for purposes of comparative salary interpretations. The highest average salary figure in this study was $14,769 for the management-administrative group based on nineteen respondents in either the director or deputy director position, i.e., number one or number two position in charge of their respective control agencies. Such limited data preclude further comment.

Salaries in the Labor Market for Inexperienced College Graduates-to-Be

With control agency development blossoming with the 1963, 1965, and 1967 Clean Air and Air Quality Acts has come the related problem of inadequate supply versus demand for experienced personnel in a relatively new field, at least relatively new for the majority of air pollution control agencies through-

Table III. Average Salaries for Selected Occupations in Private Industry. United States except Alaska and Hawaii. June 1967 and Percent Increase in Mean Salaries since February - March 1965

Occupation and Class	Number of Employees	Annual Salaries				Percent increase in mean Salaries
		Mean	Median	Middle Range		
				First Quartile	Third Quartile	
Chemists I	2,097	$ 7,590	$ 7,488	$ 6,996	$ 8,220	6.8
Chemists II	3,503	8,482	8,400	7,788	9,048	7.6
Chemists III	8,579	9,719	9,540	8,808	10,392	6.7
Chemists IV	9,677	12,044	11,820	10,680	13,380	5.2
Chemists V	7,831	14,405	14,340	12,900	15,756	4.8
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chemists VII	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chemists VIII	445	24,676	24,000	21,060	27,492	5.9
Engineers I	10,587	8,388	8,400	7,920	8,856	8.0
Engineers II	28,273	9,078	9,000	8,496	9,540	6.9
Engineers III	77,570	10,330	10,224	9,528	11,040	5.6
Engineers IV	105,705	12,424	12,300	11,160	13,500	5.4
Engineers V	65,835	14,523	14,388	12,924	15,840	5.3
Engineers VI	35,674	16,604	16,608	14,748	18,420	4.9
Engineers VII	11,930	19,332	19,284	17,292	21,012	3.5
Engineers VIII	2,955	22,235	21,900	19,632	24,384	2.8
Engineering Technicians I	5,625	5,368	5,400	4,728	5,916	5.2
Engineering Technicians II	15,188	6,305	6,252	5,724	6,768	5.1
Engineering Technicians III	25,375	7,235	7,188	6,588	7,812	3.6
Engineering Technicians IV	28,272	8,318	8,256	7,656	8,880	5.2
Engineering Technicians V	14,927	9,341	9,216	8,592	9,960	4.5

Source: June 1967 National Survey of Professional, Administrative, Technical and Clerical Pay, U. S. Department of Labor, Bureau of Labor Statistics Bulletin 1535, published January 1968.

Table IV. Selected Comparisons of Average Annual Industrial Salaries, June 1967, with Federal Salary Rates under the General Schedule

Occupation and Class	Average annual salaries in private industry	Grade	Salary rates for Federal Employees under the General Schedule									
			Per annum rates and steps									
			1	2	3	4	5	6	7	8	9	10
Engineering technicians I	$ 5,366	GS3	$ 4,466	$ 4,615	$ 4,764	$ 4,913	$ 5,062	$ 5,211	$ 5,360	$ 5,509	$ 5,658	$ 5,807
Chemists I	7,590	GS5	5,565	5,751	5,937	6,123	6,309	6,495	6,681	6,867	7,053	7,239
Engineers I	8,388	GS5										
Engineering technician V	9,341	GS9	8,054	8,323	8,592	8,861	9,130	9,399	9,668	9,937	10,206	10,475
Chemists VII	20,110	GS14	15,841	16,369	16,897	17,425	17,953	18,481	19,009	19,537	20,065	20,593
Engineers VII	19,332	GS14										
Chemists VIII	24,676	GS15	18,404	19,017	19,630	20,243	20,856	21,469	22,082	22,695	23,308	23,921
Engineers VIII	22,235	GS15										

