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LABORATORY CERTIFICATION PROGRAM IMPLEMENTATION ANALYSIS

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Mobile Source Air Pollution Control
Emission Control Technology Division
Ann Arbor, Michigan 48105

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LABORATORY CERTIFICATION PROGRAM IMPLEMENTATION ANALYSIS

by

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Contract No. 68-01-0417

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Prepared for

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NOTE: The purpose of this study was to establish the requirements of a certified laboratory program along with suggestions for implementation. As such, several of the ideas contained herein are not sanctioned by current government policy; for example, application fees. One final caution should be made concerning the economic analyses; some of the cost estimates are made on a slightly different basis than EPA's own economic projections. Any discrepancies are of little importance since these cost estimates are only preliminary and are intended to indicate the types and general range of expense that can be expected. Final, more detailed estimates will be made prior to the implementation of any program.

This notice is in no way intended to imply any criticism of the report; it is only to remind the reader that it does not necessarily reflect the EPA's position.

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FOREWORD

This report, prepared by The Aerospace Corporation for the Environmental Protection Agency, Division of Emission Control Technology, presents the results of an analysis of possible emission testing laboratory and operator certification processes under consideration by EPA.

A concise review of important findings and conclusions is presented in the Highlights and Summary sections. The remaining sections provide detailed discussions of each study topic and are of interest primarily to the technical specialist. Section 2 presents a review of the contemporary on-going certification activities of a number of federal and state regulatory agencies. It identifies what their regulatory duties are, how they go about implementing their functions, their organizational structure, work flow sequences, and the number and types of personnel involved. Section 3 describes a brief review of the emission test procedures and equipment requirements as promulgated by EPA in the Federal Register. A requirements matrix is developed which compares the facility, equipment, and procedural requirements for certification testing in any currently promulgated subpart, for 1975-1977 model years of LDVs and LDTs, and 1974 HDV engine testing. The functional tasks selected as appropriate for EPA use in implementing a laboratory certification program are delineated in Section 4 for both laboratories and operators. They encompass initial certification, renewal of certification, and on-going quality control functions. Section 5 describes and discusses detailed expansions of the selected basic functional tasks in terms of work flow sequences. The number and types of work flow elements are defined, and the interrelation of work flow elements between the laboratory (or operator) and the EPA laboratory certification control group are extensively illustrated by means of flow sheet diagrams. Section 6 identifies a reasonable EPA management organizational structure for performing the necessary work tasks identified in Section 5. Staffing requirements, personnel requirements, and management plan options are identified, together with cost estimates for implementing an independent laboratory certification program involving 17 such laboratories. Cost and staffing estimates are also developed for the case of establishing EPA-owned-and-operated emission testing laboratories in Europe and Japan.

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Mr. Warner B. Lee of The Aerospace Corporation was principally responsible for the acquisition and analysis of the data presented herein.

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HIGHLIGHTS

An analysis was made of the work task activities that would be required of an EPA group in the process of implementing a program whereby independent testing laboratories (and their test operators) would be certified as to their capability to perform vehicle exhaust emission tests in accordance with the requirements of 40 CFR 85.[1] This analysis effort included the selection and definition of the basic certification procedures to be used in the program, and resulted in estimates of staffing and scheduling requirements as well as costs likely to be incurred if such a certification program were in fact implemented by EPA.

To provide the basis for the selection of the certification procedures and methods used in the analysis, an extensive review was conducted of the procedures and practices of six federal and state regulatory agencies who have responsibility for laboratory or operator certification or licensing. This review indicated a concensus as to basic principles of certification requirements and implementation techniques; this concensus was drawn upon in formulating the basic structure of the laboratory certification program analyzed in this study.

To establish specific numerical estimates for personnel, schedules, and costs, it was necessary to establish a baseline scenario of emission test laboratories to which the program would be assumed to apply. A review led to the conclusion that about 17 independent laboratories could reasonably be expected to be early applicants (within a year) to the proposed certification program. This total was composed of 12 in the continental U.S., 4 in Europe, and 1 in Japan. A longer-term look indicated that about 26 laboratories might be involved within a few years (18 domestic, 6 in Europe, and 2 in Japan).

[1] Code of Federal Regulations, Title 40, Part 85

All of the detailed analyses of this study were based on the near-term group of 17 laboratories. However, for comparative purposes, cost estimates were made for EPA-owned-and-operated emission test laboratories in Europe and Japan (one in each location).

The following are brief highlights summarizing the major aspects of the study results.

H.1 LABORATORY CERTIFICATION PROGRAM ELEMENTS

H.1.1 Initial and Renewal Certifications

The basic elements of the laboratory initial (and renewal) certification process are the use of (a) a detailed application form and (b) a comprehensive inspection of the applicant laboratory to verify the information contained in the application. A 24-month certification period was selected as appropriate, in conjunction with the on-going quality control procedures delineated below. The major work activities of the EPA laboratory certification group are:

a. Application Processing -- The applicant is required to submit a detailed application which states compliance with the requirements of 40 CFR 85. The EPA laboratory certification group must make a paragraph-by-paragraph determination of compliance, based on the facts stated in the application, prior to approving for and scheduling an inspection visit to the laboratory.

b. Laboratory Inspection -- The applicant laboratory is visited by a team of EPA certification inspectors who perform a detailed examination of the general facility, equipment, instruments, and operational procedures, as well as verifying the presence of the requisite certified operator(s) on the laboratory staff. The results of this inspection are key inputs to a final EPA staff review which results in issuance or denial of certification.

H.1.2 On-Going Quality Control

Control of the quality of work performed by the certified laboratory prior to the certification renewal time is accomplished by a number of on-going quality control techniques, including:

a. Scheduled Inspections -- An EPA inspection team visits the laboratory at scheduled 6-month intervals. This inspection of the laboratory is similar to that made for initial certification purposes, but less extensive in nature. Major emphasis is placed on (a) determining if the key calibration and test procedures are being followed, and (b) ensuring that the calibration schedules for key equipment are in compliance with requirements.

b. Unannounced Inspections -- Less extensive random inspections of the laboratory are made between scheduled inspection periods. These inspections are principally concerned with (a) checking for certified personnel and (b) examination of records to verify calibration frequency and major instrument and equipment maintenance activity. However, the EPA inspectors may request the demonstration of equipment, operation, calibrations, etc., which in their judgment may be necessary.

c. Transmittal of Data and Information -- The laboratory is required to transmit to EPA (a) a complete set of data (raw and reduced) for each certified test performed by the laboratory, and (b) any change of status of personnel, equipment, procedures, etc. This permits on-going surveillance of the quantity and quality of the data being taken, and enables the opportunity to make timely re-inspections of the laboratory if any changes in the facility so indicate.

d. Gas Analysis Cross-Checks -- On a quarterly basis, EPA sends gas cylinder standards "unknowns" to the laboratory for measurement and identification on the laboratory instruments to verify their accuracy. In addition, the laboratory sends some of its span and calibration gas cylinders to EPA, for "naming" on EPA's equipment. Although this will normally be done at the option of the laboratory, it may be requested by EPA in the case of analysis discrepancies.

Any discrepancies discovered by EPA in any element of the above quality control processes can be the basis for:

a. Suspension of certification

b. The requirement for changes in laboratory equipment, operations, procedures, etc.

c. An additional inspection for further surveillance of the laboratory

H.2 OPERATOR CERTIFICATION PROGRAM ELEMENTS

H.2.1 Initial and Renewal Certification

The basic elements of the operator initial (and renewal) certification process are the use of (a) a detailed application form and (b) both written and practical tests to verify the capability of the operator to perform certified tests in accordance with requirements. A 24-month certification period was selected as appropriate, in conjunction with the on-going quality control procedures delineated below. The major work activities of the EPA laboratory certification group are:

a. Application Processing -- The applicant is required to submit a detailed application which on its face indicates that the operator has the requisite minimum job experience and talents to perform certified vehicle tests. The preferred approach is to have the laboratory employing the operator to both verify the job experience requirement and recommend that the applicant be certified. However, an alternative path would be for the operator to apply directly to EPA for certification. In either case, the EPA laboratory certification group must make a determination of compliance with requirements, based on the facts stated in the application, prior to approving for and scheduling both written and practical tests.

b. Written Examinations -- Each applicant is required to take and pass a written examination which is designed to assure a specified minimum level of knowledge and expertise with regard to EPA exhaust emission regulations and the theory with regard to emission measurements made in compliance with EPA regulations. A preferred approach is to administer this examination in conjunction with an inspection visit made to the laboratory employing the applicant. If the applicant has applied directly to EPA, then such examinations would probably have to be given at the EPA Ann Arbor test laboratory.

c. Practical Tests -- Each applicant is required to take and pass a practical or "hands-on" test during which the applicant is required to demonstrate his proficiency with regard to instrument and equipment operation, calibration, and maintenance. As in the case of written examinations, it is preferred that such practical tests be given at the employer's facility. If direct application to EPA is permitted, these practical tests would have to be given at the EPA Ann Arbor test laboratory.

H.2.2 On-Going Quality Control

The on-going quality control of the operator is accomplished in conjunction with laboratory quality control. First, the operator is required to verify (by signature) that the certified test data submitted to EPA by the laboratory has been performed under his surveillance and control. This permits EPA to screen the submitted test data for compliance with procedures. Second, the operator can be required to participate in or perform any tests, calibrations, or other checks requested by EPA inspectors at times of laboratory inspections (scheduled or unannounced). This permits direct observation of the operator's performance and techniques.

H.3 STAFFING REQUIREMENTS

It is estimated that a laboratory certification group consisting of seven inspectors and one supervisor is adequate to perform the certification activities listed above (H.1 and H.2) for the near-term scenario of 17 laboratories and 34 operators (two operators at each laboratory). In addition, clerical support would be required for paperwork processing and filing.

On the above basis, each inspector would be required to make an average of 16 trips per year, spending an average of 72 days per year on the road (counting travel time). This also includes an average of three weekend days per year travel time, in conjunction with a European inspection trip.

The above time spent out of the office represents approximately 32 percent of an inspector's total work time. A comparable figure is 27 percent for examiners of the Atomic Energy Commission office which licenses nuclear power plant operators. Increasing the EPA staff from seven inspectors to eight could reduce the field-plus-travel time to about 60 days per year per inspector or approximately 27 percent of the total work time.

H.4 SCHEDULING IMPLICATIONS

Under the worst-case condition of simultaneous application for certification by 17 laboratories (and their test operators), the initial certification process can be completed in from 7 months to 1 year with the above eight-man laboratory certification group staff, the exact time value depending upon the technical complications encountered in application processing. This time allotment also includes all scheduled and unannounced facility inspections which would come due during the period for those laboratories being certified first.

If an additional three inspectors were made available during this worst-case initial certification period, the required time could probably be reduced to less than 6 months.

The likely result of such a worst-case situation would be to produce an undesirable, asymetrical certification cycle. That is, there would be a preponderance of renewal applications and inspections coming due within a period of from a few months to a year. This can be avoided if EPA uses the discretionary option of extending (or shortening) the certification period of selected facilities. This technique can be used to smooth out the certification cycle and produce a more uniform workload for the laboratory certification group.

H.5 COSTS

If a staff of seven inspectors and one supervisor is assumed at a burden rate of $50,000 per position per year, the cost of the initial 17 laboratory certification program would be approximately $400,000 staff burden plus $60,000 travel expenses, for a total annual cost of approximately $460,000.

The cost of certifying just the four European and one Japanese laboratory (plus operators) is estimated to be one-third of the total program cost, or approximately $156,000 per year ($120,000 staff burden plus $36,000 travel cost).

A cost estimate was also performed for the special case of EPA-owned-and-operated emission testing laboratories in Europe and Japan (one at each location). The estimate was based on facilities and personnel to perform near-term vehicle certification tests of 360 and 210 per year, respectively. The total cost to perform 570 certification tests per year in these two foreign laboratories is approximately $900,000 per year, or $1600 per certification test. The equivalent figure for EPA Ann Arbor testing is estimated to be approximately $1000 per test when performing about 3100 certification tests annually.

The higher cost per test of the foreign laboratories is a result of the inherently lower personnel and equipment utilization efficiency of a small facility as compared to that of a much larger one. Not until the volume of testing could justify at least three or four test cells per laboratory could the costs per test become significantly closer to the Ann Arbor level.

H.6 MANAGEMENT ORGANIZATION OPTIONS

Since the initial laboratory certification program manpower requirements consist principally of seven or eight inspectors plus one supervisor, it would appear more utilitarian and effective to initially organize the group as a section or branch within an existing branch or division of the Office of Mobile Source Air Pollution Control (OMSAPC). This would enable the new laboratory certification group to utilize existing lines of management control and clerical services. Also, it would not divert their time to nonproductive activities which are often associated with the formation of a totally new organizational structure.

In the longer term, it is expected that there will be an increase in the number of personnel assigned to the group because of (a) an increase in the number of certified laboratories covered by the program, (b) the need to expand and develop additional written and practical examinations for the operators, and (c) an increased clerical work load, particularly with respect to retention of records. Because of these factors, it may be advisable in the long run to provide a more formal organizational structure for the laboratory certification group.

One such option would have the "laboratory certification group" organized as a branch of an existing OMSAPC division in Ann Arbor. Three sections would be included in accordance with the three principal functional task areas:

a. A "Certification Processing Section" would be charged with responsibility for ensuring that all in-office certification activities are accomplished in a timely and effective manner. Corollary functions would include (a) the development of examinations for operators, and (b) changes and updating of certification regulations and forms. When the inspectors are not on laboratory field inspections, their efforts would be available to this section.

b. An "Operations Section" would be charged with the responsibility of conducting all field activities, including the scheduling of the inspectors for each trip and the coordination required between the laboratory and the laboratory certification group.

c. A "Clerical Section" would be charged with all paperwork processing, filing, and information storage functions. In the long term such a separate clerical office section may be essential for efficient operation of the laboratory certification group. This is particularly true since the inspectors are engaged in field work for a high percentage of the time.

H.7 PROGRAM START-UP CONSIDERATIONS

H.7.1 Inspector Training

It is unlikely that a sufficient number of personnel will be available initially who satisfy the requirements for appointment as an "inspector", including essential recent "hands-on" experience with emission test equipment. Therefore, a training program would have to be instituted prior to full-scale implementation of the certification program. This program should consist of working in the EPA Testing Laboratory at Ann Arbor in the areas of basic instrument and equipment operation, calibration, maintenance, and trouble-shooting. It is estimated that approximately 3 months full time work in these areas would be required to establish the necessary knowledge and skills.

H.7.2 Additional Start-Up Manpower

Because of potential scheduling problems at program initiation (item H.4), it would be advantageous to have three additional men of the "inspector" level available during the first 6 months or so of the program. These additional inspectors could be borrowed temporarily from other Ann Arbor activities (e.g., Emission Testing Laboratory, Certification and Surveillance Division, or the Emission Control Technology Division).

H.8 LONGER-TERM IMPLICATIONS

It is considered likely that some 26 independent laboratories could be involved in the program after a few years. A review of the analysis details used to obtain the results for the near-term scenario of 17 laboratories leads to the conclusion that, to a first approximation, both personnel staffing requirements and travel expenses would be increased in direct proportion with the increase in the number of certified laboratories. For 26 laboratories, there would be a staff requirement of 11 to 13 inspectors and 2 or 3 supervisory or administrative positions.

SUMMARY

S.1 INTRODUCTION

Except for a few heavy duty vehicle (HDV) emission certification tests performed for EPA by the Southwest Research Institute and those emission tests permitted by EPA to be performed abroad, all other emission certification tests [including light duty vehicles (LDVs) and light duty trucks (LDTs)] are performed at the emission testing laboratory of the EPA located in Ann Arbor, Michigan. For example, foreign automakers have only the 4000- and 50,000-mile LDV emission certification tests performed at EPA and are allowed to send in their own test results for the intermediate mileages.

A significant increase in certification test work load, such as could be caused by new certification regulations (e.g., motorcycles, truck CVS tests, etc.), increased frequency of foreign vehicle emission certification tests, and retrofit device tests, might require either an increase in the Ann Arbor testing laboratory facilities and personnel, or a means whereby independent laboratories could be certified to perform emission tests.

This potential problem is further accentuated by the fact that there are a number of inventors or other entrepreneurs who wish to evaluate new devices or ideas applicable to emission control for new cars, after-market parts, or used-car retrofit. Currently, the Ann Arbor laboratory cannot accommodate these people and must refer them to a list of about ten independent laboratories who do perform exhaust emission testing. At the present time there is no mechanism for certifying that such laboratories have the facilities, equipment, and personnel necessary to meet the emission testing requirements published by EPA in the Federal Register.

Therefore, the present study was initiated to explore and characterize alternative means whereby laboratories such as these could be certified. This characterization could aid in the implementation of a laboratory certification process and/or enable a tradeoff between such laboratory certification and the continuation of all emission certification testing by EPA.

With regard to manpower and cost estimations, major emphasis was focused on an initial scenario in which it was assumed that 17 such independent emissions testing laboratories would apply to EPA for certification. These laboratories were geographically distributed as follows: 12 laboratories in the continental United States, 4 laboratories in Europe (e.g., England, France, Italy, Germany), and 1 laboratory in Japan. A limited amount of effort was devoted also to estimating the manpower and cost requirements to EPA for staffing and operating EPA-owned emission test facilities in Europe and Japan (one laboratory at each location).

S.2 CONTEMPORARY CERTIFICATION ACTIVITIES

A review of contemporary on-going certification activities was made by contacting a number of federal and state regulatory agencies who have responsibility for laboratory or operator certification or licensing. The purpose of this review was to determine (a) what their regulatory duties were, and (b) how they go about implementing their functions, particularly with regard to organizational structure, work flow sequence, number and types of personnel involved, and work load. The agencies contacted and the type of information obtained from each is shown in Table S-1.

This review has resulted in a comprehensive picture of established regulatory procedures as used in the certification process in general. There is a consensus as to basic principles of certification requirements and implementation techniques; this consensus was drawn upon in selecting the basic elements of the laboratory certification program analyzed in this study (delineated in Section S.3). The consensus as to general functional requirements is delineated below.

Table S-1. Data Sources

Agency/Company	Type of Information
Federal Aviation Administration (FAA)	Certification activities related to: a. Aircraft repair stations b. Aviation mechanic training schools c. Flight and ground schools d. Aviation mechanics e. Designated mechanic examiners f. Designated pilot examiners g. Flight ratings
Atomic Energy Commission (AEC)	Certification activities related to operators of nuclear power plants
California Bureau of Automotive Repair (BAR)	Certification activities related to: a. Motor vehicle pollution control (MVPC) device installers b. MVPC stations
California Department of Public Health, Laboratory Field Service (DPH)	Certification activities related to: a. Clinical laboratories b. Clinical laboratory technologists
Pennsylvania Department of Transportation, Bureau of Traffic Safety (BTS)	Certification activities related to: a. Safety inspection mechanics b. Safety inspection stations
New Jersey Department of Environmental Protection (DEP)	Voluntary program for training mechanics

S.2.1 Facility Certification

S.2.1.1 Initial Certification Requirements

An application for certification plus inspection visits to verify the information contained in the application are the principal tools used in the facility certification process. Testing, per se, is not involved, except in the case of an FAA-approved flight school where the chief flight inspector is required to undergo a standardization flight check. Application fees are required in some instances.

All agencies require that the application explicitly list (a) certified personnel on the staff and (b) adequate definition and description of the facility's physical plant and equipment. Aside from training schools, the other information required, in some instances, relates to personal information on the owner, operator, or directors of the facility. The information required in the application is considered necessary to make both initial and final assessments of compliance with regulatory requirements.

S.2.1.2 Renewal and/or On-Going Quality Control Requirements

In most cases, extensive inspection visits/checks are used for the quality control of facilities. In every case, regular inspection visits are used; however, the frequency of the scheduled inspections varies from a few months to 2 years, depending upon the nature of the particular facility involved. In four of the six cases examined, additional special checks are included in the quality control process.

S.2.2 Personnel Certification

S.2.2.1 Initial Certification Requirements

As in the case of facility certification, all agencies use the application as a principal tool for personnel certification. However, testing (both written and practical) instead of inspection visits or contacts (as in the case of facility certification) is the other principal tool used in personnel certification. Except for the Designated Mechanic Examiner (DME) and

Designated Pilot Examiner (DPE) ratings of the FAA, all other personnel ratings are required to pass a written examination. Even in the DME and DPE cases, however, these same personnel have previously passed a written examination when obtaining the prerequisite aviation mechanic or flight rating. Practical tests are required (or optional) in six of the eight cases examined. Medical examinations are required only in those cases (FAA flight ratings and AEC nuclear power plant operators) where inadvertent medical problems could lead to substantial property damage or personal injury as a result of operator incapacitation.

In all cases there are minimum requirements for prior experience and/or qualifications that must be included. For the FAA DME and DPE ratings, prior certification in the appropriate aviation mechanic or flight rating must be shown. In three of the eight cases examined, the facility employing the operator is required to request and recommend that the operator be certified.

S.2.2.2 Renewal and/or On-Going Quality Control Requirements

Except for AEC operators and the FAA DME and DPE ratings, very little actual quality control is exercised over personnel. In these cases, where operator proficiency may be considered to be more closely related to potential property damage or personnel injury, periodic inspection contacts and checks are made. The AEC operator is required to participate in a requalification program which is essentially a continuous updating and retraining program.

S.2.3 Term of Certification

There is considerable variability in the term of certification for both facilities and personnel; in both cases the term of certification varies from 1 year to valid indefinitely. For those facilities having definite certification period durations (i.e., other than indefinite validation), the renewal period is 2 years or less. Similarly, for personnel having definite certification periods, in four of the six cases examined the period was also 2 years or less.

However, there does not appear to be any real consensus as to term of certification, either for facilities or personnel. Rather, it appears the term of certification is somewhat arbitrarily selected in each case to fit the needs of the particular organization involved in the certification process.

S.3 PRINCIPAL ELEMENTS OF LABORATORY CERTIFICATION PROGRAM

A set of discrete basic requirements and procedures was selected to form the basis of a sound certification program for both laboratories and operators. These functional task selections were made after reviewing the status of established regulatory procedures used by other federal and state certification agencies (Section S. 2) and noting the consensus as to functional task requirements in the comparable certification processes. Also considered in the selection process were the specific requirements of 40 CFR 85[2] regarding facilities, procedures, and test operations.

S.3.1 Laboratory Certification

S.3.1.1 Initial Certification

Table S-2 lists the specific functional tasks required of EPA and the laboratory requesting certification, both for initial certification and renewals.

The EPA tasks are directed to:

a. Application form preparation

b. Application processing and review after receipt

[2] Code of Federal Regulations, Title 40, Part 85.

Table S-2. Initial and Renewal Laboratory Certification

LABORATORY TASKS

- PREPARE AND SUBMIT APPLICATION (FOR SUB-PART RATING DESIRED)
  - LISTING CERTIFIED OPERATORS ON STAFF
  - IDENTIFY FACILITY, EQUIPMENT, AND TEST PROCEDURES USED IN ACCORDANCE WITH 40 CFR 85 REQUIREMENTS
  - PROVIDE OTHER INFORMATION
    - DIRECTORS
    - RELATIONSHIPS WITH OTHER ORGANIZATIONS
    - FINANCIAL AND BUSINESS DATA

EPA TASKS

- PREPARE APPLICATION FORMS
- PROCESS AND REVIEW APPLICATION DETAILS
- SCHEDULE INSPECTION VISIT
- PERFORM INSPECTION OF LABORATORY
  - TESTING
  - CALIBRATION
  - PROCEDURES
  - EQUIPMENT
- REVIEW INSPECTION RESULTS
- ISSUE OR DENY CERTIFICATION

c. Laboratory inspection

d. Final review of inspection results and determination as to issuance or denial of certification

The laboratory tasks are solely concerned with preparing and submitting the application for certification to EPA. The basic information required, as noted in Table S-2, would be concerned with (a) certified operators on the staff of the laboratory, (b) a complete description of the facility, equipment, and test procedures used by the laboratory (to permit an initial determination as to compliance with 40 CFR 85 requirements), and (c) other organizational and financial data which might be relevant to the desirability or suitability of certifying the laboratory for emission testing purposes. For example, if the laboratory were a part of another organization which manufactured or sold retrofit or emission-control-related parts, it might be considered a conflict of interest to permit certification of the laboratory.

Figure S-1 summarizes the principal elements of initial (and renewal) certification and their interrelationship in flow-sheet format.

S.3.1.2 On-Going Quality Control

The specific functional tasks selected for quality control are listed in Table S-3. The basic EPA tasks consist of:

a. Periodic scheduled (semiannual) laboratory inspections

b. Unannounced (random) laboratory inspections

c. Naming the laboratory's calibration gases on EPA equipment

The scheduled inspections would be extensive and consist of test observations; inspection of calibration procedures; checking for certified personnel; examination of facility data and records; and observation of the general facility, equipment, and operations. The unannounced inspections would be less extensive in nature, and would be principally directed to verifying that proper calibration schedules were being followed.

FLOW SHEET 201

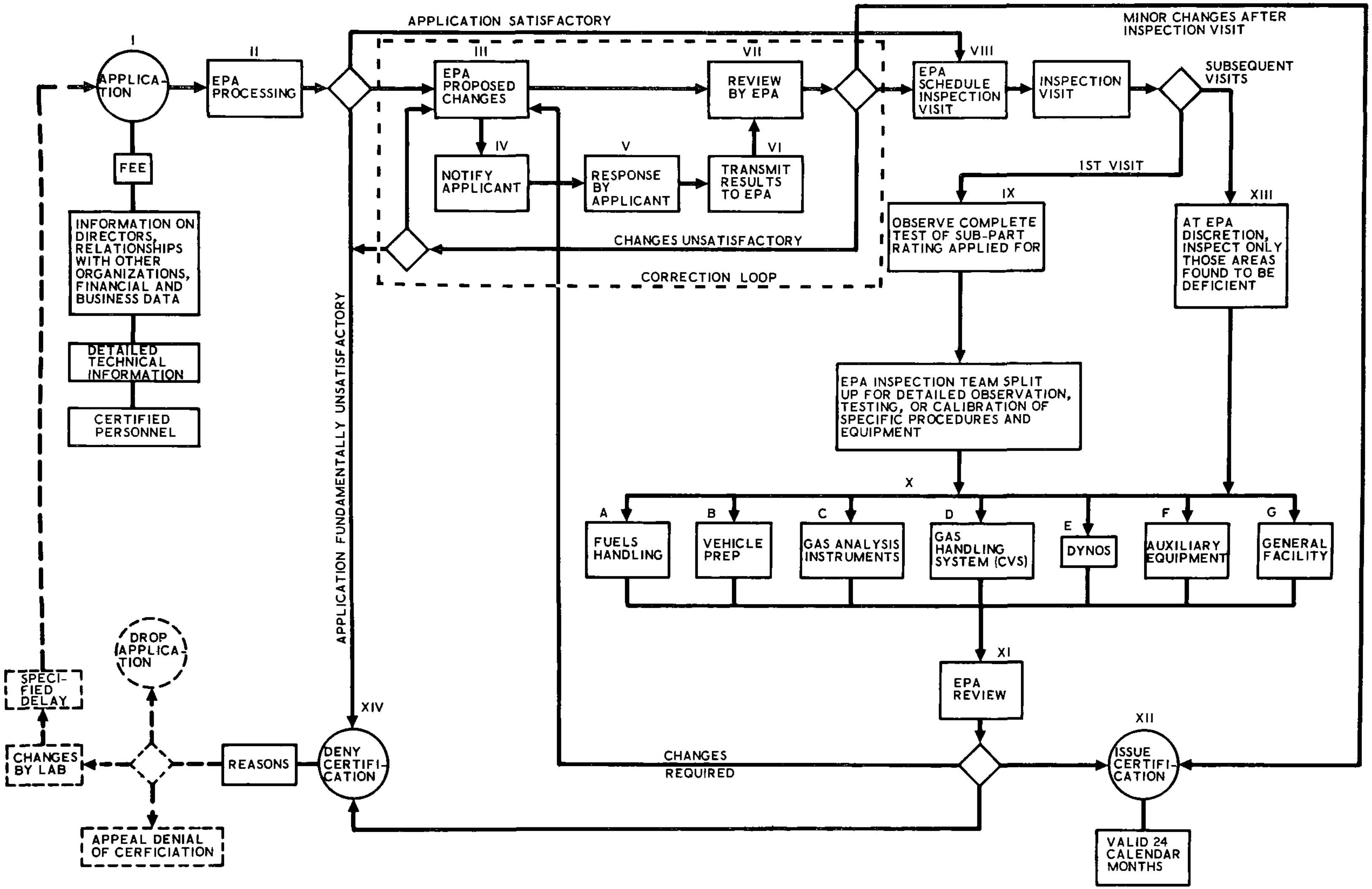


Figure S-1. Initial and Renewal Laboratory Certification

Table S-3. On-Going Laboratory Quality Control

LABORATORY TASKS

- TRANSMIT TO EPA COMPLETE DATA SET FOR EACH CERTIFIED TEST MADE
- TRANSMIT TO EPA ANY STATUS CHANGES
  - EQUIPMENT LOSS OR CHANGE
  - CERTIFIED OPERATORS
  - ETC.
- MAKE QUARTERLY MEASUREMENTS OF EPA GAS CYLINDER "UNKNOWNS"
  - TRANSMIT TO EPA
- PERFORM ANY TESTS, CALIBRATIONS, OR OTHER CHECKS REQUIRED BY EPA DURING INSPECTION VISITS

EPA TASKS

- PERIODIC SCHEDULED INSPECTIONS OF LABORATORY
  - SEMI-ANNUAL
  - OBSERVE TESTS
  - CHECK FOR CERTIFIED PERSONNEL
  - INSPECT CALIBRATION PROCEDURES
  - EXAMINE DATA AND RECORDS
  - OBSERVE STATUS OF
    - FUEL HANDLING OPERATIONS
    - AUXILIARY EQUIPMENT
    - GENERAL FACILITY
- UN-ANNOUNCED LABORATORY INSPECTIONS
  - RANDOM, AVERAGE 2 PER YEAR
  - VERIFY PROPER CALIBRATION SCHEDULES
- NAMING OF LABORATORY'S CALIBRATION GASES ON EPA EQUIPMENT

The laboratory would be required to transmit a complete set of emission test data to EPA for each certified test made; this would permit the opportunity for a direct observation of the quality of the test data. Quarterly measurements of EPA gas cylinder "unknowns" would be required to verify the laboratory's gas sampling instrumentation accuracy. During EPA inspection visits, the laboratory would be required to perform any tests, calibrations, or other checks required by EPA inspectors. In addition, any changes in certified operators, equipment loss or change, etc. would have to be provided to EPA to permit temporary suspension of certification or reinspection, if necessary.

Figure S-2 summarizes the principal elements of the on-going quality control process in flow-sheet format.

S.3.2 Operator Certification

S.3.2.1 Initial Certification and Renewals

Table S-4 lists the specific functional tasks required of EPA and the operator requesting certification, both for initial certification and renewals. The principal EPA tasks are directed to:

a. Preparing application form
b. Processing and reviewing application after receipt
c. Preparing, administering, and grading written examinations
d. Preparing, administering, and grading practical examinations
e. Granting or denying certification

The operator's tasks are concerned with:

a. Preparing and submitting the application
b. Taking and passing the written examination
c. Taking and passing the practical examination

With regard to the application, a preferred approach is to have the employer request that the operator be certified and verify the minimum job experience

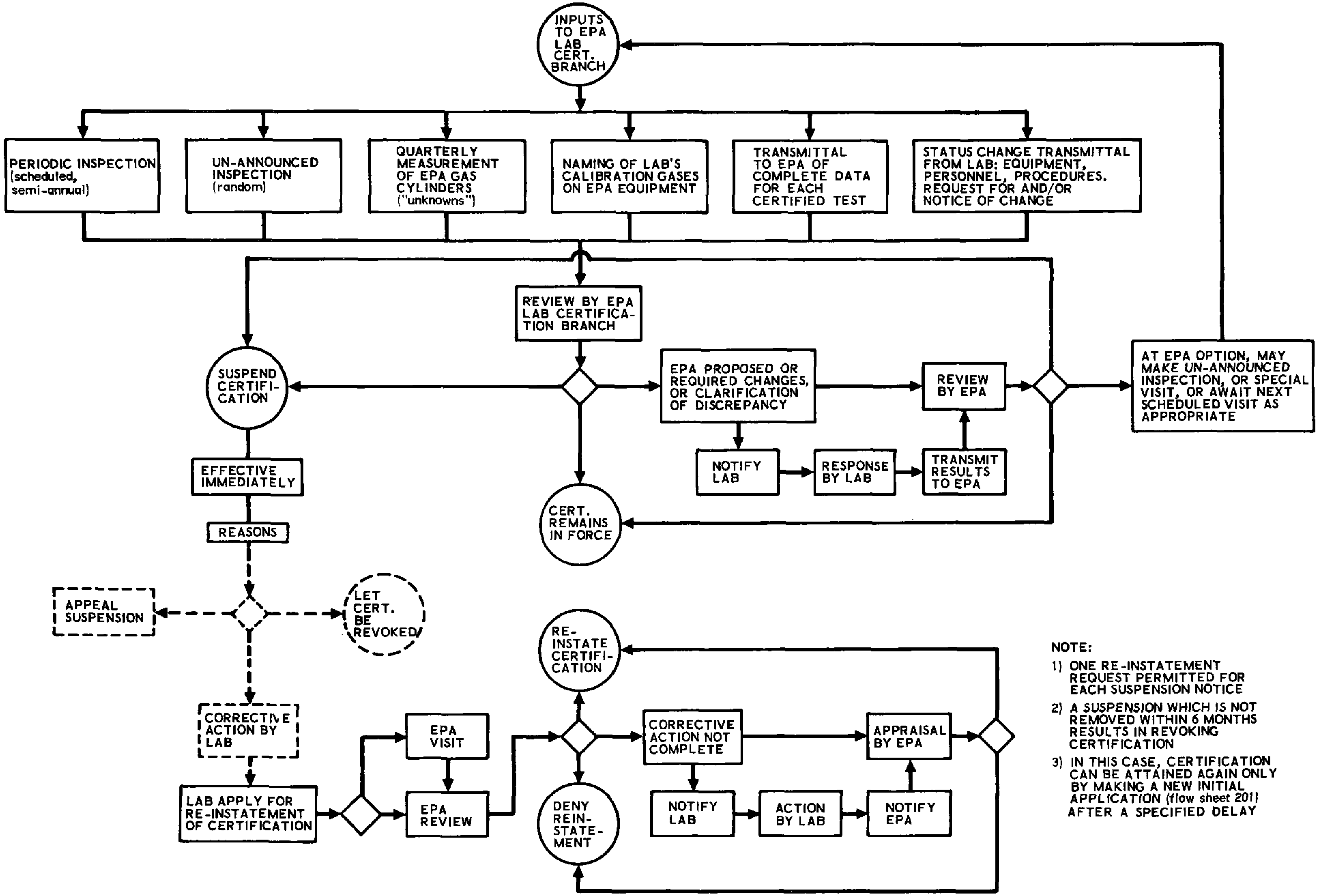


Figure S-2. Laboratory Certification – On-Going Quality Control Process

Table S-4. Initial Operator Certification*

OPERATOR TASKS

- PREPARE AND SUBMIT APPLICATION (FOR SUB-PART RATING DESIRED)
  - HAVE EMPLOYER REQUEST THAT HE BE CERTIFIED**
  - HAVE EMPLOYER VERIFY APPLICANT HAS MINIMUM JOB EXPERIENCE REQUIREMENTS**
- TAKE AND PASS WRITTEN EXAMINATION
  - AT EMPLOYERS FACILITY
- TAKE AND PASS PRACTICAL TEST
  - AT EMPLOYERS FACILITY

* SAME TASKS INVOLVED IN CERTIFICATION RENEWAL, EXCEPT FOR VERIFICATION OF EXPERIENCE

**AN ALTERNATIVE PATH IS FOR THE APPLICANT TO APPLY DIRECTLY TO EPA FOR EXAMINATION AT EPA ANN ARBOR FACILITIES

EPA TASKS

- PREPARE APPLICATION FORMS
- PROCESS AND REVIEW APPLICATION DETAILS
- SCHEDULE EXAMINATIONS
- PREPARE WRITTEN EXAMINATION
- ADMINISTER AND GRADE WRITTEN EXAM
- PREPARE PRACTICAL TEST
- ADMINISTER AND GRADE PRACTICAL TEST
- GRANT OR DENY CERTIFICATION

requirements of the applicant. It would appear, however, that an alternative path should be available whereby the applicant can apply directly to EPA. Similarly, it would be preferred to have the written and practical tests given at the employer's facility, but it may be necessary to permit such testing at the EPA test facility.

Figure S-3 summarizes the principal elements of the initial (and renewal) certification process in flow-sheet format.

S.3.2.2 On-Going Quality Control

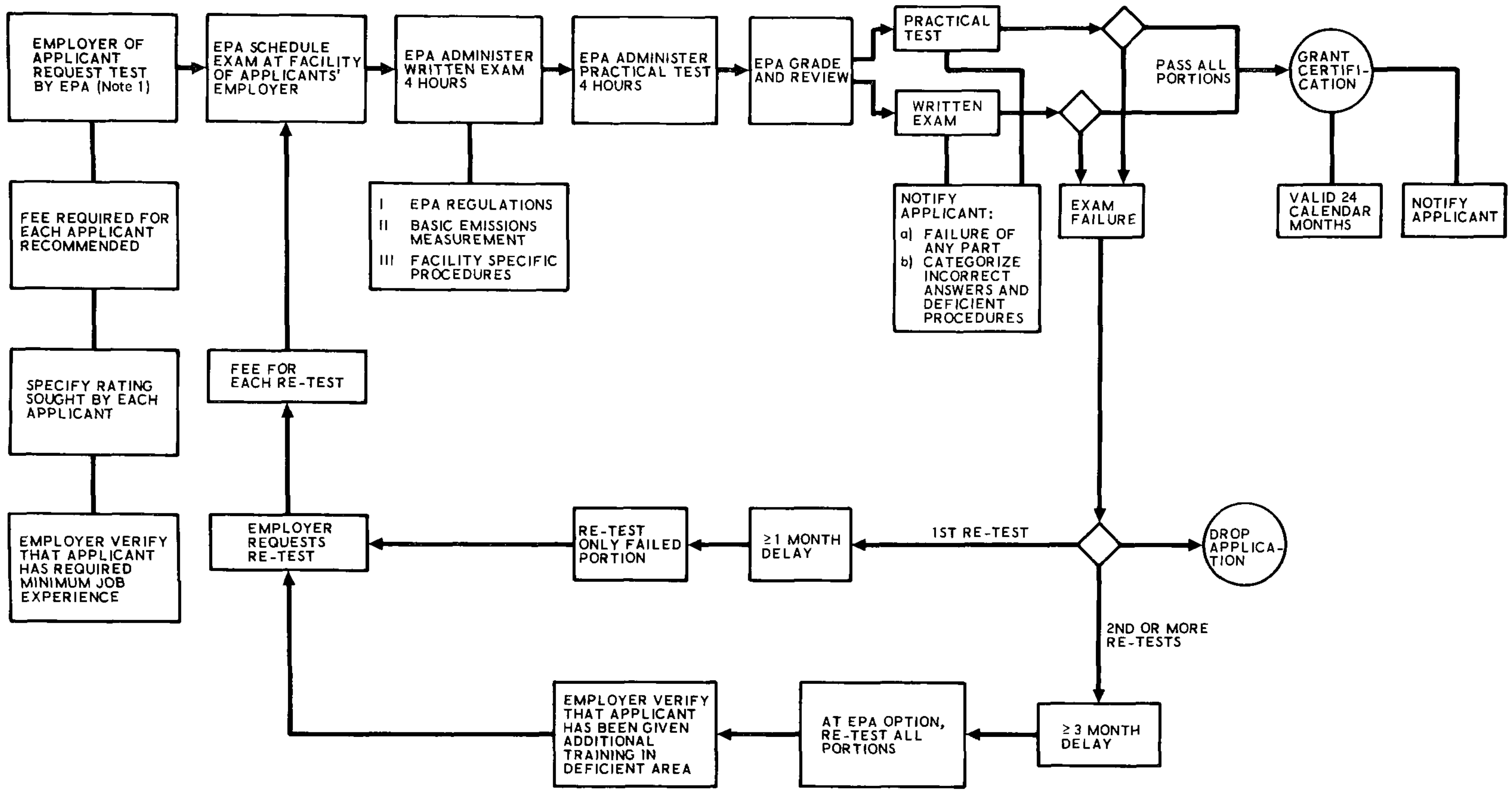
As noted in Section S.2, ordinarily there is very little on-going quality control exercised over operators (except in the specific case of AEC-licensed nuclear power station operators). However, as listed in Table S-5, the nature of the task functions selected for the laboratory certification process makes it possible to exercise a reasonable degree of control over the quality of the work performed by the operator.

First, the operator is required to verify (by signature) that the certified test data submitted to the EPA by the laboratory has been performed under his surveillance and control. This permits EPA to screen the submitted test data for compliance with procedures. Second, the operator can be required to participate in or perform any tests, calibrations, or other checks requested by EPA inspectors at times of laboratory inspections (scheduled or unannounced). This permits direct observation of the operator's performance and techniques.

S.3.3 Use of the Functional Tasks

The selected functional tasks, as described above, are the basic building blocks of the laboratory and operator certification processes. They provide the basis for further breaking down the certification process into more definitive work elements (or steps) which can be developed to ensure meeting the specific requirements of 40 CFR 85 as well as permitting a simple and logical sequencing of required work elements. The so-developed work flow sequences are described in Section 5.

FLOW SHEET 101



NOTE 1: AN ALTERNATIVE PATH IS FOR THE APPLICANT TO APPLY DIRECTLY TO EPA, FOR EXAMINATION AT EPA ANN ARBOR FACILITIES. IN THIS CASE, ALL BLOCKS OF THIS FLOW SHEET WHICH REFER TO "EMPLOYER" ACTIONS, MUST BE PERFORMED BY APPLICANT. ALL OTHER PARTS OF FLOW SHEET ARE UNCHANGED. APPLICANT IS RESPONSIBLE FOR PERSONAL COSTS.

Figure S-3. Initial and Renewal EPA Operator Certification

Table S-5. On-Going Quality Control

OPERATOR TASKS	EPA TASKS
• VERIFY CERTIFIED TEST DATA TRANSMITTED TO EPA • PARTICIPATE IN OR PERFORM ANY TESTS, CALIBRATIONS, OR OTHER CHECKS REQUESTED BY EPA AT TIMES OF SCHEDULED OR UN-ANNOUNCED INSPECTIONS OF LABORATORY BY EPA PERSONNEL	• SCREEN CERTIFIED TEST DATA SUBMITTED FOR COMPLIANCE WITH PROCEDURES • OBSERVE OPERATOR'S PERFORMANCE DURING SCHEDULED AND UN-ANNOUNCED INSPECTIONS OF LABORATORY

S.4 PROGRAM IMPLEMENTATION REQUIREMENTS

S.4.1 Generalized Personnel Requirements

The basic EPA staff position which is required for the proposed laboratory certification program is termed "Inspector" in this report. This position involves participation in all aspects of certification activity -- application processing, office work, panel review sessions, operator examination, and facility inspections. The job requirements of an inspector fall into three main categories. The first requirement is complete familiarity with both theory and practice of instrument and equipment operation -- including details of operation, calibration, and maintenance. There is no alternative to prior "hands-on" experience in this case. If a person does not have a recent background in this area, a job training program, probably conducted at the EPA Ann Arbor testing laboratory, would be required.

The second requirement is that the inspector be intimately familiar with all applicable provisions of 40 CFR 85, including all recent EPA promulgations in the Federal Register, and their implementation.

The third requirement, which is nontechnical, is that the inspector be capable of working well with people of widely different backgrounds and at all organizational levels of the certified laboratories. The inspector position is an important one, and the inspector serves as an EPA representative both in this country and abroad.

S.4.2 Staffing Requirements

S.4.2.1 Estimate of Laboratories to be Certified

To establish specific numerical estimates for personnel, schedules, and costs, it was necessary to establish a baseline scenario of emission test laboratories to which the program would be assumed to apply. A review of this subject led to the conclusion that about 17 independent laboratories could be reasonably expected to be early applicants (within a year) to the proposed laboratory certification program. This total was composed of 12 in the continental U.S., 4 in Europe, and 1 in Japan. The foreign laboratories were assumed to be located as follows: one each in the vicinity of London, Paris, Rome, and Tokyo, plus one in an unspecified location in northern Europe. A longer-term look indicated that about 26 laboratories might be involved within a few years (consisting of 18 domestic laboratories, 6 in Europe, and 2 in Japan). All of the detailed program implementation analyses of this report were applied to the near-term group of 17 laboratories.