Source: June 1967 National Survey of Professional, Administrative, Technical and Clerical Pay, U. S. Department of Labor, Bureau of Labor Statistics Bulletin 1535, published January 1968.
Note: Under section 5303 of title 5 of the U. S. Code, higher minimum rates (but not exceeding the maximum salary rate prescribed in the General Schedule for the grade or level) and a corresponding new salary range may be established for positions or occupations under certain conditions. The conditions include a finding that the salary rate in private industry are so substantially above the salary rates of the statutory pay schedules as to handicap significantly the Government's recruitment or retention of well-qualified persons. Such special pay scales have been established for specific grades or levels of certain occupations (including engineers and scientists).

out the country. This brings us to another part of the question set forth at the outset, namely, air pollution control salaries in today's competitive labor market for attracting and motivating the better graduating students from our colleges and universities to the comparatively small organizations with comparatively limited growth and promotional opportunities of by the "typical" air pollution control agency.

The College Placement Council Study of 1967 – 68 beginning offers by business and industry[9] is not very encouraging when compared with this nation-wide air pollution control salary study. A young man who is a candidate for a bachelors degree in chemical engineering has been offered on the average $9396 per year. This average exceeds the $8670 per year first quartile in our nationwide study of state and local air pollution control chemical engineers, thus exceeding the lowest 25% of the on-the-job chemical engineers salaries reported. When compared with the $10,450 median figure of air pollution control chemical engineers, the competitive disadvantage is even more striking — the young inexperienced graduating engineers are being offered private industry salaries averaging approximately $1060 less than the top salary in the lower 50% of the air pollution control chemical engineers salaries reported. When further compared with the young inexperienced candidate for a master's degree in chemical engineering being offered an average of $10,872 per year, it is quite evident that air pollution control salaries reported have not been competitive with a first quartile of $8670 and a median of $10,450, both below the average figure offered the young master's degree candidates; in other words, 50% of all reported air pollution control chemical engineering salaries at the state and local levels are exceeded by the average offer to inexperienced master's degree candidates.

Recent offers to inexperienced candidates for a bachelor's degree in chemistry averaged $8748 per year as compared with a first quartile figure in the air pollution control survey of $7800 and a median of $9408. Candidates for master's degrees in chemistry have recent offers averaging $10,320 per year as compared with the median of $9408 almost $1000 above the highest salary among 50% and close to $1000 below the top salary of 75%, i.e., the third quartile.

Since the educational requirements for the beginning sanitarian differ considerably throughout the country, but in many instances require a bachelor's degree not restricted to any particular discipline, it seems conservatively appropriate to compare the average salary recently being offered to bachelor's degree candidates in the humanities and social sciences (the lowest paying of the various educational fields reported). These young graduates have recently been offered an average of $7368 per year as compared to a median of $7000, and a mean of $7379 and a third quartile of $8086 reported by sanitarians in state and local air pollution control assignments. In other words the inexperienced degree candidates are being offered by industry (*a*) higher starting salaries than over 50% of the working sanitarians salaries reported. (*b*) approximately $700 less than the highest salary among 75% of all sanitarians surveyed, and (*c*) approximately the same salary as the average all sanitarians are receiving for the entire gamut of responsibilities including supervisory assignments.

To conclude this bleak outlook for air pollution control recruiting and retention of college graduates, one further comparison of the average offers to master's degree candidates in business administration, industrial management, or commerce is pertinent in light of the need for administrative talent throughout the country. For those receiving the master's degree after receiving a non-technical undergraduate degree, the average annual salary offered is $10,056; for those receiving the master's degree after a technical undergraduate degree, the average offer is $10,800 per year. Since we don't have a comparable occupational group in the air pollution control study direct comparisons are not entirely appropriate. However, it is rather disconcerting to look at the salaries reported by the 19 directors and deputy directors of air pollution control agencies with a first quartile figure of $10,400 and a median of $12,024; the mean of $14,769 and third quartile of $15,252 are presented to conclude this section but not with any claim of statistical worth in light of the very limited sample.

Occupations Unique to Government

As noted above air pollution control inspectors and sanitarians are occupational groups which have in common the problem of being unique to the public service, i.e., with no comparable counterparts in non-governmental organizations. Such occupations have been a long-time problem for governmental salary setting. Much of the concern relates to the prevalent method for (and particularly the legislative implementation of) setting salaries for all jobs in government. The preferred methodology has been and continues to be the use of prevailing community rate surveys. This approach is well illustrated by the United States Bureau of Labor Statistics' *National Survey of Administrative, Technical, and Clerical Pay* referred to throughout this article; in this instance, the federal government's "community" is the nation of competing private industrial employers.

This nationwide community of competition is a realistic one for state and local levels of government competing for scarce manpower resources which cannot be readily recruited in the immediate "community" of the region, state, or locality. The prevailing rate approach to salary setting has contributed much to realistic, competitive levels of compensation for those jurisdictions which have been able to have their findings implemented by annual (in some cases semi-annual) adjustments based on comparative analyses of prevailing community pay data for key or benchmark jobs.

This policy has the disadvantage of merely "catching up with the competition." This means there is a time lag of months (many times extending to years) "after the fact" of surveying, compiling, and analytically applying prevailing pay rates, incorporating resulting pay adjustment recommendations in executive budgetary requests, reviewing these by the legislative body with the purse string power under competing presssure of all other monetary demands at budget setting time (annually in some jurisdictions; biannually in others).

Table V. Median Annual Salaries of Full-Time Employed Civilian Scientists, for Selected Fields and Highest Degree, 1966

Three Selected Scientific and Technical Fields and Highest Degrees	Number of Scientists	Median for Total of all Employers
All Fields	242,703	$12,000
Chemistry	65,917	12,000
Ph.D.		14,000
Professional Medical		15,500
Master's		11,000
Bachelor's		10,500
Less than Bachelor's		10,000
Meteorology	6,283	11,000
Ph.D.		15,000
Professional Medical		—
Master's		12,000
Bachelor's		11,000
Less than Bachelor's		10,000
Biological Sciences	29,633	12,000
Ph.D.		12,000
Professional Medical		12,500
Master's		9,000
Bachelor's		9,000
Less than Bachelor's		9,000

Source: National Register of Scientific and Technical Personnel, National Science Foundation, Washington, D. C. 20550. Summary of American Science Manpower, 1966. N.S.F. 66-9, March 1967.

The above complications are further involved for those particular occupations which have no counterpart in private industry.' This has resulted in a long standing practice of some public jurisdictions more or less "looking in the mirror," i.e., surveying salaries of similar occupations in other governmental jurisdictions. An example would be the surveying of sanitarians pay rates in other public health agencies. It has been observed that this method has "the equally hazardous possible effects of either a stalemate or an unwarranted escalation of rates for all resulting from the actions of a few."[11] In response to the request to "find a better way," the late Louis Kroeger and his associates applied their rich and varied backgrounds to produce a report requested by fellow professionals with the following pertinent conclusions and recommendations considered worthy of extensive quotation here:

We find that to an extent the problem is created by requirements of law that agencies should pay the prevailing rate, without recognizing the problems that creates in the case of those jobs peculiar to public service.

We recommend that these laws be amended to require only that prevailing pay practices be "taken into account" in setting public salaries.

We find that part of the difficulty in interpreting and using any salary data which may be gathered is that in common practice the data are now gathered about all employees, regardless of length of service or other considerations.

We recommend that salary data be gathered only for the hiring rate, since this is the single point at which salaries are a means of competing in the job market.

We find that some of the problem is caused by the widespread use of five-step pay plans, applying the same salary increments to positions of all kinds without regard to inherent differences in their nature.

We recommend serious consideration of a concept first adopted in Hartford, Connecticut, which recognizes more effectively the differing natures of positions by providing varying increments of salary increase at varying times; and which provides separately for treatment of normal growth on the job, seniority and exceptional service.

We find that present practices make no distinction in treatment between non-administrative and administrative positions, although there are considerable differences in the competitive conditions that apply to these two broad categories.

We recommend two completely different methods, as between the non-administrative and the administrative, for determining the salaries of classes peculiar to the public service.

For the non-administrative classes, *we recommend* that salaries be set for classes peculiar to public service in relation to information about hiring rates for all of the occupations in the private labor market to which individuals of comparable training and interests might be attracted. This can establish the public service in a truly competitive position, will make public salaries more directly responsive to current economic conditions, and will overcome the faults we find in the present system.