Available information indicated that the candidate laboratories could be divided into four classifications based on equipment capabilities. This facility classification system is defined in Table S-6.

Table S-6. Laboratory Facility Classification

Equipment and Locations	Facility Classification			
	A	B	C	D
Emissions Test Capability (For 1975 LDV Testing, Subpart A)				
Number of Dynamometers	1	2	2	3
Number of CVS Systems	1	2	2	3
Number of Complete Sets of Gas Analysis Instruments	1	1	2	2
Number of Laboratories				
Domestic	6	2	3	1
Europe	2	-	2	-
Japan	-	-	1	-
Total	8	2	6	1

S.4.2.2 Man-Hour Estimates

Estimates were made of the man-hours required to perform every operation specified in the work elements presented in Section S.3. Each class of laboratory was followed through every step of the certification process, starting with the receipt in the mail at EPA of the completed application form and proceeding through the various analysis and panel review phases, the inspection visit, and the final review process prior to granting certification. This same facility was then subjected to a periodic and unannounced inspection, in which all steps in the pre- and post-inspection office work were analyzed, as well as the inspection visit proper. In every phase of this process, a degree of technical complication was structured into the analysis which was considered to be representative of a real situation. In addition, allowances were made to cover work interruption or competing work assignments.

Personnel requirements were developed based on these man-hour estimates. The development process consisted of cataloging this information in terms of man-day requirements to perform each of the required functional tasks over the 24-month certification cycle. A distinction was made between office and field (inspection) work. Each of these two categories was cataloged for each of the four basic task functions of the laboratory certification group; namely, initial/renewal application and inspection, periodic inspection, unannounced inspection, and operator testing. This resulted in the total inspector office burden shown in Table S-7; a requirement for approximately four inspectors.

Similar analyses were performed for the on-site inspection visit work load for each type of inspection for each class of facility. From this information, the inspection team numerical structures of Table S-8 were established. Next, the total man-day requirements for these inspection visits, including travel time, were computed. This man-day figure must include the time required for certified operator testing. The latter item is not included in Table S-8. The results of these calculations on inspection

Table S-7. Total Inspector Office Burden

Activity	Inspector Office Burden, Man-days (2-year cycle)
Initial Inspection	943
Periodic Inspection	456
Unannounced Inspection	388
Operator Testing	73
$\sum$ Man-days	1860
Number of Inspectors[a]	4.2

[a]Based on 225 work days per year per inspector

Table S-8. Inspection Team Numerical Structure

Facility Classification	Initial/Renewal Inspection		Periodic Inspection		Unannounced Inspection	
	No. of Inspectors	Days of Visit	No. of Inspectors	Days of Visit	No. of Inspectors	Days of Visit
A	3	2	2	2	1	1
B	3	2	2	2	2	1
C	3	3	2	3	2	1
D	3	3	2	3	2	2

visit man-day requirements are shown in Table S-9, from which it is seen that the inspection work load is equivalent to approximately a 2-1/2-man-level staffing. Combining this with the results of Table S-7 for the office burden gives a requirement for a seven-man staff to handle both the office and field work associated with the laboratory certification program for 17 independent testing laboratories.

A similar analysis procedure was applied to estimate the work load associated with the supervision of the activities of the inspection staff. The results indicated that one supervisory position was required.

S.4.2.3 Scheduling of Inspection Visits

The goal was to establish an efficient scheduling of inspection trips, consistent with two restrictions. The first restriction is that there be minimum weekend travel or stay time. This is considered to be an essential requirement for long-term job acceptability, as the inspector positions require relatively extensive travel time. The second restriction is that there be no compromise with the surprise element of the unannounced inspections, such as would occur by combining them with other visits to the area in a more time-efficient but predictable manner. Table S-10 presents the summarized results for all inspection visits, based on a seven-man inspection staff.

The key results of this analysis are that each inspector must make an average of 16 trips per year, spending an average of 72 days per year on the road (counting travel time) which includes an average of three weekend days per year travel time (in conjunction with a European inspection trip).

This is a rather high travel load and is probably near the upper range of a practicable schedule. A travel time reduction down to about 68 or 69 days per inspector should be readily achievable in practice by utilizing specific features of the distribution of the applicant laboratories. If a larger reduction in travel load is considered necessary, this can only

Table S-9. Inspection Visit Man-Day Requirements (2-Year Certification Cycle)

Type of Inspection	Time, Man-days			No. of Trips	Man-Trips
	Inspection	Travel	Total		
Initial/Renewal (Including Operator Certification)	157	136	293	17	68
Periodic	246	204	450	51	102
Unannounced	112	208	320	68	104
Σ	515	548	1063	136	274

Inspectors Required[a] $= \dfrac{1063}{2 \times 225} = 2.4$

Inspectors Required For Office Burden (See Table S-7) 4.2

Total Inspectors Required 6.6 = 7

[a] Based on 225 work days per year per inspector.

Table S-10. Overall Inspector Travel Schedule (24-Month Certification Cycle)

Type of Trip	Man-days	Number of Trips	Man-trips
Domestic	712	76	164
Europe			
Initial/Renewal/ Operator	146	4	16
Unannounced	72	16	24
Japan	73	8	18
$\sum$	1003	104	222

Average Inspector Load per Year

Travel Time (work days)	71.7 days
Individual Trip Duration	4.5 days
Trips per Year	15.9
Time Between Start of Successive Trips	16.4 work days
Weekend Travel Time	2.9 days (plus that which may result solely from time change on foreign trips)

be accomplished (without voiding the basic features of the proposed certification process) by increasing the size of the inspection staff. Thus, an eight-man staff would reduce the travel time to about 60 days per year per inspector.

S.4.3 Costs

Based on the inspection visit schedule derived in the preceding section, travel expenses for each inspection trip were computed in accordance with the following basic procedure. Each trip was assumed to be a round trip from Ann Arbor, with some trips including one or more intermediate sites. Airline fare was taken as the coach rate in effect on the date the calculations were performed. Per diem (lodging plus meals) was assumed to be $34 per 24-hour day per inspector for domestic trips, and $50 for foreign trips. Ground transportation estimates were included for all applicable stages. The summarized results are given in Table S-11, which shows a total inspection visit travel expense of approximately $61,000 per year.

If the staff is assumed to consist of seven inspectors and one supervisor at a burden rate of $50,000 per position per year, the cost of the laboratory certification program would be approximately $400,000 staff burden plus $61,000 travel expenses, for a total annual cost of approximately $461,000.

It should be noted that the travel allowances and costs per position as used above are made on a different basis than used by EPA for its own economic projections. The EPA uses a different accounting structure for personnel costing, full details of which were neither available nor directly pertinent to the present analysis. The purpose of the present estimate is to indicate the approximate total magnitude of the charges which should be attributed to the proposed laboratory certification program, regardless of the details as to how these costs would be distributed internally by the EPA.

Table S-11. Travel Expenses for Inspection Visits (2-Year Certification Cycle)

Geographical Category and Number of Laboratories	Type of Inspection	Cost, in dollars			Percent of Total
		Travel[a]	On-site[b]	Total	
Domestic (12)	Initial/Renewal[c]	7,870	5,690	13,560	27.1
	Periodic	11,790	9,510	21,300	42.6
	Unannounced	9,700	5,460	15,160	30.3
	Σ	29,360	20,660	50,020	100.0
European (4)	Initial/Renewal[d] and Periodic	14,430	9,750	24,180	52.7
	Unannounced	18,700	2,980	21,680	47.3
	Σ	33,130	12,730	45,860	100.0
Japan (1)	Initial/Renewal[c]	5,140	860	6,000	22.7
	Periodic	7,720	1,430	9,150	34.6
	Unannounced	10,290	990	11,280	42.7
	Σ	23,150	3,280	26,430	100.0
Overall Subtotals					
Domestic		29,360	20,660	50,020	40.9
Europe		33,130	12,730	45,860	37.5
Japan		23,150	3,280	26,430	21.6
Σ		85,640	36,670	122,310	100.0

[a] Round trip cost from Ann Arbor to airport of destination

[b] Per diem and ground transportation from airport of destination to return

[c] Includes operator certification

[d] Initial/renewal, operator certification, and periodic inspections combined in inspection tour

S.4.4 Organizational Structure

Since the initial laboratory certification program manpower requirements consist principally of seven or eight inspectors plus one supervisor, it would appear more utilitarian and effective to initially organize the group as a section or branch within an existing branch or division of the Office of Mobile Source Air Pollution Control (OMSAPC). This would enable the neophyte laboratory certification group to utilize existing lines of management control and clerical services.

In the longer term, it is expected that there will be an increase in the number of personnel assigned to the group in accordance with an increased number of certified laboratories covered by the program.

There is an additional operational difference which concerns the development of written and practical tests for operators. In the near-term structure (first 2 years or so), this task has been assumed to be performed for EPA by an outside contractor. After this period, EPA will have an option in this regard. One is for EPA to assume this task. This is the procedure used by the FAA (e.g., aviation mechanic written examinations) and the AEC (nuclear power plant operator written and practical tests). Exercise of this option would probably require additional EPA personnel.

Because of the factors of (a) increased number of staff members, (b) increased clerical work load, and (c) examination development requirements, it may be advisable in the longer term to provide a more formal organizational structure for the laboratory certification group. One such option is delineated in Figure S-4. Here, the "laboratory certification group" is pictured as a branch of an OMSAPC division in Ann Arbor. Three sections are included in accordance with the three principal functional task areas: office technical work, field work, and clerical work. The Certification Processing Section is charged with responsibility for ensuring that all in-office certification activities are accomplished in a timely and effective manner. In this regard, then, the principal function of this section is coordination of application processing. Corollary functions would include

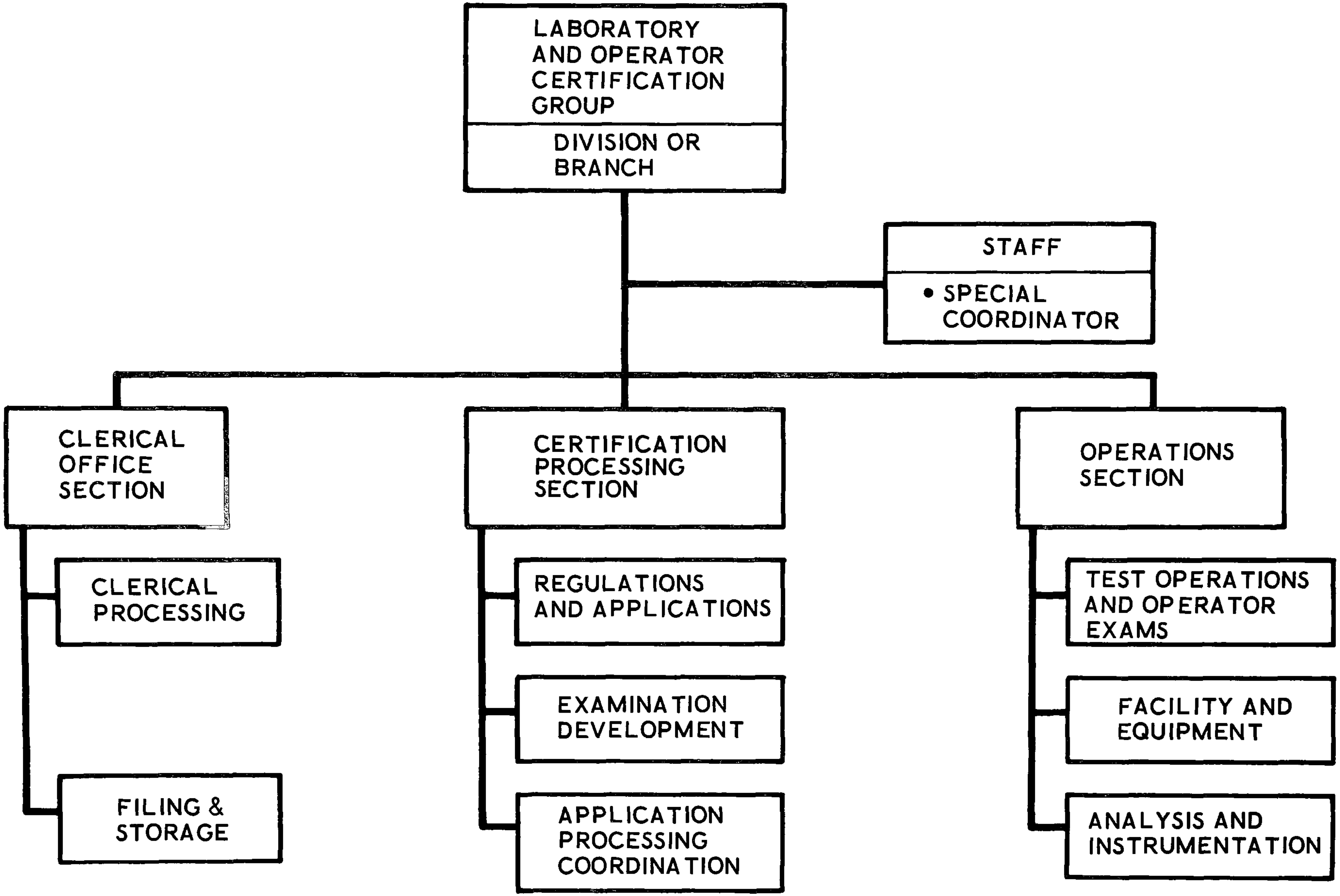


Figure S-4. Organization of Laboratory Certification Group — A Long-Term Option

(a) the development of examinations for operators, and (b) changes and updating of the regulations pertaining to laboratory and operator certification, as well as any necessary changes in the application forms. When the inspectors were not on laboratory field inspections, then, their in-office efforts would be available to this section for completion of the necessary work.

The Operations Section would be charged with the responsibility of conducting all field activities, including the scheduling of the inspectors for each trip and the coordination required between the laboratory and the laboratory certification group with regard to inspections and other on-going quality control activities. As noted in Figure S-4, if the number of inspectors on the staff were large enough, it might be advisable to further segregate the inspection staff into areas of special expertise or proficiency, as indicated.

The third section, Clerical, would be charged with all paperwork processing, filing, and information storage functions. In the long term, if a sufficiently large number of laboratories and operators apply for certification, a separate Clerical Office Section may be essential for efficient operation of the laboratory certification group. This is particularly true because the individual inspectors are assumed to be engaged in field work for a high percentage of the time.

S.4.5 Special Problems

S.4.5.1 Inspector Training

It is unlikely that a sufficient number of personnel will be available initially who have the requisite recent "hands-on" experience with emission control test equipment. Accordingly, a training program would have to be instituted prior to full-scale implementation of the laboratory certification program. Such a program could consist of working in the EPA Testing Laboratory (OPM) at Ann Arbor, under the direction of normal laboratory line supervision. The work should entail basic instrument and equipment operation, calibration, maintenance, and trouble-shooting. For a person with no prior experience in these specific areas, but who possesses the proper technical background and good motivation, it is estimated that about three months' full-time work under these conditions would be required to establish the necessary knowledge and skills.

S.4.5.2 Program Startup

A subject of concern is the possible conflict that might arise on program startup, due to initial overloading of the capabilities of the laboratory certification group. For example, consider the worst-case occurrence and assume that all 17 laboratories of the near-term scenario were to apply immediately upon announcement by EPA of implementation of the certification program. An analysis was performed for this case with two three-man teams working on the processing of the applications. Each team was assumed to work on two applications concurrently. The analysis resulted in an estimate of from 7 to 12 months required to complete the processing of all 17 initial applications, depending upon the degree of complexity encountered in the application processing activity. This time allotment accounts for all unannounced and periodic inspections which come due during the 7 to 12 months for those laboratories which receive early certification.

The situation may arise in which it is desirable to augment temporarily the inspection staff during the startup period by borrowing personnel from other branches or divisions of OMSAPC. This case was investigated by assuming that enough additional personnel were available to permit continuous activity by three three-man teams. An average application processing complexity was assumed, resulting in a time requirement of less than 6 months to complete the processing of all 17 applications.

In summary, under the assumed worst-case condition of simultaneous application by 17 laboratories, the initial certification process can be completed in between 6 months to 1 year, the exact time depending on the degree of technical complication encountered in application processing, and on the availability of temporary support personnel for the laboratory certification staff. This does not appear to be an unreasonable schedule, and it gives a good indication that in actual practice the start-up process should not present any major roadblocks to efficient program implementation.

It is seen, however, that a likely result of the initial certification schedule would be to produce an undesirable, asymmetrical certification cycle. That is, there would be a preponderance of renewal applications and inspections coming due within a period of a few months to a year. This can be avoided if EPA retains the discretionary option of extending the certification period of selected facilities. This device can be used to smooth out the certification cycle and produce a more uniform work load for the laboratory certification group.

S.4.6 Extension of Analysis Results to Longer-Term Implementation

It is considered likely that up to 26 independent laboratories could be involved in this program after a few years. A review of the analysis details used to obtain the results for the near-term scenario of 17 laboratories leads to the conclusion that, to a good approximation, both personnel staffing and travel expenses would be increased in direct proportion to this increase in the number of certified laboratories. That is, a factor of about 1.5 should be applied, giving a staff requirement of 11 to 13 inspectors, which would probably require a total of two or three supervisory or administrative positions. Annual travel expenses (at present rates) would be approximately $94,000.

S.5 COST OF EPA-OPERATED CERTIFICATION TEST FACILITIES IN EUROPE AND JAPAN

An alternative to certification of independent foreign testing laboratories would be for EPA to own and operate an emission testing laboratory in Europe and one in Japan, to perform certified testing in those areas. A cost estimate was performed for such an arrangement, for comparison with the proposed laboratory certification program for foreign laboratories and also for comparison with existing certification test costs at the EPA Ann Arbor testing laboratory. The estimate was performed for one laboratory in Europe and one in Japan to perform near-term vehicle certification tests of 360 and 210 per year, respectively. The cost estimate for these foreign facilities was structured to the same format as that used by EPA to determine cost of certification testing at Ann Arbor. These cost estimates do not represent official EPA figures, however. They are estimates prepared during this study based on general guidance from EPA.

The workload and staffing estimates for these laboratories are shown in Table S-12.

The cost estimates for this laboratory structure are shown in Table S-13. The staff burden was based on a fixed dollar rate salary for each position (exclusive of clerical). The salary rate used was chosen to be 10 percent higher than the comparable figure used in conjunction with the EPA Ann Arbor testing laboratory. Computer-related costs were assumed to be fixed at $100 per test. The estimate for facility rental was arrived at on the basis of a comparable dollar figure per test cell, as that allocated at the Ann Arbor facility. The program support fund is an overhead-related item, and was based on an equivalent rate as that allocated to the Ann Arbor testing function. The equipment depreciation value applies primarily to emissions test equipment and instrumentation, and was again selected on a comparable basis to that attributed to the EPA Ann Arbor testing laboratory.

It is seen that, by this method of accounting, the total cost to perform 570 certification tests in these two foreign laboratories is approximately $917,000 or $1610 per certification test. The equivalent figure for EPA Ann Arbor testing (using a similar accounting system) is approximately $1000 per test to perform about 3100 certification tests annually. The higher cost per test of the foreign laboratories is a result of the inherently lower personnel and equipment utilization efficiency in a small facility compared

Table S-12. EPA Laboratory in Europe and Japan—Workload and Staffing Estimates

Parameters	Europe	Japan	Combined
Number of Certification Tests per Year	360	210	570
Number of Dynamometer Test Cells	2	1	3
Staff			
Supervisor	1	1	2
Emission Test Specialist	2	1	3
Manufacturer Liaison	3	2	5
Subtotal, EPA Staff	6	4	10
Operators[a]	7	4	11
Total Personnel[b]	13	8	21

Notes:

[a]Possibly local nationals, provided on contract basis
[b]Exclusive of clerical

Table S-13. Cost Estimates for EPA Laboratories in Europe and Japan

Cost Category	Cost Estimate, in dollars		
	Europe	Japan	Combined
Staff Burden	280,000	172,000	452,000
Computer Charge	36,000	21,000	57,000
Facility Rent	200,000	140,000	340,000
Program Support Fund	24,000	14,000	38,000
Equipment Depreciation	20,000	10,000	30,000
Total	560,000	357,000	917,000
Cost per Certification Test	1560	1700	1610

to that of a much larger one. The analysis performed herein indicates that is not until the volume of testing can justify at least three or four test cells per test laboratory that costs per test could become significantly closer to the Ann Arbor level.

The cost of certifying just the four European and one Japanese independent laboratory as part of the overall laboratory certification program is estimated to be approximately $156,000 per year. Thus, the proportionate share of staff burden attributable just to the foreign laboratories is approximately 30 percent, or an annual burden of approximately $120,000. The travel cost allocable to the foreign laboratories is approximately $36,000 per year.

1. INTRODUCTION

1.1 BACKGROUND, OBJECTIVES, AND SCOPE

Except for a few heavy duty vehicle (HDV) emission certification tests performed for EPA by the Southwest Research Institute and those emission tests permitted by EPA to be performed abroad, all other emission certification tests [including light duty vehicles (LDVs) and light duty trucks (LDTs] are performed at the emission testing laboratory of the EPA located in Ann Arbor, Michigan. For example, foreign automakers have only the 4000- and 50,000-mile LDV emission certification tests performed at EPA and are allowed to send in their own test results for the intermediate mileages.

A significant increase in certification test work load, such as could be caused by new certification regulations (e.g., motorcycles, truck CVS tests, etc.), increased frequency of foreign vehicle emission certification tests, and retrofit device tests, might require either an increase in the Ann Arbor test laboratory facilities and personnel, or a means whereby independent laboratories could be certified to perform emission tests.

This potential problem is further accentuated by the fact that there are a number of inventors or other entrepreneurs who wish to evaluate new devices or ideas applicable to emission control for new cars, after-market parts, or used-car retrofit. Currently, the Ann Arbor laboratory cannot accommodate these people and must refer them to a list of about about ten independent laboratories who do perform exhaust emission testing. At the present time there is no mechanism for certifying that such laboratories have the facilities, equipment, and personnel necessary to meet the emission testing requirements published by EPA in the Federal Register.

Therefore, the present study was initiated to explore and characterize alternative means whereby laboratories such as these could be certified. This characterization could aid in the implementation of a laboratory certification process and/or enable a tradeoff between such laboratory certification and the continuation of all emission certification testing by EPA. The specific study objectives were to examine the emission laboratory certification process under consideration by EPA and (a) identify the functional tasks required to be performed by EPA during the initial and continuing phases of certifying the test facilities of domestic and foreign independent testing laboratories for performing exhaust emission tests per the requirements of the Federal Register, (b) identify a logical work flow sequence of the EPA tasks necessary for the above functions, (c) identify a reasonable EPA organization structure for performing the necessary work tasks, and (d) provide information to support the preparation of laboratory certification requirements to be promulgated in the Federal Register.

The above objectives were met by means of (a) the acquisition of available data concerning all aspects of the test laboratory certification process from organizations/agencies which certify laboratories and/or personnel for auto-related areas and scientific or engineering test measurement purposes, (b) a review of the test procedures and equipment requirements as set forth in the Federal Register for currently controlled vehicles and engines, (c) an analysis of the functional tasks required to enable certification by EPA of domestic and foreign independent laboratories, (d) an analysis of the work flow sequences required to implement and maintain the laboratory certification processes, and (e) an assessment of the management organizational structure, size, or manpower required in EPA to perform the initial and on-going quality control and certification tasks.

With regard to manpower and cost estimations, major emphasis was focused on an initial scenario in which it was assumed that 17 such independent emissions testing laboratories would apply to EPA for certification. These laboratories were geographically distributed as follows: 12 laboratories in the continental United States, 4 laboratories in Europe (e.g., England, France, Italy, Germany), and 1 laboratory in Japan. A limited amount of effort was devoted also to estimating the manpower and cost requirements to EPA for staffing and operating EPA-owned emission test facilities in Europe and Japan (one laboratory at each location).

1.2 ACQUISITION OF RELEVANT DATA

Nearly all the data reported herein were acquired and developed between 1 March 1974 and 31 August 1974 from technical reports and technical discussions held with representatives of federal and state regulatory agencies having responsibility for laboratory or operator certification or licensing; companies engaged in emission-testing-related activities (e.g., operators of test facilities, equipment suppliers, etc.) also provided information. Table 1-1 summarizes the government agencies from whom data were acquired. Appendix A contains a listing of significant visits or communications, including date of contact, agency/company contacted, and personnel involved.

1.3 ORGANIZATION OF THIS REPORT

Section 2 presents a review of the contemporary on-going certification activities of a number of federal and state regulatory agencies. It identifies what their regulatory duties are, how they go about implementing their functions, their organizational structure, work flow sequences, and the number and types of personnel involved.

Section 3 describes a brief review of the emission test procedures and equipment requirements as promulgated by EPA in the Federal Register. A requirements matrix is developed which compares the facility, equipment, and procedural requirements for certification testing in any currently promulgated subpart, for 1975-1977 model years of LDVs and LDTs, and 1974 HDV engine testing.

The functional tasks selected as appropriate for EPA use in implementing a laboratory certification program are delineated in Section 4 for both laboratories and operators. They encompass initial certification, renewal of certification, and on-going quality control functions.

Table 1-1. Principal Data Sources

Agency/Company	Type of Information
Federal Aviation Administration (FAA)	Certification activities related to: a. Aircraft repair stations b. Aviation mechanic training schools c. Flight and ground schools d. Aviation mechanics e. Designated mechanic examiners f. Designated pilot examiners g. Flight ratings
Atomic Energy Commission (AEC)	Certification activities related to operators of nuclear power plants
California Bureau of Automotive Repair (BAR)	Certification activities related to: a. Motor vehicle pollution control (MVPC) device installers b. MVPC stations
California Department of Public Health (DPH), Laboratory Field Service	Certification activities related to: a. Clinical laboratories b. Clinical laboratory technologists
Pennsylvania Department of Transportation, Bureau of Traffic Safety (BTS)	Certification activities related to: a. Safety inspection mechanics b. Safety inspection stations
New Jersey Department of Environmental Protection (DEP)	Voluntary program for training mechanics

Section 5 describes and discusses detailed expansions of the selected basic functional tasks in terms of work flow sequences. The number and types of work flow elements are defined, and the interrelation of work flow elements between the laboratory (or operator) and the EPA laboratory certification control group are extensively illustrated by means of flow sheet diagrams.

Section 6 identifies a reasonable EPA management organizational structure for performing the necessary work tasks identified in Section 5. Staffing requirements, personnel requirements, and management plan options are identified, together with cost estimates for implementing an independent laboratory certification program involving 17 such laboratories. Cost and staffing estimates are developed also for the case of establishing EPA-owned-and-operated emission testing laboratories in Europe and Japan.

2. REVIEW OF CONTEMPORARY ON-GOING CERTIFICATION ACTIVITIES

A review of contemporary on-going certification activities was made by contacting a number of federal and state regulatory agencies who have responsibility for laboratory or operator certification or licensing. These included:

a. The Federal Aviation Administration (FAA)
b. The Atomic Energy Commission (AEC)
c. The California Bureau of Automotive Repair (BAR)
d. The California Department of Public Health (DPH)
e. The Pennsylvania Department of Transportation, Bureau of Traffic Safety (BTS)
f. The New Jersey Department of Environmental Protection (DEP)

The purpose of this review was to determine (a) what their regulatory duties were, and (b) how they go about implementing their functions, particularly with regard to organizational structure, work flow sequence, number and types of personnel involved, and work load.

This review has resulted in a comprehensive picture of established regulatory procedures as used in the certification process in general. As summarized in Section 2.7, there is a consensus as to basic principles of certification requirements and implementation techniques; this consensus was drawn upon in selecting the recommended functional tasks for implementation of the laboratory certification program analyzed in this study (Section 4).

Details of the review for each agency contacted are presented in the following sections.

2.1 THE FEDERAL AVIATION ADMINISTRATION (FAA)

2.1.1 Certification Functions and Scope of Activities

The FAA certification activities examined were confined to those having the closest analogy to the proposed EPA laboratory certification processes. These certification measures are those used by the FAA Flight Standards Division, general aviation section. There are many other FAA activities related to other types of certification which were not examined because they were not directly relevant.

In the category of facility certification, three activities were selected. The first activity concerns aircraft repair stations. A repair station must be certified to perform maintenance and repair of aircraft and equipment, and to perform certain required inspections. The second activity concerns aviation mechanic training schools. These schools provide training covering the knowledge, skill, and experience required for mechanic ratings. Such a school must be certified for this training to be accepted by the FAA. The third facility certification activity is that for flight and/or ground schools. Certification is not a requirement to conduct a flight or ground school, but a certified school enjoys certain advantages which may affect its operation, principally a lower minimum flight time requirement for its students.

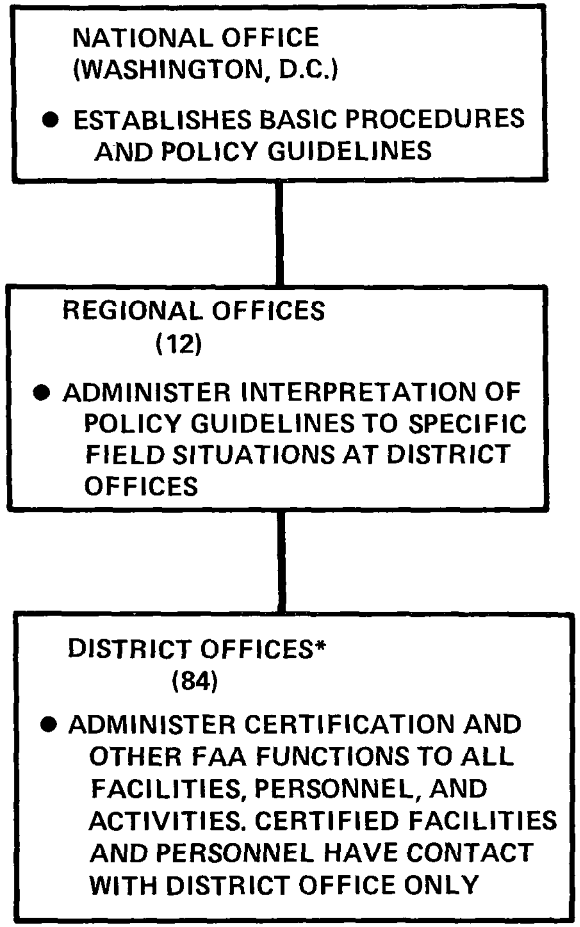
Four types of personnel certification procedures were selected for examination. The first is that of aviation mechanic. This classification was examined in greater detail since it was more directly related to the proposed EPA operator certification activity. An aviation mechanic must be certified in order to perform, supervise, or sign-off certain types of aircraft maintenance or alterations. There are two ratings, airframe and powerplant, and many mechanics hold both ratings. The second class of personnel certification is that for personal flight ratings, such as private pilot, commercial pilot, instrument rating, etc. The third and fourth classifications refer to examiners (non-FAA employees) designated by the FAA to give the practical test to applicants for the mechanic and flight ratings. These personnel are referred to as designated mechanic examiner (DME) and designated pilot examiner (DPE), respectively.

The material presented below covers the aspects of initial certification procedures (and renewal, if applicable) and on-going quality control or surveillance. With respect to this latter function, attention is also given to the "SWAP" quality control activities. "SWAP" is an acronym for Systems Worthiness Analysis Program, and refers to a procedure whereby very detailed inspections of certain facilities are performed, lasting 1 to 2 weeks or more. These inspections are carried out by a different team of inspectors than those who perform the initial, renewal (if applicable), and normal quality control inspections.

2.1.2 Management Structure and Staffing

The management structure of the Flight Standards Division is shown in Figure 2-1. Also shown in the figure are the basic functions performed at the national, regional, and district office levels. Staffing levels for the national, regional, and district offices are shown in Tables 2-1 through 2-3, respectively.

The job duties and qualifications for the various positions are as follows. Maintenance inspectors are responsible for certification activities relating to aviation mechanics, mechanic training schools, and repair stations. A maintenance inspector must be an FAA-certified mechanic, and have specific experience as a working mechanic, including a minimum of 2 years supervisory experience over certified mechanics doing work on aircraft. Operations inspectors are responsible for certification activities concerning all the personal flight ratings, and flight/ground schools. An operations inspector must hold valid FAA pilot ratings appropriate to his specific certification activities, have a minimum of 1500 hours total flying time, and meet minimum flight time requirements in each of certain applicable categories. Electronics inspectors and accident prevention specialists are primarily concerned with activities other than those covered in this section, and are not described further.



*GENERAL AVIATION

Figure 2-1. Management Structure – Flight Standards Division

Table 2-1. Staffing — National Office
(Flight Standards Division)

Personnel	Maintenance Division	Operations Division
Administrative	3	3
General Aviation (G/A) Specialist	18	21
Air Carrier (A/C) Specialist	18	29
Clerical	12	18
Total	51	71

Table 2-2. Staffing — Regional Offices
(Flight Standards Division)

Personnel	Total, All Regional Offices	Western Regional Office[a]
Regional		
Administrative	12	1
Maintenance Specialist	22	3
Operations Specialist	25	3
Other G/A Specialist	11	1
Clerical	27	3
Total	97	11
SWAP Team[b]		
Administrative	10	1
G/A Maintenance Specialist	37	9
G/A Operations Specialist	41	9
A/C Specialist	101	23
Manufacturing Inspector	35	7
Clerical	39	8
Total	263	57

[a]For California, Arizona, and Nevada (in Los Angeles)

[b]Both general aviation (G/A) and air carrier (A/C) staff are included in the SWAP level as it is an integral part of these offices.

Table 2-3. General Aviation Staffing — District Offices (Flight Standards Division)

Personnel	Total, All District Offices	Twelve District Offices in Western Region	Santa Monica District Office
Administrative	68	7	1
Maintenance Inspector	303	48	3
Electronics Inspector	50	7	1
Operations Inspector	419	67	5
Accident Prevention Specialist	84	12	1
Clerical	300	45	4
Total	1224	186	15

Maintenance and operations specialists at a regional office must have prior experience as inspectors at a district office. Job requirements for specialists at the national office are similar to those for the regional office. Although it is not a specific requirement, the usual procedure is to fill vacancies in the national office with qualified specialists from a regional office.

The numerical scope of certification activities is summarized in Table 2-4.

2.1.3 Specific Certification Activities

The following sections describe in more detail the certification procedures in use for each of the three facility and four personnel categories listed in Section 2.1.

2.1.3.1 Aircraft Repair Stations

A repair station applying for certification must submit an application in which it must demonstrate that the station has the necessary equipment and facilities, and that it has the necessary certified personnel in

Table 2-4. Scope of Activities — General Aviation (Flight Standards Division)

Facility/Function	Total, All District Offices	Twelve District Offices in Western Region	Santa Monica District Office
Mechanic Training Schools	138	25	2
Repair Stations	2,735	591	73
Flight/Ground Schools	2,562	373	28
Designated Mechanic Examiners	487	82	13
Designated Pilot Examiners	1,540	288	11
New Mechanic Ratings (1972)	8,138		
New Pilot Ratings (1972)	83,877		

its employ. An inspection visit is made to verify each of these factors. Certification, if granted, is valid indefinitely unless suspended. On-going quality control has consisted of quarterly inspection visits, but this is in the process of being put on an as-required basis. This basis will be determined by monitoring the station's activity. Information and data relating to the routine activities of a repair station are routed through the inspector's office in the normal course of events. Certification is suspended if a repair station loses the services of its certified employees, and remains suspended until they are replaced by new certified personnel.

2.1.3.2 Aviation Mechanic Training Schools

A school desiring certification must submit an application covering details of curriculum, physical plant, and facilities; number and qualifications of instructors; and number of students. Instructors of shop courses (in which the students acquire the experience requirement of their training) must hold the appropriate FAA mechanic rating. The curriculum is compared with the detailed requirements specified in a Federal Air Regulation (FAR). Noncompliance with these FAR requirements causes rejection of an application at this stage. If all parts of the application are in order and meet all applicable FAR requirements, an inspection visit is made to verify the accuracy of the information contained in the application. Certification, if granted, is valid indefinitely unless suspended. This initial certification process is illustrated in Figure 2-2.

There are three aspects to the on-going surveillance of a certified school, as shown in Figure 2-3. First is the normal semiannual inspection visits performed by maintenance inspectors from the cognizant district office. This inspection normally lasts a day for a two- or three-man team. They sit in on lectures and shop courses, examine school curriculum and records, and check for certification of shop instructors. Additional shorter quarterly visits may also be made.

The second quality control aspect involves the national office for technician training at Oklahoma City. This office is responsible for establishing the basic criteria for certification of mechanic training schools and has sole jurisdiction over preparation, grading, and record keeping of the written examination required of all applicants for the mechanic ratings. This group periodically reviews the examination grades of the graduates of each certified school. The grades are compared with a national norm based on the school's size. If the average results fall below this norm, corrective action is required on the part of the school. The Oklahoma City office participates in determining the nature of their action, but the actual enforcement of these changes remains with the district office.

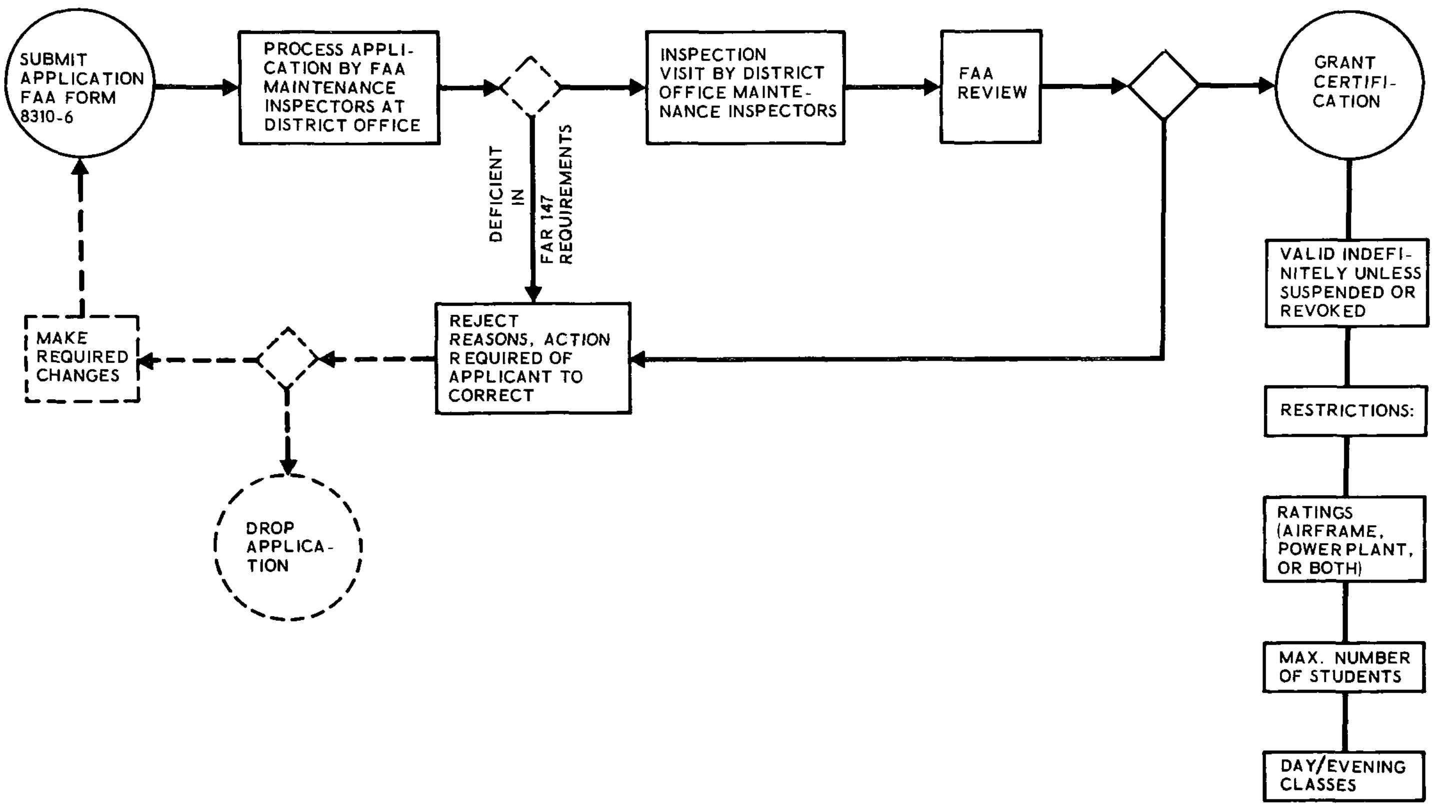


Figure 2-2. Sequence of Initial Certification Procedures — Aviation Mechanic Training School

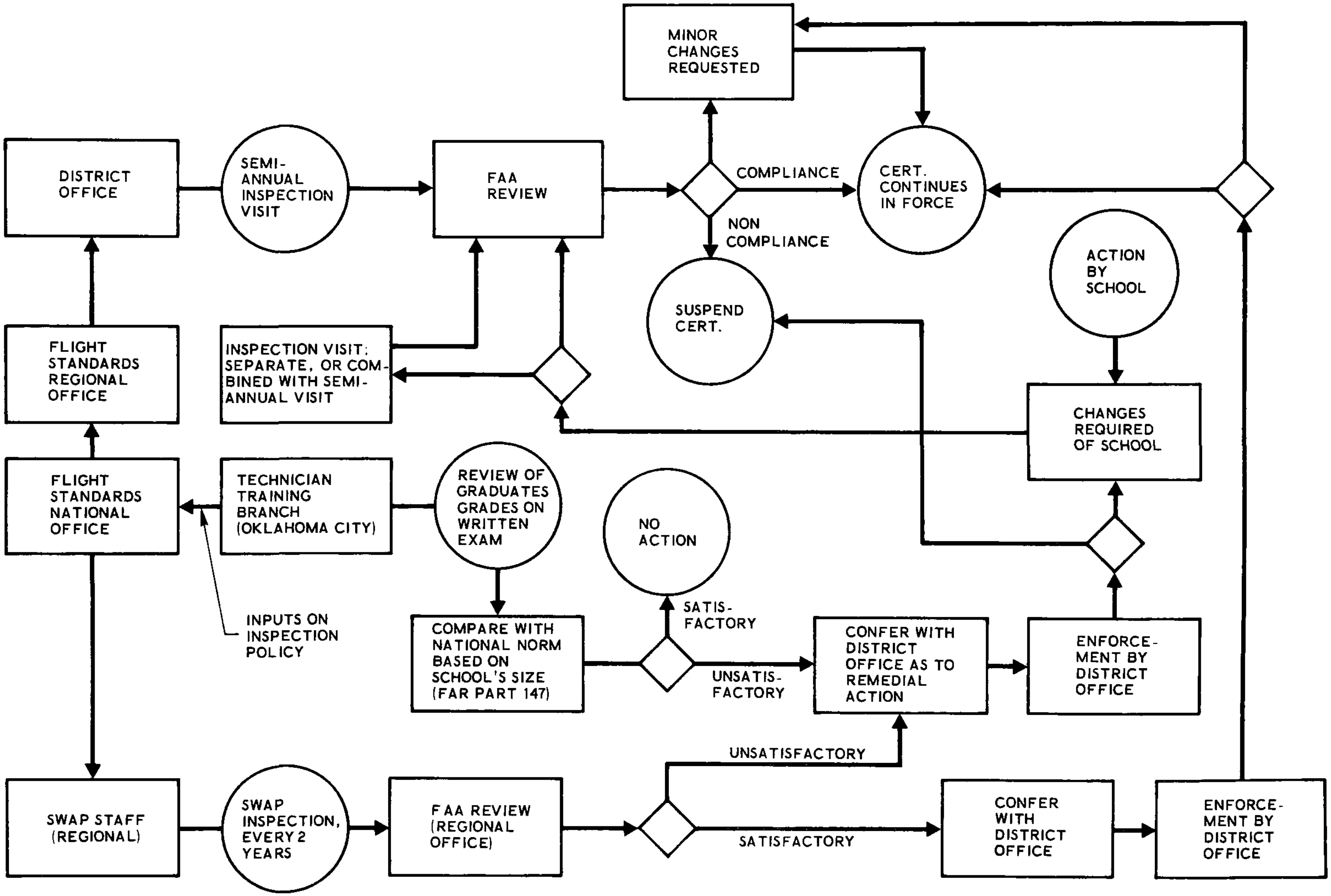


Figure 2-3. Sequence of On-Going Quality Control Procedures — Aviation Mechanic Training School

The third facet of surveillance is the SWAP inspection, performed at approximately 2-year intervals to schools above a certain minimum size. This special class of quality control inspection is described in Section 2. 1. 3. 8. It need only be remarked here that this is an in-depth inspection lasting about 2 weeks, in which maintenance specialists at the regional level observe classroom and shop procedures daily over this period, as well as examining school records and facilities. Any corrective actions generated by this inspection are worked out in conjunction with the district office, which again retains sole jurisdiction over implementation.

2. 1. 3. 3 Flight and/or Ground Schools

An application is required covering three main areas. The first is a detailed description of the training curriculum, which is compared against FAR requirements. The second is a description of the facilities, including aircraft and training aids, showing compliance with FAR requirements as to maintenance and procedures. Third is a listing of instructors, with evidence of certification of each.

If all applicable FAR requirements appear to be satisfied, an inspection visit is performed to verify the accuracy of the information contained in the application. This visit must include a flight check of the chief flight instructor. The term of certification is 24 calendar months. The renewal process is identical to that for initial certification.

On-going quality control is primarily of an operational nature. The chief control is that eight out of the ten most recent graduates of a given school flight tested by an FAA inspector must pass the test on the first trial. Failure to meet this requirement will require corrective action on the part of the school, and possible loss of certification. In addition, random spot checks may be made of the facility.

2. 1. 3. 4 Aviation Mechanics

There are three requirements for these ratings; namely, experience, knowledge, and skill. These requirements must be established in the order given. The experience requirement is established by graduating from a certified training school, or by demonstrating satisfactory experience in industry or the military. The knowledge and skill requirements are demonstrated by passing an FAA written examination, and an FAA practical test, respectively.

The procedure is as follows (see also Figure 2-4). The applicant must present an application showing fulfillment of the experience requirements to an FAA maintenance inspector. If the applicant is not a graduate of a certified training school, he must demonstrate 18 months approved experience for either rating alone, or 30 months approved experience for both ratings. It is the responsibility of the applicant to present this information in sufficient detail and in a form which permits the inspector to evaluate it properly. The inspector has sole authority to approve or disapprove the experience.

If this requirement is established, the inspector signs an authorization for the applicant to take the FAA written examination at any district office. Upon passing this examination, the applicant is eligible to take the practical test. This may be given either by an FAA maintenance inspector, or by a designated mechanic examiner (DME). The mechanic rating is granted upon passing this test. The certificate is valid indefinitely, unless suspended. There are no formal contacts required as to on-going surveillance. There are recency of experience requirements, however, which state that a certified mechanic may not exercise his privileges unless he has had 6 months experience as a mechanic in the last 2 years, or has been checked out and approved by an FAA inspector.

2.1.3.5 Designated Mechanic Examiner (DME)

A person wishing to obtain this rating must submit an application to the nearest district office. In this application he must show that he is an FAA certified mechanic with appropriate experience, and that he has access to equipment and facilities (normally requiring a complete aircraft) necessary to give a practical test to applicants for the mechanic rating. The FAA does not necessarily give a test for this rating. Most DME's are on the faculty of certified training schools, but this is not a requirement.

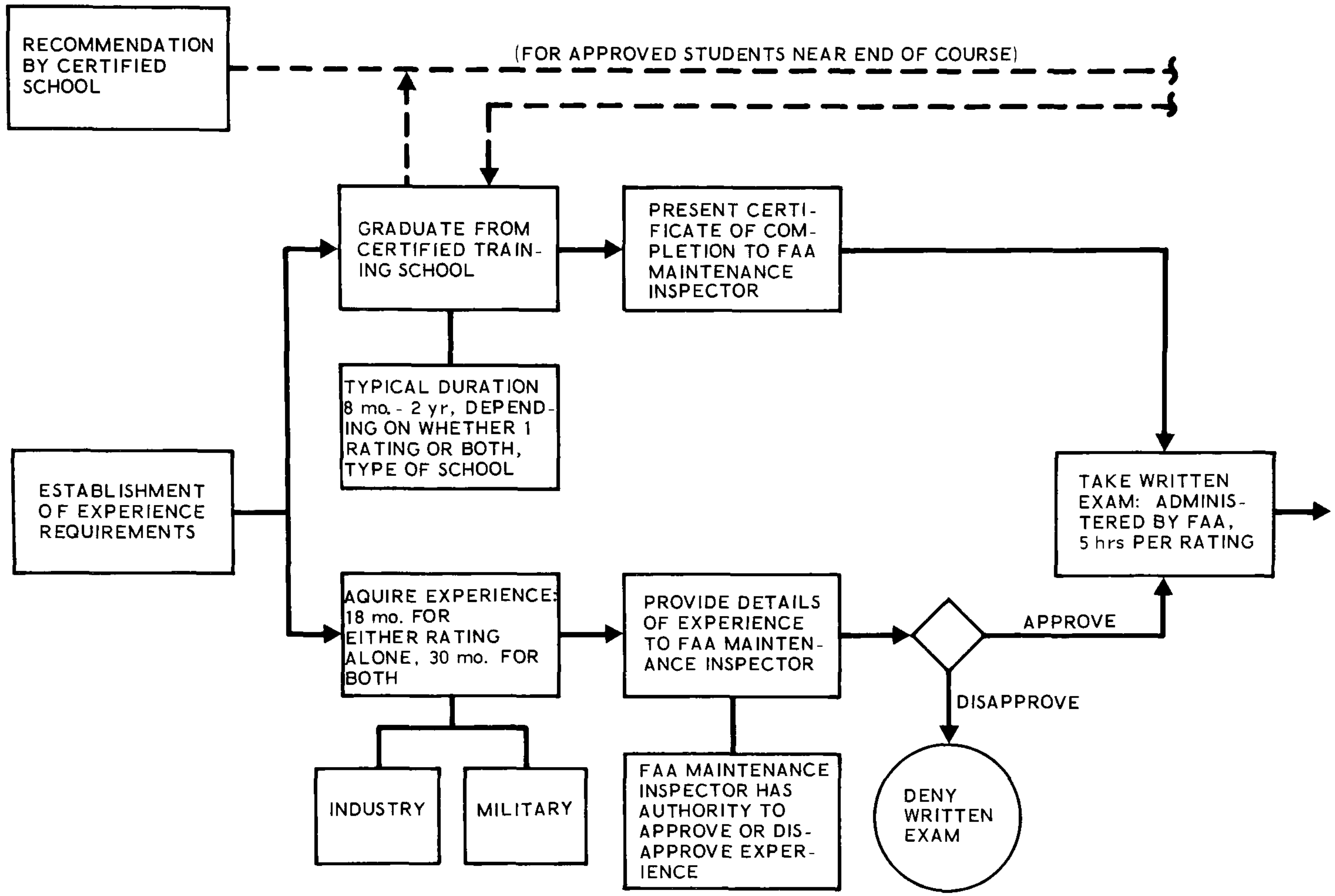


Figure 2-4. Steps in Certification Process for Aviation Mechanics

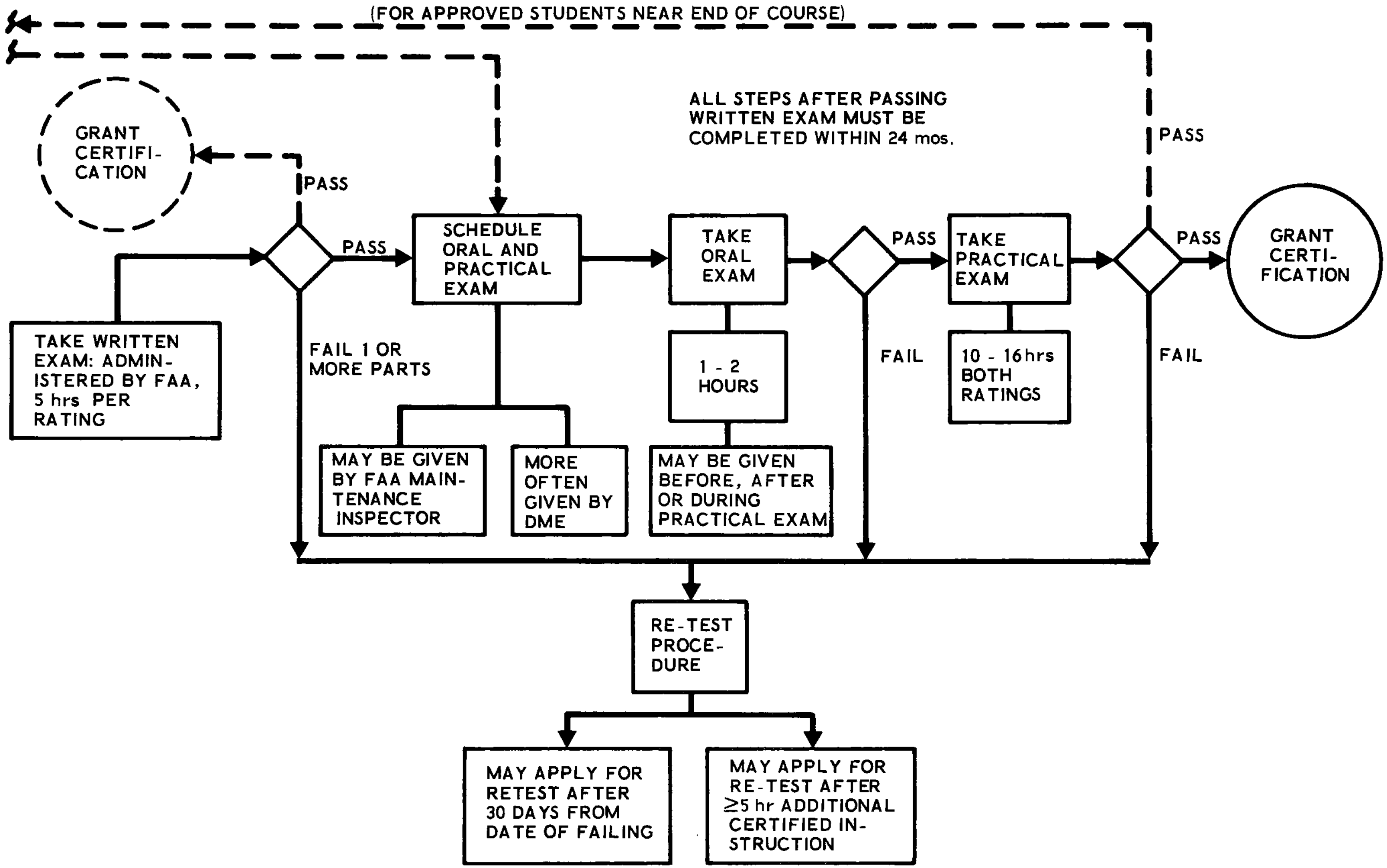


Figure 2-4. Steps in Certification Process for Aviation Mechanics (Continued)

The term of certification is 1 year. Annual renewal is normally obtained by demonstrating a satisfactory level of activity as a DME, and by satisfactory performance during the semiannual contact with an FAA maintenance inspector. The latter may consist of a standardization check by the inspector, or he may observe while the DME gives a test to an applicant. The FAA supplies information concerning suggested topics for both the oral and practical phases of the test, but the actual makeup of a test is the prerogative of the individual DME.

The purpose of the DME rating is to reduce the workload on the FAA inspectors. The main advantage to the applicant is that the DME supplies all the equipment for the test, whereas this becomes the responsibility of the applicant if the practical test is given by an FAA inspector. The DME receives no compensation from the FAA. He is authorized to charge the applicant for his services, but in practice this charge is a nominal one which normally does not cover the cost of giving the test.

2.1.3.6 General Aviation Flight Ratings

An applicant for a flight rating must apply to an FAA operations inspector or Designated Pilot Examiner (DPE) for the flight test. There are three essential requirements to this application. The first is a notice by the FAA that the applicant has passed the written examination appropriate to the rating sought. The second is that he must show evidence of the required instruction (properly annotated log book) plus a statement by the instructor recommending him for the test. Third is a valid medical certificate appropriate to the rating sought.

The inspector or examiner gives an oral test covering ground and flight handling of aircraft, navigation, and FAA flight rules. The practical test consists of a flight test in which the applicant must demonstrate safe, proficient handling of the aircraft during maneuvers and procedures specified for each flight rating. It is the responsibility of the applicant to supply a suitable aircraft for this test.

Certification is valid indefinitely unless suspended. The only formal on-going contact required between the individual and the FAA (for that particular rating) is periodic renewal of the medical certificate. There are recency of experience requirements, however, which place certain restrictions on an individual who does not meet them.

2.1.3.7 Designated Pilot Examiner (DPE)

Application for this rating must show that an applicant meets the same basic requirements as those for FAA operations inspectors, defined in Section 2.1.2. A flight check by an operations inspector is required. The term of certification is 1 year. Annual renewal is dependent on the analogous conditions as described for the DME in Section 2.1.3.5. On-going quality control consists of semiannual contacts with an operations inspector. In one contact, the inspector gives a standardization flight check to the examiner. In this check, the inspector defines the flight maneuvers to be used in the test, and observes the performance of the examiner in performing them. The second semiannual check consists of the inspector observing from the back seat while the examiner gives a flight test to an applicant. As with the DME, the reason for the DPE rating is to reduce the work load on the FAA inspectors. About 90 percent of all general aviation flight tests are given by DPE's. The DPE also receives no compensation from the FAA. A nominal fee is charged the applicant for his services by the DPE.

2.1.3.8 Systems Worthiness Analysis Program (SWAP)

This relatively new quality control activity is in addition to the primary quality control procedures described in the preceding sections. It consists of a special team of maintenance and operations specialists operating at the regional level to support certification activities of the district offices within that region. Their work consists of in-depth quality control inspections of certified facilities above a minimum size. The duration of the inspection of a given facility is 1 or more weeks. The inspection team is typically two to four men, depending on the facility and function being examined. These visits are scheduled to occur at approximately 2-year intervals at a given facility. The inspection results are reviewed with the cognizant district office, which retains sole jurisdiction over enforcement.

The facilities described herein that are subject to SWAP inspections are: technician schools with more than 100 students, repair stations with more than 25 employees, and certified flight schools with more than 6 aircraft.

2.1.3.9 Summary of FAA Certification Procedures

For the initial certification process, it is seen that there are two main phases, namely, an application and an inspection visit. The application must include all the essential elements necessary to make an initial assessment of compliance with FAR requirements. As appropriate, this must include information on prior certification of personnel, curriculum details (for schools), description of physical plant and equipment, staff members (number and qualifications), prior training and/or experience, and availability of essential equipment and facilities.

If the completed application gives good evidence that all statutory requirements are satisfied, an inspection visit is scheduled to verify accuracy of the information contained in the application, and in some cases to administer required personnel operational checks.

Examinations required for the various personnel ratings fall into the following categories. Written exams are required for all mechanic, flight, and ground instructor ratings. Oral and practical tests are required for all mechanic and flight ratings. Standardization flight checks are required of DPE's, and the chief flight instructor of a certified school.

For aircraft repair stations, mechanic training schools, and all mechanic, flight, and ground instructor ratings, certification is valid indefinitely unless suspended. The period of certification for flight and/or ground school is 24 calendar months, while that of the designated examiners is 1 year.

The on-going quality control or surveillance procedures fall into the following categories. Semiannual (and sometimes quarterly) inspection visits are made to aircraft repair stations and mechanic training schools. For those personnel ratings which have an indefinite term of certification, there are recency of experience requirements. These place restrictions (or a total ban) on the certification activities of the persons so affected until these requirements are fulfilled. Semiannual (and sometimes quarterly) FAA contacts are made with designated examiners. These contacts normally take the form of a standardization check, or observation during a test being administered by the examiner. Operational performance checks on certified flight schools are performed by administering spot flight checks to their graduates.

Finally, the detailed SWAP quality control inspections, applied to facilities above a minimum size, support the primary on-going quality control activities.

2.2 THE ATOMIC ENERGY COMMISSION (AEC) - LICENSING OF NUCLEAR POWER PLANT OPERATORS

2.2.1 Certification Functions and Scope of Activities

This AEC office, located at Bethesda, Maryland, has responsibility for licensing all operators of nuclear power plants in the U.S. The personnel ratings licensed are "operators" and "senior operators." The operator rating designates personnel who manipulate the controls of licensed nuclear facilities. The senior operator rating refers to those personnel who directly supervise the activities of operators. Employment of licensed operators is a requirement for facility licensing. The operator's license is valid only at the facility where granted.

Facilities with personnel licensed by this office consist of 42 operating power plants and 85 research facilities. These facilities have nationwide distribution. The research facilities are primarily associated with the larger universities, while the power plants tend to follow population distribution. There are approximately 1600 licensed operators and senior operators, with 410 new personnel licenses issued in 1973.

Two types of examinations are administered: written and operating. The former covers theory and practice of nuclear plant operation -- in general and for the specific facility at which the applicant is employed. The practical test consists of "hands-on" performance by the applicant as he manipulates the plant controls (either real or simulated) through the full range of normal and emergency positions appropriate to the applicant's job classification. The term of the license is 2 years.

The above tests are given to all new applicants for a rating, and until recently were also given to renewal applicants. This office is now establishing a requalification program at each facility, which is basically a continuous training and job upgrading activity conducted by the facility under approval of the Bethesda office. Operators and senior operators who successfully complete an approved requalification program need not take the renewal written and practical tests.

2.2.2 Management Structure and Staffing

The Bethesda office deals directly with all licensed nuclear facilities; there are no district offices. The staff is structured as follows. There is one supervisor, three group leaders, five examiners, and two clerical. The group leaders are senior examiners who participate in field work to the same extent as examiners. In addition, there are 21 consultants throughout the nation who participate in administering examinations at certain licensed facilities. There is a functional breakdown of the staff within the office, based on three classifications of reactor types, but they do not have separate staffs for preparation of examinations, administering examinations, and surveillance of requalification programs. Basically, everyone is involved in all phases of the work.

The entrance level job requirements for the examiner position are a B.S. degree in an appropriate engineering or science discipline, plus 3 years of nuclear power plant experience. A GS-14 grade would require 5 years nuclear power plant experience, with part of that time in training work. A group leader position would require at least 7 years experience, but the preferred approach is for these people to work up from the staff, rather than being hired in as a group leader.

2.2.3 Specific Activities

2.2.3.1 Examination Preparation and Administration

This task is performed by the staff of the Bethesda office. A new written examination is prepared for each visit to a facility. It may contain some questions in common with a former examination for that facility. The examination questions are nearly all essay type, drawing schematics from memory, etc. They avoid multiple choice questions. They do have some questions where, for example, a series of operations and manipulations are listed, and the applicant is asked to list them in the correct sequence. They have a bank of approved examination questions. About half of the questions on a given test are generic, covering basics which are common to nearly all facilities. The remainder of the questions are tailored to the specific facility. This facility-specific information is obtained from information contained in the facility license applications (which are not processed by this Bethesda office, but are available to them), from periodic reports required of each licensed facility, and from personal observations of their staff during previous trips to that facility.

There is no specific time limit for the written test. The operator and senior operator tests are normally completed within 7 and 6 hours, respectively, but an applicant is usually given more time if he needs it. A senior operator applicant must take the operator written test first, then the senior operator examination on the next day.

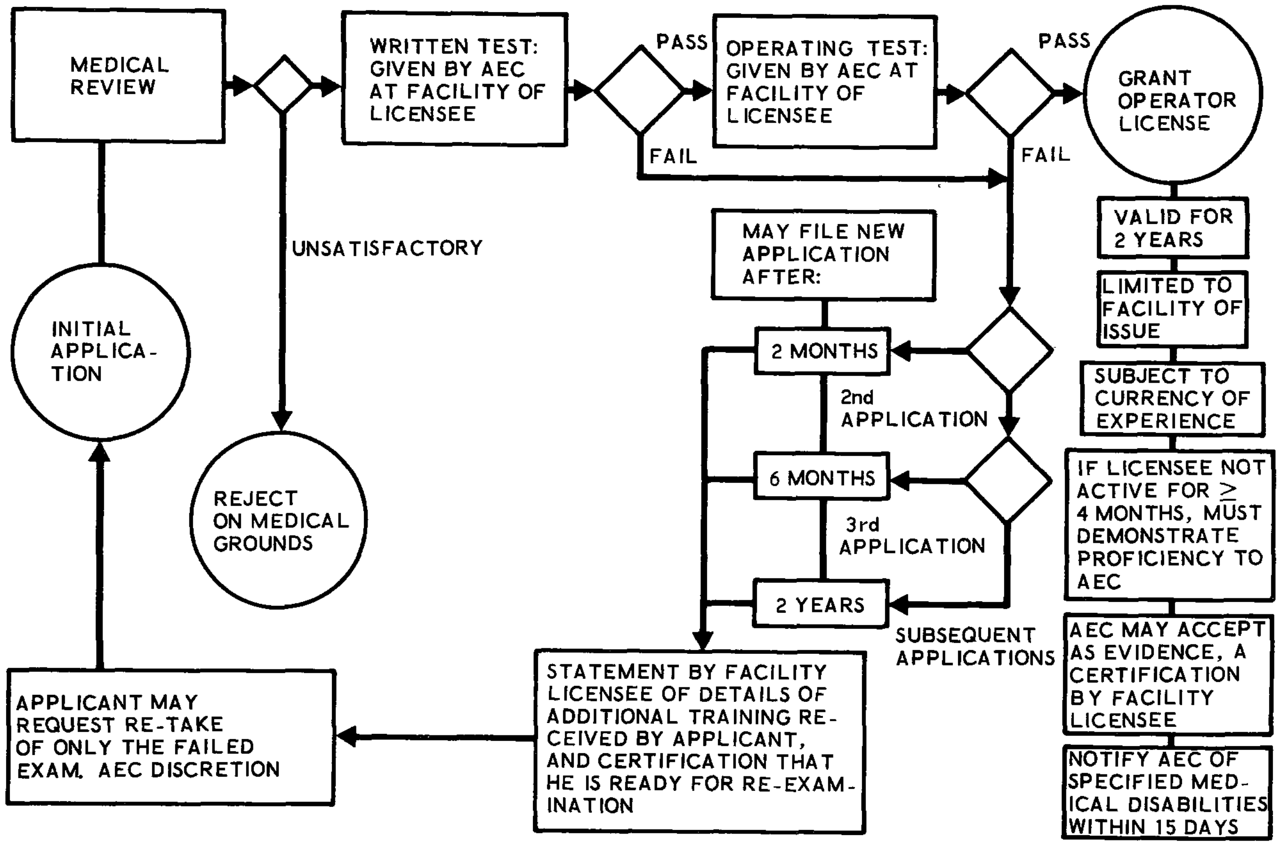
The operating test is structured entirely to the specific facility, and to a certain extent, the specific job assignment of the applicant. The sequence of manipulations which the applicant will be asked to perform are established beforehand in check list form. These manipulations normally involve the actual controls of an operating plant whenever possible, including facility start up, shutdown, and other normal and emergency procedures. For a new facility, at which the operators must be licensed before the plant can go into operation, the control movements are of necessity simulated. The operating examination normally takes 5 hours.

The administration of these tests proceeds in the following manner. Each examiner makes an average of approximately one trip per month, and the average trip duration is 1 week, for a travel schedule of approximately 60 days per year per examiner. The usual procedure is to give all the operator written examinations the first day, and senior operator written examinations the second day. Operating tests are also started the second day. If several applicants are to take operating tests (which is the usual case) the examinations are arranged for minimum interference with plant operations, but each applicant takes the test by himself; they do not walk through a group of applicants at the same time. They try to keep the number of operating tests per trip to six or less. This does not apply to a new facility, in which all the operators must be licensed. Normally there is one examiner per trip, except for the first trip to a new facility, where there may be as many as 30 applicants.

All examinations, written and operating, are returned to the Bethesda office for grading. The minimum passing grade on the written test is 70 percent. The operating tests are conducted in accordance with a check list upon which the administering examiner makes comments and notes. He uses this annotated check list as the basis for a pass/fail recommendation. The final decision is made by the group supervisor, after discussing the completed check list with the examiner. The applicant is notified of the results by mail.

2.2.3.2 Operator Licensing

The examinations described in the preceding section form the final basis as to whether or not a license is awarded, but they represent only part of the licensing procedure, an overview of which is shown in Figure 2-5.



*Operators and Sr. operators of nuclear production and utilization facilities (Ref. 10CFR55)

Figure 2-5. Sequence of AEC Licensing Procedures*

The licensed facility which employs the applicant is heavily involved in all aspects of the personnel licensing procedure. The expansion of the initial application format given in Figure 2-6 shows that the facility licensee must request and recommend that the applicant be tested by the AEC.

2.2.3.3 Requalification Program

The operator and senior operator license renewal procedures are shown in overview in Figure 2-7. The renewal application content is expanded in Figure 2-8. The requalification program, about which the license renewal process is structured, is outlined in Figure 2-9. Details of the program are shown in the succeeding three breakdowns of Figures 2-10, 2-11, and 2-12.

2.2.3.4 Summary of AEC Procedures

It is seen that the initial license is based on an application, which must demonstrate extensive training and qualification requirements as well as a recommendation by the facility licensee. The latter must also demonstrate that there is a need for the personnel license, by requesting that the applicant be tested. A medical examination, per AEC format, is required. This is followed by comprehensive written and practical tests administered by the AEC at the facility at which the applicant is employed. The term of license is 2 years, with currency of experience requirements. The license is valid only at the facility for which it is granted.

License renewal is by application, which must show evidence of proficient operation during the term of the current license, and satisfactory completion of an approved requalification program.

On-going quality control consists of the AEC approved requalification program, which is conducted by the facility licensee. This program is a continuous retraining and job upgrading activity, which must include features tailored to the specific needs of each individual licensed operator.

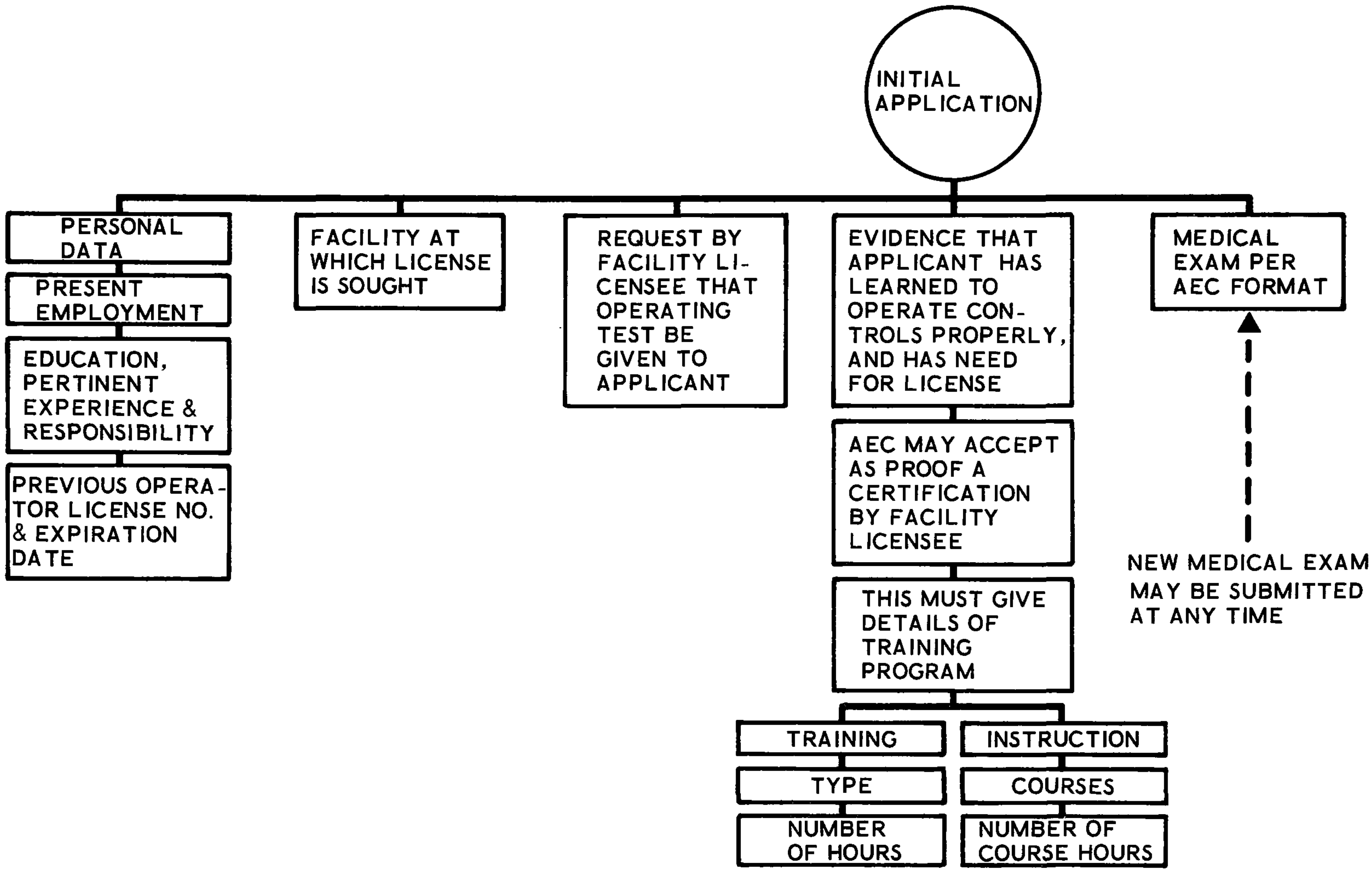


Figure 2-6. Initial Application Content

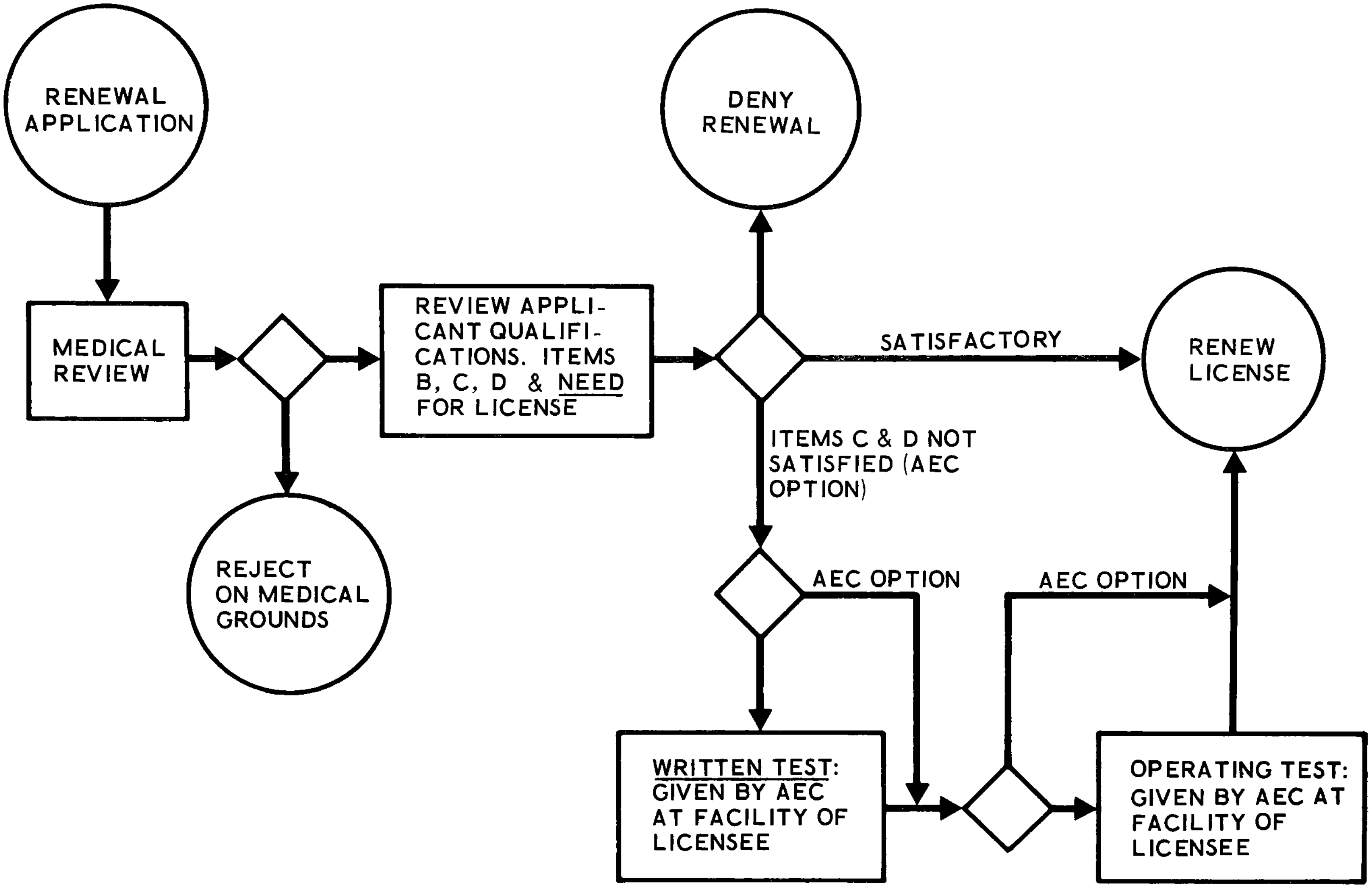


Figure 2-7. Sequence of AEC Renewal Licensing Procedures

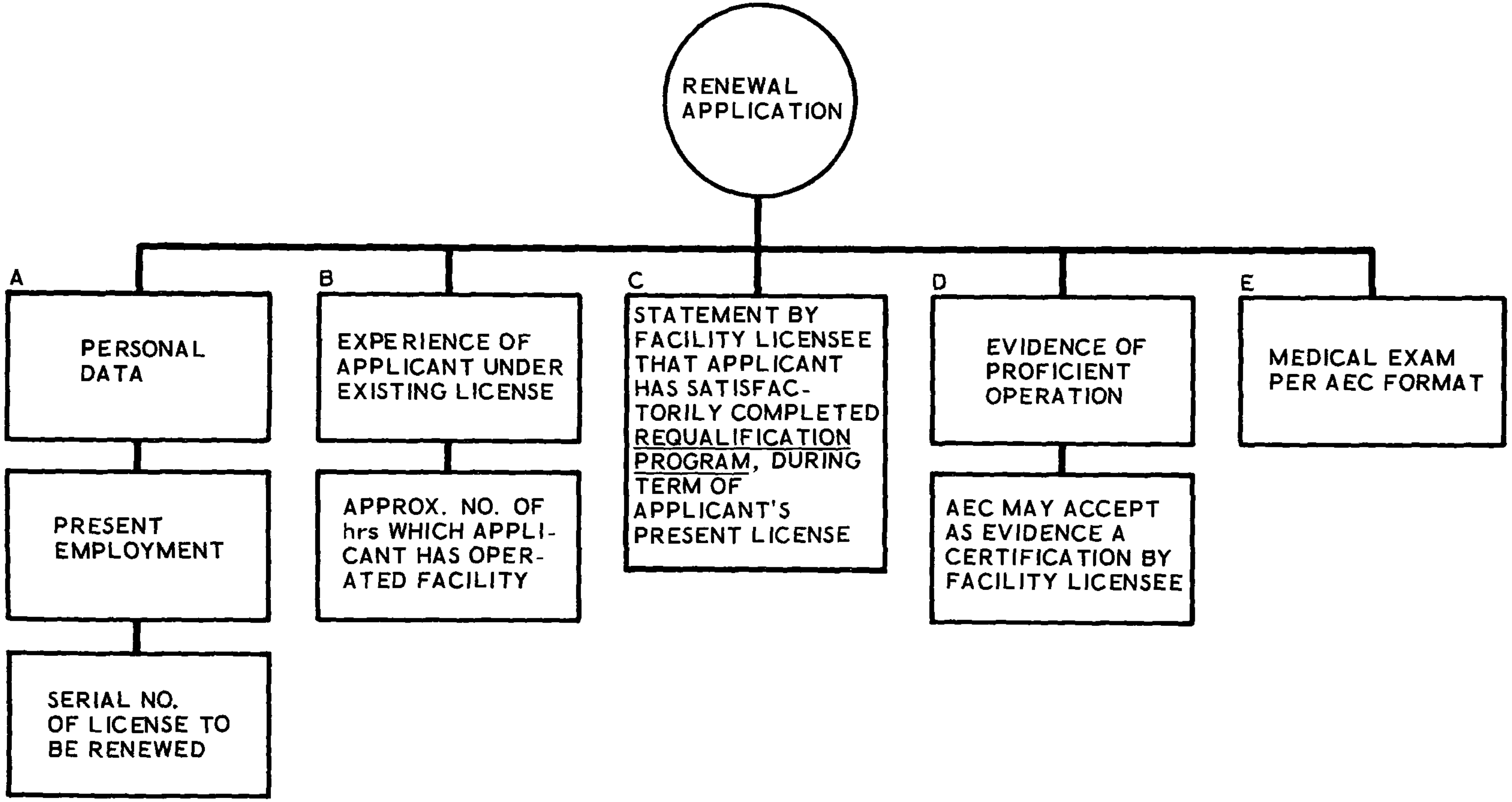


Figure 2-8. Renewal Application Content

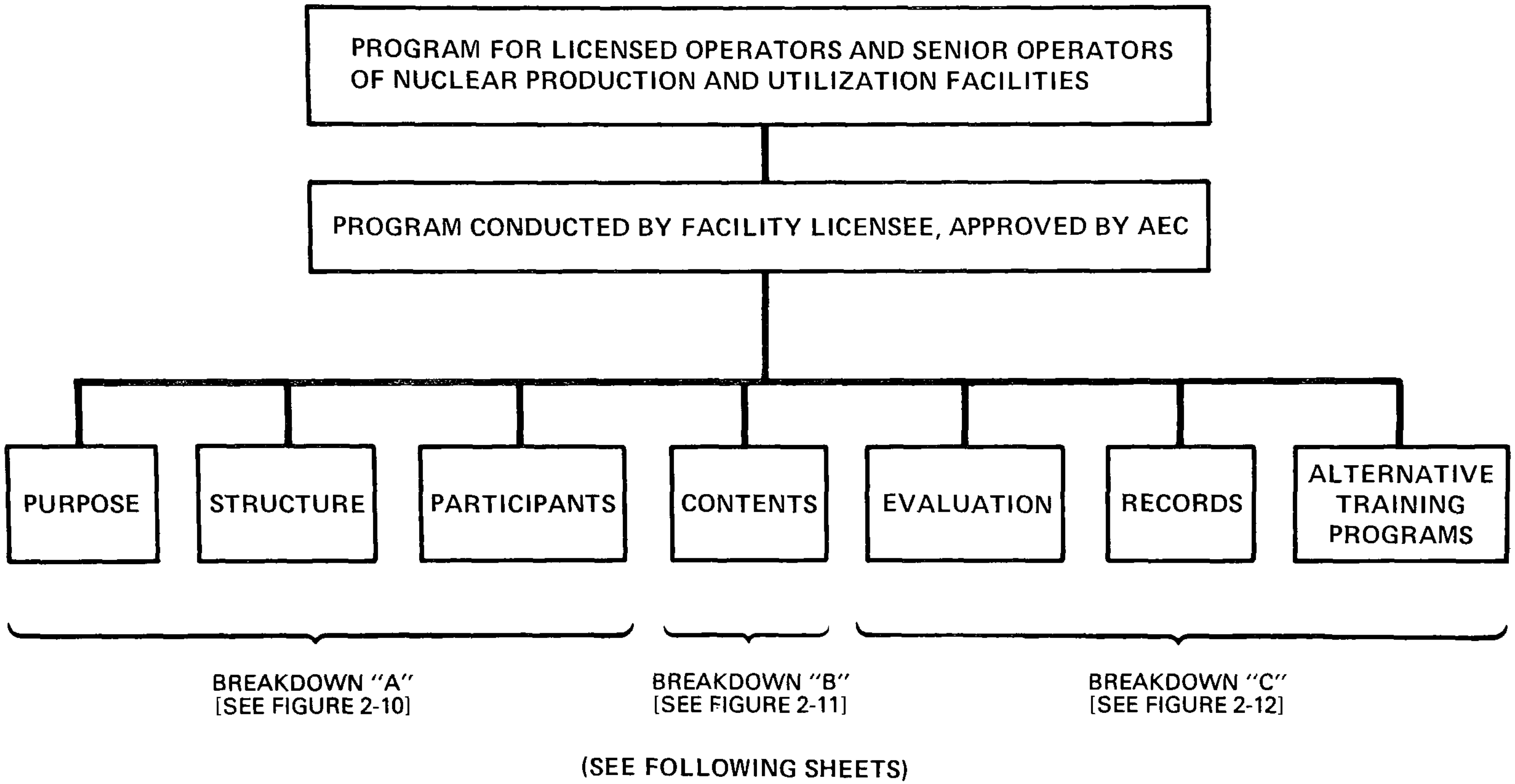


Figure 2-9. Requalification Program — Overview

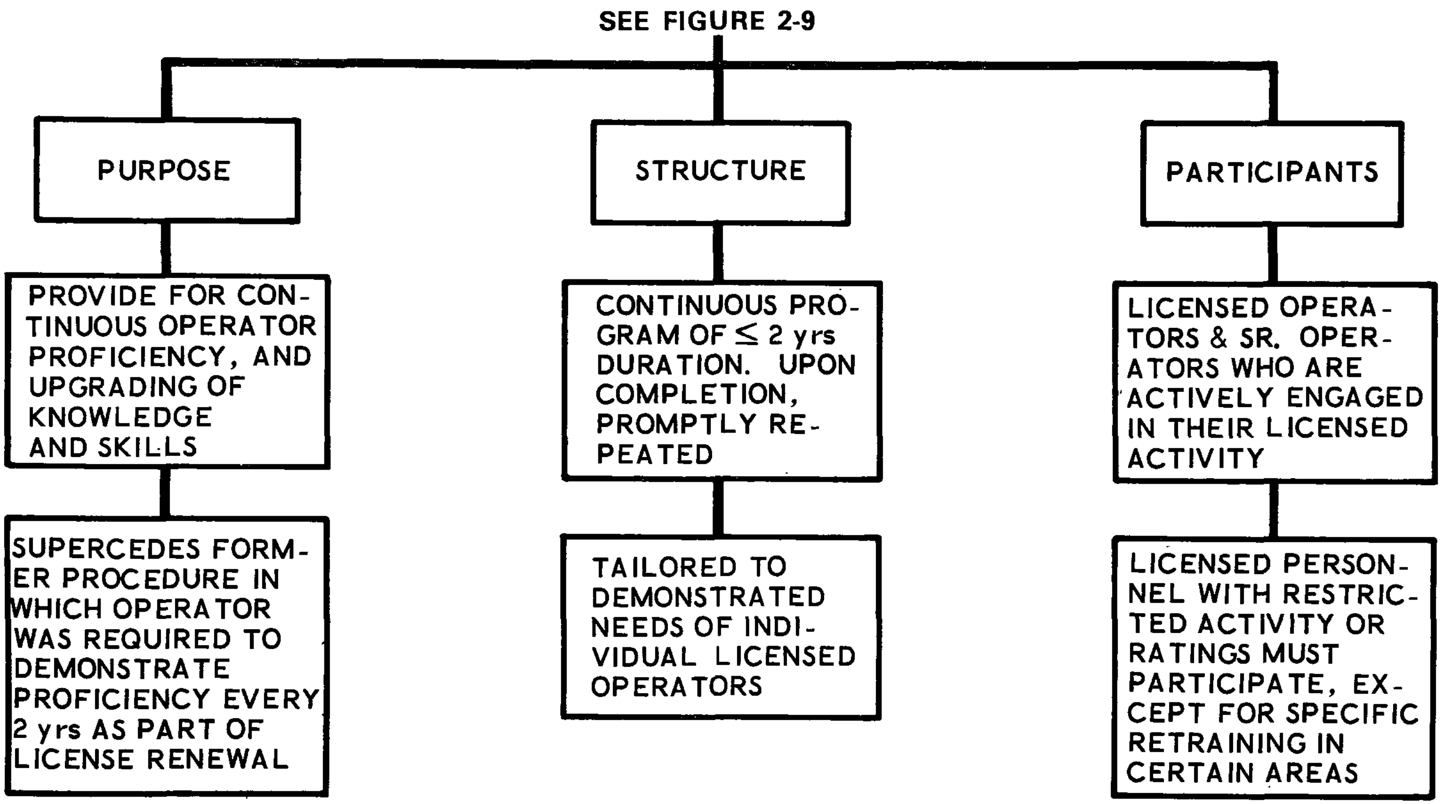


Figure 2-10. Requalification Program — Breakdown "A"