For administrative classes, *we recommend* that, as a group, they be set in fair relation to all other jobs and that then, within the group, individual classes be related to each other mainly on the basis of responsibility, taking into account the several aspects of responsibility as outlined in this report.[11]

Counter-arguments are presented concerning the next to the last recommendation above. It is contended that salary surveys based on "only the hiring rate" are potentially hazardous and highly volatile if not misleading over relatively short periods of time as the job market changes. Consider private industries' comparatively large amount of discretion, flexibility, and speed in making hiring rate adjustments during individual negotiations. It is entirely possible that public jurisdictions could very well be misled by hiring rates alone, except for certain entrance level positions such as those which are filled by college graduates without experience.

The only other reservation concerns the overly restrictive recommendation for setting salaries for administrative classes on the one basis of fair internal relationships. Add to this the counter wisdom of comparing private industrial prevailing salaries for administrative positions. The aforementioned annual Bureau of Labor Statistics nationwide study has provided the factual bases for applying the so-called "comparability principle" — another term for the prevailing community rates policy; resulting salary adjustment recommendations have produced increasingly more attractive pay levels, both at the entrance hiring rates as well as throughout the rate ranges. The federal government still has a long way to go to catch up with its competition at the executive levels but certainly the noted progress could not have been so realized without the aid of the "comparability principle."

The key distinction to keep in mind is comparability with private industrial rates of pay; when such comparability cannot be established, comparability with other governmental jurisdiction rates can result in an unrealistic if not vicious circle. The recommendations above are therefore worthy of positive support, with the additional recommendation that there be flexible hiring rates and related adjustments authorized during the interim (one to two year) periods between governmental salary setting; the additional flexibility has proven most helpful to major governmental employers, including the federal level.

Findings and Observations

The following briefly summarizes the statistical and related contents presented above:

1. Air pollution control agency employees constitute a miniscule part of the total private as well as governmental employment market in the United States.
2. Government employment as a whole, and particularly the state and local levels, has been growing rapidly during the past 20 years, and is now approaching a ratio of one out of every five non-agricultural employees.
3. Within the governmental labor market, state and local air pollution control agencies are also growing but typically are disadvantaged by reason of small size of organization and comparative potential for employee growth and recognition.
4. With the four to six billion cut in federal funds, immediate future development of plans under the Air Quality Act of 1967 may be seriously handicapped by lack of funds for needed personnel in control agencies at the federal, state, and local levels.
5. Comparisons of central tendency 1967 salary data for state and local air pollution control agency employees with BLS, NSF, and NSPE surveys indicate state and local salaries below the competition in the labor market.
6. Further comparisons with the 1967 – 68 College Placement Council survey of salary offers to inexperienced male candidates for bachelor's and master's degrees resulted in a very discouraging picture for state and local control agency recruiting of competent college graduates; this condition is compounded by the aforementioned disadvantages of limited organizational size.

7. Occupations unique ... in recommendations outlined above, emphasizing (*a*) modified application of the prevailing rates policy along the lines of the Hartford Plan, (*b*) realistic flexibility in hiring rates between governmental annual and biannual salary setting periods, and (*c*) avoidance of the sterile surveys limited only to comparisons of other governmental salaries.

What can be done about the bleak comparative salary situation? The obvious, simple answer is to increase salaries to clearly competitive levels by means summarized in item 7 above. However, the answer is not so simple when the facts of state and local control agency status are reviewed. Typically, such agencies are small subdivisions of health departments with many manpower shortage specialties in long established subdivisions competing for the budgetary dollars. In turn, the health department as a whole usually must compete with other departments for needed shares of the entire jurisdictional budget. This picture is partially modified by earmarked federal grants-in-aid provisions. Salary adjustments are typically late if not last on the agenda of budgetary decision-making, meaning that the remaining funds from anticipated revenues, *et al.*, may be inadequate to meet all needed increases in salaries along with increased numbers of positions. What happens? The salary surveys presented above indicate some cumulative results.

What else has been happening relative to such results? Public service employees have been joining unions, have begun collective bargaining, and (below the federal level) have begun striking in increasing numbers in recent years. The future impact of such organized employee efforts is to some extent foretold by what happened earlier in private industry. Salaries for the organized can be expected to become increasingly competitive, with beneficial side effects to some of the unorganized including administrative and executive salary levels. Other implications are worthy of attention but are beyond the scope of this article.

How can air pollution control agencies expect to interest (initially recruit) needed talents and then maintain the interest on a career basis, in light of the limitations outlined above? Can a national "treasury" of information on trained and experienced manpower be established, maintained, and utilized? Can such talent become part of an intergovernmental career system to cope with high priority control needs and at the same time provide for the growth and recognition offered employees in larger organizations? Can intergovernmental mobility be fostered by intergovernmental retirement systems or alternative plans with the same effect of not penalizing the experienced public servant for moving into new job challenges? Can career development plans in the public service be established comparable to those found in such holding corporations as Standard of Jersey? When will Congress pass needed, related legislation such as the Intergovernmental Personnel Act sponsored for some years by Senator Muskie, and the Intergovernmental Manpower Act formulated under the leadership of U. S. Civil Service Commission Chairman John Macy?

Answers to these questions, and a myriad of related ones, are basic regardless of what a particular salary study may or may not indicate.

The author's salary study of state and local air pollution control agencies is a baseline study; it requires refinement, and coordination with the Federal 1967 baseline study in which there was very little duplication of data. The situation calls for follow-up attention as outlined in the Air Quality Act of 1967. This should be a sophisticated as well as comprehensive report — which realistically faces up to the problem — not mere numbers employed and paid in government, industry, research, and related areas — but an analysis in depth along the lines presented in another paper on the levels of zeroes in pragmatically on comparative progress in differing air pollution communities/areas, conversely on what are the problem areas, and what are the "manpower" causes. "Manpower" is placed in quotes because this refers to the entire spectrum of human elements — (*a*) internal: within the APC agency, within the government agency above the APC agency including executive elected and appointed officials; and (*b*) external: the legislative body, the judiciary, community power structure, news media, and related "manpower" variables.

Application of the PPBS approach to intergovernmental decision-making in pollution control is called for at the earliest possibility — to have positive effect in determining intelligent alternatives in program, budget, and implementation via manpower, equipment, facilities, and incentive systems for polluters to speed up control at the sources of pollution. The 1967 Air Quality Act sets the stage for creative federalism, i.e., spelling out the roles of federal and state levels, with rather tight timetables for states to establish regional standards and implement them. Bold, direct actions may well allocate our citizens money (taxes collected) and radically increased supplemental funds from fines for violations on the basis of results achieved, i.e., not primarily on the basis of repeated extensions of budget and grant "pitches," but upon reduction of pollution at the sources, with obvious consequences for control agencies and polluters. Scarce, highly paid professionals are not needed to measure pollution at the sources; so-called paraprofessionals and subprofessionals requiring comparatively limited education, training, and financial expenditures, can help fill the manpower gap, reduce poverty as well as pollution through the strategy of cross-commitment involving the interaction of two (or more) programs with different but mutually helpful goals.