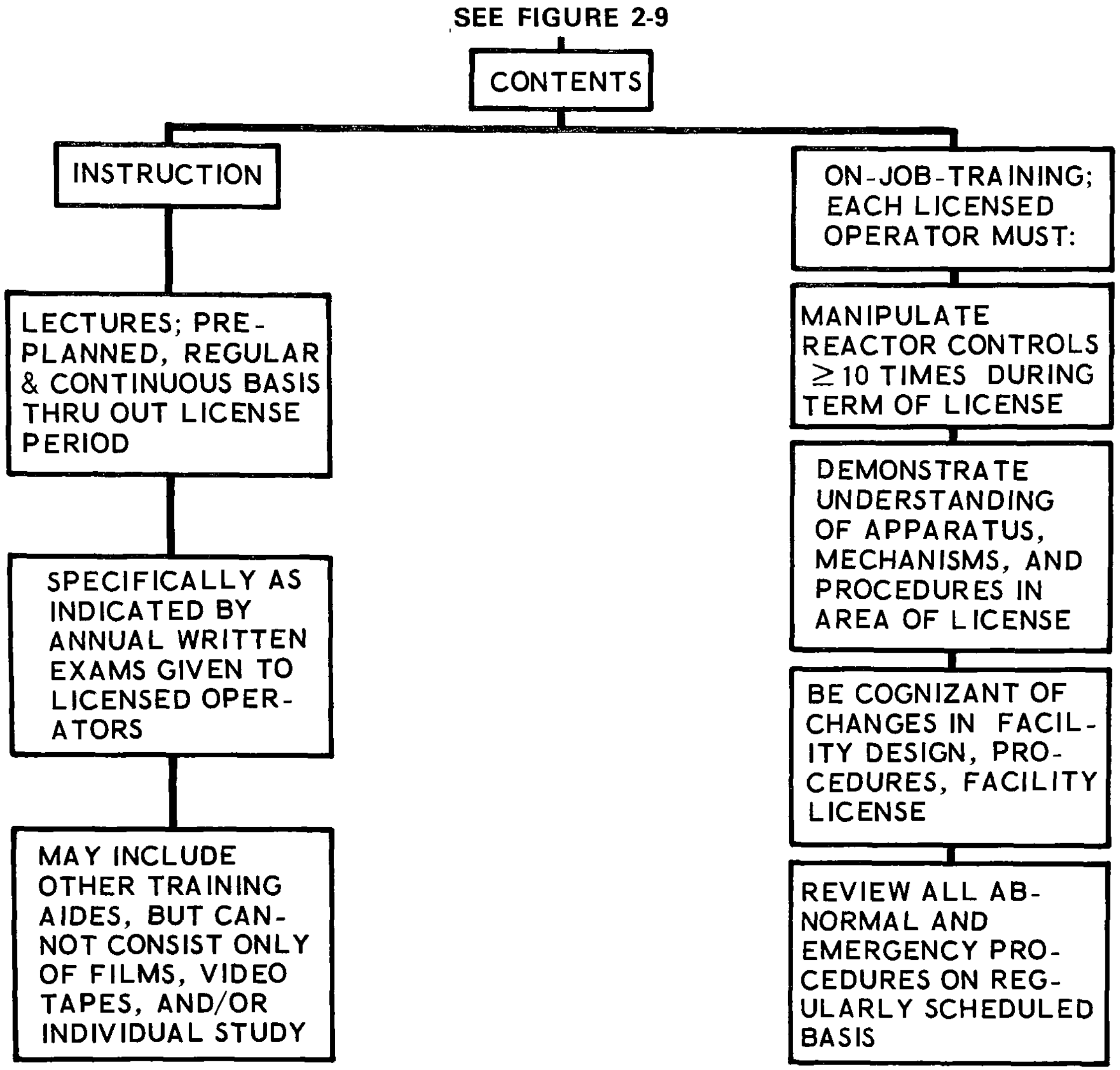


Figure 2-11. Requalification Program — Breakdown "B"

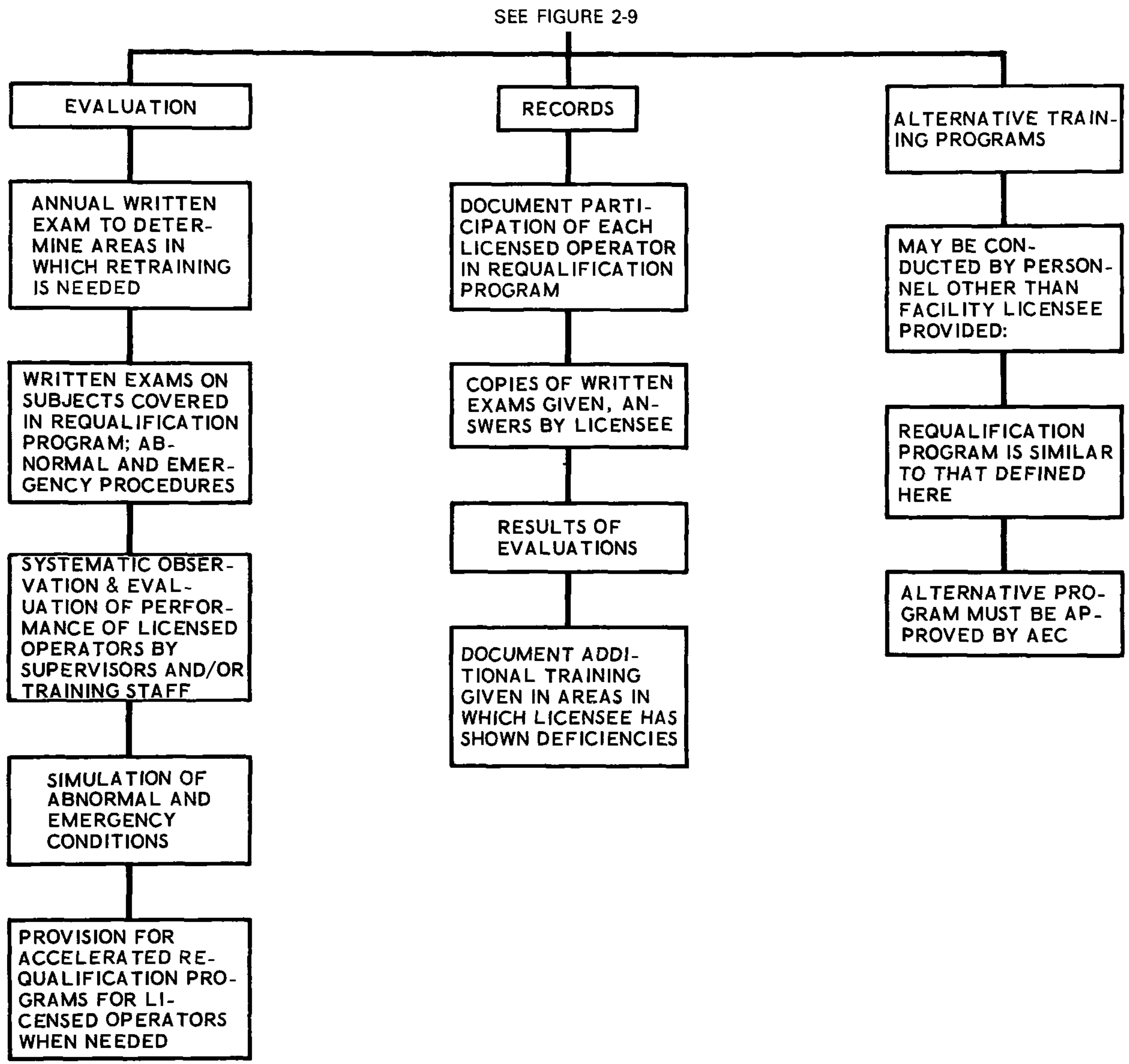


Figure 2-12. Requalification Program — Breakdown "C"

There is thus extensive involvement by the employer of the applicant in every phase of the licensing procedure.

2.3 THE CALIFORNIA BUREAU OF AUTOMOTIVE REPAIR (BAR)

This agency is part of the California Department of Consumer Affairs. It has the responsibility for licensing motor vehicle pollution control (MVPC) installation and inspection stations, and MVPC device installers (personnel). All legally required MVPC retrofit devices must be installed or approved by a licensed installer. Employment of a licensed installer is a requirement for licensing of a station.

The management structure and staffing of this bureau are shown in Figure 2-13. The scope of its MVPC activities are shown in Figure 2-14. The scope of its safety check activities is included as Figure 2-15 and complete the definition of the overall management structure and staffing of this bureau.

The licensing procedure applicable to MVPC device installation and inspection stations is shown in Figure 2-16. The essential parts to this procedure are an application plus inspection visit. The license is valid for 1 year, with the renewal procedure being identical to that for the initial application. There are thus no separate on-going quality control methods, although an inspector has the right to re-examine a licensed facility at any time.

The licensing procedure for the personnel rating is given in Figure 2-17. The certification control techniques are an application, in which the applicant must supply evidence of proficiency or training, plus a written exam. The trend is toward new applicants using school training for the proficiency requirement, rather than the certificate of competence signed by a station licensee. Exact figures are not available, but is is estimated that at least 50 percent of new applicants are currently using school training. Community college vocational courses are predominant in this respect, with

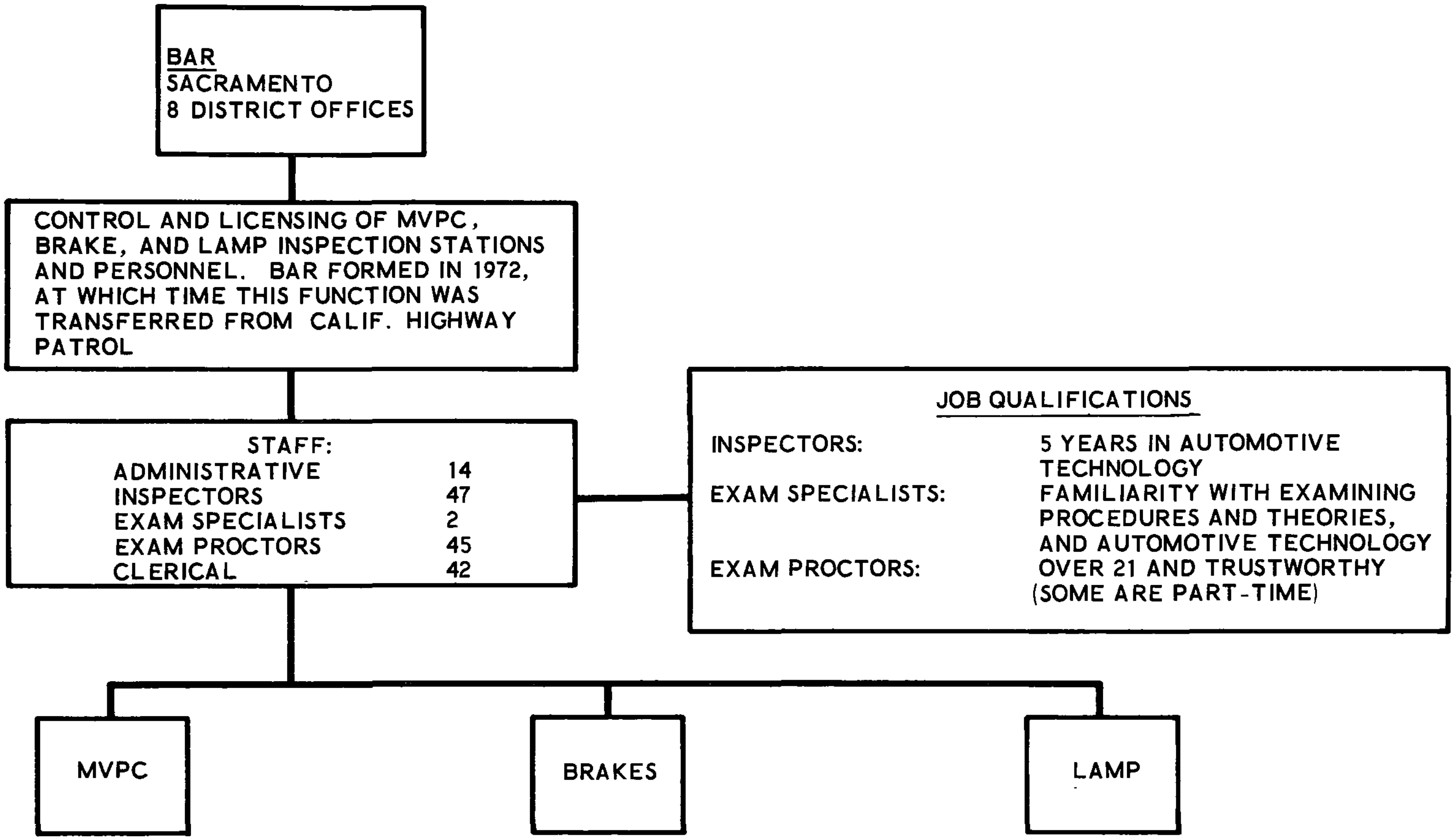


Figure 2-13. Management Structure and Staffing — California BAR

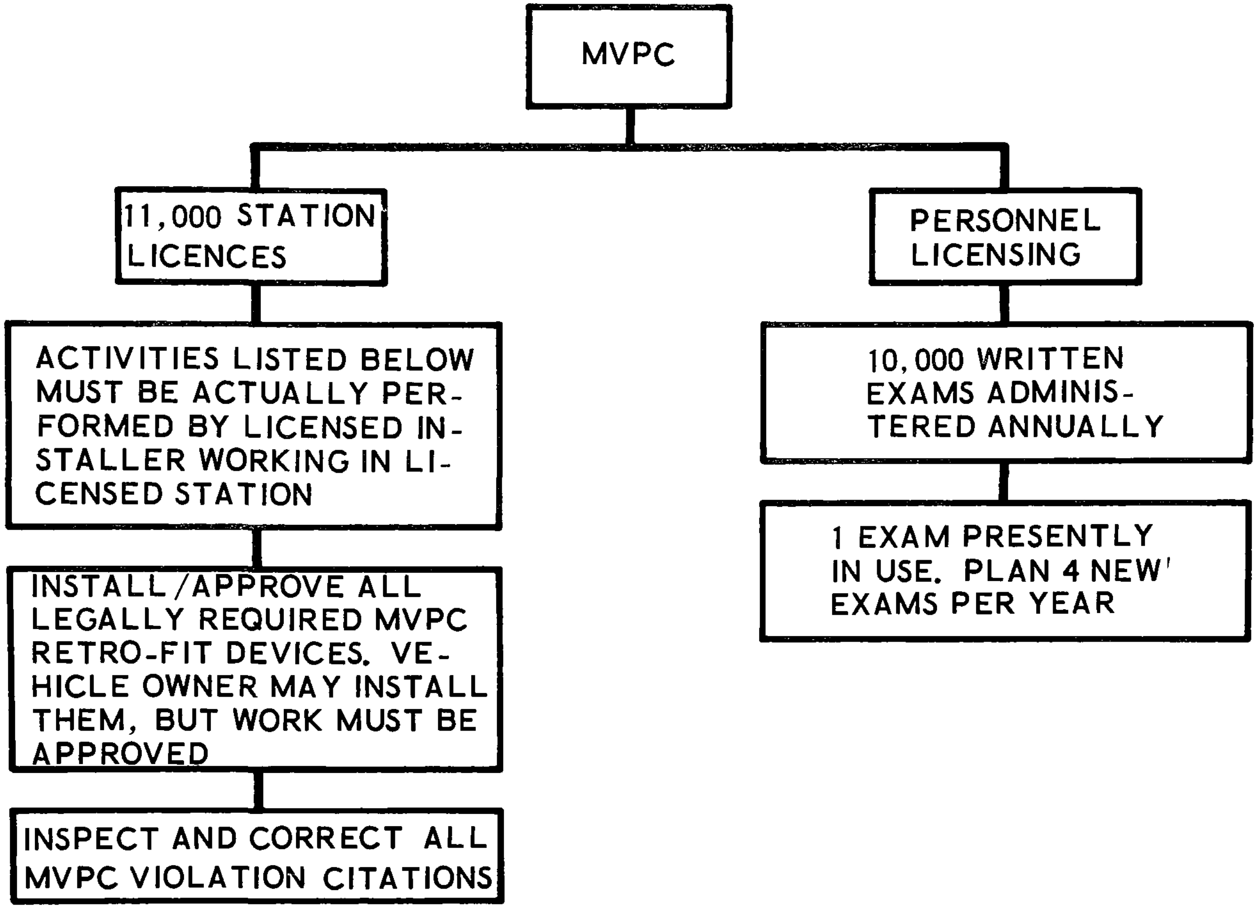


Figure 2-14. Scope of MVPC Activities — California BAR

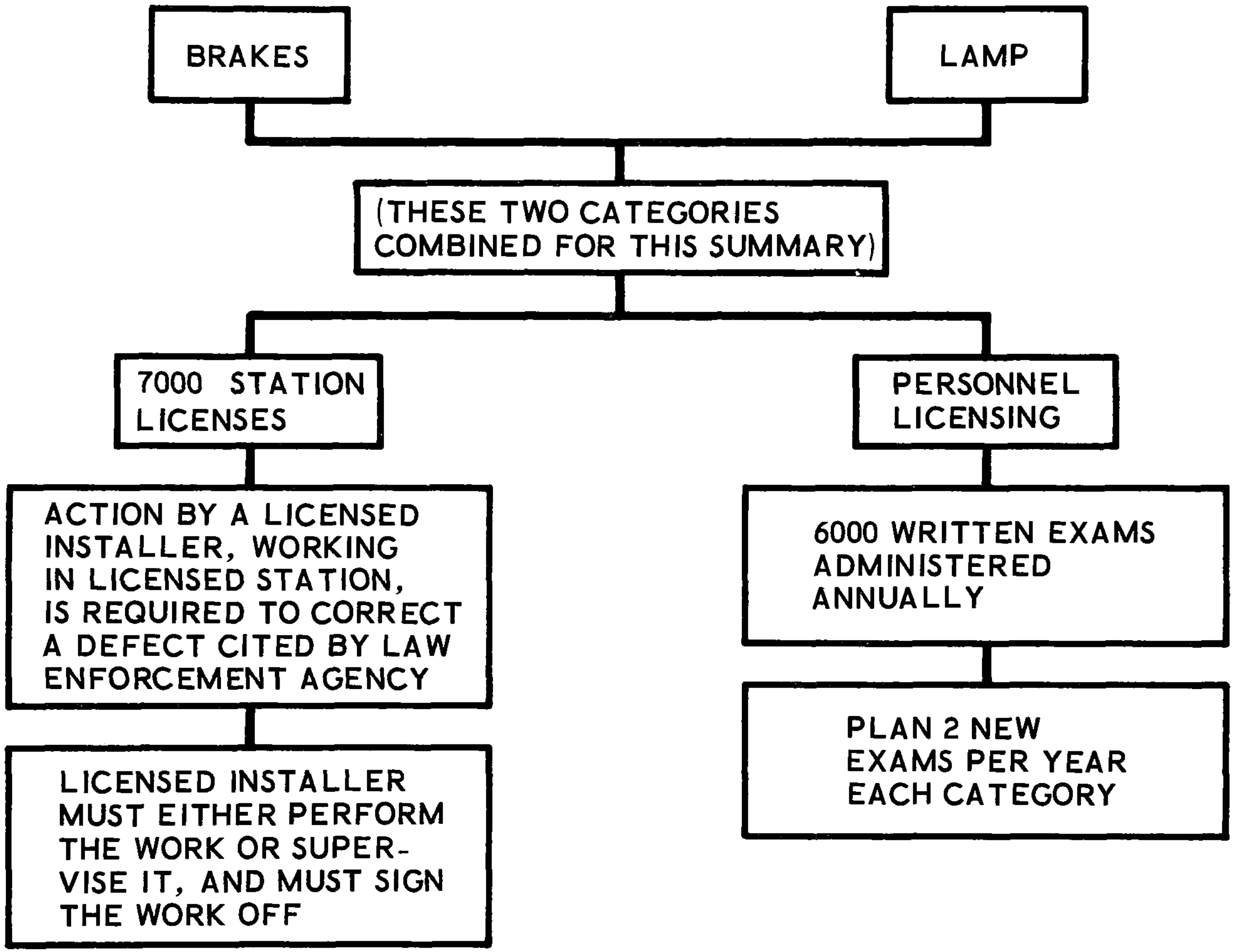


Figure 2-15. Scope of Safety Check Activities — California BAR

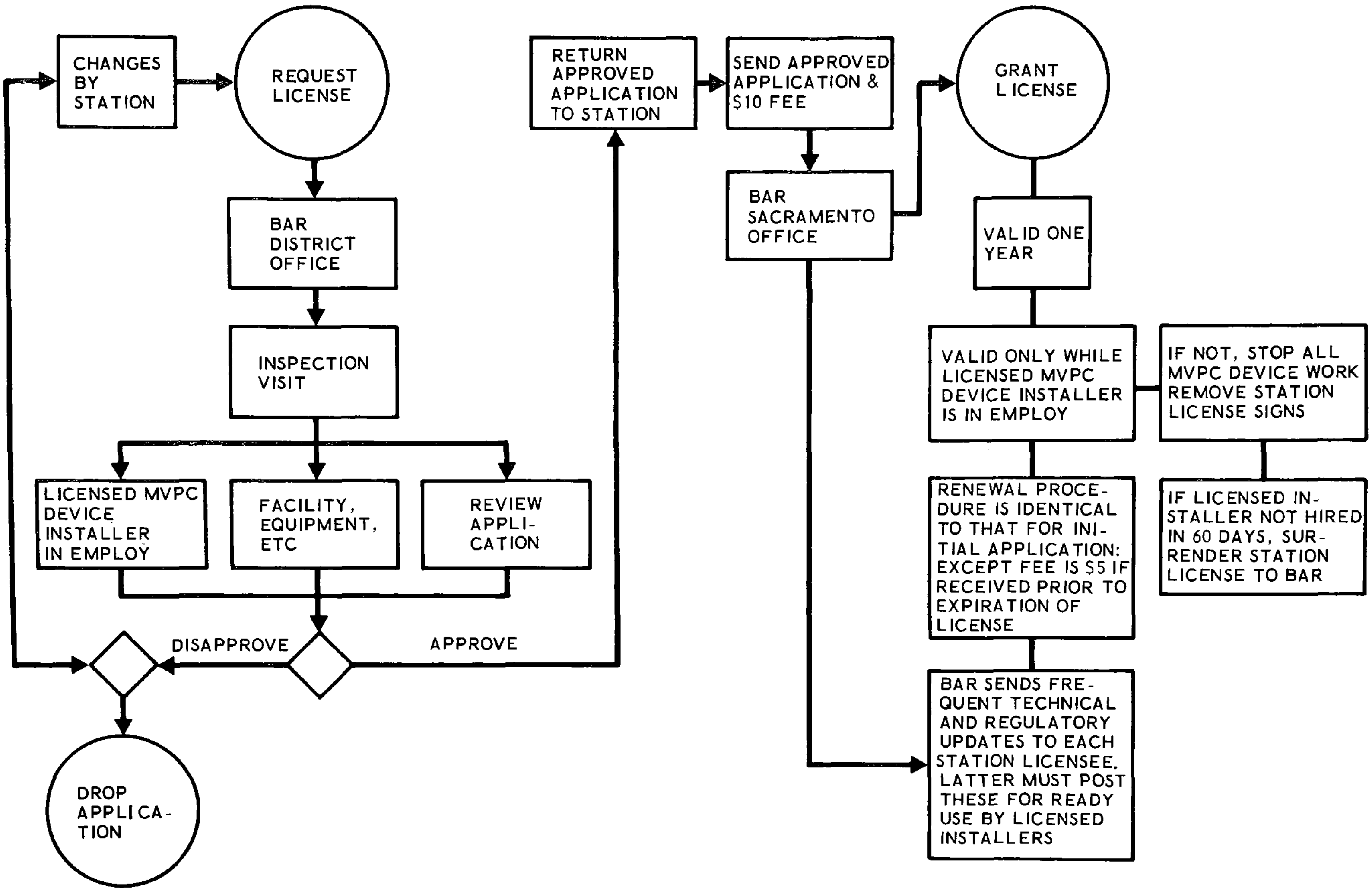


Figure 2-16. Licensing Procedures for MVPC Device Installation and Inspection Stations — California BAR

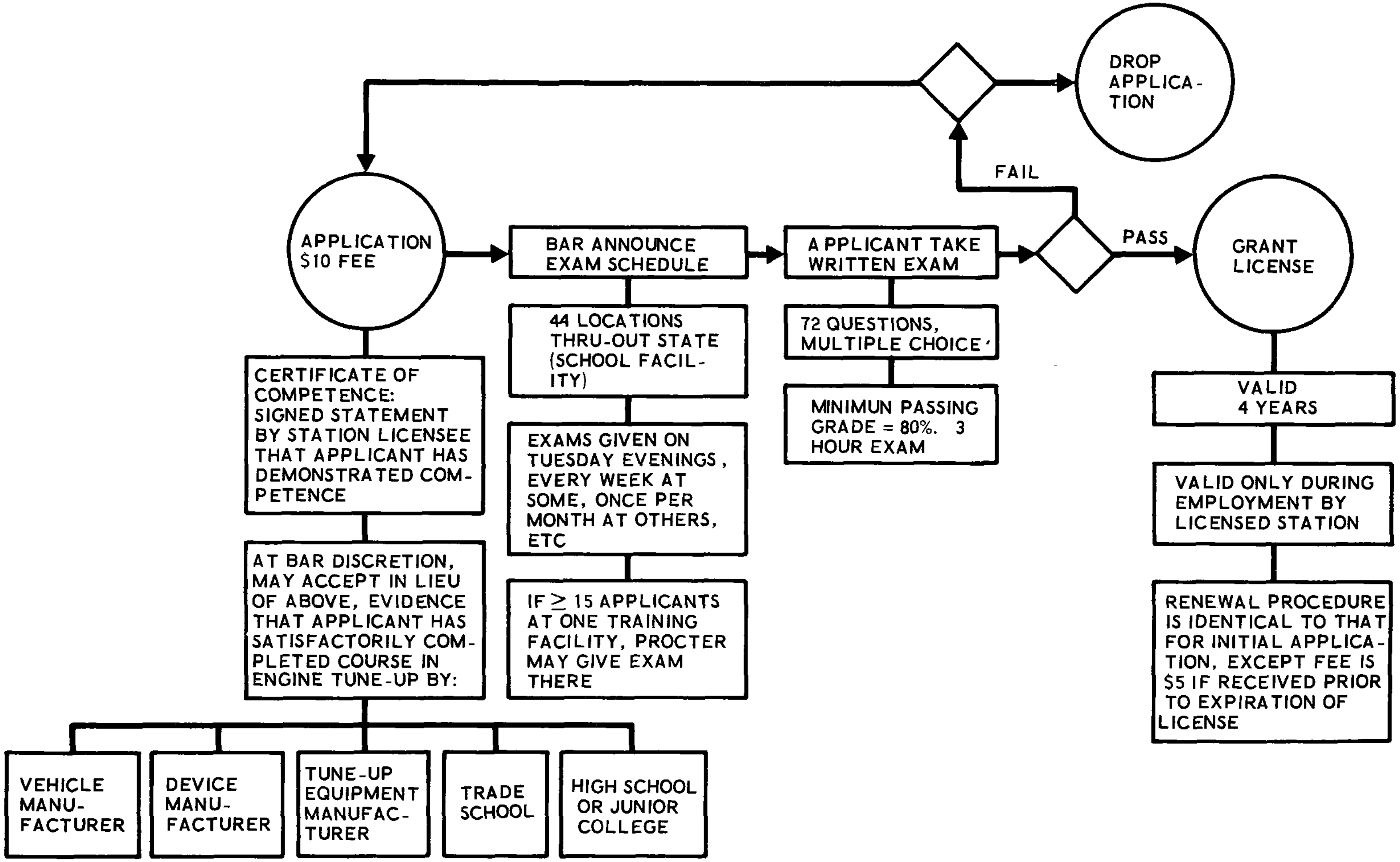


Figure 2-17. Licensing Procedures for MVPC Device Installers — California BAR

some high school vocational courses being accepted, as well as adult evening extension courses conducted at high school facilities. Typically, a course satisfying BAR requirements is one semester (4-1/2 months) in duration. The BAR makes no separate evaluation or inspection of the facility or curriculum. Training courses conducted by such concerns as oil companies, auto manufacturers, and device manufacturers do not account for a significant number of new applications.

The term of the personnel license is 4 years. It is valid only during employment by a licensed station. The renewal procedure is identical to that for the initial application. In this case, most renewal applications use the certificate of competence, signed by the station licensee by whom they are employed. There are no other on-going quality control requirements, and there are at present no provisions for actual on-site inspection of an installer's performance.

2.4 THE CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (DPH)

The activity of interest here is the licensing and surveillance of clinical laboratories, and the licensing and training of clinical laboratory technologists. Clinical laboratory activities pertain to biomedical testing and analyses concerning diseases in human beings. Test samples are received from, and results reported to, physicians and other licensed practioners of the healing arts, exclusively. The activities described herein are performed by the Laboratory Field Service unit of the California DPH.

There are approximately 1800 licensed clinical laboratories, of which approximately 200 are approved training laboratories. The latter are subject to additional inspection criteria such as library, audio-visual training aids, number and types of specimens analyzed, and ratio of licensed laboratory personnel to trainees. The DPH differentiates between "licensing" and "certification." The latter refers to laboratories connected with federal Medicare programs. These facilities require additional inspection details to satisfy Medicare requirements.

There is no personnel licensing at the technician level. Clinical laboratory technologists must have a B.S. degree plus 1 year as a trainee in an approved training laboratory. They must then pass a written examination. The examinations are administered by DPH, but preparing and grading of the tests is contracted out to private testing firms. The DPH reviews the examinations and can make changes. The DPH also has an advisory committee which determines the passing grade, usually taken as one sigma below the mean. The examinations are given twice a year, at two locations (Los Angeles and Berkeley) using state-owned facilities. Approximately 1200 examinations are administered per year. The tests are multiple choice, of 3 to 4 hours duration. The license is valid for 1 year, but is renewable simply by paying a $6 renewal fee. There are approximately 15,000 licensed laboratory personnel in the state.

There are two Laboratory Field Service offices; a main office at Berkeley, and a district office at Los Angeles. The staffing of both offices combined is as follows:

Administrative	1
Senior Examiner	3
Examiner I and II	16
Clerical	12
Total	32

The job qualifications for these positions are as follows. The Examiner I position requires a B.S. degree in an appropriate science discipline, plus licensing both as a clinical laboratory technolgist and as a certified public health microbiologist, plus 2 years approved experience. The requirements for Examiner II include those for Examiner I, plus 2 additional years approved experience plus an M.S. degree (or equivalent extra experience or training). The Senior Examiner position includes the requirements for Examiner II, plus 2 additional years approved experience, plus a Ph.D. degree (or equivalent extra experience or training).

The licensing procedures for facilities are shown in Figure 2-18. The application requires all owners and directors to be identified, and the directors must give their California license numbers, and the hours per week to be spent in the laboratory. It is the responsibility of the directors to define three main aspects of laboratory operation. The first is to select laboratory procedures, techniques, and reagents to be used. The second is to establish and maintain an internal quality control program. Last, they must establish and maintain record keeping procedures, which provide for retention of full information for 2 years on each sample analyzed. A list of all licensed laboratory personnel and trainees must be included with the initial application.

An inspection visit is performed to interview the directors, examine the facility and procedures, and check for licensed personnel.

The renewal procedure is similar to that for initial application. However, the DPH is not always able to perform the facility inspection for renewal application, and some facilities have gone 18 to 36 months between visits. The "certified" Medicare laboratories take priority, and here the annual inspection rate is maintained. Inspection visits average approximately 12 hours of examiner time; 2 to 4 hours in the laboratory, with the remainder in travel and report writing.

On-going quality control for the laboratories consists of participation in a DPH-approved laboratory testing program. In this program, an approved proficiency testing service (APTS) prepares standard "unknown" clinical samples for distribution at least four times per year to each participating clinical laboratory. Each laboratory reports its analysis results to the APTS, which in turn reports the results from all participating laboratories to DPH. The latter monitors the procedures used by the APTS to prepare, distribute, and cross-check specimens. At present there are four APTS (all private firms) and each clinical laboratory may choose the APTS with which it is to participate.

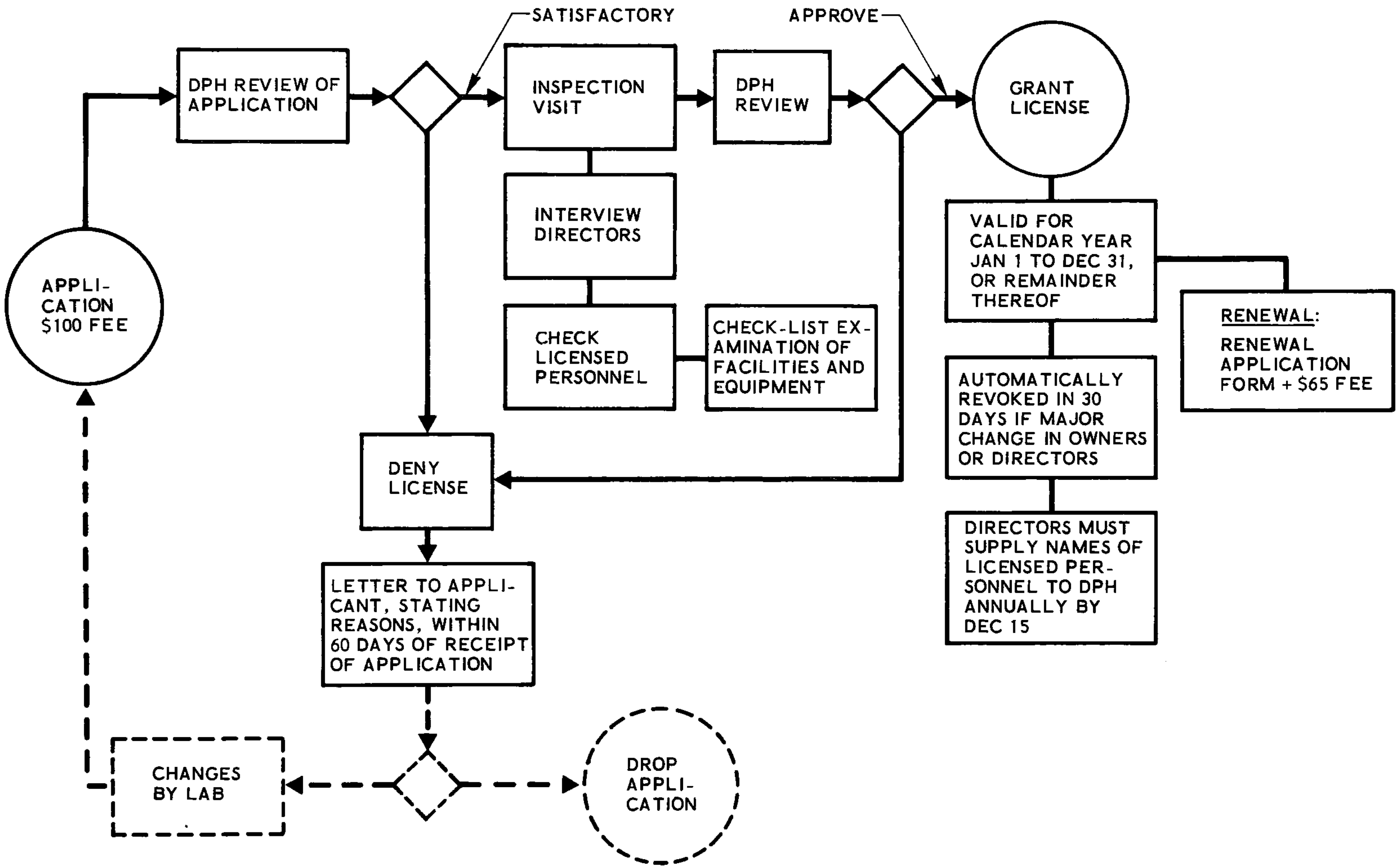


Figure 2-18. Licensing Procedures for Clinical Laboratories — Laboratory Field Service, California DPH

The license of a clinical laboratory may be suspended if its analysis results to the APTS (based on the average of the preceding four quarters) exceed a specified tolerance for three consecutive quarters.

2.5 THE PENNSYLVANIA BUREAU OF TRAFFIC SAFETY (BTS)

This bureau is part of the Pennsylvania Department of Transportation, and has administrative responsibility for the state vehicle safety inspection certification program. This is a federally-funded program (DOT) which started July 1972, and ends June 30, 1974. It is aimed exclusively at experienced mechanics (~80,000) working in approved inspection stations (~17,000) of an old program which has been in effect for about 20 years. The new program first involved working with vocational schools throughout the state, certifying facilities and equipment, and establishing details of a brief mechanic upgrading course. Mechanic training started in January 1973. After June 1974 the program will continue at a much lower level, certifying only new mechanics entering this field.

Pennsylvania is developing an emission test inspection program which is scheduled to go into effect January 1975, but the details have not yet been finalized. At present the mechanic visually inspects emission control devices during the safety inspection to see if they have been tampered with.

All administrative work is done at the Harrisburg, Pennsylvania office. The staff is concerned almost exclusively at present with application processing. The staff consists of two administrative positions and 62 clerical. The bureau has prepared one examination of 50 multiple choice questions which has been used throughout this program. One new examination is planned per year.

Program enforecement is the responsibility of the state police. There are 67 state police garage supervisors, each of whom is assigned approximately 250 certified safety inspection stations. The garage supervisor examines each station twice a year. He examines records of station inspection activity, and inspects facility and equipment. The state policeman also administers the practical test to each applicant for mechanic certification. The practical test consists of a complete safety inspection of a vehicle, performed in the presence of the garage supervisor. He may also give a repeat practical test to certified mechanics at his discretion, based on customer complaints, general observations, or inspection of station records.

Program training is performed by vocational schools located in 61 counties throughout the state. These schools conduct an 8-hour training course, at the conclusion of which they administer and grade the 1-hour written examination. There is no charge to the applicant in this program, other than personal transportation expenses to attend the training course.

The procedure whereby a station obtains appointment as an official inspection station is shown in Figure 2-19. The application form requires personal and business data for the owner and operator, and identifies any other automotive-related business ventures in which they may be involved. The applicants must also supply technical information concerning certain inspection procedures, and list the certified mechanics in their employ. The BTS evaluates the technical aspects of the application, while the state police garage supervisor performs the facility inspection to verify that state inspection requirements are satisfied. The state police run a character check of the owners and certified mechanics; a station license may be denied on these grounds. The certificate of appointment is valid indefinitely unless suspended.

The procedure for certifying mechanics is shown in Figure 2-20. The term of certification is 3 years, but renewal is accomplished by completing a renewal application form, with no additional tests required.

2.6 THE NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP)

New Jersey has a mandatory vehicle emissions inspection program in effect since February 1974. There was no pre-existing mechanic

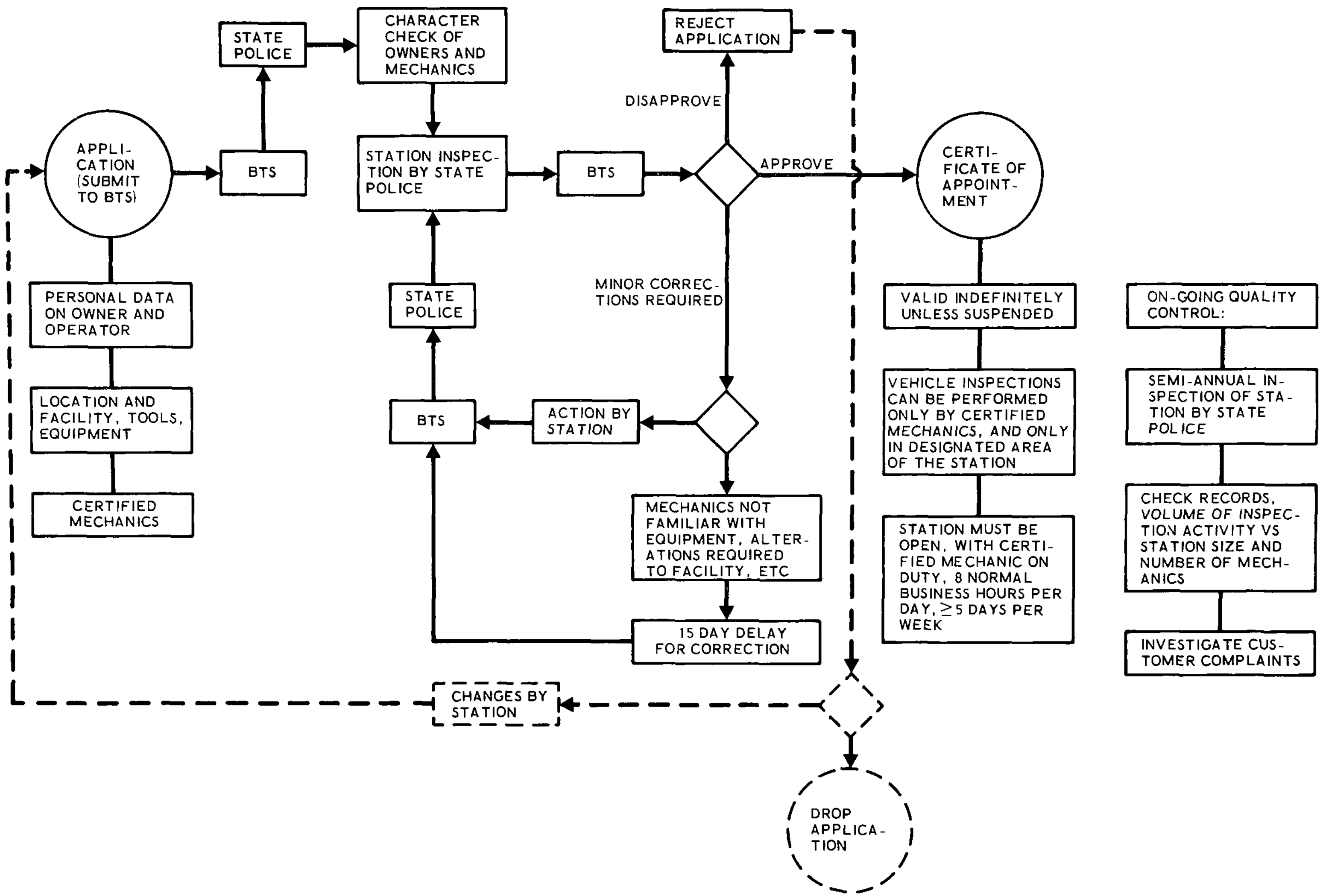


Figure 2-19. Procedures for Licensing as Official Inspection Station — Pennsylvania BTS Program

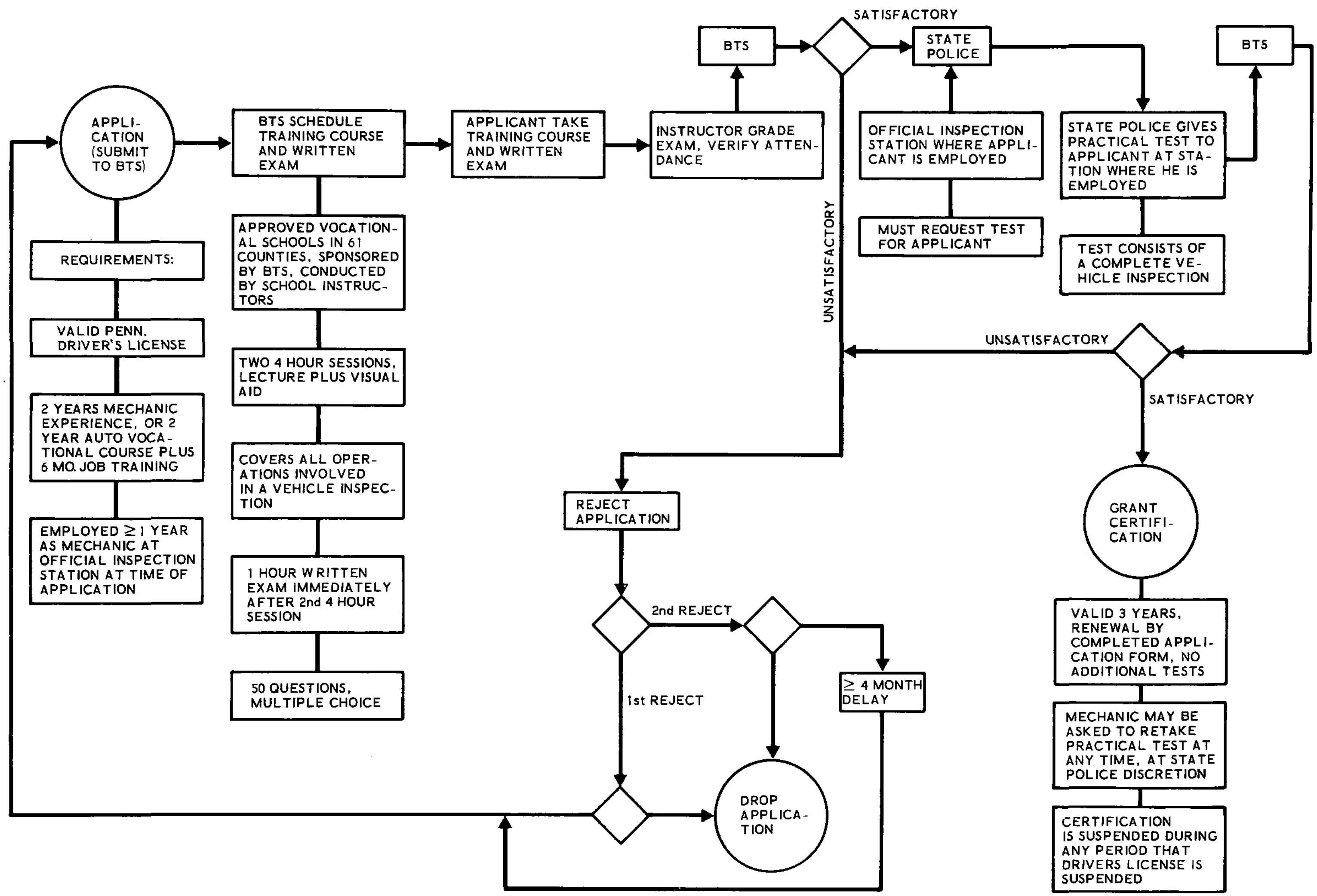


Figure 2-20. Procedures for Certifying Mechanics — Pennsylvania BTS Vehicle Safety Inspection Program

certification program to build on, and DEP had no technical instructors on their staff. Therefore, they arranged with the state Department of Education for a vocational instructor to initiate a training program. This is an informal, voluntary program for training mechanics in practical, hands-on aspects of emission control systems. At the present time there is only one instructor in the program, although they expect to have about ten instructors in the field shortly.