Acknowledgement

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References

1. U. S. Bureau of Labor Statistics, "Employment and Earnings for States and Areas 1939–66," Bulletin No. 1370-4, p. XVI, Washington, D. C. (1967).
2. U. S. Bureau of the Census, "Chart Book on Governmental Finances and Employment: 1967," GF No. 15, p. 32, Washington, D. C. (1967).
3. National Center for Air Pollution Control, U.S.P.H.S. Fiscal Year 1969 budget request, p. 94, Washington, D. C. (1968).
4. "1967 Directory: Governmental Air Pollution Agencies," Air Pollution Control Association and National Center for Air Pollution Control, U.S.P.H.S., Pittsburgh (1967).
5. U. S. Congress, Senate, Subcommittee of the Committee on Public Works, "Hearings, S. 780 and Related Matters Pertaining to the Prevention and Control of Air Pollution," 90th Congress, 1st Session, pp. 1160–1283, Washington, D. C. (1967).
6. National Society of Professional Engineers, "Professional Engineers' Income and Salary Survey – 1967," Washington, D. C. (1968).
7. U. S. Bureau of Labor Statistics, "1967 National Survey of Professional Administrative, Technical, and Clerical Pay," Bulletin No. 1585, Washington, D. C. (1968).
8. National Science Foundation, "National Register of Scientific and Technical Personnel," Washington D. C. (1968).
9. Placement Service (Unpublished Estimate), The Pennsylvania State University, University Park, Pa. (1968).
10. College Placement Council, "College Placement Council Salary Survey," Report No. 2, Bethlehem, Pa. (1968).
11. Kroeger, L. J., Ennis, E., Williams, E. V., and Martin, H. E., "Pricing Jobs Unique to Government," Personnel Report No. 643, Public Personnel Association, Chicago, (1967).
12. *Ibid.*, 3 – 4.
13. Public Law 90-148, 90th Congress, S. 780 (Nov. 21, 1967).

The Mexican government's long-standing policy to promote "Mexicanization" of foreign-owned companies operating within its borders has won a signal success with the sale by General Electric of 10% of its Mexican subsidiary to Mexican nationals. General Electric de México, the country's biggest manufacturer of electrical products, had been one of the major Mexican firms still wholly owned by a foreign parent. Last year it earned $2.7 million on sales of $40 million. GE's yielding to government suggestions to Mexicanize, after prolonged talks, may put increased pressure on other large wholly owned subsidiaries of foreign companies, such as General Motors and Ford, to do likewise.

GE's stock offering, restricted to Mexican nationals and foreigners who are permanent residents, was an initial success. The 446,000 shares sold to Mexican investors at the equivalent of $5.80 a share were oversubscribed and quickly rose in price on the Mexico City stock exchange.

The Mexicanization of Mexican industry is a complex issue of interwoven laws, official decrees, and unofficial arm twisting. Major sectors of the economy, among them the petroleum industry, the production of basic petrochemicals and most fertilizers, electric power, and railroads are run solely by government-owned enterprises. In general, though, Mexicanization is not a matter of nationalization but rather of participation of private Mexican investors in partnership with foreign capital.

Even where there is no legal requirement for Mexicanization, government policy encourages it. And government officials can apply many subtle pressures to bring it about. Firms that Mexicanize may, for example, find themselves less hindered by official red tape. Tax concessions, import licenses, and tariff protection all may be easier to obtain.

The Mexican affiliates of several U.S. chemical companies have been Mexicanized for many years. Celanese has long owned less than half of its two large Mexican enterprises. Du Pont has a wholly owned subsidiary that makes explosives, paints, and agricultural chemicals, but most of its expansion south of the border in the past 10 years has been through four joint ventures in which its interest is 49% or less. Union Carbide Mexicana, in which the U.S. parent's stake now is 60%, sold stock to the Mexican public in 1960. Nevertheless, many large Mexican producers of chemicals continue to be wholly owned arms of their U.S. parents.

Graduates' salary climb continues apace

	Number of offers 1967–68	Average offers 1967–68	Average offers 1966–67	Average offers 1965–66
Bachelor's-degree candidates				
Chemical engineering	3228	$ 790	$ 733	$ 682
Chemistry	498	729	689	648
Master's-degree candidates				
Chemical engineering	613	919	858	809
Chemistry	90	864	814	760
Doctoral-degree candidates				
Chemical engineering	461	1247	1175	1102
Chemistry	588	1180	1118	1063

Source: College Placement Council

RECRUITING:

Salaries Up, Offers Down

Viewed as not quite enough by the 1968 graduate, far too much by his less recently graduated coworker, competitive by his employer, and likely to drop drastically to an Army private's pay of $102.30 by his local draft board's action—starting salaries for this year's graduates continued the familiar upward pattern. But fewer offers were made and salaries were up not quite as much as in preceding years.

That's the starting salary picture that emerges from the College Placement Council's salary survey of the college recruiting season just completed. The Bethlehem, Pa., council calls this an erratic recruiting year. In January, for example, the number of offers to technical students was down 26% from last year. By March this loss had been recouped and a slight increase took place. But activity then leveled off to a year-end total that was 1.4% below last June's.

Overall, the volume of offers dropped 2% at the bachelor's degree level from last year. Even more serious was the decline in offers to advanced degree graduates. The number of offers this year to those graduating with master's degrees dropped 18.9% while offers to those with doctoral degrees fell 12.4%.

A major factor behind the decline in offers, the CPC study points out, is reduced activity by the aerospace industry. Aerospace registered a drop of 23.7% this year over last despite the fact that it made more offers (6137) than any other employer group in the study, which is based on information on male graduates at 127 universities and colleges from coast to coast. The chemicals, drugs, and allied products group was third with 3526 offers, behind electronics and instruments with 4380.

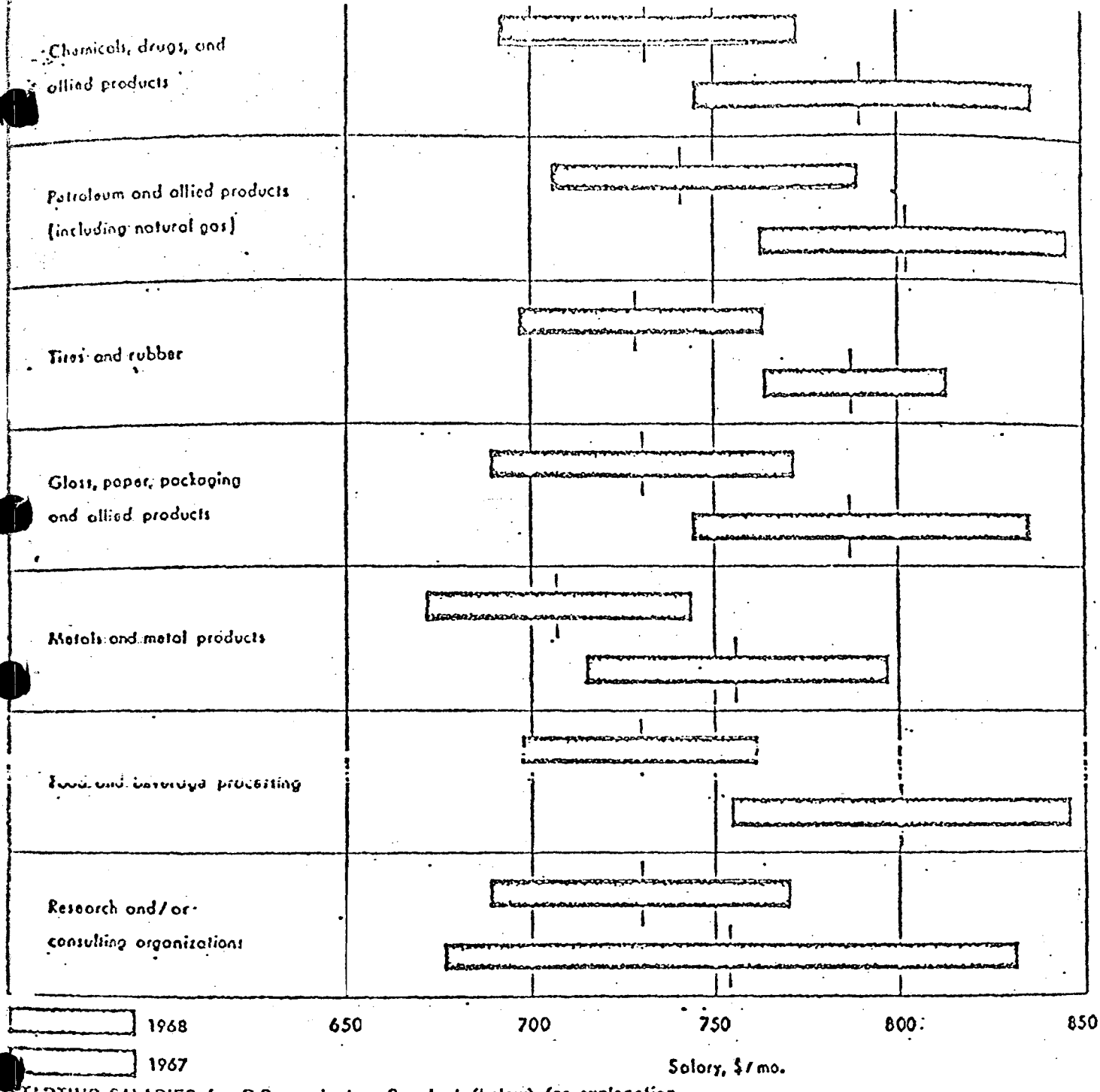
The chemicals-drugs group, however, offered the top average starting salary of $767 per month to bachelor's degree graduates. Among all types of employer, the bachelor-level chemical engineers and chemists fared rather well when compared with graduates in other areas. The chemical engineers topped the CPC salary list for the third straight year with average offers of $790, 7.8% higher than last June. Bachelor-level chemists received offers of starting salaries that were less than those made to engineers, but high among the sciences with average offers of $729 per month, an increase of 5.8% over last year. This contrasts with an increase of 7% for the preceding year. A similar drop occurred in the dollar average of offers to technical students; it rose 6.5% this year, compared with a 7.3% gain in the previous season.