The program started in 1971, consisting of familiarization clinics with a generalized slide presentation covering the basics of emission control systems and state procedures and requirements. In 1972, these became 8 to 12 hour clinics with equipment provided by manufacturers. In 1973 the number of clinics was expanded, covering much of the state. By March 1974, approximately 4000 mechanics had attended clinics and received hands-on experience. In these clinics the instructor introduced typical faults, such as a defective spark plug, improper carburetion, etc., and demonstrated the effect on emissions. The clinic attendees would then repair the defect and measure the emissions afterward to note the improvement. The New Jersey DEP is trying to have this program expanded, possibly involving certification of mechanics. For the present, however, this is an example of an agency trying to establish some form of personal contact at the technician level, in an area where none has formerly existed and with tight budget constraints. Therefore, they chose to concentrate their limited resources entirely on providing a measure of hands-on training to mechanics, prior to any formalization of procedures and documentation.

2.7 OVERVIEW OF CONTEMPORARY CERTIFICATION REQUIREMENTS AND PROCEDURES

The essential features of facility and operator certification procedures and techniques are summarized in this section for those federal and state agencies reviewed in detail in Sections 2.1 through 2.6. The concensus as to general functional requirements, as delineated below, is used in Section 4 as the basis for selecting the functional tasks required for the EPA independent laboratory and operator certification program.

2.7.1 Facility Certification

2.7.1.1 Initial Certification Requirements

Table 2-5 summarizes the principal functional requirements utilized by the federal and state agencies listed in the process of certifying the facilities indicated. As can be seen, the application for certification plus inspection visits to verify the information contained in the application are the principal tools used in the facility certification process. Testing, per se, is not involved, except in the case of an FAA-approved flight school where the chief flight inspector is required to undergo a standardization flight check. Application fees are required in some instances.

Because of the universal reliance on the application, the critical or essential elements of the facility application are summarized in Table 2-6. Here again, there is a consensus in that all cases listed require that the application explicitly list (a) certified personnel on the staff and (b) adequate definition and description of the facility's physical plant and equipment. Aside from training schools, the other information required, in some instances, relates to personal information on the owner, operator, or directors of the facility. The information required in the application is considered necessary in order to make both initial and final assessments of compliance with regulatory requirements.

2.7.1.2 Renewal and/or On-going Quality Control Requirements

Table 2-7 summarizes the renewal and/or on-going quality control requirements for facilities, other than those associated with initial certification. As can be seen, in most cases extensive inspection visits/checks are used for the quality control of facilities. In every case, regular inspection visits are used, however, the frequency of the scheduled

Table 2-5. Summary of Initial Facility Certification Requirements

	APPLICATION	INSPECTION VISITS(2)	TESTING	FEE
● FAA				
● AIRCRAFT REPAIR STATIONS	✓	✓		
● AVIATION MECHANIC TRAINING SCHOOLS	✓	✓		
● APPROVED FLIGHT/GROUND SCHOOLS	✓	✓	(1)	
● CALIFORNIA BAR				
● INSTALLATION AND INSPECTION STATIONS	✓	✓		$10
● CALIFORNIA DPH				
● CLINICAL LABORATORIES	✓	✓		$100
● PENNSYLVANIA BTS				
● SAFETY INSPECTION STATIONS	✓	✓		

(1) STANDARDIZATION FLIGHT CHECK OF CHIEF FLIGHT INSTRUCTOR
(2) TO VERIFY INFORMATION CONTAINED IN APPLICATION

APPLICATION PLUS INSPECTION VISITS ARE PRINCIPAL TOOLS FOR FACILITY CERTIFICATION

Table 2-6. Summary of Critical Elements of a Facility Application*

	CERTIFICATION OF PERSONNEL	PHYSICAL PLANT AND EQUIPMENT DESCRIPTION	CURRICULUM DETAILS	OTHER STAFF MEMBERS	NO. OF STUDENTS	PERSONAL INFORMATION
● FAA ● AIRCRAFT REPAIR STATIONS	✓	✓				
● MECHANIC TRAINING SCHOOLS	✓	✓	✓	✓ NUMBER AND QUALIFICATIONS	✓	
● FLIGHT/GROUND SCHOOLS	✓	✓	✓			
● CALIFORNIA BAR ● INST. & INSP. STATIONS	✓	✓				
● CALIFORNIA DPH ● CLINICAL LABS	✓	✓				✓ ON OWNERS AND DIRECTORS
● PENNSYLVANIA BTS ● INSPECTION STATIONS	✓	✓				✓ GENERAL DATA ON OWNER OR OPERATOR

*Essential elements necessary to make initial assessment of compliance with requirements.

Table 2-7. Summary of Renewal and/or On-Going Facility Quality Control Requirements[1]

	INSPECTION VISITS/CHECKS	
	REGULAR	SPECIAL
● FAA		
● AIRCRAFT REPAIR STATIONS	QUARTERLY, OR AS REQUIRED	SWAP(2)
● MECHANIC TRAINING SCHOOLS	SEMI-ANNUAL(QUARTERLY MAY BE ADDED)	SWAP(2)
● FLIGHT/GROUND SCHOOLS	EVERY 2 YEARS AS IN ORIGINAL CERTIFICATION	SPOT-CHECKS OF RECENT GRADUATES IN FLIGHT TESTS SWAP(1)
● CALIFORNIA BAR ● INST. & INSP. STATIONS	EVERY YEAR AS IN ORIGINAL CERTIFICATION	
● CALIFORNIA DPH ● CLINICAL LABS	ANNUAL INSPECTIONS(SOME GO 18-36 MONTHS EXCEPT FOR MEDICARE-CERTIFIED LABS)	LAB. SAMPLE CHECKS 4 TIMES PER YEAR BY APPROVED PROFICIENCY TESTING SERVICE
● PENNSYLVANIA BTS ● INSPECTION STATIONS	SEMI-ANNUAL INSPECTIONS	

(1) OTHER THAN THOSE ASSOCIATED WITH INITIAL CERTIFICATION

(2) SWAP: SYSTEMS WORTHINESS ANALYSIS PROGRAM. IN-DEPTH Q.C. INSPECTIONS OF CERTIFIED FACILITIES. ONE TO TWO WEEKS OR MORE IN DURATION. SCHEDULED AT ~ TWO YEAR INTERVALS

IN MOST CASES, EXTENSIVE INSPECTION VISITS/CHECKS ARE USED FOR QUALITY CONTROL OF FACILITIES inspections varies from a few months to 2 years, depending upon the nature of the particular facility involved. In four of the six cases shown, additional special checks are included in the quality control process, as noted.

2.7.2 Personnel Certification

2.7.2.1 Initial Certification Requirements

For personnel, Table 2-8 summarizes the principal functional requirements used by the agencies for the personnel classifications shown. As in the case of facility certification, all agencies utilize the application as a principal tool. However, testing (both written and practical) instead of inspection visits or contacts (as in the case of facility certification) is the other principal tool used in personnel certification. Except for the Designated Mechanic Examiner (DME) and Designated Pilot Examiner (DPE) ratings of the FAA, all other personnel ratings are required to pass a written examination. Even in the DME and DPE cases, however, these same personnel have previously passed a written examination when obtaining the prerequisite aviation mechanic or flight ratings. Practical tests are required (or optional) in six of the eight cases illustrated. Medical examinations are required only in those cases (FAA flight ratings and AEC nuclear power plant operators) where inadvertent medical problems could lead to substantial property damage or personal injury as a result of operator incapacitation.

The critical elements of the application for personnel certification are summarized in Table 2-9. In all cases there are minimum requirements for prior experience and/or qualifications which must be included. For the FAA DME and DPE ratings, prior certification in the appropriate aviation mechanic or flight rating must be shown. In three of the eight cases shown, the facility employing the operator is required to request and recommend that the operator be certified.

Table 2-8. Summary of Initial Personnel Certification Requirements

	APPLICATION	INSPECTION VISITS OR CONTACTS	TESTING			FEE
			WRITTEN	PRACTICAL	MEDICAL	
● FAA						
● AVIATION MECHANICS	✓		✓	✓		
● FLIGHT RATINGS	✓		✓	✓	✓	
● DME'S	✓			(1)		
● DPE'S	✓			✓		
● AEC						
● OPERATORS OF NUCLEAR POWER PLANTS	✓		✓	✓	✓	
● CALIFORNIA BAR						
● MVPC DEVICE INSTALLERS	✓		✓	—		$10
● CALIFORNIA DPH						
● CLINICAL TECHNOLOGISTS	✓		✓	—		$15
● PENNSYLVANIA BTS						
● MECHANICS	✓		✓	✓		

(1) MAY BE GIVEN AT DISCRETION OF EXAMINER

APPLICATION PLUS TESTS ARE PRINCIPAL TOOLS FOR PERSONNEL CERTIFICATION

Table 2-9. Summary of Critical Elements of Personnel Application[1]

	FACT OF PRIOR CERTIFICATION	PRIOR EXPERIENCE AND QUALIFICATIONS	AVAILABILITY OF ESSENTIAL EQUIPMENT AND FACILITIES	RECOMMENDATION BY FACILITY
• FAA				
• AVIATION MECHANICS		✓		
• FLIGHT RATINGS		✓		
• DME'S	✓	✓	✓	
• DPE'S	✓	✓		
• AEC				
• OPERATORS		✓		✓
• CALIFORNIA BAR		✓		
• MVPC DEVICE INSTALLERS		(2)		✓
• CALIFORNIA DPH				
• CLINICAL TECHNOLOGISTS		✓		
• PENNSYLVANIA BTS				
• MECHANICS		✓		✓

(1) ESSENTIAL ELEMENTS NECESSARY TO MAKE INITIAL ASSESSMENT OF COMPLIANCE WITH REQUIREMENTS

(2) MAY BE ACCEPTED IN LIEU OF RECOMMENDATION BY FACILITY

2.7.2.2 Renewal and/or On-going Quality Control Requirements

Table 2-10 summarizes the spectrum of renewal and/or on-going quality control requirements utilized in the personnel certification process. Except for AEC operators and the FAA DME and DPE ratings, very little actual quality control is exercised over personnel. In these cases, where operator proficiency may be considered to be more closely related to potential property damage or personnel injury, periodic inspection contacts and checks are made. The AEC operator is required to participate in a requalification program which is essentially a continuous updating and retraining program.

2.7.3 Term of Certification

Table 2-11 describes the variability of term of certification for both facilities and personnel. As can be seen, for both facilities and personnel, the term of certification varies from 1 year to valid indefinitely.

For those facilities having definite certification period durations (i.e., other than indefinite validation), the renewal period is 2 years or less. Similarly, for personnel having definite certification periods, in four of the six cases shown the period was also 2 years or less.

However, there does not appear to be any real consensus as to term of certification, either for facilities or personnel. Rather, it appears the term of certification is somewhat arbitrarily selected in each case to fit the needs of the particular organization involved in the certification process.

Table 2-10. Summary of Renewal and/or On-Going Personnel Quality Control Requirements[1]

	INSPECTION CONTACTS	RECENCY OF EXPERIENCE	LOG OF OPERATING TIME	REQUAL. PROGRAM	MEDICAL EXAM	REQUEST OF FACILITY
● FAA ● AVIATION MECHANICS		6 MONTHS WITHIN LAST 2 YEARS				
● FLIGHT RATINGS		✓			✓	
● DME'S	TWO SEMI-ANNUAL CONTACTS. STANDARDIZATION CHECKS OR OBSERVATION OF TEST.					
● DPE'S	TWO-SEMI-ANNUAL CONTACTS. ONE STANDARDIZATION CHECK. ONE FLIGHT TEST OBSERVAT'N					
● AEC ● OPERATORS			✓ UNDER EXISTING LICENSE	✓ (2)	✓	✓
● CALIFORNIA BAR ● MVPC DEVICE INSTALLERS						
● CALIFORNIA DPH ● TECHNOLOGISTS						
● PENNSYLVANIA BTS ● MECHANICS	MAY BE ASKED TO TAKE PRACTICAL TEST AT ANY TIME BY STATE POLICE					

(1) OTHER THAN THOSE ASSOCIATED WITH INITIAL CERTIFICATION
(2) ESSENTIALLY A CONTINUOUS UPDATING AND RETRAINING PROGRAM

EXCEPT FOR AEC OPERATORS, DME'S AND DPE'S, VERY LITTLE ACTUAL QUALITY CONTROL IS EXERCISED OVER PERSONNEL

Table 2-11. Summary of Term of Certification

	VALID INDEFINITELY (1)	4 YEARS	3 YEARS	2 YEARS	1 YEAR
● FACILITIES					
● FAA					
● AIRCRAFT REPAIR STATIONS	✓				
● MECHANIC TRAINING SCHOOLS	✓				
● FLIGHT/GROUND SCHOOLS				✓	
● CALIFORNIA BAR					
● INST. & INSP. STATIONS					✓
● CALIFORNIA DPH					
● CLINICAL LABS					✓
● PENNSYLVANIA BTS					
● INSP. STATIONS	✓				
● PERSONNEL					
● FAA					
● AVIATION MECHANICS	✓				
● FLIGHT RATINGS	✓				
● DME'S					✓
● DPE'S					✓
● AEC					
OPERATORS				✓	
● CALIFORNIA BAR					
● DEVICE INSTALLERS		✓			
● CALIFORNIA DPH					
● TECHNOLOGISTS					✓
● PENNSYLVANIA BTS					
● MECHANICS			✓		

(1) UNLESS SUSPENDED

3. REVIEW OF TEST PROCEDURES AND EQUIPMENT REQUIREMENTS

A brief review of emission test procedures and equipment requirements, as specified in 40 CFR 85[3], was made to provide a reference base for subsequent task activities. This review encompassed the vehicle categories of LDV-G, LDV-D, LDT-G, HDV-G, and HDV-D. Test and equipment requirements were segregated into the following categories:

a. Basic test parameters
b. General facility requirements
c. Gas sampling and instrumentation
d. Test conditions
e. Other significant factors

As a result of this review, a matrix was prepared (see Table 3-1). This matrix defines and compares the facility, equipment, and procedural requirements for certification testing in any currently promulgated subpart of 40 CFR 85; for 1975 to 1977 model years of LDVs and LDTs, and 1974 engine testing for HDVs. The information in this matrix was used in developing many of the work flow elements required to demonstrate that laboratory and operator certification measures were sufficient to ensure that emission tests performed by independent laboratories would be made in accordance with 40 CFR 85.

The laboratory certification procedures described in Sections 4 and 5 are presented for the example of subpart A (LDV-G), 1975 model year requirements. This is the largest volume subpart (along with subpart C) with respect to facility and procedural requirements. Thus, any changes in detailed certification procedures which might be required for certification in the other subpart areas can be determined directly from examination of the matrix (Table 3-1).

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[3] Code of Federal Requlations Title 40, Part 85.

Table 3-1. Emission Test Requirements

		EXHAUST GASEOUS EMISSION TEST					FUEL EVAPORATIVE EMISSIONS TEST		EXHAUST SMOKE TEST
		LDV–G	LDV–D	LDT–G	HDV–G	HDV–D	LDV–G	LDT	HDV–D
BASIC TEST PARAMETERS	TYPE OF TEST: VEHICLE, V, OR ENGINE, E	V	V	V	E	E	V	V	E
	NATURE OF DYNO TEST	FEDERAL 23 MINUTE CYCLE			9 MODE, SERIES OF BRIEF STDY STATES	13 MODE SERIES OF STDY STATES	FEDERAL 23 MIN. CYCLE		TRANSIENT, ACCELERATION AND LUGGING MODES
	TYPE OF GAS SAMPLING	CVS: INGEST ENTIRE VEHICLE EXHAUST, DILUTE WITH AMBIENT AIR, COLLECT BAG SAMPLES			CONTINUOUS SAMPLING AND RECORDING OF PORTION OF EXHAUST		TRAP VAPORS IN WEIGHED CONTAINERS		PASS LIGHT BEAM THROUGH EXHAUST PLUME
	FEDERAL EMISSION STDS	HC CO NO_X GRAM/MI	HC CO NO_X GRAM/MI	HC CO NO_X GRAM/MI	[HC + NO_X] CO GRAM/BHP HR	[HC + NO_X] CO GRAM/BHP HR	GRAM/TEST	GRAM/TEST	% OPACITY ACC. LUG. PKS
	1974	3.4 39 3.1		3.4 39 3.1	16 40	16 40	2.0	2.0	20 15 50
	1975, 76 NATL	1.5 15 3.1	1.5 15 3.1	2.0 20 3.1			2.0	2.0	
	1975, 76 CALIF	0.9 9 2.0	1.5 9 3.1				2.0	2.0	
	1977	0.41 3.4 2.0	0.41 3.4 2.0	2.0 20 3.1			2.0	2.0	
	1978	0.41 3.4 0.4	0.41 3.4 0.4				2.0	2.0	
GENERAL FACILITY REQUIREMENTS	DURABILITY DRIVING TRACK	NO	NO	NO	NO	NO	YES	YES	NO
	TEMP. CONTROLLED ROOMS FOR VEHICLE STORAGE DURATION PER TEST UNIT, HR TEMP. RANGE, °F DYNO ROOM TEMP, °F DYNO ROOM BAROMETRIC, IN Hg	YES ≥ 12 60 – 86 76 – 86 68 – 86	YES ≥ 12 68 – 86 68 – 86	YES ≥ 12 60 – 86 76 – 86 68 – 86	NO ≥ 1 60 – 86 68 – 86	NO ≤ 86 ≤ 31	YES ≥ 12 60 – 86 76 – 86 68 – 86		NO ≤ 86 ≤ 31
	DYNAMOMETER REQUIREMENTS MAX VEHICLE WT, lb INERTIA SIMULATION POWER ABSORPTION UNIT CALIB. OF FRICTION LOSS READ OUT OF SPEED AND TORQUE RECORDING OF SPEED AND TORQUE	CHASSIS CAN BE > 6000 YES YES YES YES NO	CHASSIS CAN BE > 6000 YES YES YES YES NO	CHASSIS 6000 YES YES YES YES NO	ENGINE YES	ENGINE YES	 CAN BE > 6000 YES YES YES YES NO	 6000 YES YES YES YES NO	ENGINE YES TORQUE
GAS SAMPLING AND INSTRUMENTATION	CVS SYSTEM OF 300–350 CFM CAPACITY, WITH ALL ASSOCIATED EQUIP.	YES	YES	YES	NO	NO			
	GAS ANALYSIS INSTRUMENTS CO CO_2 NO_X HC	 NDIR NDIR CL FID	 NDIR NDIR CL HFID	 NDIR NDIR CL FID	 NDIR NDIR NDIR (NO ONLY) NDIR (HIGH HC) NDIR (LOW HC)	 NDIR NDIR NDIR (NO ONLY) HFID	ADSORB FUEL VAPORS IN ACTIVATED CHARCOAL TRAP. DETERMINE AMOUNT COLLECTED BY WEIGHT DIFFERENCE		SMOKEMETER (LIGHT EXTINCTION METER)
	SEPARATE, CONTINUOUS SAMPLING OF HC VIA HEATED SMPL LINE	NO	YES	NO	NO	YES			

Table 3-1. Emission Test Requirements (Continued)

		EXHAUST GASEOUS EMISSION TEST					FUEL EVAPORATIVE EMISSIONS TEST		EXHAUST SMOKE TEST
		LDV–G	LDV–D	LDT–G	HDV–G	HDV–D	LDV–G	LDT	HDV–D
GAS SAMPLING AND INSTRUMENTATION	ELECTRONIC INTEGRATOR FOR COMPUTING TOTAL HC	NO	YES	NO	NO	NO			
	TEST PHASES INVOLVED IN GAS SAMPLING	COLD START TRANSIENT COLD START STABILIZED HOT START TRANSIENT			SAMPLE CONTINUOUSLY THRUOUT TEST	SMPL CONT. FOR AT LEAST LAST 5 MIN EACH MODE	DIURNAL BREATHING LOSS RUNNING LOSS HOT SOAK LOSS		RECORD CONT. THRUOUT TEST
	APPROX. CONC. OF EACH POLLUTANT CORRESPONDING TO SPEC. LIMIT, AS MSRD, ppm HC AS C_1 CO NO_X 1974 1975, 76 NATL 1975, 76 CALIF 1977 1978	 400 1500 80 240 900 50 110 340 50 110 340 10	 400 1500 80 900 110 340 50 110 340 10	540 2000 80 540 2000 80	1700 6700 1120	1330 5300 890			
	INTERCHANGEABILITY OF GAS ANALYSIS INSTRUMENTS HC, NO_X, CO_2, CO 1974 FOR HDV 1975 – 78 FOR LDV 1975, 76 NATL (FOR LDV) 1975, 76 CALIF (FOR LDV) 1977 (FOR LDV) 1978 (FOR LDV)	A_1 B_1 C_1 D_1 D_1 OR D_2 D_2 D_2	A_2 B_1 C_1 D_1 D_1 OR D_2 D_2 D_2	A_1 B_1 C_1 D_1 D_1	A_3(HIGH HC) A_4(LOW HC) B_2 C_2 D_3	A_2 B_2 C_3 D_3			
	CALIBRATION GASES	ALL IN NOMINAL % FS				NOMINAL % FS			NEUTRAL DENSITY FILTERS OF % OPACITY 10 20 40
	HC	(PROPANE, DILUENT AIR) 50, 100			(DILUENT N_2) LOW HC, ppm HEXANE 100, 200, 300, 400, 600, 800, 1000 (DILUENT N_2) HIGH HC, ppm HEXANE 600, 1000, 1500, 2500, 4000, 6000, 8000, 10,000	NOT SPECIFIED			
	NO_X (NO, DILUENT N_2)	50, 100			NO, DILUENT N_2,ppm 250, 500, 750, 1000 1500, 2000, 2500, 3000, 3500, 4000	25, 50, 75, 100			
	CO (DILUENT N_2)	10, 25, 40, 50, 60, 70, 85, 100			BLEND OF CO & CO_2 DILUENT N_2	25, 50, 75, 100			
	CO_2 (DILUENT N_2)	10, 25, 40, 50, 60, 70, 85, 100			CO PLUS CO_2 % % 0.5 16.0 1.0 15.0 2.0 14.0 3.0 13.0 4.0 12.0 6.0 10.0 8.0 8.0 10.0 6.0	25,50,75,100			
TEST CONDITIONS	TEST UNIT PRE-CONDITIONING	SOAK ≥ 1 HR 76–86°F SOAK ≥ 10 HR 60–86°F SOAK ≥ 1 HR 76–86°F (NORMALLY ACCOMPLISHED AS PART OF EVAP EMISSIONS TEST)	RUN ONE 23 MIN. CYCLE ON DYNO. SOAK ≥ 12 HR 68–86°F	SOAK ≥ 1 HR 76–86°F SAOK ≥ 10 HR 60–86°F SOAK ≥ 1 HR 76–86°F (NORMALLY ACCOMPLISHED AS PART OF EVAP EMISSIONS TEST)	≥ 1 HR 60–86°F RUN 5 MIN ON DYNO	RUN 10 MIN ON DYNO	1 HR DRIVING ON DURABILITY TRACK ONE 23 MIN CYCLE ON DYNO. SOAK ≥ 1 HR 76–86°F SOAK ≥ 10 HR 60–86°F SOAK ≥ 1 HR 76–86°F (DIURNAL LOSS MSRD HERE)		RUN 10 MIN ON DYNO

Table 3-1. Emission Test Requirements (Continued)

		EXHAUST GASEOUS EMISSION TEST					FUEL EVAPORATIVE EMISSIONS TEST		EXHAUST SMOKE TEST
		LDV–G	LDV–D	LDT–G	HDV–G	HDV–D	LDV–G	LDT	HDV–D
TEST CONDITIONS	DYNAMOMETER TEST	COLD START TRANSIENT COLLECT BAG SMPLE #1 (FIRST 505 SEC OF FED. DRIVING CYCLE, WITHOUT INTERRUPTION, CONTINUE WITH.) COLD START STABILIZED. COLLECT BAS SMPLE #2 (THIS IS REMAINDER OF 23 MIN CYCLE) 10 MIN SOAK ON DYNO. HOT START TRANSIENT COLLECT BAS SMPLE #3 (FIRST 505 SEC OF FED. DRIVING CYCLE)					COLD START TRANSIENT COLD START STABILIZED (RUNNING LOSS MSRD HERE) VAPOR LOSS NOT MSRD DURING 10 MIN SOAK OR HOT START SOAK 1 HR HOOD DOWN 76–86°F (HOT SOAK LOSS MSRD HERE)		
	MODES PER TEST CYCLE				9	13			2
	NUMBER OF CYCLES/TEST				4	1			3
	APPROX. MIN. DYNO TEST TIME	38 MIN			18 MIN	2 HR 10 MIN	23 MIN		> 20 MIN
	DYNO/ENGINE SPEED & LOAD	FED. DRIVING CYCLE			CONSTANT DYNO SPEED OF 2000 RPM, XCPT IDLE. CT TO FL	IDLE TO RATED SPEED, 0 TO MAX HP	FED. DRIVING CYCLE		IDLE TO RATED SPEED 0 TO MAX HP
	TEST CONTROL PARAMETERS	DYNO SPEED VS TIME			MANIFOLD PRESSURE	ENGINE RPM & HP	DYNO SPEED VS TIME		ENGINE RPM & DYNO LOAD
	EXHAUST SYSTEM	CVS			CHASSIS TYPE	15 ±5' FROM XHST MNFLD. CHASSIS TYPE MUFFLER			15 ±5' FROM XHST MNFLD. CHASSIS TYPE MUFFLER
	EXHAUST BACK PRESSURE	± 5 IN H_2O ± 1 IN H_2O ON REQUEST	±5 IN H_2O ±1 IN H_2O ON REQUEST	±5 IN H_2O, ±1 IN H_2O ON REQUEST		SPCFD PER MNFCTR'S LIT.			SPCFD PER MNFCTR'S LIT
	INLET AIR SYSTEM					SPCFD PER MNFCTR'S LIT			SPCFD PER MNFCTR'S LIT.
	VEHICLE/ENGINE FLOW MEASUREMENTS				FUEL FLOW	FUEL AND AIR FLOW (OR EXHAUST FLOW)			
OTHER	TYPE OF EMISSION DATA RECORD	READ OUT OF BAG SMPL CONC	READ OUT OF BAG SMPL CONC + CONT. TRACE WITH INTEGRATION, OF HC CONC. VS TIME	READ OUT OF BAG SMPL CONC	CONTINUOUS RECORDING	CONTINUOUS RECORDING	RECORD WEIGHT CHANGE OF COLLECTION TRAP		CONTINUOUS RECORDING
	LENGTH OF TIME IN EACH MODE UPON WHICH EMISSION CALCS. ARE BASED	CONTINUOUS			LAST 3 SEC (XCPT ALL 43 SEC OF CT MODE)	LAST 60 SEC	CONTINUOUS		CONTINUOUS
	TEST DATA OTHER THAN GAS ANALYSIS INSTRUMENTS USED IN EMISSION CALCS	CVS PUMP NO. OF REVOLUTIONS, T & P OF DILUTE EXHAUST AT PUMP INLET HUMIDITY			FUEL FLOW RATE, ENGINE RPM & TORQUE, HUMIDITY	FUEL & AIR FLOW RATES (OR EXHAUST FLOW ENGINE RPM & TORQUE, HUMIDITY			
	BASIC COMPUTATION PROCESS	ACCOUNT FOR POLLUTANT CONC. OF DILUENT AIR. FROM BAS SMPL CONC. + TOTAL VOLUME DILUTE XHST, CALC. GRAM POLLUTANT EACH TEST PHASE FINAL RESULT IS $(GRAM/MI)_i = [0.43\ Y_{ct} + 0.57\ Y_{ht} + Y_s]/7.5$ Y_{ct} = GRAM IN COLD START TRANSIENT PHASE Y_{ht} - GRAM IN HOT START TRANSIENT PHASE Y_s = GRAM IN COLD START STABILIZED PHASE (HDV-G:) EMISSIONS FOR EACH MODE BY. $B.S.(MASS)_i = \frac{\Sigma(MASS_i \times WF)}{\Sigma(BHP \times WF)}$ AVG B.S. MASS FOR FIRST 2 CYCLES: = A AVG B.S. MASS FOR LAST 2 CYCLES - B COMBINE AS (0.35A + 0.65B)			BASED ON FUEL FLOW RATE & C BALANCE, CMPTE GRAM/HR PLLTNT EACH MODE. MULTIPLY BY WEIGHTING FCTR (WF) FOR EACH MODE. CMPTE BRAKE SPCFC	CALC. GRAM/HR PLLNT EACH MODE FROM CONC. X EX-HAUST FLOW. MLTPLY EACH BY WF FOR THAT MODE. MLTPLY BHP BY WF EACH MODE CMPTE FINAL RESULT AS $(B.S.)_i = \frac{\Sigma(MASS_i \times WF)}{\Sigma(BHP \times WF)}$			DIVIDE EACH MODE INTO 1/2 SEC INTERVALS, RECORD 15 HIGHEST 1/2 SEC INTERVALS IN "ACC" MODE, 5 HIGHEST 1/2 SEC INTRVLS IN LUGGING MODE, & 3 HIGHEST INTRVALS OVERALL REPEAT FOR ALL 3 CYCLES. "ACC" VALUE = AVG OF 45 VALUES "LUGGING" VALUE = AVG OF 15 VALUES "PEAK" VALUE = AVG OF 9 VALUES

4. FUNCTIONAL TASK SELECTION

A set of discrete basic requirements and procedures were selected to form the basis of a sound certification program for both laboratories and test operators. These functional task selections were made after reviewing the status of established regulatory procedures used by other federal and state certification agencies (Section 2.7) and noting the consensus as to functional task requirements in the comparable certification processes. Also considered in the selection process were the specific requirements of 40 CFR 85 regarding facilities, procedures, and test operations (Table 3-1).

4.1 LABORATORY CERTIFICATION

4.1.1 Initial Certification and Renewals

Table 4-1 lists the specific functional tasks required of EPA and the laboratory requesting certification, both for initial certification and renewals.

The EPA tasks are directed to:

a. Application form preparation
b. Application processing and review after receipt
c. Laboratory inspection
d. Final review of inspection results and determination as to issuance or denial of certification.

The laboratory tasks are solely concerned with preparing and submitting the application for certification to EPA. The basic information required, as noted in Table 4-1, would be concerned with (a) certified operators on the staff of the laboratory; (b) a complete description of the facility, equipment, and test procedures used by the laboratory (to permit an initial determination as to compliance with 40 CFR 85 requirements); and (c) other organizational and financial data which might be relevant to the desirability or suitability of certifying the laboratory for emission testing

Table 4-1. Initial and Renewal Laboratory Certification

LABORATORY TASKS

- PREPARE AND SUBMIT APPLICATION (FOR SUB-PART RATING DESIRED)
  - LISTING CERTIFIED OPERATORS ON STAFF
  - IDENTIFY FACILITY, EQUIPMENT, AND TEST PROCEDURES USED IN ACCORDANCE WITH 40 CFR 85 REQUIREMENTS
  - PROVIDE OTHER INFORMATION
    - DIRECTORS
    - RELATIONSHIPS WITH OTHER ORGANIZATIONS
    - FINANCIAL AND BUSINESS DATA

EPA TASKS

- PREPARE APPLICATION FORMS
- PROCESS AND REVIEW APPLICATION DETAILS
- SCHEDULE INSPECTION VISIT
- PERFORM INSPECTION OF LABORATORY
  - TESTING
  - CALIBRATION
  - PROCEDURES
  - EQUIPMENT
- REVIEW INSPECTION RESULTS
- ISSUE OR DENY CERTIFICATION

purposes. For example, if the laboratory were a part of another organization which manufactured or sold retrofit or emission-control-related parts, it might be considered a conflict of interest to permit certification of the laboratory.

4.1.2 On-Going Quality Control

The specific functional tasks selected for quality control are listed in Table 4-2. The basic EPA tasks consist of:

a. Periodic scheduled (semi-annual) laboratory inspections
b. Unannounced (random) laboratory inspections
c. Naming the laboratory's calibration gases on EPA equipment

The scheduled inspections would be extensive and consist of test observations, inspection of calibration procedures, checking for certified personnel, examination of facility data and records, and observation of the general facility, equipment, and operations. The unannounced inspections would be less extensive in nature, and would be principally directed to verifying that proper calibration schedules were being followed.

The laboratory would be required to transmit a complete set of emission test data to EPA for each certified test made; this would permit the opportunity for a direct observation of the quality of the test data. Quarterly measurements of EPA gas cylinder "unknowns" would be required to verify the laboratory's gas sampling instrumentation accuracy. During EPA inspection visits, the laboratory would be required to perform any tests, calibrations, or other checks required by EPA inspectors. In addition, any changes in certified operators, equipment loss or change, etc., would have to be provided to EPA to permit temporary suspension of certification or reinspection, if necessary.

Table 4-2. On-Going Laboratory Quality Control

LABORATORY TASKS

- TRANSMIT TO EPA COMPLETE DATA SET FOR EACH CERTIFIED TEST MADE
- TRANSMIT TO EPA ANY STATUS CHANGES
  - EQUIPMENT LOSS OR CHANGE
  - CERTIFIED OPERATORS
  - ETC.
- MAKE QUARTERLY MEASUREMENTS OF EPA GAS CYLINDER "UNKNOWNS"
  - TRANSMIT TO EPA
- PERFORM ANY TESTS, CALIBRATIONS, OR OTHER CHECKS REQUIRED BY EPA DURING INSPECTION VISITS

EPA TASKS

- PERIODIC SCHEDULED INSPECTIONS OF LABORATORY
  - SEMI-ANNUAL
  - OBSERVE TESTS
  - CHECK FOR CERTIFIED PERSONNEL
  - INSPECT CALIBRATION PROCEDURES
  - EXAMINE DATA AND RECORDS
  - OBSERVE STATUS OF
    - FUEL HANDLING OPERATIONS
    - AUXILIARY EQUIPMENT
    - GENERAL FACILITY
- UN-ANNOUNCED LABORATORY INSPECTIONS
  - RANDOM, AVERAGE 2 PER YEAR
  - VERIFY PROPER CALIBRATION SCHEDULES
- NAMING OF LABORATORY'S CALIBRATION GASES ON EPA EQUIPMENT

4.2 OPERATOR CERTIFICATION

4.2.1 Initial Certification and Renewals

Table 4-3 lists the specific functional tasks required of EPA and the operator requesting certification, both for initial certification and renewals. The principal EPA tasks are directed to:

a. Preparing application form
b. Processing and reviewing application after receipt
c. Preparing, administering, and grading written examinations
d. Preparing, administering, and grading practical examinations
e. Granting or denying certification

The operator's tasks are concerned with:

a. Preparing and submitting the application
b. Taking and passing the written examination
c. Taking and passing the practical examination

With regard to the application, a preferred approach is to have the employer request that the operator be certified and verify the minimum job experience requirements of the applicant. It would appear, however, that an alternative path should be available whereby the applicant can apply directly to EPA. Similarly, it would be preferred to have the written and practical tests given at the employer's facility, but it may be necessary to permit such testing at the EPA test facility.

4.2.2 On-Going Quality Control

As noted in Section 2.7, ordinarily there is very little on-going quality control exercised over operators (except in the specific case of AEC-licensed nuclear power station operators). However, as listed in Table 4-4, the nature of the task functions selected for the laboratory certification process make it possible to exercise a reasonable degree of control over the quality of the work performed by the operator.

Table 4-3. Initial Operator Certification*

OPERATOR TASKS

- PREPARE AND SUBMIT APPLICATION (FOR SUB-PART RATING DESIRED)
  - HAVE EMPLOYER REQUEST THAT HE BE CERTIFIED**
  - HAVE EMPLOYER VERIFY APPLICANT HAS MINIMUM JOB EXPERIENCE REQUIREMENTS**
- TAKE AND PASS WRITTEN EXAMINATION
  - AT EMPLOYERS FACILITY
- TAKE AND PASS PRACTICAL TEST
  - AT EMPLOYERS FACILITY

* SAME TASKS INVOLVED IN CERTIFICATION RENEWAL, EXCEPT FOR VERIFICATION OF EXPERIENCE

**AN ALTERNATIVE PATH IS FOR THE APPLICANT TO APPLY DIRECTLY TO EPA FOR EXAMINATION AT EPA ANN ARBOR FACILITIES

EPA TASKS

- PREPARE APPLICATION FORMS
- PROCESS AND REVIEW APPLICATION DETAILS
- SCHEDULE EXAMINATIONS
- PREPARE WRITTEN EXAMINATION
- ADMINISTER AND GRADE WRITTEN EXAM
- PREPARE PRACTICAL TEST
- ADMINISTER AND GRADE PRACTICAL TEST
- GRANT OR DENY CERTIFICATION

Table 4-4. On-Going Operator Quality Control

OPERATOR TASKS	EPA TASKS
• VERIFY CERTIFIED TEST DATA TRANSMITTED TO EPA • PARTICIPATE IN OR PERFORM ANY TESTS, CALIBRATIONS, OR OTHER CHECKS REQUESTED BY EPA AT TIMES OF SCHEDULED OR UN-ANNOUNCED INSPECTIONS OF LABORATORY BY EPA PERSONNEL	• SCREEN CERTIFIED TEST DATA SUBMITTED FOR COMPLIANCE WITH PROCEDURES • OBSERVE OPERATOR'S PERFORMANCE DURING SCHEDULED AND UN-ANNOUNCED INSPECTIONS OF LABORATORY

First, the operator is required to verify (by signature) that the certified test data submitted to the EPA by the laboratory has been performed under his surveillance and control. This permits EPA to screen the submitted test data for compliance with procedures. Second, the operator can be required to participate in or perform any tests, calibrations, or other checks requested by EPA inspectors at times of laboratory inspections (scheduled or unannounced). This permits direct observation of the operator's performance and techniques.

4.3 USE OF THE FUNCTIONAL TASKS

The selected functional tasks, as described above, are the basic building blocks of the laboratory and operator certification processes. They provide the basis for further breaking down the certification process into more definitive work elements (or steps) which can be developed to assure meeting the specific requirements of 40 CFR 85 as well as permitting a simple and logical sequencing of required work elements. The so-developed work flow sequences are described in detail in Section 5.

5. WORK FLOW SEQUENCE ANALYSIS

5.1 INTRODUCTION

This section presents the results of an analysis of the work flow sequence required to actually perform the selected basic functional tasks for laboratory and operator certification as delineated in Section 4. The analysis was directed to a detailed expansion of the selected basic functional tasks, to identify the number and types of work elements involved, and to indicate the interrelation of work flow elements between the laboratory (or test operator) and the EPA laboratory certification control group.

During the analysis effort, emphasis was directed to:

a. Simple and logical work flow elements
b. Minimum sequencing of operations
c. Minimum EPA staff requirements
d. Adequate control over key activities of the certified laboratory
e. Minimum interference with day-to-day activities of the laboratory
f. Minimum involvement of the employer in the operator certification process.

The analysis resulted in the formulation of work flow sequences or steps in the form of logic or flow sheet diagrams. These flow sheets are necessarily detailed in nature in order to adequately describe both the nature of the work flow elements involved and their relationship to one another. Therefore, the results are presented in graphical form with a minimum of discussion to identify and describe the flow sheet, per se.

5.2 LABORATORY CERTIFICATION

The work flow sequence analysis for laboratory certification was principally directed to defining two levels of expansion of the selected functional tasks of Section 4. In the first level of expansion, each significant work task area was identified and assigned a "block number" for reference purposes. Then a basic task flow sequence was established to define the interrelationship of the work task areas. In the second level of expansion, the principal work elements (or steps) within each work task area were identified. This work element description was used as the basis for defining the scope of the laboratory certification group work load, and enabled the definition of staffing requirements, schedules, and costs as described in Section 6.

In two areas, application form preparation and application processing, a third level of expansion was carried out as examples of the level of detail to which each key block area can be further expanded. This degree of expansion identified detailed work processes performed by individuals in accomplishing specific work elements.

The total number of flow sheets developed in the analysis activity is shown in Table 5-1. These flow sheets are described in the following sections.

5.2.1 Initial and Renewal Certification

Figure 5-1 describes the overall process of laboratory certification (both initial and renewal) in flow sheet format. The major work task areas are identified by a roman numeral "block number", and Block X is further sub-identified by letter for further work element definition purposes. As can be noted, a 2-year certification term was selected as appropriate in view of the frequency of scheduled and unannounced quality control inspection visits described in succeeding flow sheets. Although not addressed in this study, a provision for appeal by a rejected applicant laboratory is included in the overall certification program. The major work elements are described below.

5.2.1.1 Application Requirements

Figure 5-2 outlines the essential informational areas which should be included in an application for certification for sub-parts "A" and

Table 5-1. Flow Sheet Breakdown — Laboratory Certification

(Work Flow Sequence Analysis)

	FLOW SHEET NO.
• FIRST LEVEL OF EXPANSION	
/ LABORATORY CERTIFICATION BASIC WORK AREAS (INITIAL AND RENEWAL)	201
• SECOND LEVEL OF EXPANSION	
/ BLOCK I: INFORMATION REQUIRED IN APPLICATION	2011-1
- BLOCK IA: BASIC INFORMATION ON LABORATORY	2011-2
- BLOCK IC: EXHAUST EMISSION MEASUREMENT INFORMATION	2011-3
/ BLOCK II: OVERVIEW OF APPLICATION PROCESSING	201-A
- BLOCK II: PROCESSING OF APPLICATION	2012-1
- BLOCK II: PRELIMINARY PROCESS SCREENING	2012-2
/ BLOCKS III THROUGH VII: APPLICATION CORRECTION LOOP	2013
/ BLOCK VIII: ORGANIZE AND SCHEDULE INSPECTION VISIT	2018
/ BLOCK IX: TEST OBSERVATIONS	2019
/ BLOCK X: DETAILED OBSERVATIONS OF EQUIPMENT, TEST AND CALIBRATION PROCEDURES	2010-1 2010-2
/ BLOCK XI: INSPECTION VISIT REVIEW	20111
• THIRD LEVEL OF EXPANSION	
/ BLOCK I: ROUGH DRAFT OF APPLICATION FORM	APPENDIX B
/ BLOCK II: PROCESSING OF GAS HANDLING SYSTEM AND GAS ANALYSIS INSTRUMENTS SECTIONS OF APPLICATION	
- SCHEMATICS AND COMPONENT LISTS	2012-C1 (i)
- CALIBRATION OF CVS SYSTEM	2012-C1 (ii)
- VERIFICATION OF CVS SYSTEM	2012-C1 (iii)
- GAS ANALYSIS INSTRUMENTS	2012-C2

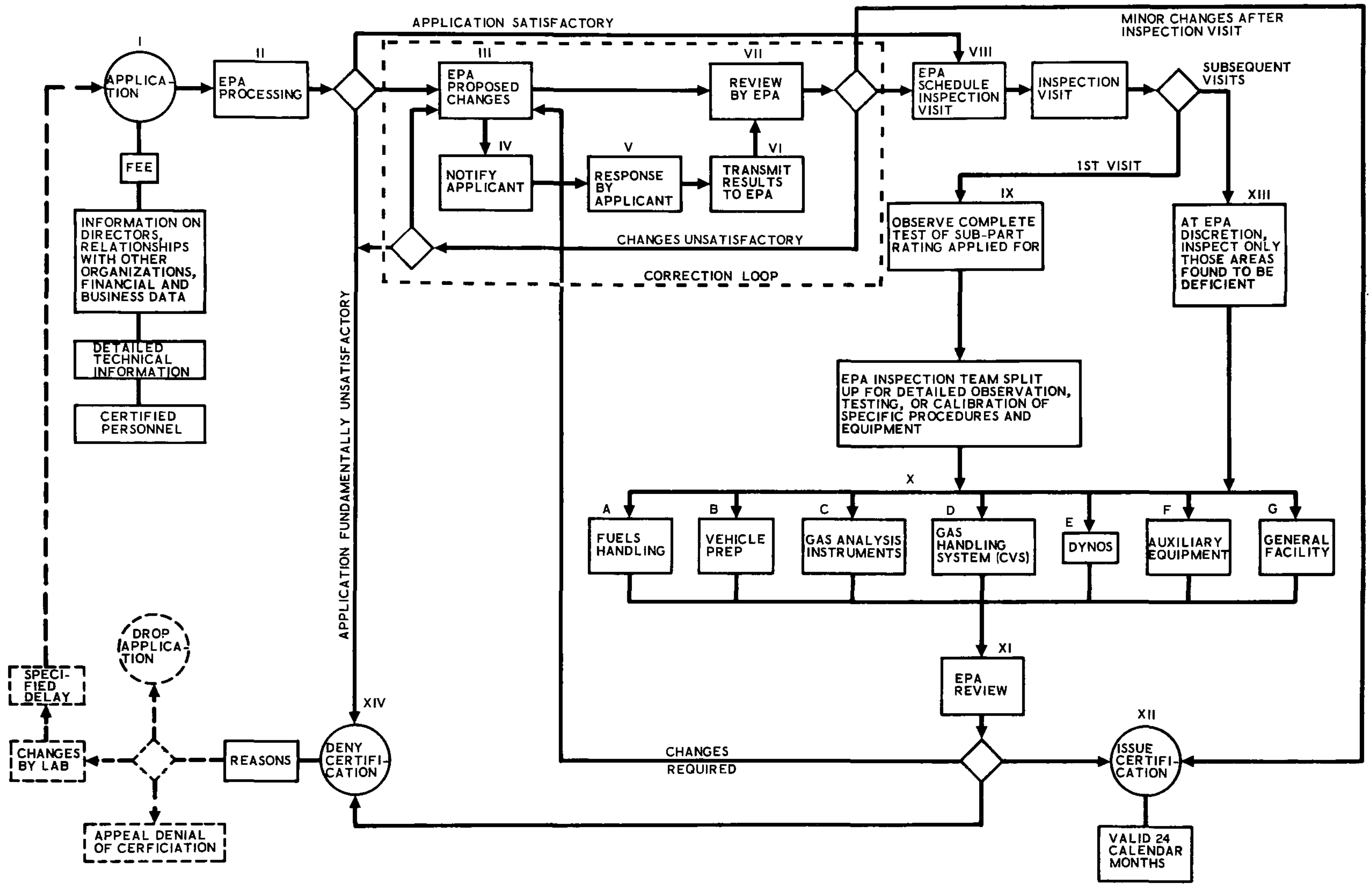


Figure 5-1. Initial and Renewal Laboratory Certification

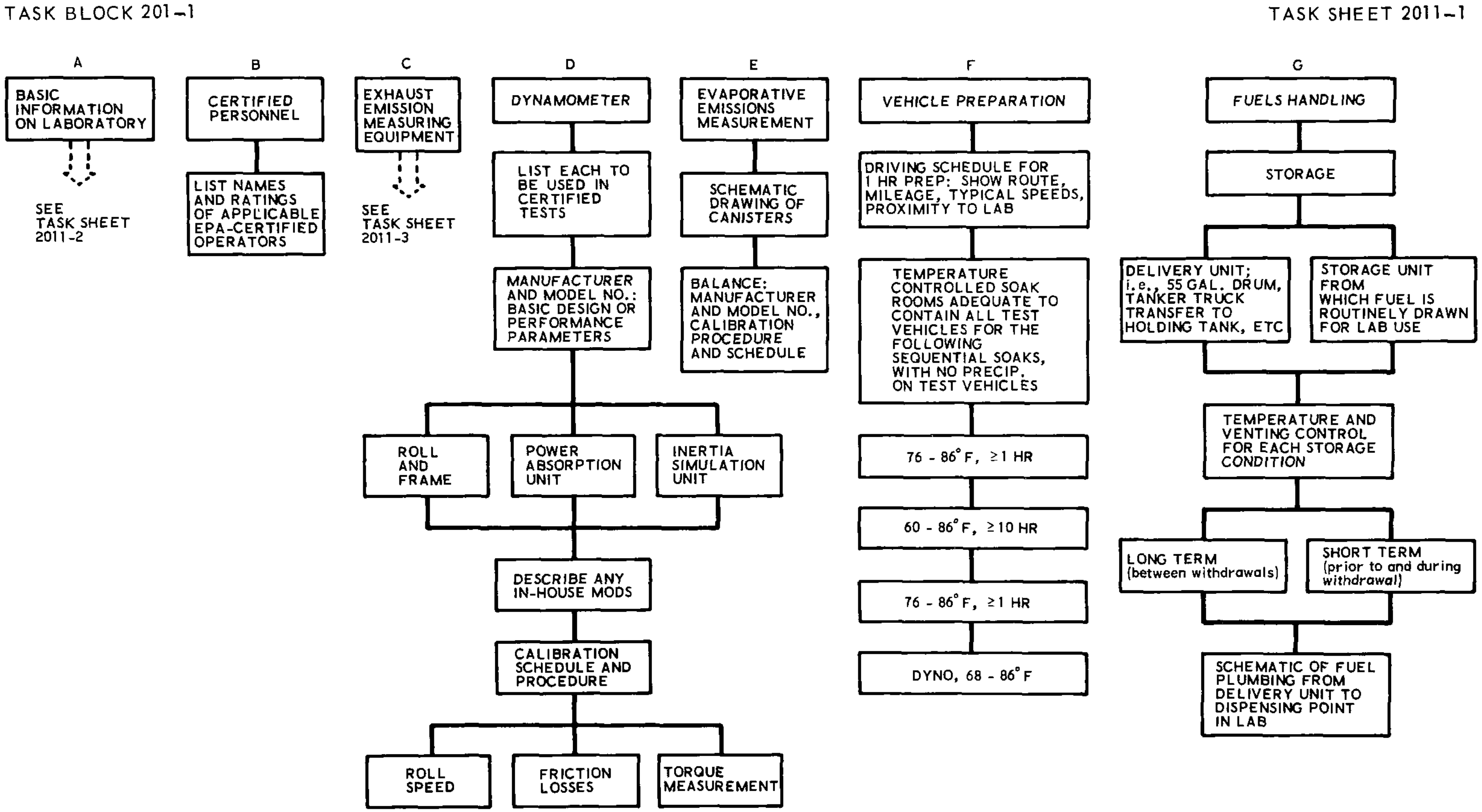


Figure 5-2. Application for Subparts "A" and "C" Certification

"C" ratings. Variations for other subpart ratings may be determined by inspection from the matrix of requirements presented in Table 3-1. Figure 5-3 further illustrates the level of detail required in the area of information concerning the laboratory proper, and Figure 5-4 notes the level of informational detail required for the exhaust emission measurement systems.

It is considered that the application must contain statements, drawings, etc., in sufficient detail to permit the EPA laboratory certification staff to make a preliminary finding of compliance with 40 CFR 85 test procedures and equipment requirements (see Table 3-1) prior to scheduling an inspection visit to verify compliance. Appendix B describes the format for a typical application form which would require the inclusion of the necessary detailed information.

5.2.1.2 Application Processing and Evaluation

Figure 5-5 presents an overview of the application processing and evaluation function. It is visualized that submitted applications would fit into one of four categories:

a. The test procedures and equipment delineated in the application are identical to or very similar to the requirements of 40 CFR 85.

b. The procedures or equipment delineated are different from 40 CFR 85 requirements but demonstrated to be equivalent or closely comparable.

c. The procedures or equipment are different from 40 CFR 85 requirements, but a variance is granted by EPA.

d. The procedures or equipment are not reconcilable with 40 CFR 85 requirements and certification is denied.

As graphically depicted in the lower half of Figure 5-5, the overall work involved in comparing the test procedures and equipment proposed by the applicant laboratory with the specific requirements of 40 CFR 85 falls into four basic "block-number" work areas:

a. Block II - application processing

b. Blocks III to VII - application correction loop

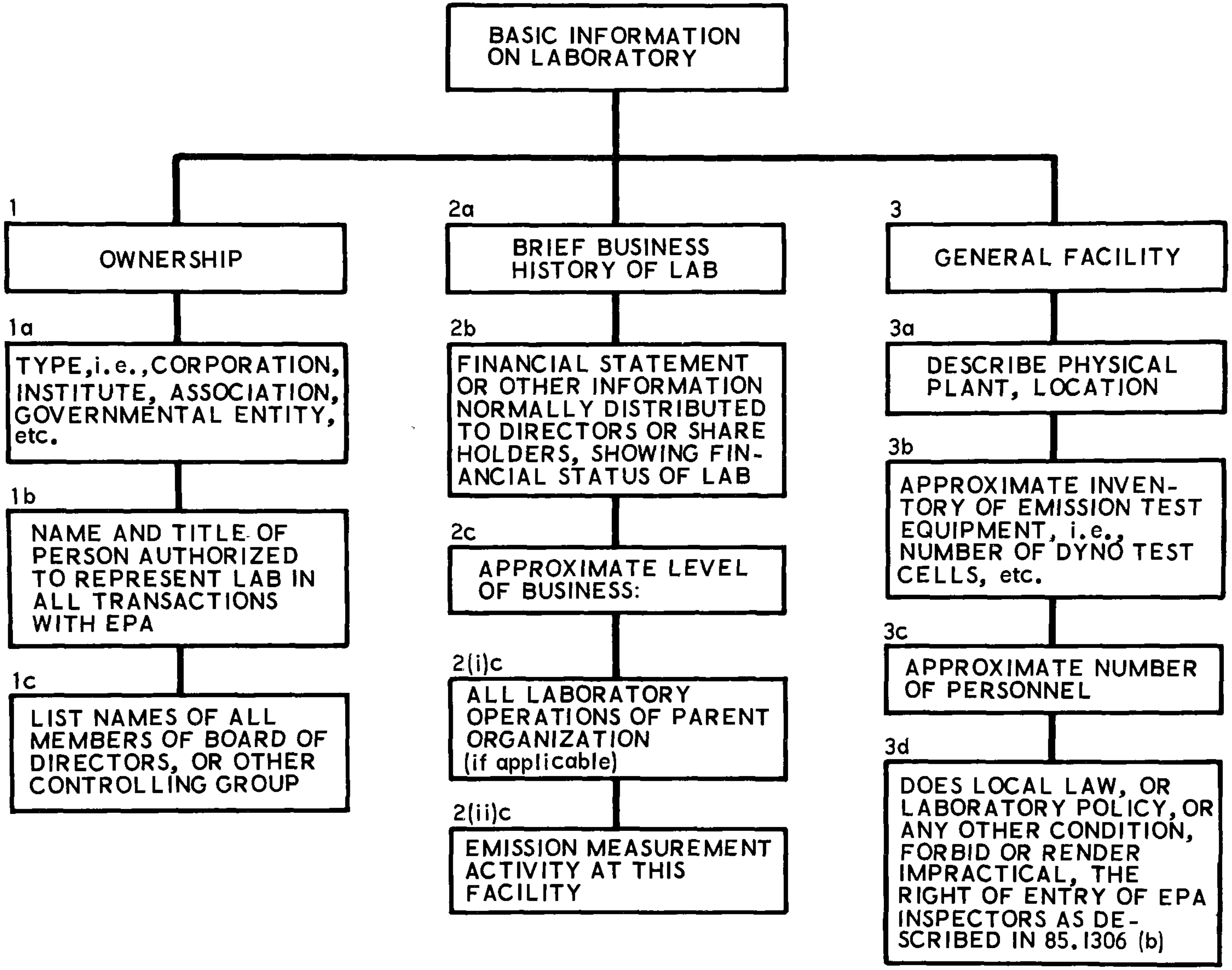


Figure 5-3. Laboratory Information Requirements

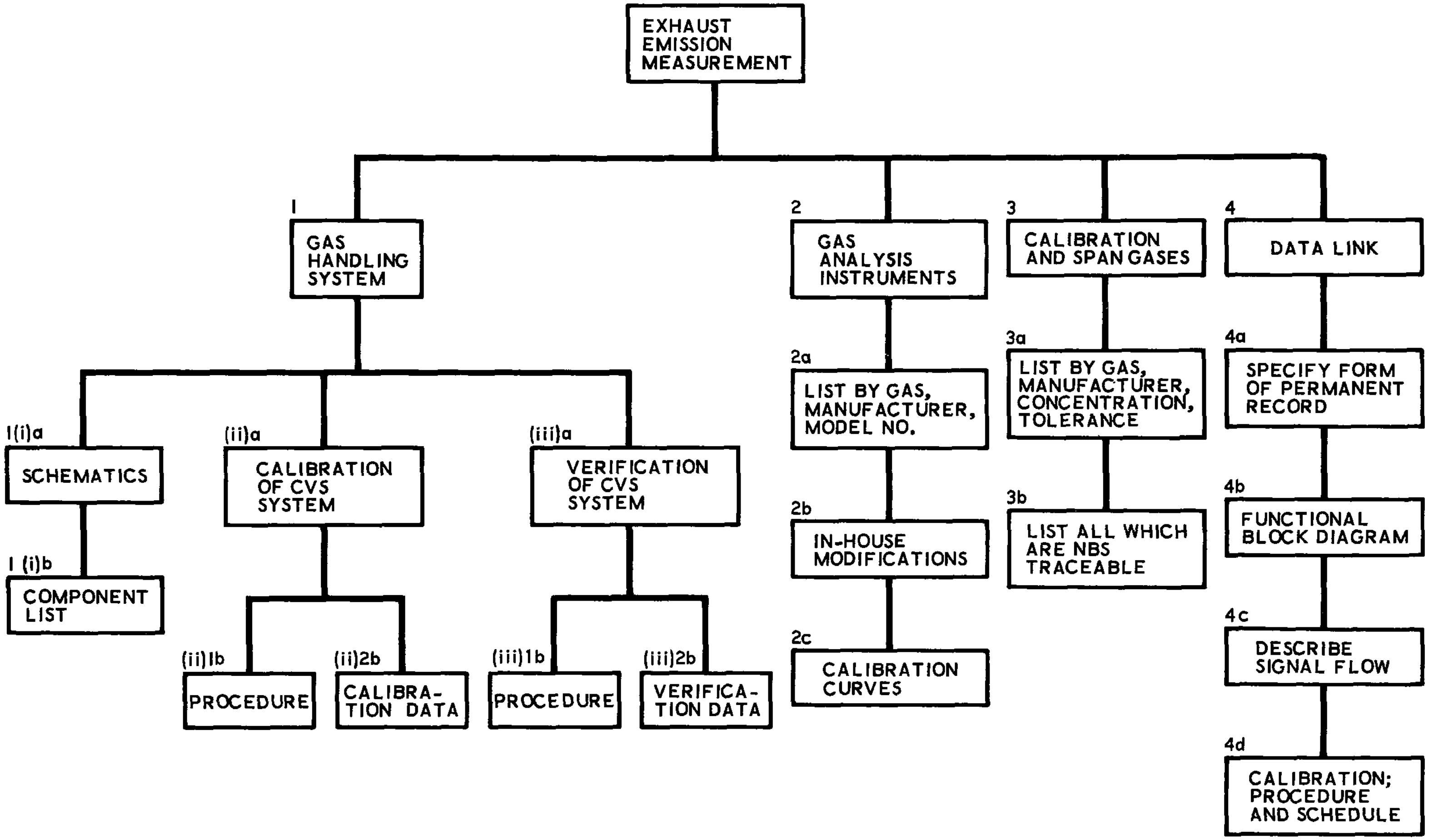


Figure 5-4. Exhaust Emission Measurement Details

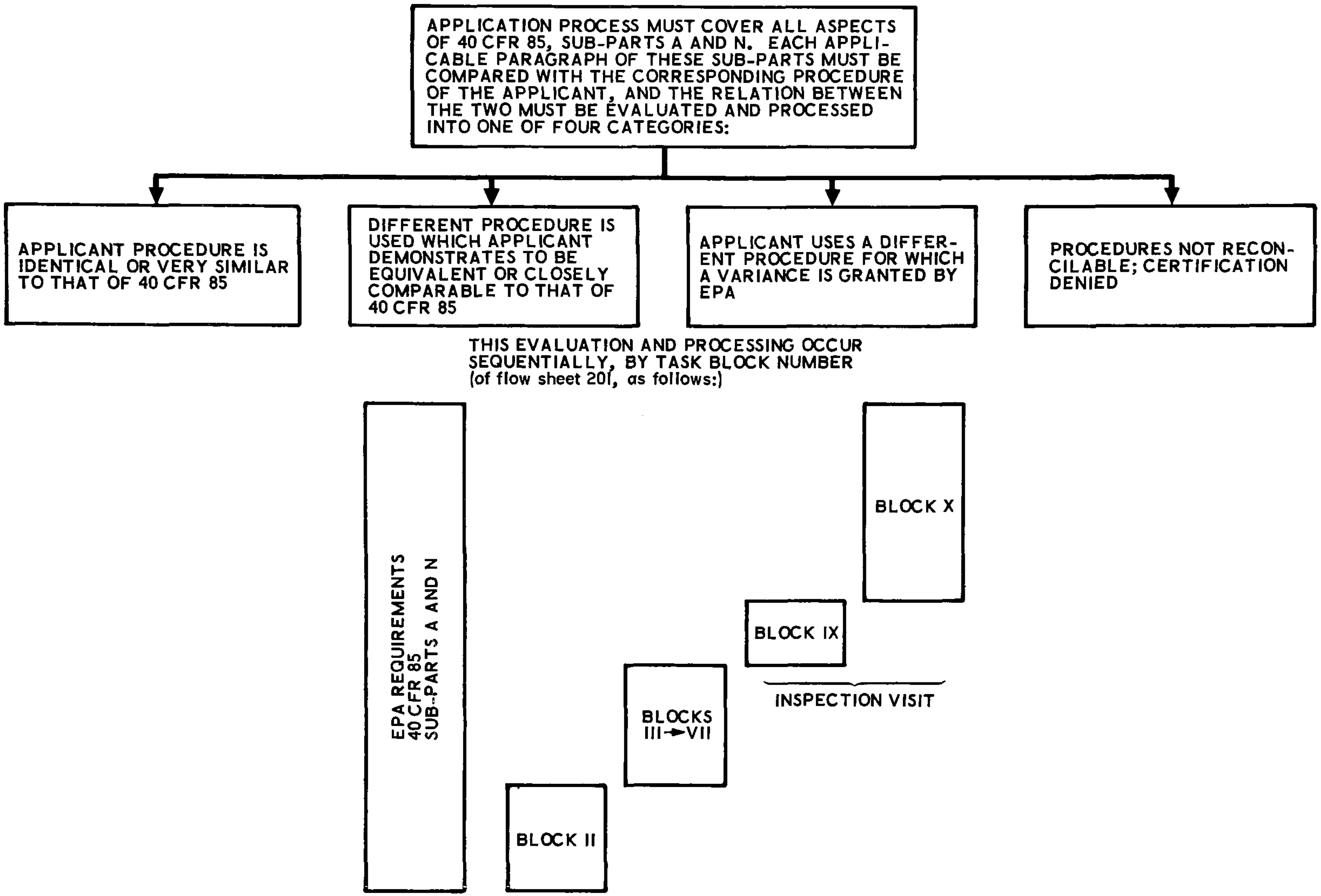


Figure 5-5. Overview of Application Processing

c. Block IX - observation of actual subpart test during the inspection visit

d. Block X - detailed observations of testing, calibrations, procedures, and equipment during the inspection visit.

Figure 5-6 (left-hand side) summarizes a step-by-step method of processing the application from initial receipt through final evaluation by the EPA laboratory certification group, using the information obtained from a through d above. Also shown in Figure 5-6 (right-hand side) is the sequence of operations involved in evaluating the application using a four-point grading system as noted on the figure.

Because of the level of detail included in the application, it may be advisable to perform a preliminary examination of the completed application immediately upon receipt to identify possible causes for denial or areas of obvious uncertainty. This information is required to communicate with the laboratory and resolve such issues prior to scheduling the inspection visit. Figure 5-7 denotes a brief critical scan path which can be followed in preliminary application processing activities.

An application correction loop (Blocks III through VII of Figure 5-1) is included in the certification work flow process. Its purpose is to ensure that, prior to the inspection visit, there is every indication that certification is warranted, i. e. , that the application, on its face, is felt to be in compliance with the test procedures and equipment requirements of 40 CFR 85. Figure 5-8 illustrates the work flow elements involved in the process of making corrections to the application until the necessary degree of compliance with requirements appears in the application proper.

As an example of the level of detailed work that has to be performed in order to qualitatively and quantitatively evaluate the application, Figures 5-9 through 5-12 were prepared. In checklist fashion, they illustrate specific items that should be examined and denote questions which must be

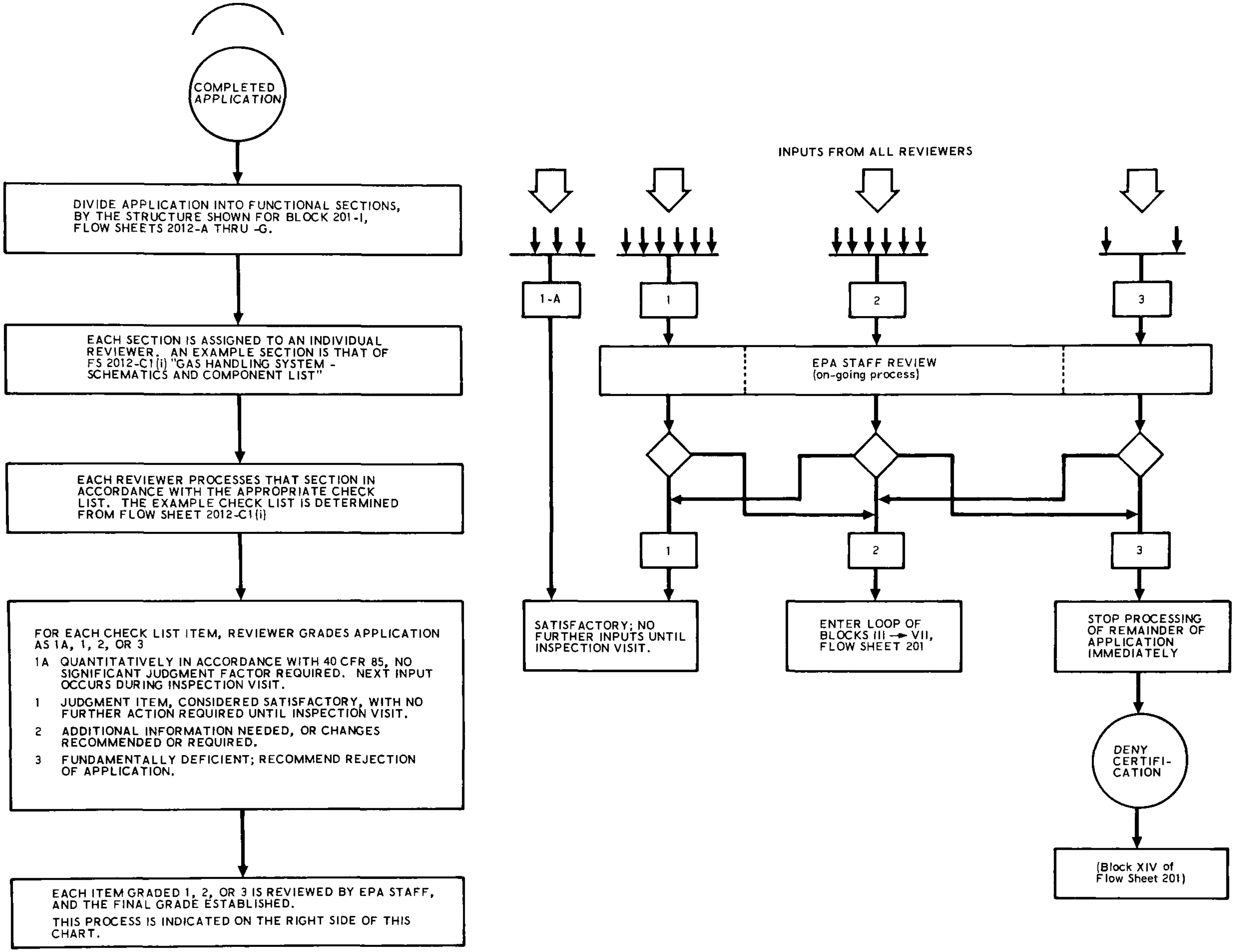


Figure 5-6. Processing of Application

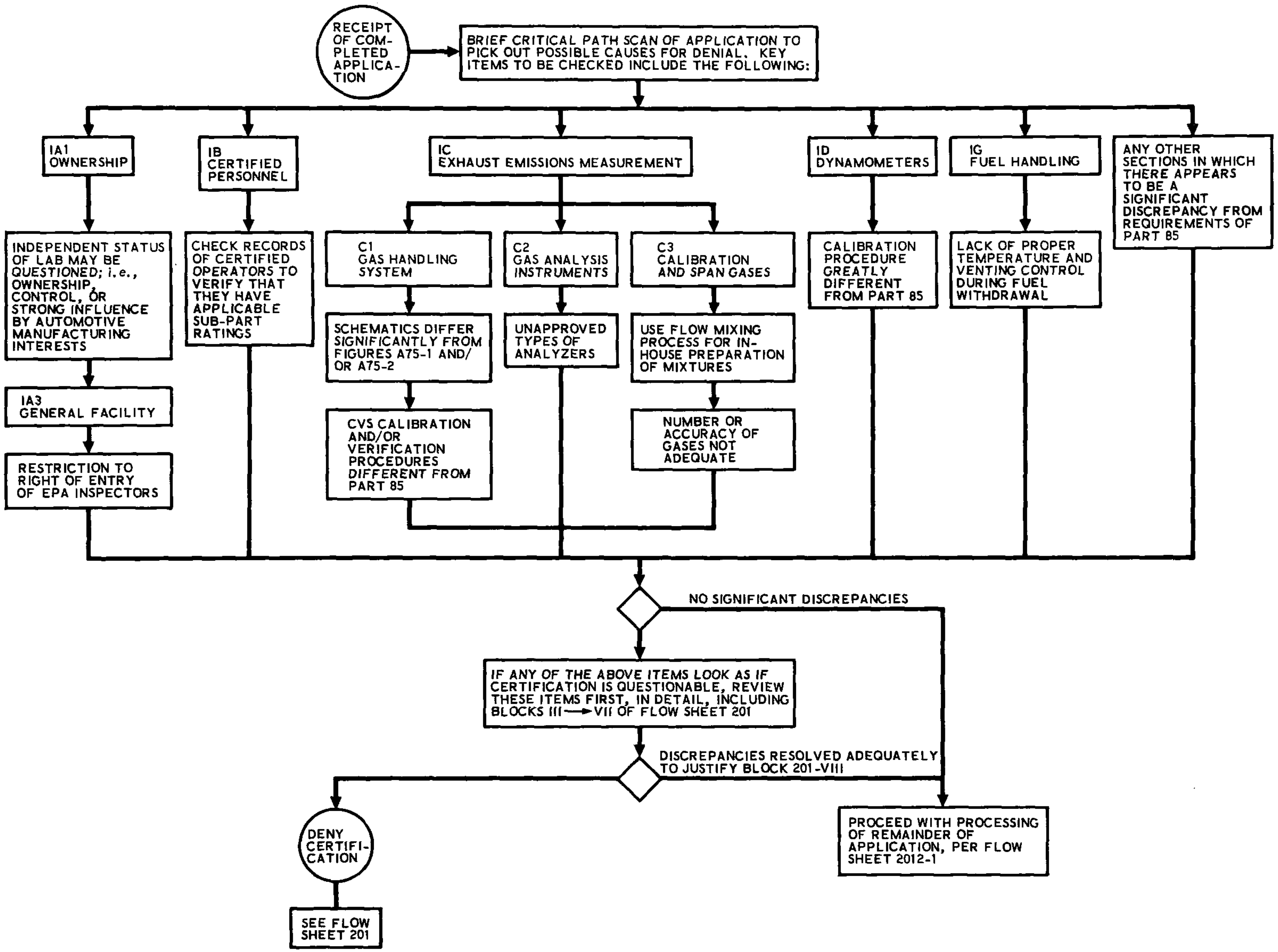


Figure 5-7. Preliminary Processing of Application

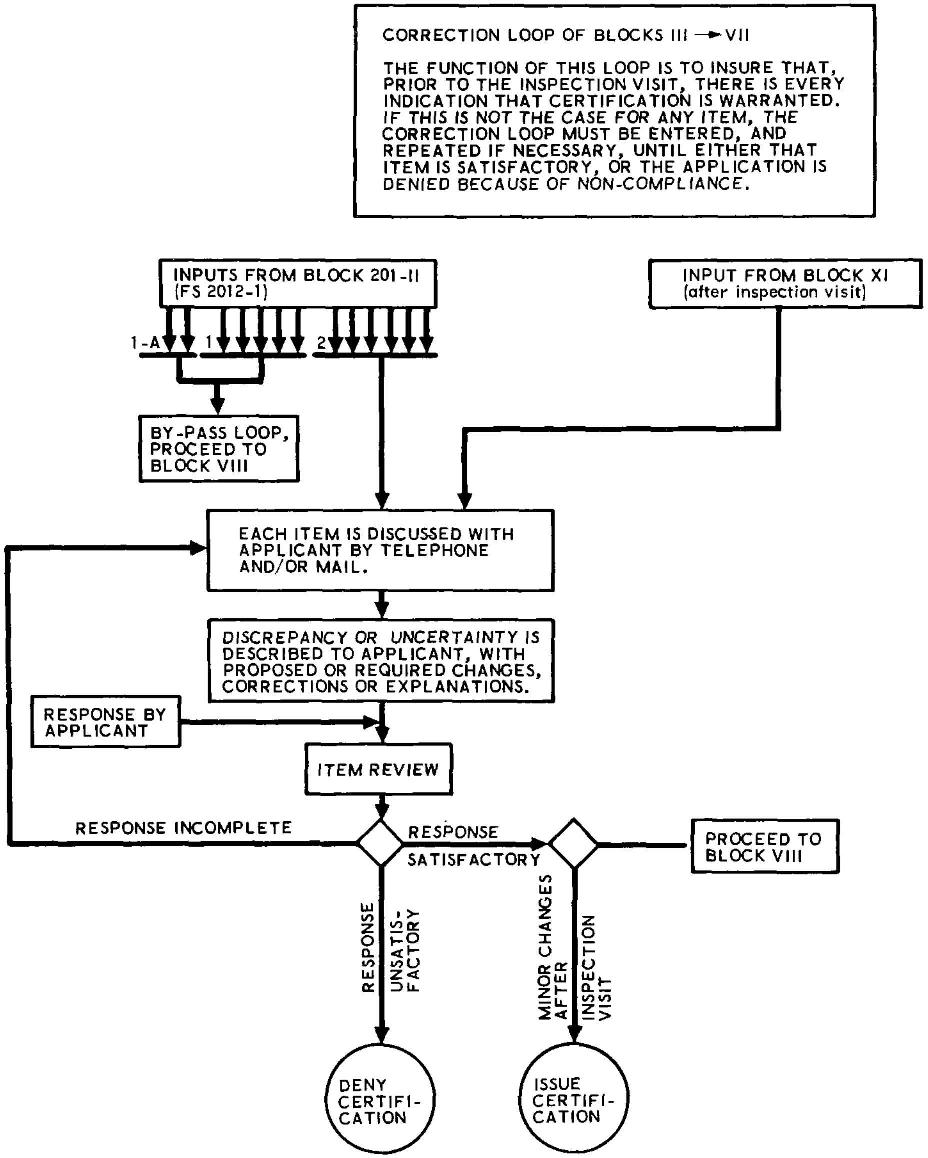


Figure 5-8. Application Correction Loop

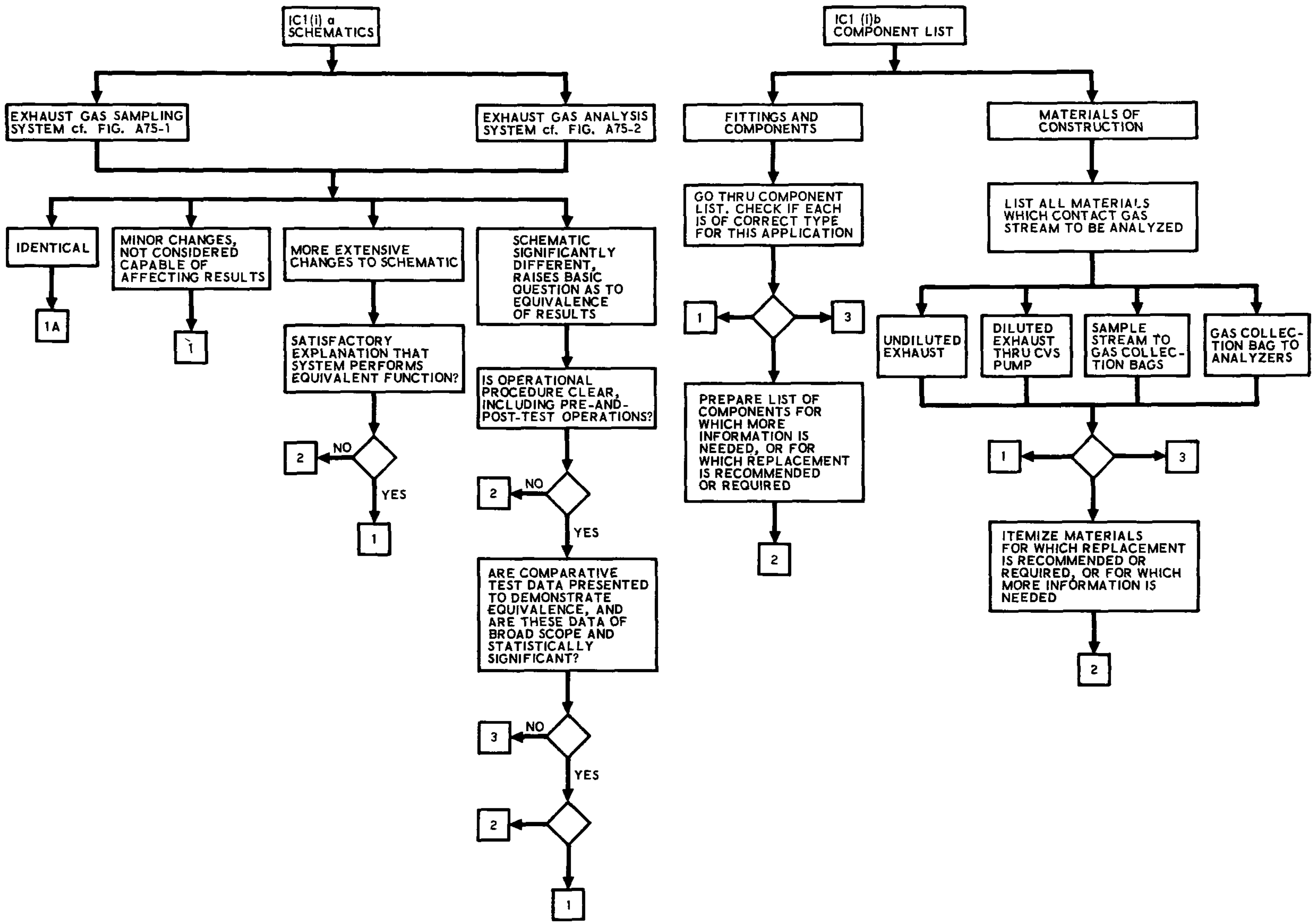


Figure 5-9. Checklist for Exhaust Gas Sampling and Analysis System

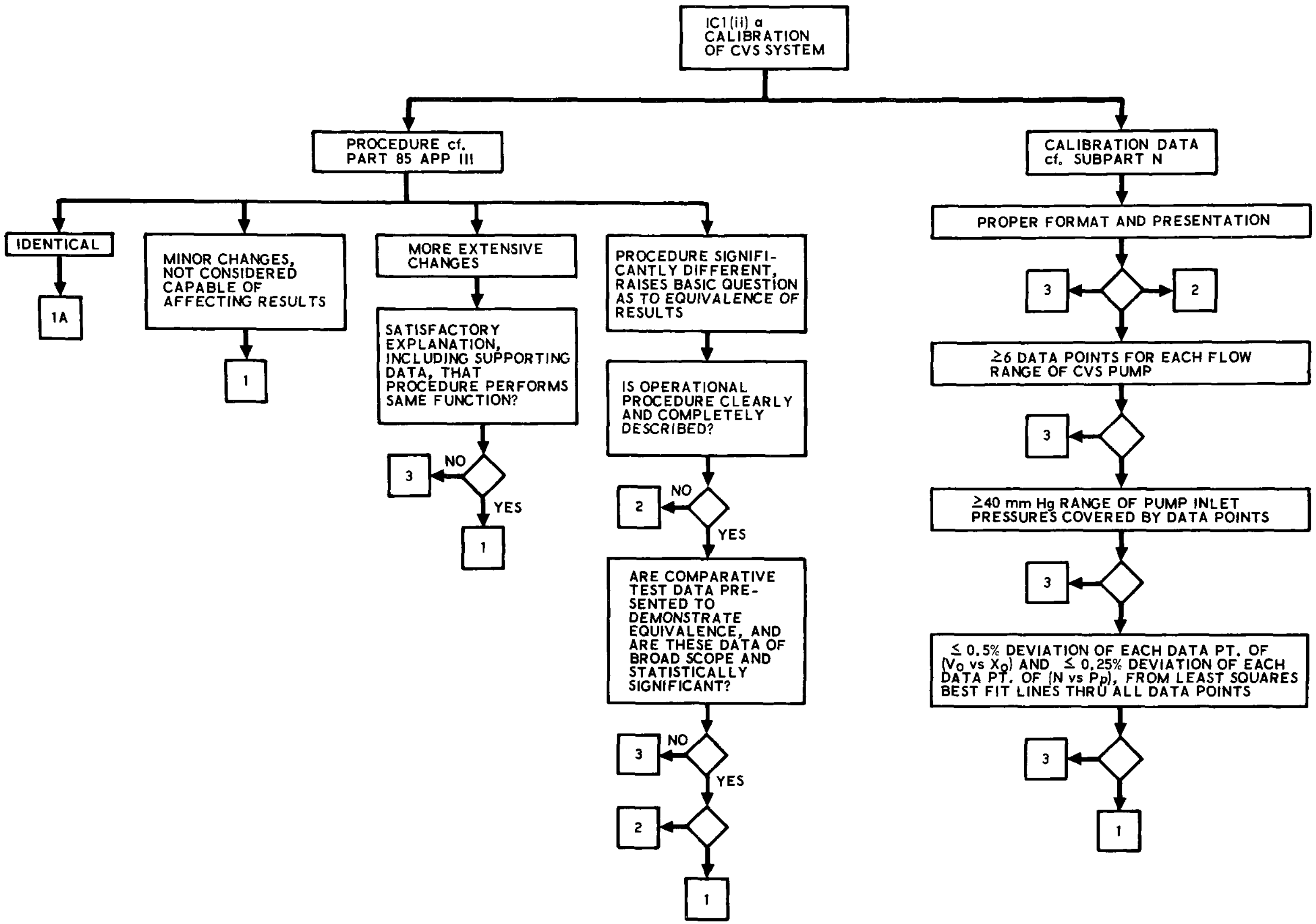


Figure 5-10. Checklist for CVS System Calibration

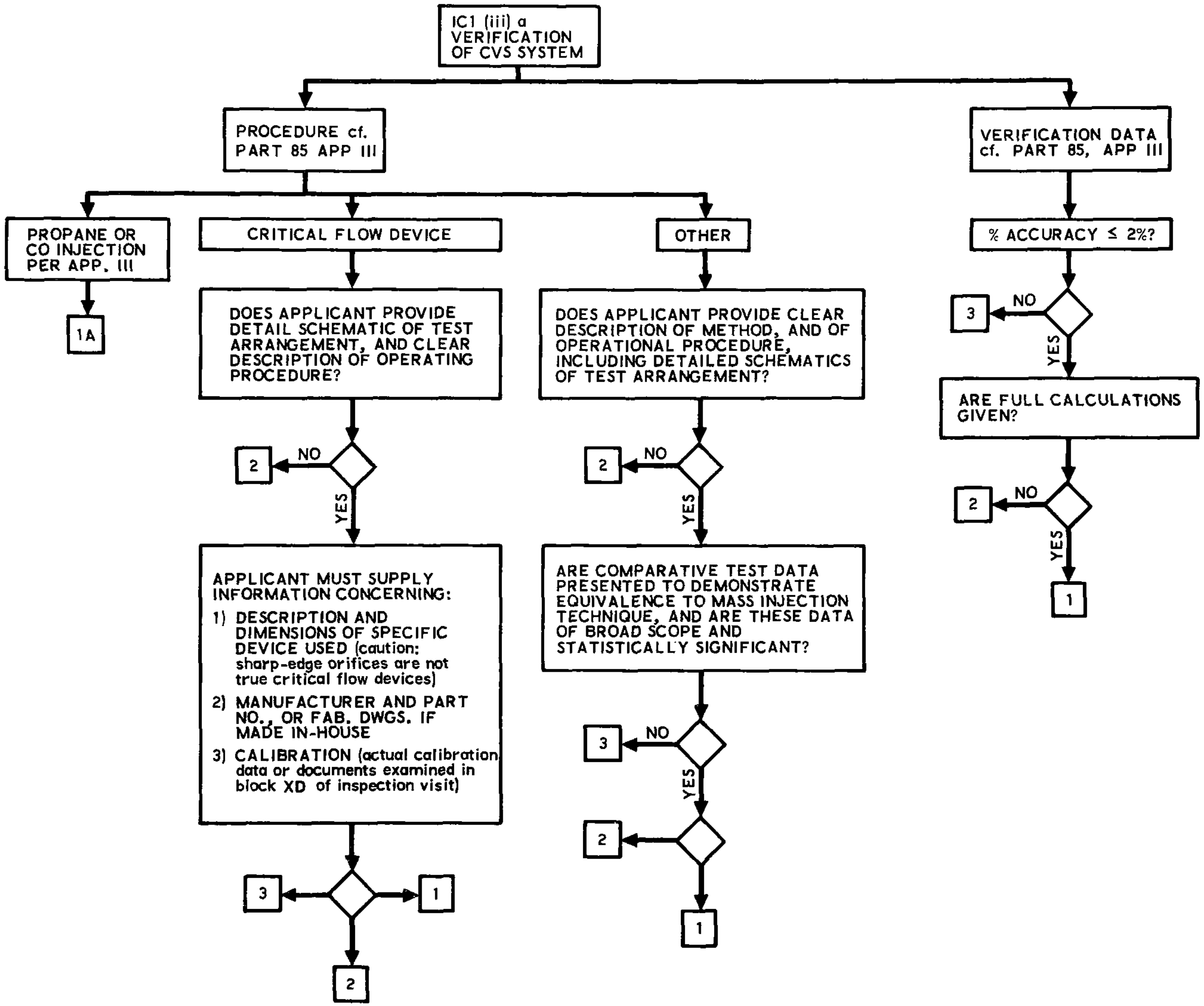


Figure 5-11. Checklist for CVS System Verification

FLOW SHEET 2012–C2

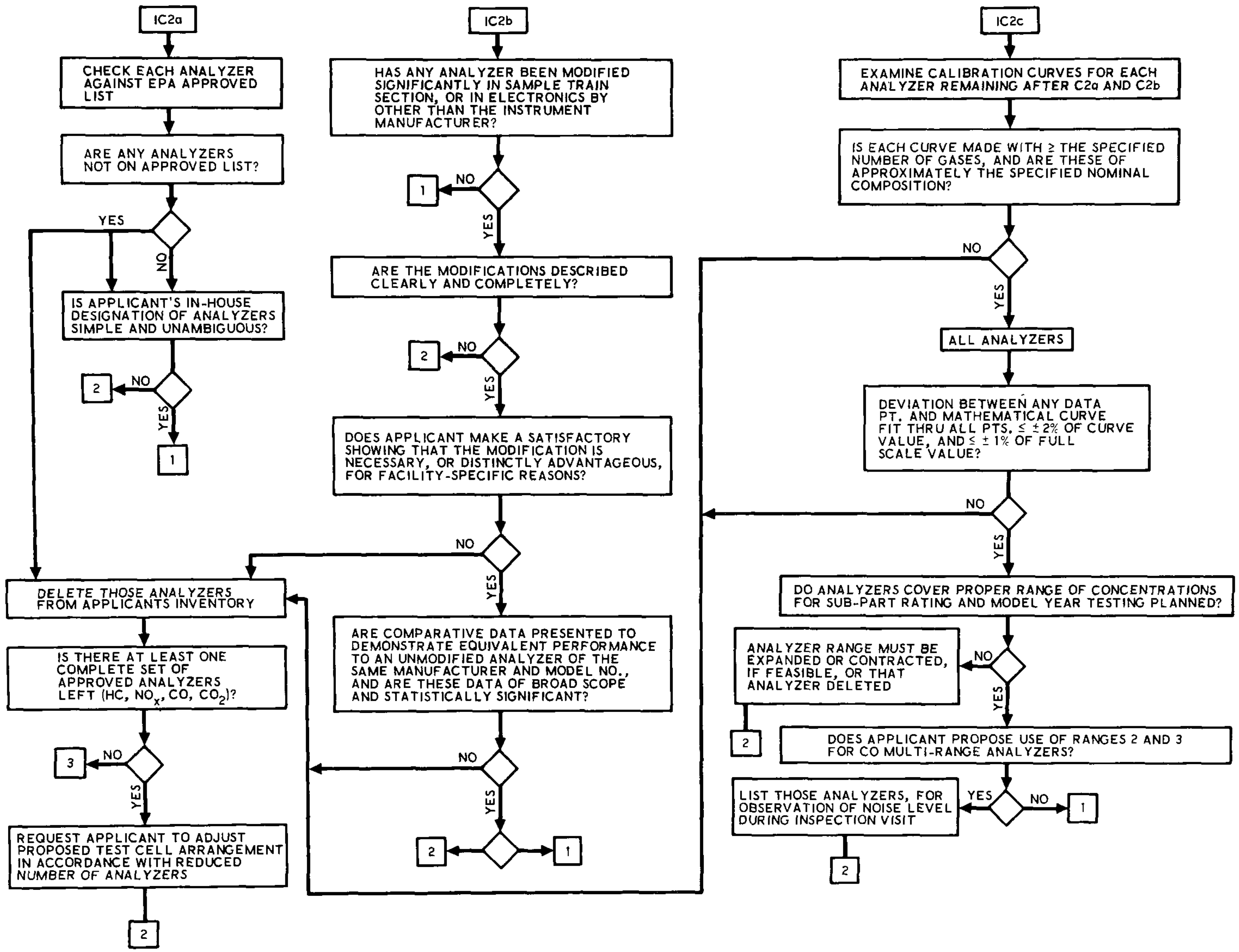


Figure 5-12. Checklist for Gas Analysis Instruments

answered or resolved to evaluate the gas handling system and gas analysis instruments sections of the application. In each instance shown, the item being reviewed is evaluated until a numerical grade can be assigned (numbers shown in figures correspond to grading system of Figure 5-6).