GRANTS:

H.R. 875 a Key First Step

The funds authorized in H.R. 875 for institutional grants are a drop in the bucket compared to the needs of colleges and universities, Dr. Harvey Brooks told Rep. Emilio Daddario's Subcommittee on Science, Research, and Development. However, he continued, the proposals in the bill are an important first step that should be taken if the pressing financial problems of the schools in science education and scientific research are to be solved.

Dr. Brooks, dean of engineering at Harvard and chairman of the National Academy of Sciences' committee on



STARTING SALARIES for B.S. graduates. See text (below) for explanation.

years. For the class of 1972-1973, we prognosticate a starting salary for master's degree chemical engineers of $1,150/mo., and for Ph.D. Ch.E.'s of $1,600/mo. (over $19,000/yr.).

As we said at the start of this article, maybe we all ought to go back to college and start over.

The bar graphs on this page may bring us back to a degree of actuality. These are starting salaries for 1968 chemical engineering B.S. degree graduates, broken down by the industry segments that they entered, compared with the data for last year. Each bar represents the middle 80% range of offers. The line through each bar is the average salary offer, calculated on the entire range of offers (not merely the middle 80% shown).

In 1968, average offers for the fields shown ranged from $755/mo. (research and consulting organizations) to $804/mo. (petroleum); this is a spread of almost $50/mo.

Last year, the range was smaller, $708/mo. (metals) to $743/mo. (petroleum).

If you read the article, "How Do You Stand in Your Salary Progress?" in the last issue of CHEMICAL ENGINEERING, you may recall that the technique is based on published starting salaries. Now you have some new numbers to plug into author Olden's formulas. We wish you good luck.

March 26, 1971

Air Pollution Control Office
P. O. Box 12900
Philadelphia, Pa. 19108

Norman R. Ingraham, M. D.
Commissioner
Philadelphia Department of Public Health
Room 540, Municipal Services Building
Philadelphia, Pennsylvania 19107

Dear Dr. Ingraham:

As a result of the comments you made on the draft copy of the report evaluation for the Philadelphia program, we have revised the report to reflect many of your recommendations. However, based upon the review of the observation team that was sent to your agency, and circumstances at that time, other issues and recommendations remain in tact. We realize that your program has already made significant achievements since the APCO conducted that review. We welcome this progress and realize that your program is headed in the proper direction to implement some of the other recommendations that were made.

Although this report says "Draft Copy" on the cover, it will serve as the final report that will be issued from this office. We look forward to continuing our work with your agency. For any assistance or resources that are needed by the program or further clarification of this report, please do not hesitate to contact me. We recommend that this report serve as a document to be used by your agency and as a guide for future program improvements.

Sincerely yours,

ORIGINAL SIGNED BY

S. R. Wassersug

Stephen R. Wassersug
Regional Air Pollution
Control Director

Enclosure: As stated

cc: Mr. Edward F. Wilson
Asst. Health Commissioner