A suggested approach for accomplishing the application processing function is described below.

5.2.1.2.1 Suggested Application Processing Approach

The purpose of this application processing approach is to categorize each functional part of the application into one of four classifications which are given number designations as follows:

1A. Item is quantitatively in accordance with requirements of 40 CFR 85, with no significant judgment factor required. Next input occurs during inspection visit, Blocks IX and X of flow sheet 201 (FS201).

1. Judgment item, considered to be satisfactory, with no further action required until inspection visit.

2. Additional information needed, or changes recommended or required by EPA. These items to be processed in the correction loop of Blocks III through VII of FS 201.

3. Item is fundamentally deficient. Rejection of application is recommended.

The application is divided into several sections for processing, each section assigned to one reviewer. The latter performs his task in accordance with a check list based on the task flow sequences contained in the appropriate 2012-X series flow sheet.

The result of this first stage of processing is the four-way classification for each item described above. At this stage, the classification represents the recommendation of the individual reviewer, with the completed check list for each item to justify that recommendation.

The second stage of application processing is a critique (actually a number of separate review sessions) in which each item graded 1 through 3 by every individual reviewer is presented for discussion to at least one other staff member of the laboratory certification branch. In this stage, a recommendation for application rejection (path 3) may, for example, be softened to a request for changes or for additional information (path 2); or vice versa. The second stage decision is final for Block II. Items graded 1A are not subjected to the second stage processing.

The review continues until every functional item of the application has been classified as path 1 or 2, or until an item has been declared path 3 (denial) at the second stage. In the latter case, all remaining work on application processing ceases immediately, and the applicant laboratory is notified that certification has been denied, with the reason for this action. The laboratory is also informed as to which parts of its application were not completely processed.

For parts graded as path 2, the correction loop of Blocks III through VII of FS 201 may be entered while other parts of the application are still undergoing Block II processing.

Four flow sheets at the third level of expansion for Block 201-II are provided (Figures 5-9 through 5-12) to indicate the scope of detail involved. These are designated as FS 2012-C1 (i), -C1(ii), -C1(iii), and -C2. In these flow sheets all of the output paths 1, 2, and 3 are at the first stage of review and therefore must be subjected to the second stage review before activity on that item is completed for Block II.

An additional preliminary process is considered advisable. Due to the large amount of work required for the complete processing of an initial application, it is worthwhile to initially subject the application to a brief critical-path scan, to pick out those areas which are most likely to raise a fundamental question as to whether or not certification is warranted. This process is shown as FS 2012-2, (Figure 5-7) which indicates these potentially critical areas. These sections are processed first, including the correction loop of Blocks 201 III through VII, if necessary, to determine if there is a fundamental deficiency in these areas. If this is the case, the application may be rejected at an early stage. If not, the remainder of the application is processed as described above.

5.2.1.3 The Inspection Visit

An inspection visit is included in the overall certification process (Figure 5-1) to verify that the information contained in the application is correct and to observe first-hand that the procedures set forth in the application are being followed satisfactorily. However, there are a number of activities associated with the inspection visit which must precede it; these are summarized in Figure 5-13. First, a checklist of items requiring detailed observation and examination at the specific test laboratory should be prepared. This checklist should be based on the results of the application evaluation and give special attention to any items which were rated as questionable in view of the specific requirements of 40 CFR 85. Next, the number, type, and concentration of EPA gas cylinder "unknowns" should be selected and shipped to the applicant laboratory so that they will arrive prior to the scheduled date of the inspection visit. If a special test correlation vehicle is to be used in the inspection process, it should also be shipped at this time. Finally, the EPA inspection team should be selected and the inspection visit scheduled and coordinated with the laboratory to ensure that a complete subpart test will be performed on the date of the visit.

During the inspection visit, the inspection team observes a complete test of the subpart rating applied for (Block IX of Figure 5-1) and then splits up to make detailed observations of other tests, calibrations, procedures, and equipment (Block X of Figure 5-1). Figure 5-14 indicates the detailed work elements involved in the subpart test observation activity (Block IX) and Figure 5-15 denotes similar work elements required in the detailed observations and procedural checks required in the Block X activities.

TASK BLOCK 201-VIII

FLOW SHEET 2018

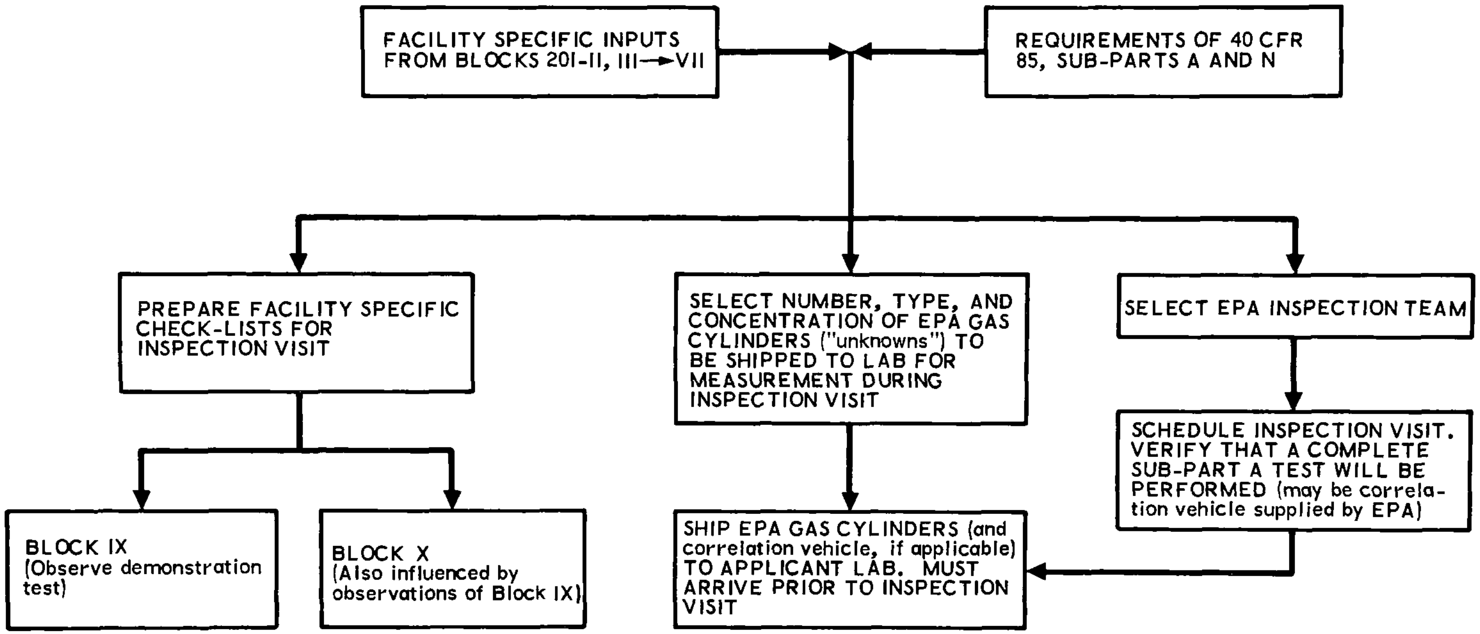


Figure 5-13. Organize and Schedule Inspection Visit

TASK BLOCK 201–IX

FLOW SHEET 2019

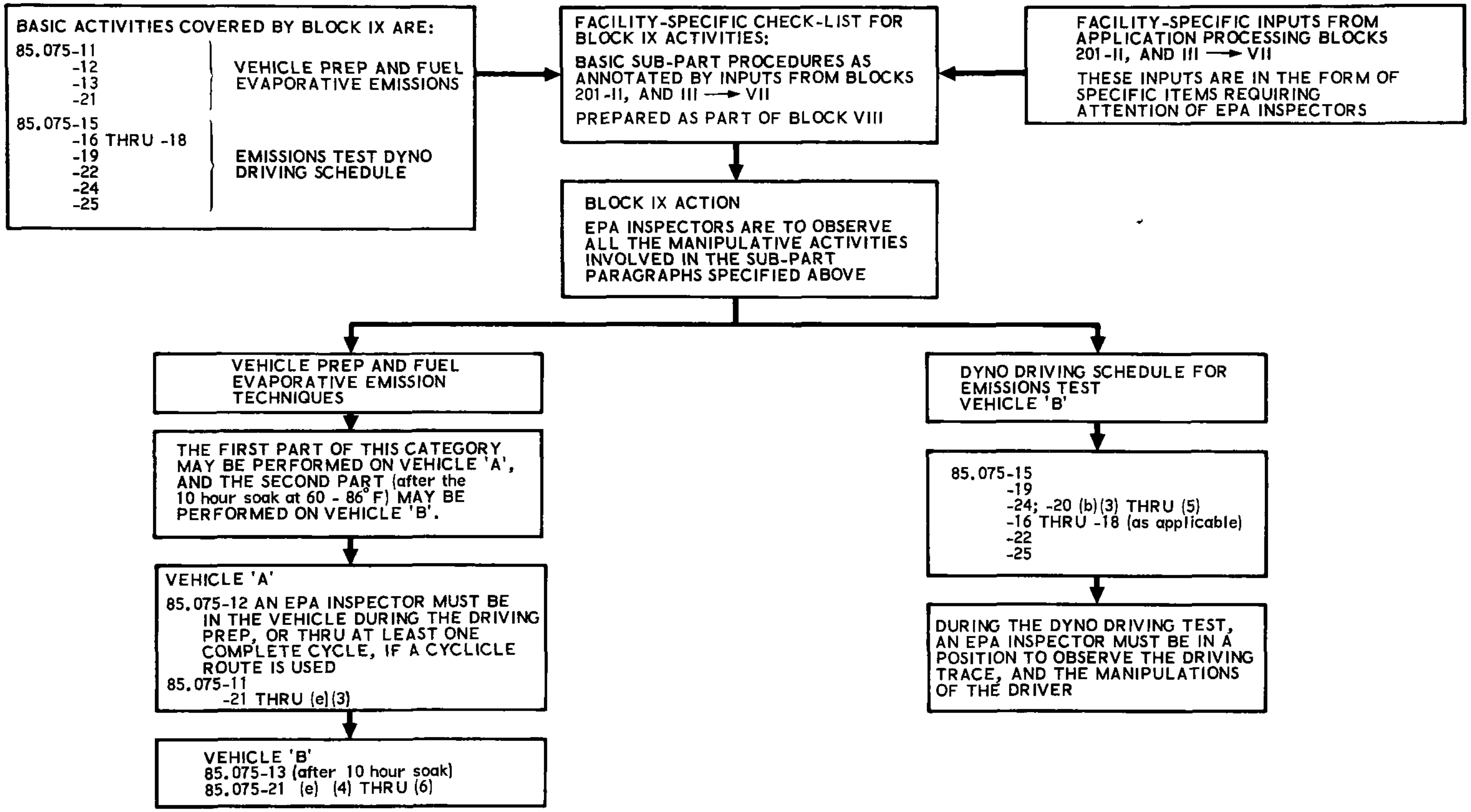


Figure 5-14. Block IX Work Element Details – Observe Complete Test of Subpart Rating Applied For

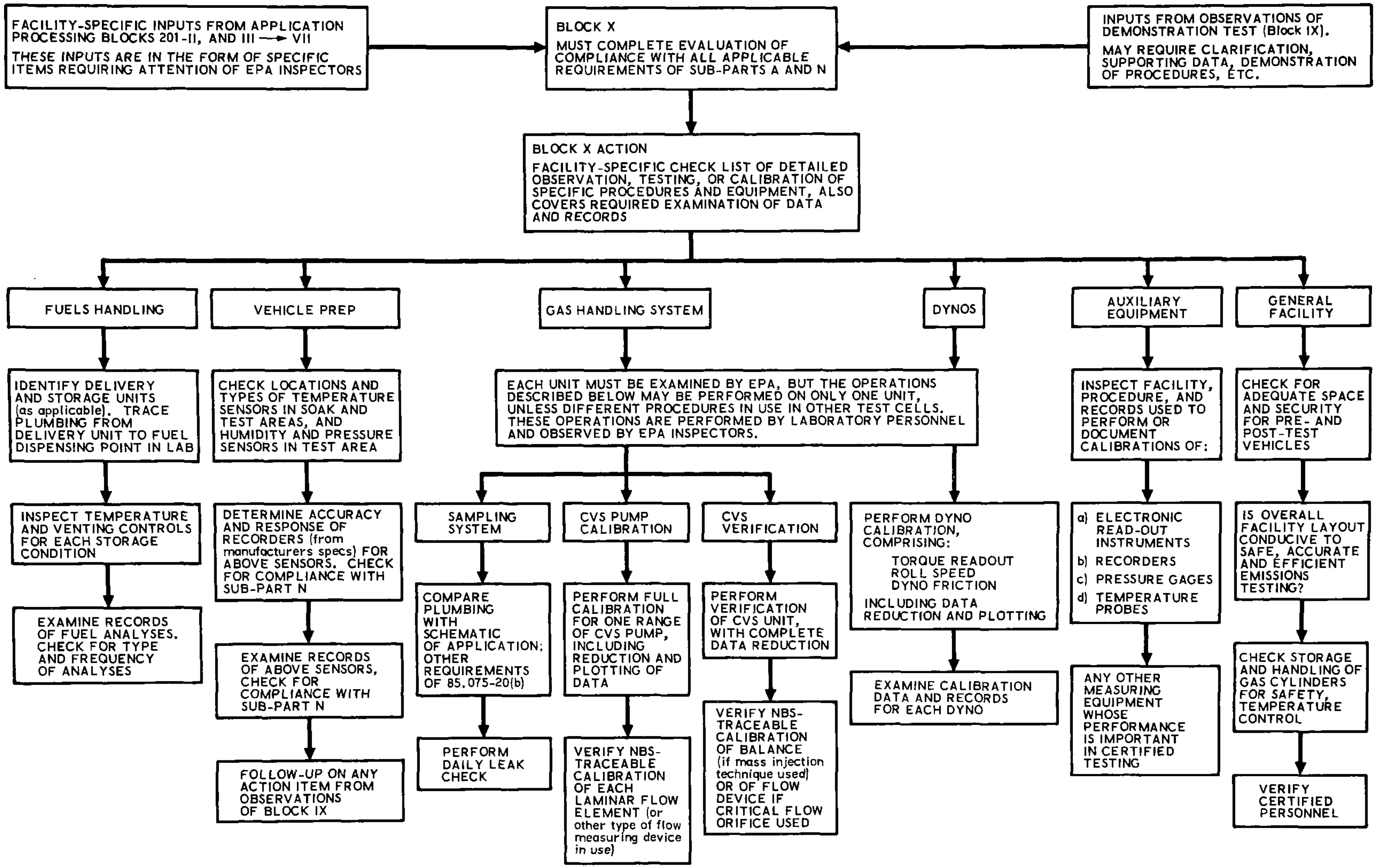


Figure 5-15. Block X Work Element Details – Inspection Visit

TASK BLOCK 201–X

FLOW SHEET 20110–2

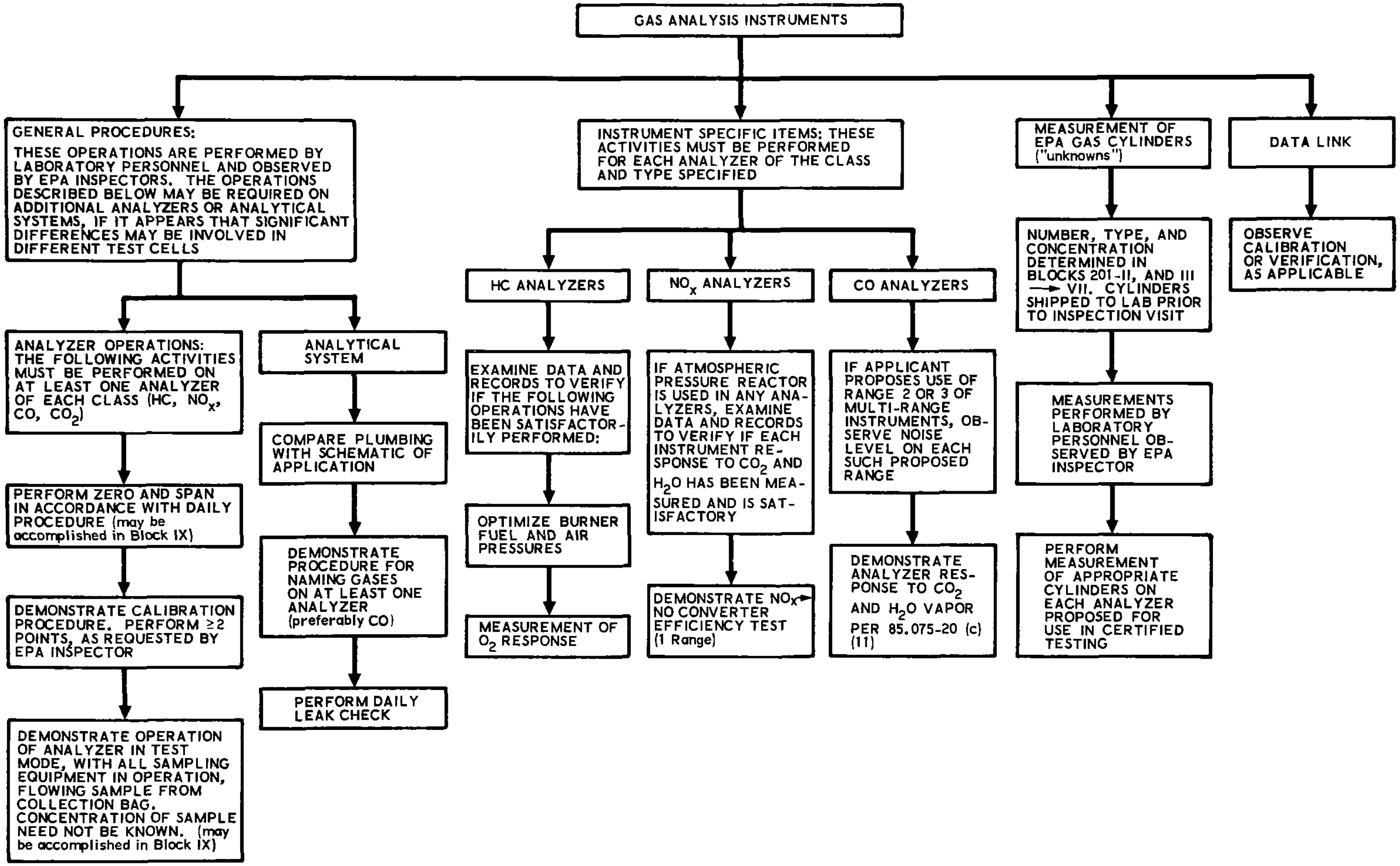


Figure 5-15. Block X Work Element Details – Inspection Visit (Continued)

As can be noted in Figure 5-14 and 5-15, the elements of work to be performed by the EPA inspection staff are extensive in number and detailed and specific in content. Such observations and checks are essential to ensure that the laboratory is in compliance with the procedural and equipment requirements of 40 CFR 85.

5.2.1.4 Final EPA Review

After the inspection visit, the results of the inspection are submitted to a final EPA staff review. These inspection visit results consist of a completed check list evaluation, which provides a paragraph-for-paragraph comparison of all applicable sections of 40 CFR 85. Each check list item has been graded by the inspection team. Figure 5-16 graphically depicts the final EPA review activity, and illustrates the various steps leading to issuance or denial of certification.

5.3 LABORATORY QUALITY CONTROL

The work flow sequence analysis for laboratory quality control was performed in a manner similar to that delineated above for the laboratory certification process (Section 5.2). The flow sheets developed in the analysis are summarized in Table 5-2 and described below.

5.3.1 Periodic Scheduled Inspections

Figure 5-17 describes the overall process of a scheduled inspection at 6-month intervals in flow sheet format. It is quite similar to the initial inspection made for initial certification purposes (Figures 5-14 and 5-15) but is less extensive in nature. Major emphasis during the scheduled inspection is placed on (a) determining if the key calibration and test procedures are the same as those observed in detail during the initial or renewal inspection visit (and upon which certification approval was based), and (b) ensuring that the calibration schedules for key equipment are in compliance with 40 CFR 85 requirements. Figures 5-18 and 5-19 denote the key operations which should be carried out in this regard during the scheduled inspection.

TASK BLOCK 201-XI

FLOW SHEET 201 11

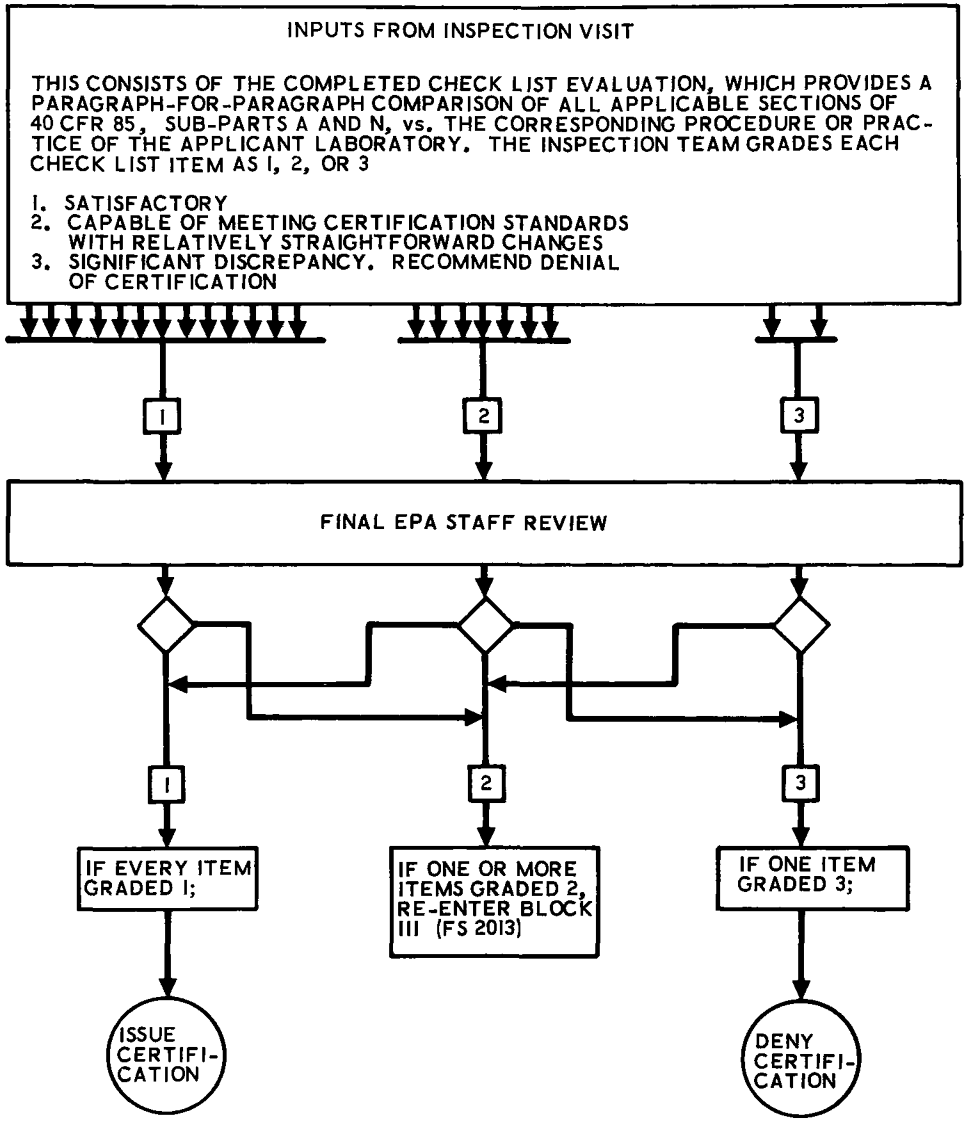


Figure 5-16. Final EPA Review

Table 5-2. Flow Sheet Breakdown — Laboratory Quality Control

	FLOW SHEET NO.
• PERIODIC SCHEDULED INSPECTIONS	202
/ SECOND LEVEL EXPANSION OF KEY BLOCKS	
- INSPECT CALIBRATION AND TEST PROCEDURES	2024
- EXAMINE DATA AND RECORDS	2025
• UNANNOUNCED INSPECTIONS	203
/ SECOND LEVEL EXPANSION OF BLOCK IV SIMILAR TO 2025 ABOVE, EXCEPT THAT EMPHASIS IS ON EXAMINING CALIBRATION SCHEDULE (LESS EMPHASIS ON EXAMINING PROCEDURES)	
• ONGOING QUALITY CONTROL PROCESS	204
• SUMMARY OF CERTIFICATION CONTROL MECHANISMS	206

FLOW SHEET 202

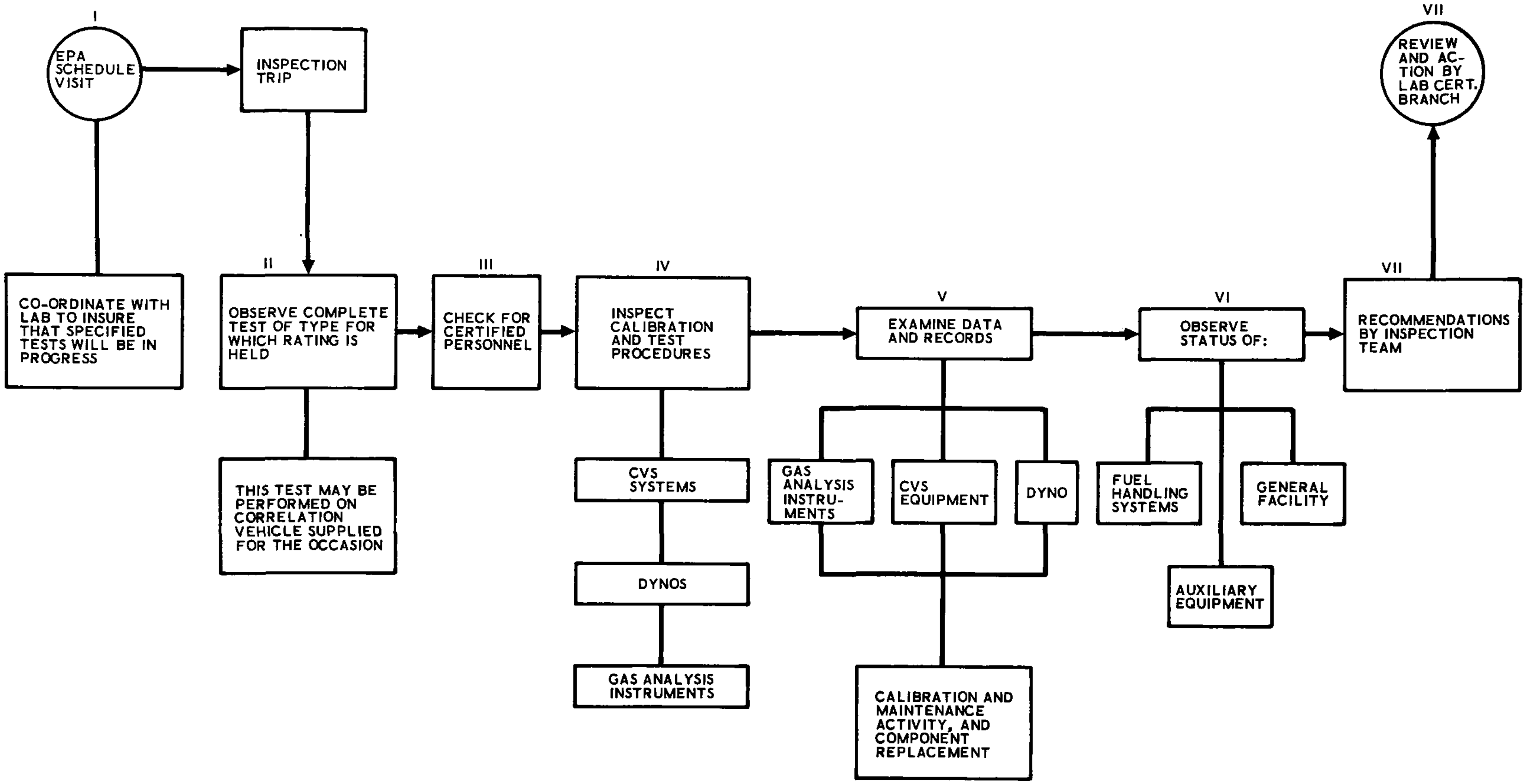


Figure 5-17. Periodic Inspection — Scheduled Inspection at 6-Month Intervals

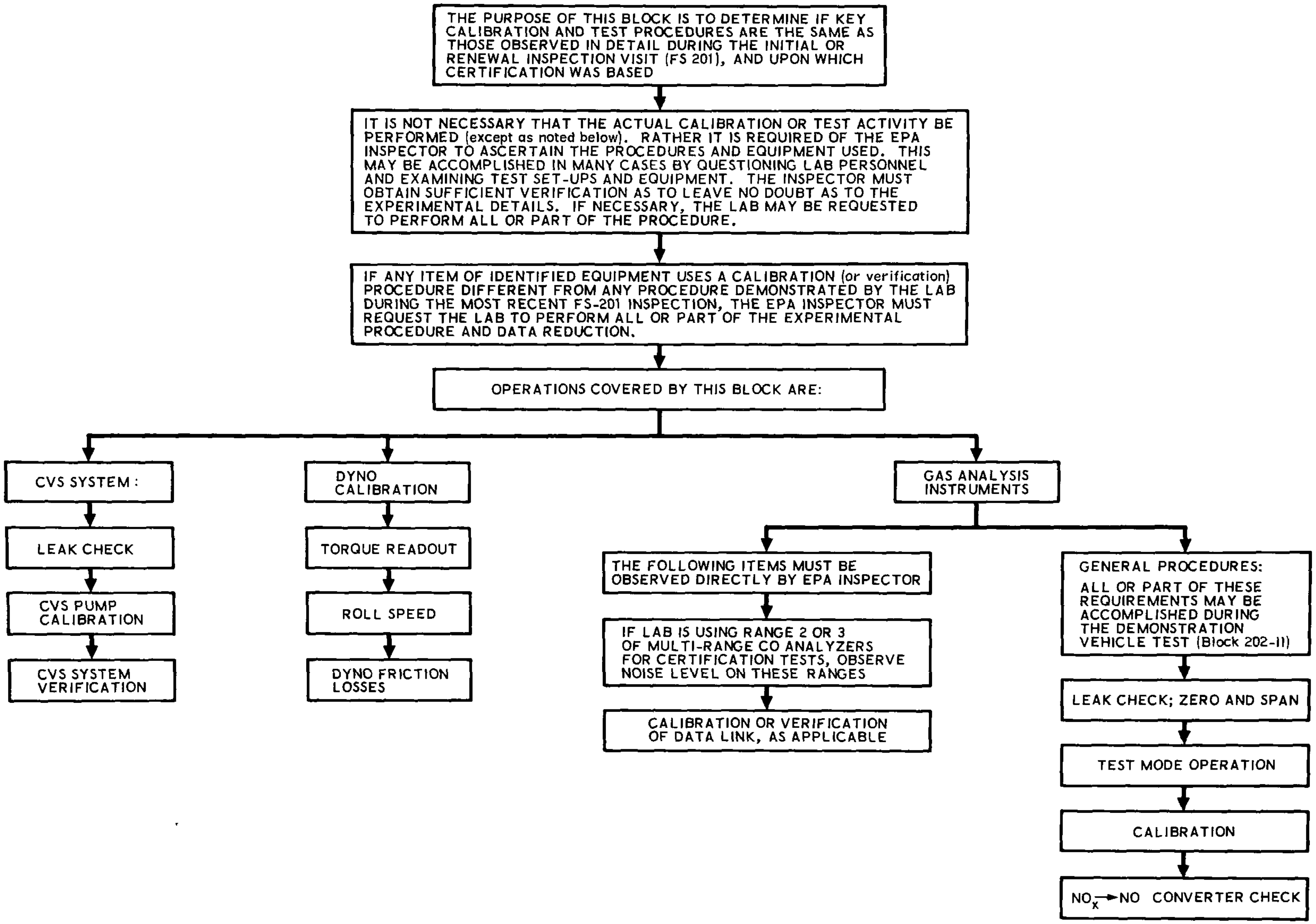


Figure 5-18. Scheduled Inspection – Inspect Calibration and Test Procedures

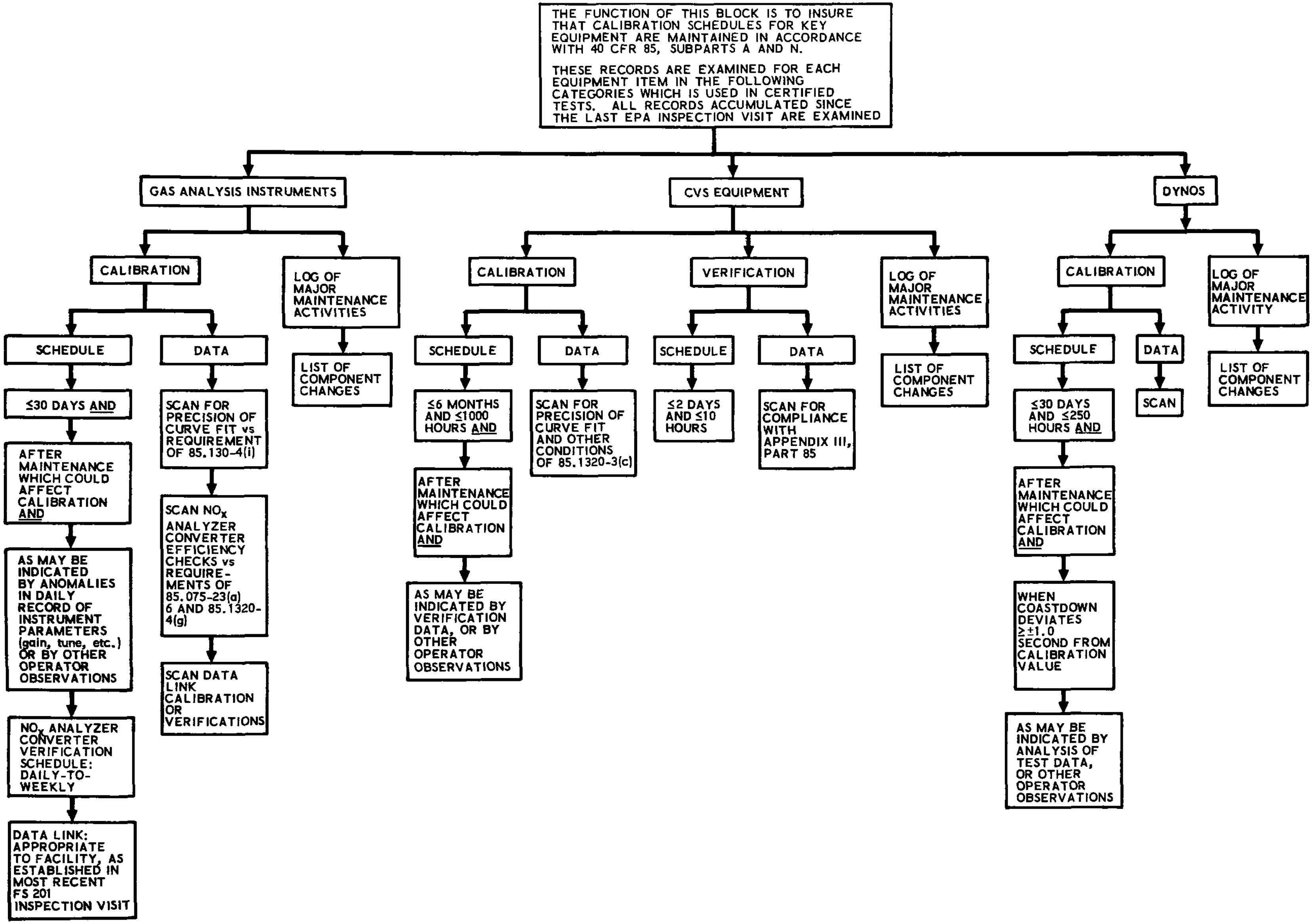


Figure 5-19. Scheduled Inspection — Examine Data and Records

5.3.2 Unannounced Inspections

Figure 5-20 denotes the principal work elements to be performed during unannounced quality control inspections. The level of activity is much less extensive than the 6-month scheduled inspection. It is principally concerned with checking for certified personnel and examination of records to verify calibration frequency and major equipment and instrument maintenance activity. However, the EPA inspectors may request the demonstration of equipment, operations, calibrations, etc., which in their judgment may be necessary.

5.3.3 On-Going Quality Control Process

Figure 5-21 denotes in flow sheet format all the major elements of the quality control program and their interrelationships. They include:

a. Scheduled periodic inspections
b. Random unannounced inspections
c. Quarterly measurements of EPA gas cylinder "unknowns" by the laboratory
d. The naming by EPA of the laboratory's calibration gases
e. The transmittal to EPA of a complete set of data, for each certified test performed by the laboratory
f. The transmittal to EPA of any change of status of equipment, personnel, procedures, etc.

Any discrepancies discovered by EPA in any element of the quality control process can be the basis for:

a. Suspension of certification
b. The requirement for changes in the laboratory equipment or operations, procedures, etc.
c. An additional unannounced inspection for further surveillance of the laboratory.

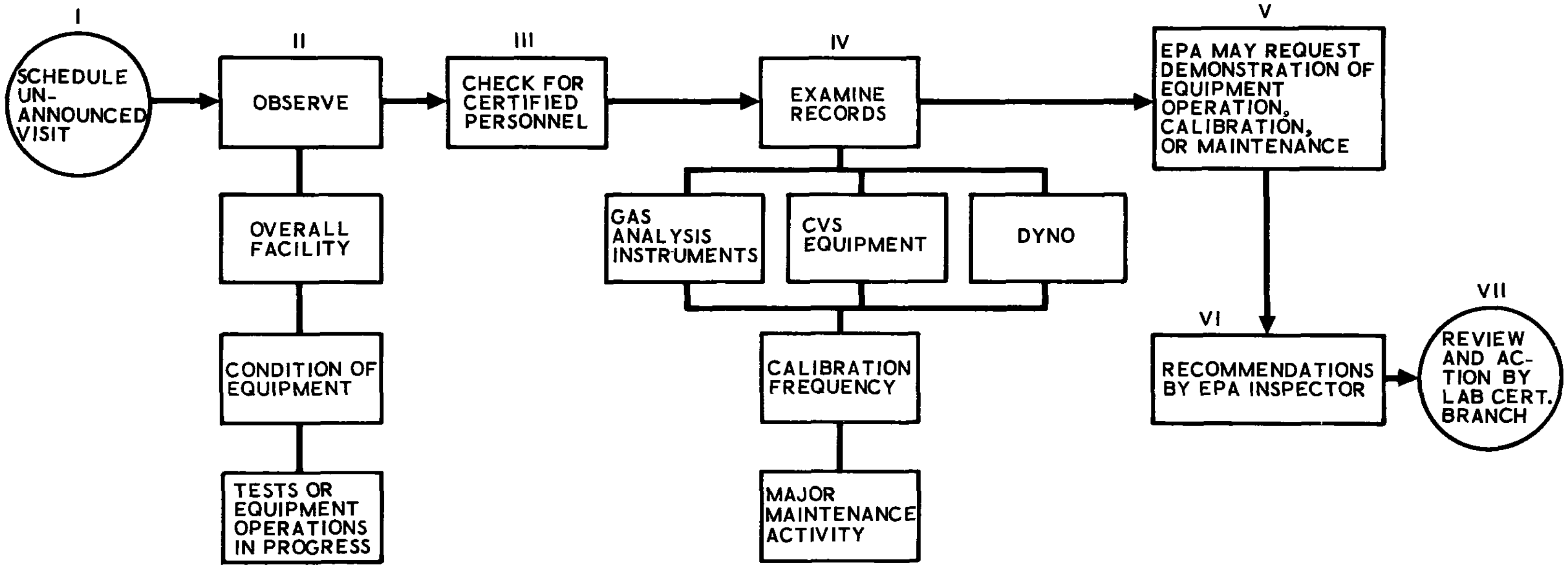
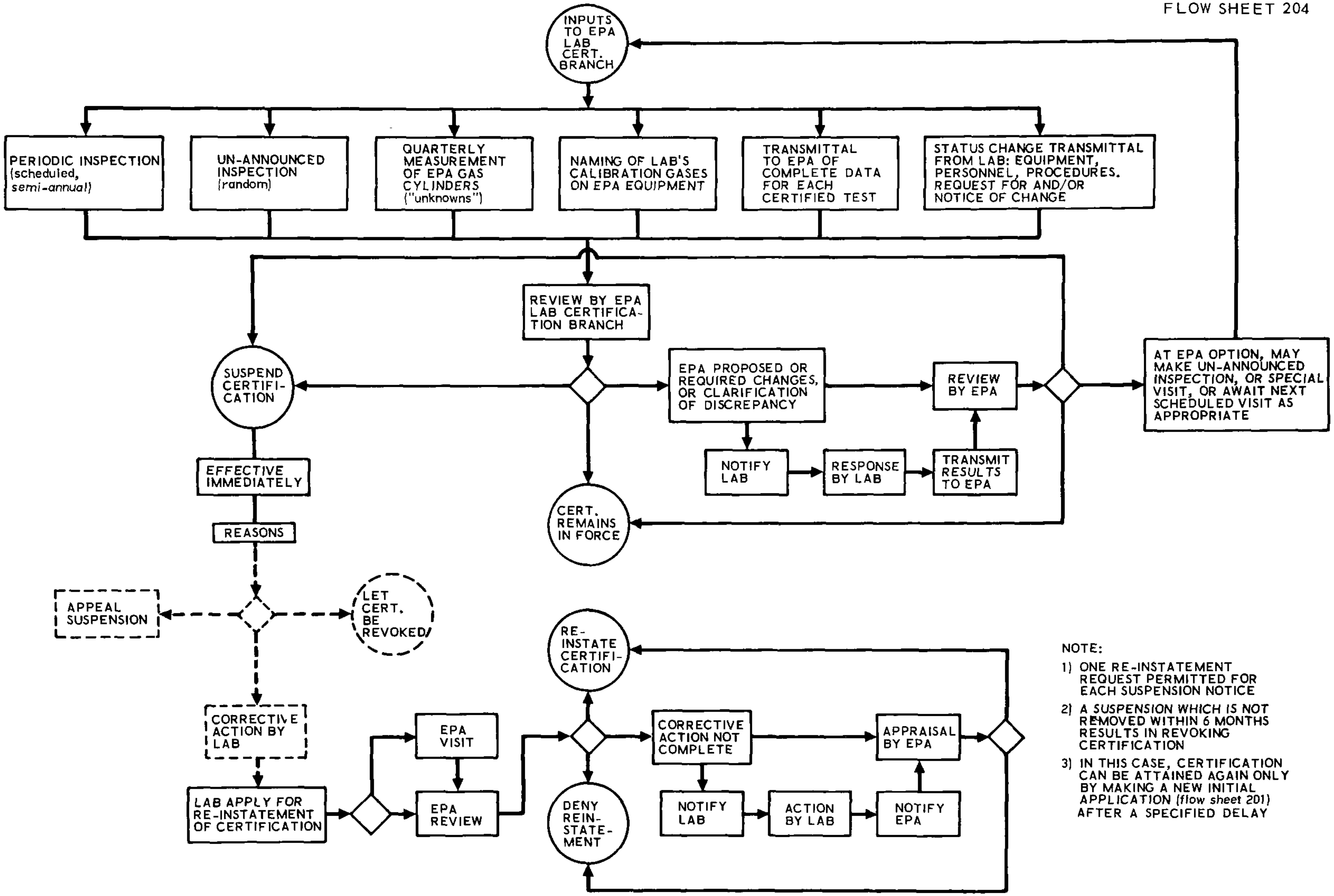


Figure 5-20. Unannounced Inspection — Random, Average Two per Year



NOTE:

1) ONE RE-INSTATEMENT REQUEST PERMITTED FOR EACH SUSPENSION NOTICE
2) A SUSPENSION WHICH IS NOT REMOVED WITHIN 6 MONTHS RESULTS IN REVOKING CERTIFICATION
3) IN THIS CASE, CERTIFICATION CAN BE ATTAINED AGAIN ONLY BY MAKING A NEW INITIAL APPLICATION (flow sheet 201) AFTER A SPECIFIED DELAY

Figure 5-21. Laboratory Certification – On-Going Quality Control Process

In the event of certification suspension, the various actions required for reinstatement of certification are indicated in the figure.

Figure 5-22 summarizes all the certification control mechanisms, including the initial (and renewal) inspection as well as the periodic and unannounced inspections discussed above. As noted, overall certification control over the laboratory has an adequately extensive basis, including EPA inspection visits, information transfer from the laboratory to EPA, and two different cross-checks on gas analysis instrumentation accuracy.

5.4 OPERATOR CERTIFICATION

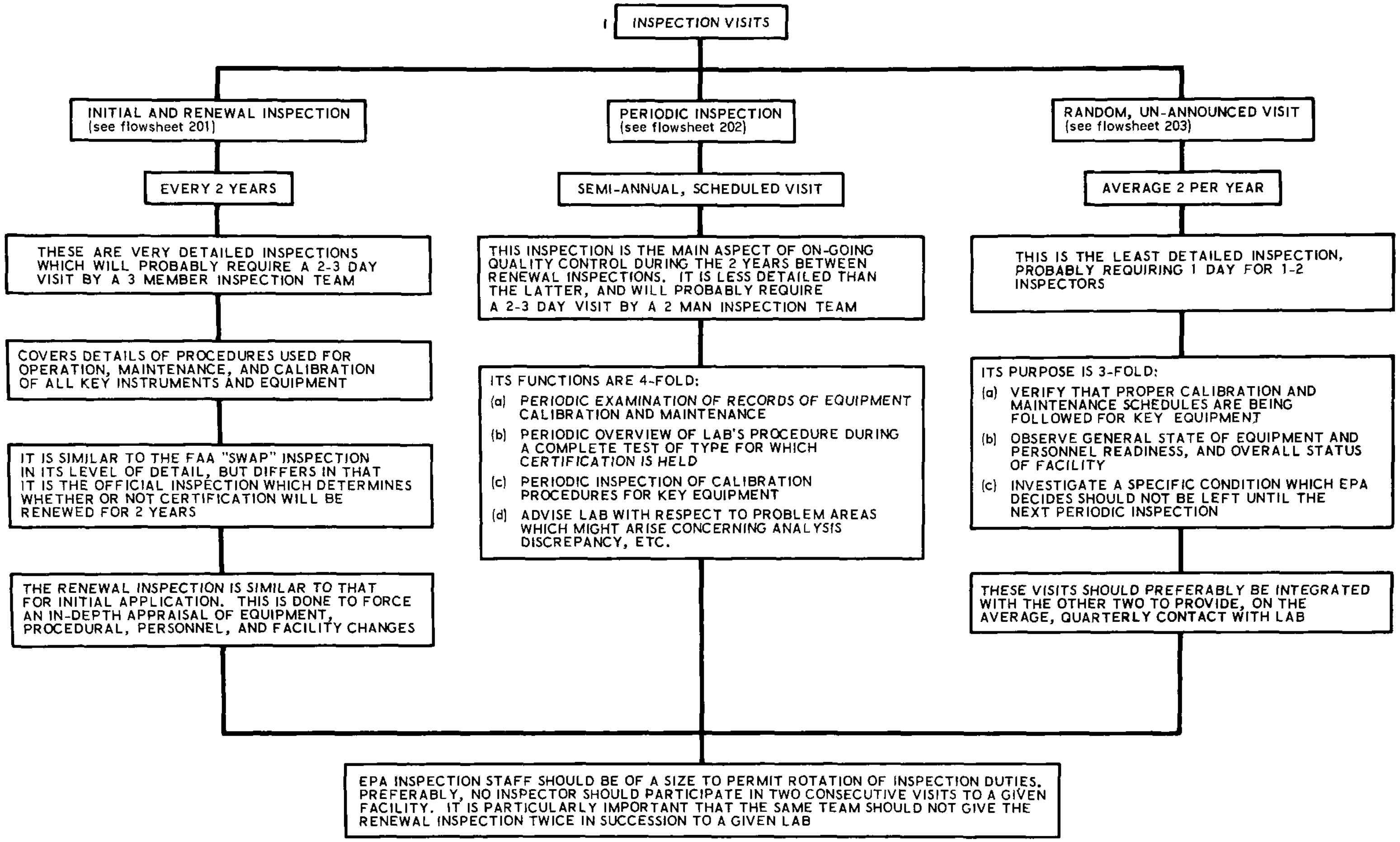
As in the case of laboratory certification, the functional task areas selected in Section 4 for operator certification were expanded through two levels of detail in the work flow sequence analysis activity. The resulting flow sheets developed are shown in Table 5-3 and identified as to number. These flow sheets are described below.

5.4.1 Initial and Renewal Certification

Figure 5-23 illustrates the overall operator certification process in flow sheet format. The EPA task assignments are principally related to preparing, scheduling, administering, and grading both written and practical examinations. Although the flow process indicated contemplates that the employer of the applicant request that the operator be certified and verify that the applicant has the requisite job experience, an alternate application path is included. This may be necessary to accommodate applicants who are as yet unemployed or who are desirous of changing employers. The alternate path contemplated is for the applicant to apply directly to EPA for both written and practical examinations to be administered at the EPA Ann Arbor facilities.

Figure 5-24 lists the major work elements involved with examinations, record retention, and examiner scheduling. With regard to preparation of written examinations, it is recommended (for a long-term

CERTIFICATION CONTROL OVER A LABORATORY IS BASED ON INSPECTION VISITS, INFORMATION TRANSFER, AND CROSS-CHECKS OF GAS ANALYSIS INSTRUMENTATION



II INFORMATION TRANSFER — LAB MUST SUBMIT COMPLETE DATA (raw and reduced) FOR EACH CERTIFIED TEST. MAIL WITHIN 2 BUSINESS DAYS OF COMPLETION OF TEST

III GAS ANALYSIS CROSS-CHECKS —

A. ON QUARTERLY BASIS, EPA SENDS GAS CYLINDER STANDARDS ("unknowns") TO LAB FOR MEASUREMENT ON ITS EQUIPMENT

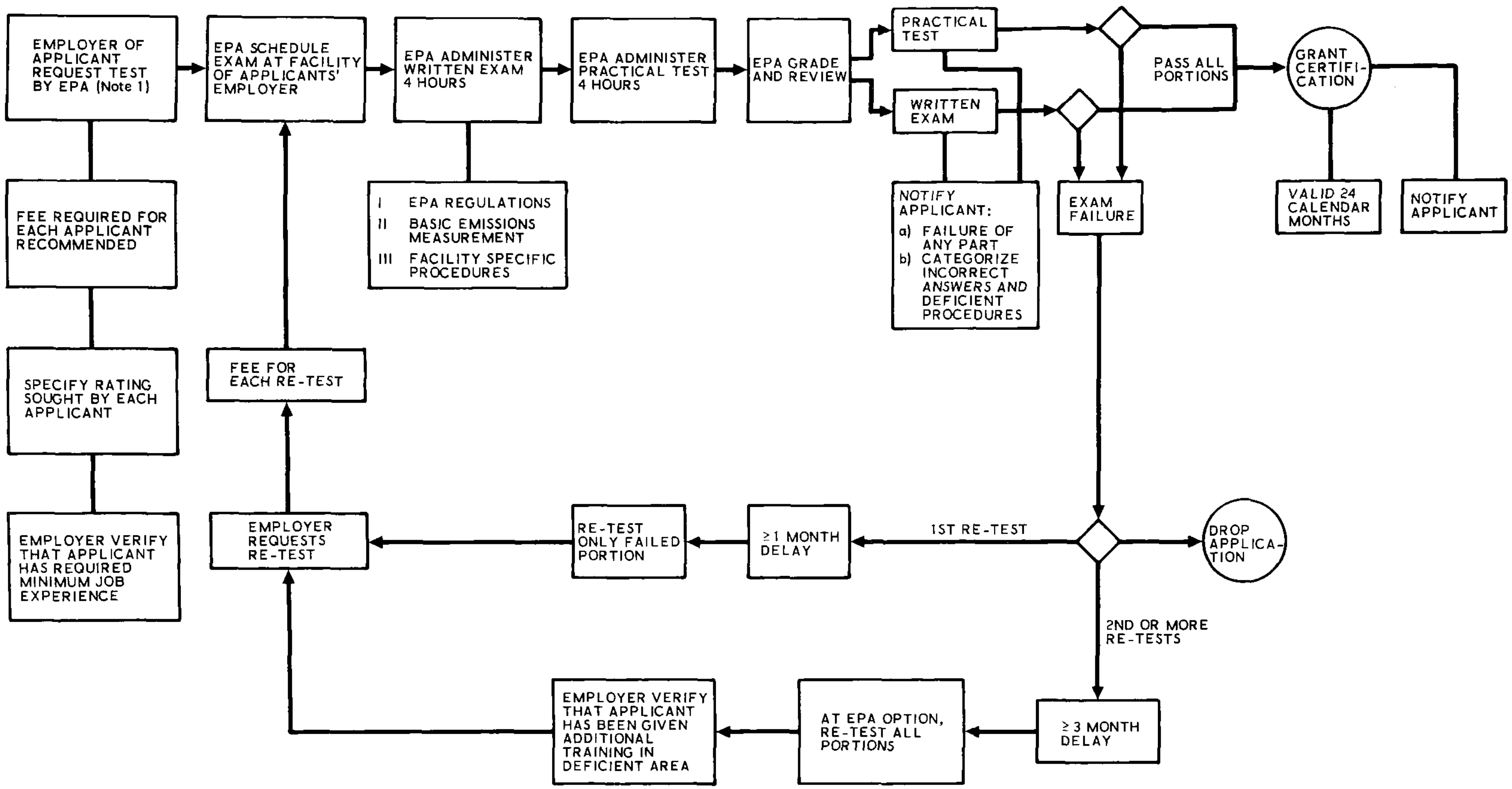
B. LAB SENDS SOME OF ITS SPAN AND CALIBRATION GAS CYLINDERS TO EPA, FOR NAMING ON LATTER'S EQUIPMENT. THIS IS NORMALLY DONE AT OPTION OF LAB, BUT MAY BE REQUESTED BY EPA IN CASE OF ANALYSIS DISCREPANCY.

Figure 5-22. Summary of Certification Control Mechanisms

Table 5-3. Operator Certification—Work Flow Sequence Analysis

	FLOW SHEET NO.
• FIRST LEVEL OF EXPANSION	
/ OPERATOR CERTIFICATION BASIC WORK AREAS	101
• SECOND LEVEL OF EXPANSION	
/ PRINCIPAL WORK ELEMENTS IDENTIFIED FOR BASIC WORK AREAS	
- WRITTEN EXAMS	1011-1
- PRACTICAL TEST	1011-2
- RECORD RETENTION	1011-2
- EXAMINER SCHEDULING	1011-2

FLOW SHEET 101



NOTE 1· AN ALTERNATIVE PATH IS FOR THE APPLICANT TO APPLY DIRECTLY TO EPA, FOR EXAMINATION AT EPA ANN ARBOR FACILITIES- IN THIS CASE, ALL BLOCKS OF THIS FLOW SHEET WHICH REFER TO "EMPLOYER" ACTIONS, MUST BE PERFORMED BY APPLICANT. ALL OTHER PARTS OF FLOW SHEET ARE UNCHANGED. APPLICANT IS RESPONSIBLE FOR PERSONAL COSTS.

Figure 5-23. EPA Operator Certification – Initial and Renewal

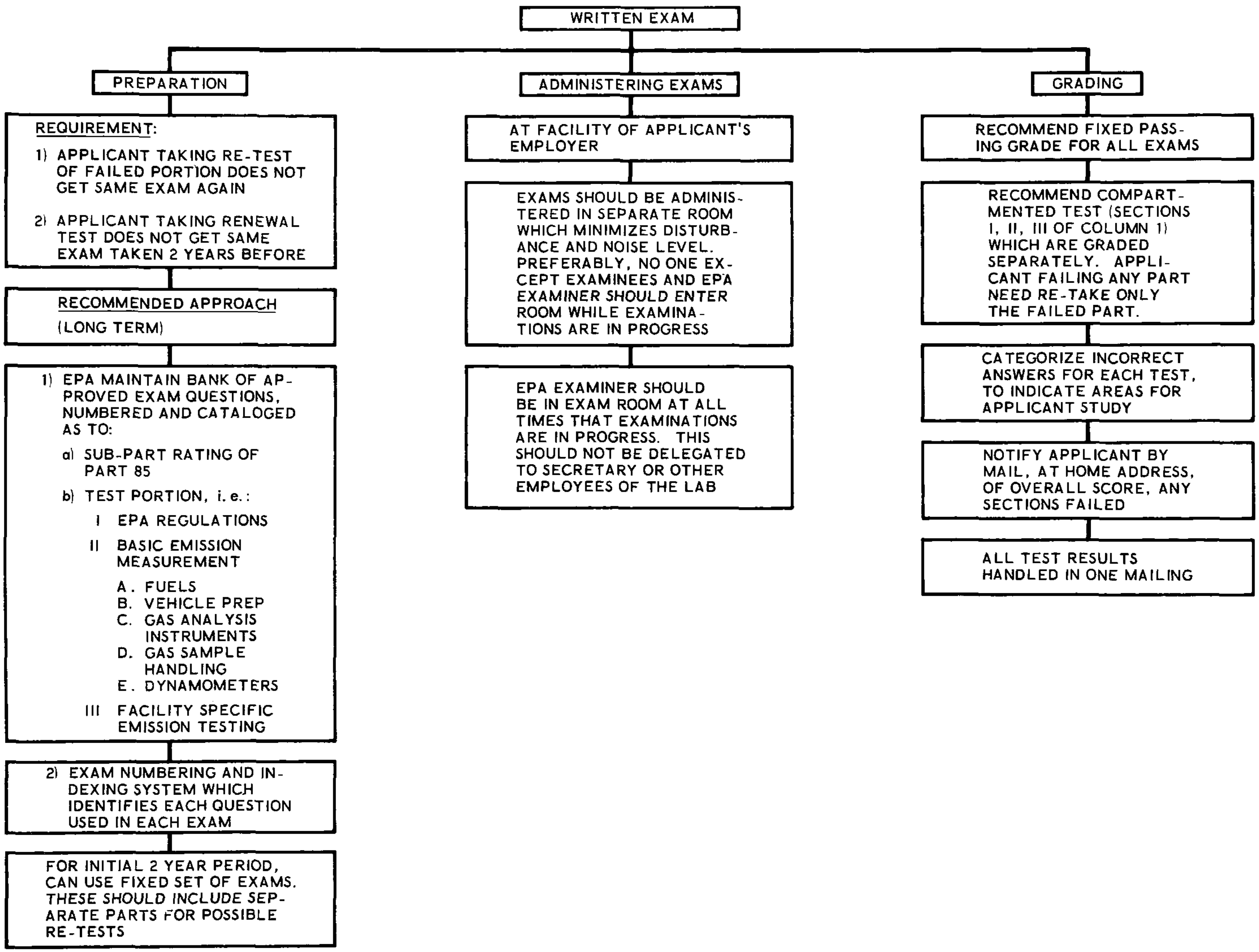


Figure 5-24. EPA Task Assignment for Operator Certification

TASK BLOCK 1011-2

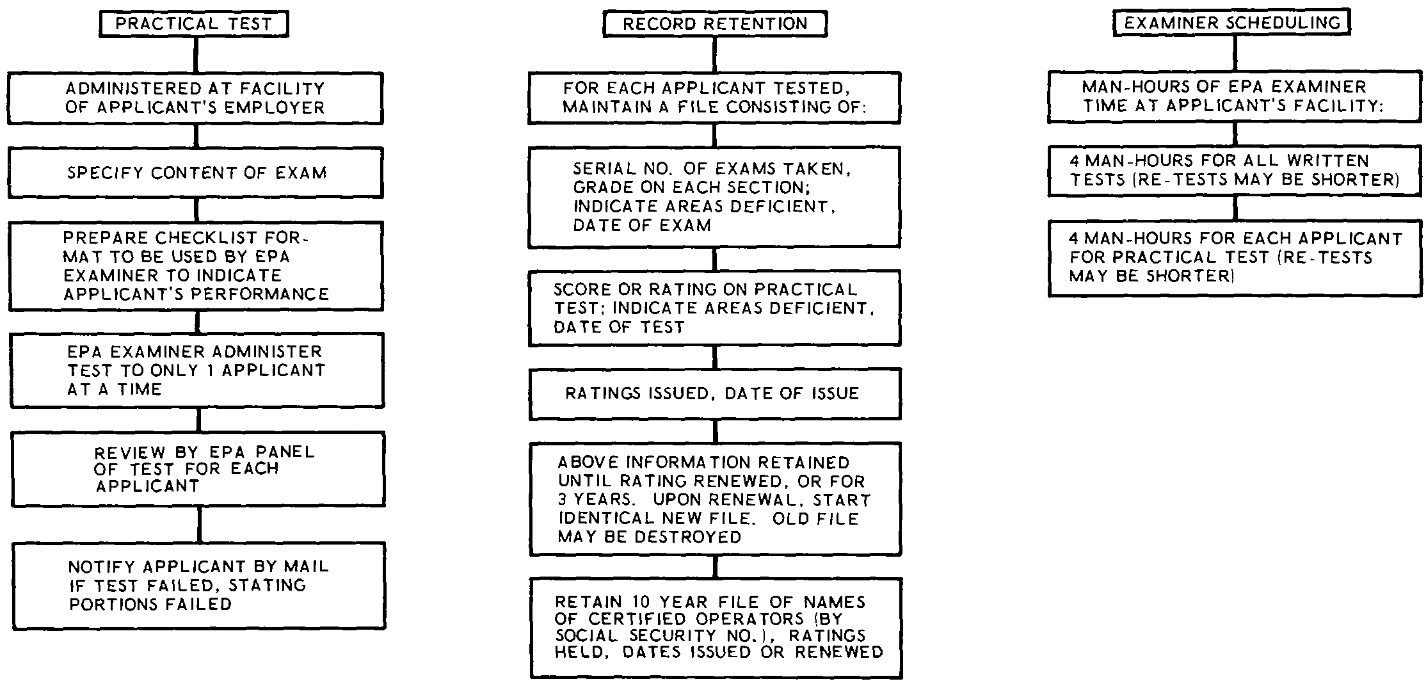


Figure 5-24. EPA Task Assignment for Operator Certification (Continued)

approach) that EPA maintain a bank of numbered and catalogued examination questions to avoid the situation where applicants would be given the same test upon certification renewal (or re-testing after failing an examination). This would entail the retention, in the applicant's records (as noted in Figure 5-24), of the serial number of examinations taken.

With regard to the man-hours estimates for written and practical examinations, the 4-hour estimates shown in Figure 5-24 were developed by Olson Laboratories, Inc., under separate contract to EPA/DECT.

5.4.2 On-Going Quality Control

As noted in Section 4.2.2, the on-going quality control of the operator is accomplished in conjunction with laboratory quality control. First, the operator is required to verify (by signature) that the certified test data submitted to EPA by the laboratory has been performed under his surveillance and control. This permits EPA to screen the submitted test data for compliance with procedures. Second, the operator can be required to participate in or perform any tests, calibrations, or other checks requested by EPA inspectors at times of laboratory inspections (scheduled or unannounced). This permits direct observation of the operator's performance and techniques.

6. MANAGEMENT ORGANIZATIONAL STRUCTURE

6.1 INTRODUCTION

This section develops the elements of personnel staffing, operational schedules, program costs, and management structure for the basic laboratory and operator certification processes described in Sections 4 and 5. It thus completes the definition of the proposed certification program. The processes and rationale used in this development are described, and the impact of each item on the overall functioning of the certification program is emphasized.

The topics are developed in sequence from the information contained in the preceding sections. Personnel requirements are addressed first. A baseline group of laboratories is established to which the analysis is directed. The work elements defined in Section 5 are then quantified in general terms of man-units of effort. This information is processed into the requisite number of EPA staff positions. This then permits an activity schedule to be generated and the program operating costs to be determined.

Organization and management structure considerations are then presented, followed by a discussion of some special topics and comparisons relevant to program implementation.

6.2 GENERALIZED PERSONNEL REQUIREMENTS

The basic EPA staff position which is required for the proposed laboratory certification program is termed "Inspector" in this report. This position involves participation in all aspects of certification activity — application processing, office work, panel review sessions, operator examination, and facility inspections. The job requirements of an inspector fall into three main categories. The first requirement is complete familiarity with both theory and practice of instrument and equipment operations — including details of operation, calibration, and maintenance. There is no alternative to prior "hands-on" experience in this case. If a person does not have a recent background in this area, a job training program, probably conducted at the EPA Ann Arbor testing laboratory would be required. This aspect is discussed more fully in Section 6.5.1.

The second requirement is that the inspector be intimately familiar with all applicable provisions of 40 CFR 85, including all recent EPA promulgations in the Federal Register, and their implementation.

The third requirement, which is nontechnical, is that the inspector be capable of working well with people of widely different backgrounds, and at all organizational levels of the certified laboratories. The inspector position is an important one, and the inspector serves as an EPA representative both in this country and abroad.

6.3 STAFFING REQUIREMENTS

6.3.1 Governing Factors

There are four principal considerations which govern the size of staff required to implement the proposed laboratory certification program. The first of these is the number, size, and geographical distribution of the certified laboratories, and the number of certified operators. For purpose of analysis, this factor was fixed (as described in the following section) at conditions considered to be representative of the first few years of the certification program.

The second factor concerns the distribution among the staff of the different categories of certification activities. It is necessary to have a clear functional distinction between office and field responsibility, but it is proposed that, at the operational level, each inspector participate in both functional areas. The office work consists primarily of working on technical phases of application processing and on-going quality control functions, and participating in panel review sessions. Field work consists of participation in each of the three types of facility inspections (initial/renewal, periodic, and unannounced), plus administering written and practical tests to certified operator applicants. However, within these basic functional areas, individual inspectors may have categories of special knowledge and proficiency, such as dynamometer equipment or gas analysis instruments, and their specific capabilities and attributes may be emphasized within these functional areas.

The third governing factor concerns travel schedule. The nature of the inspector position entails a relatively large amount of travel time. This must be kept within certain limits and structured in a specific manner to achieve a satisfactory level of long-term job satisfaction for an inspector.

The fourth consideration involves a satisfactory inspection visit rotation schedule. To achieve optimum inspection efficiency and avoid certain inherent (but usually undetected) personal bias factors, it is proposed that the following restrictions on inspection visits by an individual inspector should apply.

a. The same inspection team should not perform two successive initial/renewal inspection visits to a given facility.

b. No inspector should participate in two successive inspection visits (of any kind) to a given laboratory.

The impact of each of these four considerations on the quantitative development of the required EPA staff is discussed in the following sections.

6.3.2 Estimate of Laboratories to be Certified

To establish specific numerical estimates for personnel, schedules, and costs, it was necessary to establish a baseline scenario of emission test laboratories to which the program would be assumed to apply. This baseline must include information concerning geographical location and extent of emission test equipment at each facility. A review of this subject led to the conclusion that about 17 independent laboratories could reasonably be expected to be early applicants (within a year) to the proposed laboratory certification program. This total was composed of 12 in the continental U.S., 4 in Europe, and 1 in Japan. A longer term look indicated that about 26 laboratories might be involved within a few years (consisting of 18 domestic laboratories, 6 in Europe, and 2 in Japan).

All of the detailed program implementation analyses of this report were applied to the near-term group of 17 laboratories. The subject of extrapolating these results to the longer term arrangement is discussed in Section 6.5.4.

Eleven specific domestic facilities were assumed to be involved, representing six different parent organizations. Information was acquired from each concerning the scope of their emission test facilities. Appendix C lists the organizations contacted. Similar information was available concerning two suitable candidate European laboratories.

This information indicated that the candidate laboratories could be divided into four classifications based on equipment capabilities. The four unassigned slots in the scenario of 17 were also assigned a classification within this system. This facility classification system is defined in Table 6-1.

The geographical distribution of these domestic facilities is nationwide. The foreign laboratories were assumed to be located as follows: one each in the vicinity of London, Paris, Rome, and Tokyo, plus one in an unspecified location in northern Europe.

6.3.3 Laboratory Certification Program Implementation — Personnel Requirements, Schedules, and Costs

This section presents the results of a detailed examination of the requirements for program plan implementation for the near-term scenario of 17 certified laboratories. It describes the assumptions made and calculational procedures used to determine each of the major factors and presents the principal results. The principal requirements in the areas of staffing, schedule, and travel costs are listed below:

a. Laboratory Certification Staff:

   One Supervisor (with no inspection travel workload)

   Seven Inspectors (all participate equally in office and field work)

b. Inspection Travel Schedule:

   72 days per year travel time per inspector, 16 trips per year

   3 weekend days of travel per year per inspector, in conjunction with a European inspection trip

Table 6-1. Laboratory Facility Classification

Equipment and Locations	Facility Classification			
	A	B	C	D
Emissions Test Capability (For 1975 LDV Testing, Subpart A)				
Number of Dynamometers	1	2	2	3
Number of CVS Systems	1	2	2	3
Number of Complete Sets of Gas Analysis Instruments	1	1	2	2
Number of Laboratories				
Domestic	6	2	3	1
Europe	2	--	2	--
Japan	--	--	1	--
Total	8	2	6	1

c. Inspection Travel Costs:

Approximately $61,000 per year for the laboratory certification staff

6.3.3.1 "Ideal" Man-Hour Estimates

Initial estimates were made of the man-hours required to perform every operation specified in the work element flow sheet diagrams presented in Section 5. This required identification of the individual work elements for each subtask, and an assignment of a time estimate for the performance of each such work elements. Thus, the identification and assessment of each individual work element performed in the man-hour estimation process represents an extension of the task block sheets of Section 5 into succeeding levels of detail.

These man-hour estimates form the basis of subsequent staff, costing, and schedule computations, and consequently represent an important part of the overall analysis. Therefore, the basic procedure of the man-hour estimation process is described below.

A hypothetical minimum facility (Class A) laboratory was followed through every step of the certification process, starting with the receipt in the mail at EPA of the completed application form, and proceeding through the various analysis and panel review phases, the inspection visit, and the final review process prior to granting certification. This same hypothetical facility was then subjected to a periodic and unannounced inspection, in which all steps in the pre- and post-inspection office work were analyzed, as well as the inspection visit proper. In every phase of this process, a degree of technical complication was structured into the analysis which was considered to be representative of a real situation. These estimates are referred to as "ideal", however, since they assume no interruptions or competing work assignments, and they further assume that all supporting equipment and/or personnel which may be required are immediately available as needed.

This analysis process provided a complete, quantitative picture of the total work burden for all aspects of the proposed certification program for a specific size of facility (Class A). These results were then extended to the other facility sizes (Classes B, C, and D, as defined in Section 6.3.2). This was accomplished by repeating every step in the analyses performed for the Class A facility, and estimating for each applicable category the additional man-hour requirement to cover the extra activities resulting from the additional emissions test equipment involved. Table 6-2 presents the itemized results for application processing, three types of inspections (initial/renewal, periodic, and unannounced) and operator certification.

6.3.3.2 Personnel Requirements

Personnel requirements were developed based on the "ideal" man-hour estimates presented in Section 6.3.3.1. The development process consisted of cataloging this information in terms of man-day requirements

Table 6-2. Ideal Man-Hour Estimates for Laboratory Certification Activities

Class of Laboratory Facility[a] and Category of Inspector Work Activity	Types of Certification Activity and Personnel							
	Initial Application Processing[b]		Periodic Inspection		Unannounced Inspection		Operator Certification[c]	
	Inspector	Supervisor	Inspector	Supervisor	Inspector	Supervisor	Inspector	Supervisor
Facility A								
Office	170.0	19.3	28.0	7.6	17.0	4.6	17.0	3.6
Field	23.6	--	15.2	--	4.8	--	12.0	--
Total	193.6	19.3	43.2	7.6	21.8	4.6	29.0	3.6
Facility B								
Office	210.0	24.7	34.2	10.3	22.0	6.0	17.0	3.6
Field	29.4	--	19.4	--	6.3	--	12.0	--
Total	239.4	24.7	53.6	10.3	28.3	6.0	29.0	3.6
Facility C								
Office	275.0	30.8	41.4	13.0	27.0	7.4	17.0	3.6
Field	35.8	--	24.4	--	8.6	--	12.0	--
Total	310.8	30.8	65.8	13.0	35.6	7.4	29.0	3.6
Facility D								
Office	314.0	36.2	47.6	15.7	32.0	8.8	17.0	3.6
Field	41.6	--	28.6	--	10.1	--	12.0	--
Total	355.6	36.2	76.2	15.7	42.1	8.8	29.0	3.6

[a]See Section 6.3.2 for definition of facility class

[b]Includes inspection visit

[c]Based on two certified operators per laboratory

to perform each of the required functional tasks over the 24 month certification cycle. A distinction was made between office and field (inspection) work. Each of these two categories of activity was cataloged for each of the four basic task functions of the certification group; namely, initial/renewal application and inspection, periodic inspection, unannounced inspection, and operator testing.

The ideal man-hour estimates were converted into real-time estimates by using parametric values of a "man-hour efficiency" factor. The values selected for this factor were 1.0, 1.25, 1.5, 1.75, and 2.0. The ideal man-hour estimates are representative of the average time required to perform each individual task, assuming a representative amount of technical complication is involved. They are ideal only in the sense that they assume no interruptions or competing job assignments, and that the supporting equipment and/or personnel which may be required for any given task or work elements are immediately available as needed. The "man-hour factor" is applied to the ideal man-hours to account for those cases in which the above three assumptions are not met. As an example, consider the activity of the inspector office burden associated with processing an initial application. The ideal input data from Section 6.3.3.1 and the results of applying various "man-hour factors" are shown in Table 6-3 for the four different laboratory classifications. The other office activities were treated in the same manner. This resulted in the total inspector office burden shown in Table 6-4. This office burden reflects the three periodic and four unannounced inspections at each facility during the 24-month certification cycle, and two certified operators per laboratory are assumed. Table 6-4 shows, for example, that the total office burden would require approximately four inspectors, if a man-hour efficiency factor of 2.0 was chosen. This latter computation is based on 225 working days per year per person. This value (225 days) is used throughout the staffing and schedule analysis. It is considered a conservative estimate, and is based on 4 weeks per year vacation, 1 week sick leave, and ten holidays.

Table 6-3. Inspector Office Burden, Initial Application Processing

Facility Classification	No. of Facilities (N)	Ideal Man-hours (man-days) [Man-days × N]	Man-hours Factor			
			1.25	1.5	1.75	2.0
A	8	171 (22) [176]	214 (27) [216]	256 (32) [256]	299 (38) [304]	342 (43) [344]
B	2	210 (27) [54]	262 (33) [66]	315 (40) [80]	367 (46) [92]	420 (53) [106]
C	6	275 (35) [210]	344 (43) [258]	413 (52) [312]	481 (61) [366]	550 (69) [414]
D	1	314 (40) [40]	392 (49) [49]	471 (59) [59]	550 (69) [69]	628 (79) [79]
$\sum$ Man-Days (for 24-month cycle)		[480]	[589]	[707]	[831]	[943]

Table 6-4. Total Inspector Office Burden

Type of Activity	Inspector Office Burden, Man days (2-year cycle)				
	Ideal	Man-hours Factor Results			
Factor	1.0	1.25	1.5	1.75	2.0
Initial Inspection	480	589	707	831	943
Periodic Inspection	252	306	357	429	456
Unannounced Inspection	204	252	304	340	388
Operator Testing	37	46	55	64	73
$\sum$ Man-days	973	1193	1423	1664	1860
Number of Inspectors[a]	2.2	2.7	3.2	3.7	4.2

[a]Based on 225 work days per year per inspector

Similar analyses were performed for the on-site inspection visit work load for each type of inspection for each class of facility. From this information, the inspection team numerical structures of Table 6-5 were established. Next, the total man-day requirements for these inspection visits, including travel time were computed. This man-day figure must include the time required for certified operator testing. The latter item is not included in Table 6-5. Accordingly, it was assumed that the two certified operator applicants would be tested concurrently with the facility initial/ renewal inspection visit, and would require a 2-day trip by an additional inspector (4 hours to administer the written examination, plus 8 hours to administer two practical tests). It was further assumed, for the initial calculation, that every inspection visit is preceded and followed by a day of travel, and that there is no weekend travel or stay time. The results of these

Table 6-5. Inspection Team Numerical Structure

Facility Classification	Initial/Renewal Inspection		Periodic Inspection		Unannounced Inspection	
	No. of Inspectors	Days of Visit	No. of Inspectors	Days of Visit	No. of Inspectors	Days of Visit
A	3	2	2	2	1	1
B	3	2	2	2	2	1
C	3	3	2	3	2	1
D	3	3	2	3	2	2

calculations on inspection visit man-day requirements are shown in Table 6-6, from which it is seen that the inspection work load is equivalent to approximately a 2-1/2 man-level staffing. Combining this with the results of Table 6-4 for the office burden (for a man-hour factor of 2.0), gives a requirement for a seven-man staff to handle both the office and field work associated with the laboratory certification program associated with 17 independent testing laboratories.

A similar analysis procedure was applied to estimate the work load associated with the supervision of the activities of the inspection staff. The results are shown in Table 6-7, and indicate that one supervisory position is required.

6.3.3.3 Scheduling of Inspection Visits

This section describes the analysis activities concerned with establishing the timing and schedule factors of the various inspections, including travel time, to determine the work schedule for each inspector position. The goal was to establish an efficient scheduling of inspection trips,

Table 6-6. Inspection Visit Man-Day Requirements (2-Year Certification Cycle)

Type of Inspection	Inspection Time, Man-days	Travel Time, Man-days	Total Time, Man-days	No. of Trips	Man-Trips
Initial/Renewal (including operator certification)	157	136	293	17	68
Periodic	246	204	450	51	102
Unannounced	112	208	320	68	104
$\sum$	515	548	1063	136	274

Assuming 225 working days per year per inspector;

No. of inspectors required $= \frac{1063}{2 \times 225} = 2.4$

No. of inspectors required for office burden (Table 6-3) $= 4.2$

Total No. inspectors required $= 6.6 = 7$

Table 6-7. Supervisory Workload (2-Year Certification Cycle)

SUPERVISOR MAN-DAYS

Type of Activity	Ideal Man-days	Man-hour Factor 1.25	1.5	1.75	2.0
Initial Application	53	67	80	93	106
Periodic Inspection	64	82	99	115	132
Unannounced Inspection	51	64	77	89	102
Operator Certification	8	10	12	14	16
$\sum$ Man-days	176	223	268	311	356
Fraction of full-time supervisor (Defined as 450 man-days in 2 years)	0.39	0.50	0.60	0.69	0.74

One Supervisory Position is Required

consistent with two restrictions. The first restriction is that there be minimum weekend travel or stay time. This is considered to be an essential requirement for long-term job-acceptability, as the inspector positions require relatively extensive travel time. The second restriction is that there be no compromise with the surprise element of the unannounced inspections, such as would occur by combining them with other visits to the area in a more time-efficient but predictable manner. The unannounced inspection is an important and efficient aspect of on-going quality control, but its value would be seriously degraded if the timing of the visit fell into a pattern of established routine.

For the domestic schedule, two 1-day unannounced inspection visits are combined into a 1 week trip, with a day of travel before and after each inspection visit. No other inspection visits are combined, as this would result in weekend travel or stay time. Table 6-8 shows the resulting travel schedule for the domestic laboratories.

For the four European laboratories, it was assumed that the certification schedules were adjusted to be staggered at 6-month intervals. Thus, every 6 months an inspection tour is made of all four laboratories, consisting of an initial/renewal inspection at one facility, and periodic inspections of the other three. Each unannounced inspection was assumed to occur as a separate round trip from Ann Arbor to the one laboratory concerned. The results of these computations are shown in Table 6-9. For the one Japanese laboratory, each type of inspection visit was assumed to be a separate round trip from Ann Arbor. This produced the results shown in Table 6-10. The summarized results for all inspection visits are given in Table 6-11. All the figures for average inspector load per year shown in these tables are based on a seven-man inspection staff.

The key results of this analysis are that each inspector must make an average of 16 trips per year, spending an average of 72 days per year on the road (counting travel time) which includes an average of 3 weekend days per year travel time (in conjunction with a European inspection trip).

Table 6-8. Inspector Travel Schedule — Domestic Laboratories (24-Month Certification Cycle)

Type of Inspection	Man-days	Number of Trips	Man-Trips
Initial/Renewal/Operator	204	12	48
Periodic	312	36	72
Unannounced	196	28	44
Σ	712	76	164

Average Inspector Load Per Year:

Travel time $= \frac{712}{7x2}$ = 50.9 days

Individual trip duration $= \frac{712}{164}$ = 4.3 days

Trips per year $= \frac{164}{7x2}$ = 11.7

Time between start of successive trips = 1.02 month

Weekend travel 0

Table 6-9. Inspector Travel Schedule – European Laboratories
(24-Month Certification Cycle)

Type of Inspection	Man-days	Number of Trips	Man-Trips	Weekend Man-days
Combined Initial/Renewal/ Operator and Periodic	146	4	16	40
Unannounced	72	16	24	0

Average Inspector Load Per Year:	Combined initial/renewal/ operator and periodic inspections	Unannounced Inspections
Travel time (work days)	10.4 days	5.1 days
Individual trip durations	9.1 days	3.0 days
Trips per year	1.1	1.7
Time between start of successive trips	10.5 months	7.0 months
Weekend travel	2.9 days	0

Table 6-10. Inspector Travel Schedule — Japanese Laboratory
(24-Month Certification Cycle)

Type of Inspection	Man-days	Number of Trips	Man-Trips
Initial/Renewal/Operator	19	1	4
Periodic	30	3	6
Unannounced	24	4	8
Σ	73	8	18

Average Inspector Load Per Year:

Travel time	5.2 days
Individual trip duration	4.0 days
Trips per year	1.3
Time between start of successive trips	9.4 months
Weekend travel	0 (except as may result from time change)

Table 6-11. Inspector Travel Schedule — Overall
(24-Month Certification Cycle)

Type of Trip	Man-days	Number of Trips	Man-trips
Domestic	712	76	164
Europe - Initial/Renewal/Operator	146	4	16
-Unannounced	72	16	24
Japan	73	8	18
Σ	1,003	104	222

Average Inspector Load Per Year:

Travel time (work days)	71.7 days
Individual trip duration	4.5 days
Trips per year	15.9
Time between start of successive trips	16.4 work days
Weekend travel time	2.9 days (plus that which may result solely from time change on foreign trips)

This is a rather high travel load, and is probably near the upper range of a practicable schedule. This subject is discussed further in Section 6.5.3, but a few comments may be abstracted here. First, these calculations were intentionally made for conservative, general conditions. A travel time reduction down to about 68 to 69 days per inspector should be readily achievable in practice by using specific features of the distribution of the applicant laboratories. Some other slight reductions appear possible but are not assumed herein. If a larger reduction in travel load is considered necessary, this can only be accomplished (without voiding the basic features of the proposed certification process) by increasing the size of the inspection staff. Thus, an eight-man staff would reduce the travel time to about 60 days per year per inspector.

6.3.3.4 Travel Expenses

Based on the inspection visit schedule derived in the preceding section, travel expenses for each inspection trip were computed in accordance with the following basic procedure. Each trip was assumed to be a round trip from Ann Arbor, with some trips including one or more intermediate sites. Airline fare was taken as the coach rate in effect on the date the calculations were performed. Per diem (lodging plus meals) was assumed to be $34 per 24-hour day per inspector for domestic trips, and $50 for foreign trips. Ground transportation estimates were included for all applicable stages. The summarized results are given in Table 6-12, which shows a total inspection visit travel expense of approximately $61, 000 per year.

With a staff of seven inspectors plus one supervisor at a burden rate of $50,000 per position per year, the cost of the laboratory certification program would be approximately $400, 000 staff burden plus $61, 000 travel expenses, for a total annual cost of approximately $461, 000.

It should be noted that the travel allowances and costs per position as used above are made on a different basis than used by EPA for its own economic projections. The EPA uses a different accounting structure

Table 6-12. Travel Expenses for Inspection Visits (2-Year Certification Cycle)

Geographical Category and Number of Laboratories	Type of Inspection	Travel Costs[a] $	On-site Costs[b] $	Total Travel Costs $	Percent of Total
Domestic (12)	initial/renewal[c]	7,870	5,690	13,560	27.1
	periodic	11,790	9,510	21,300	42.6
	unannounced	9,700	5,460	15,160	30.3
	Σ	29,360	20,660	50,020	100.0
European (4)	initial/renewal[d] and periodic	14,430	9,750	24,180	52.7
	unannounced	18,700	2,980	21,680	47.3
	Σ	33,130	12,730	45,860	100.0
Japan (1)	initial/renewal[c]	5,140	860	6,000	22.7
	periodic	7,720	1,430	9,150	34.6
	unannounced	10,290	990	11,280	42.7
	Σ	23,150	3,280	26,430	100.0
Overall Subtotals					
Domestic		29,360	20,660	50,020	40.9
Europe		33,130	12,730	45,860	37.5
Japan		23,150	3,280	26,430	21.6
Σ		85,640	36,670	122,310	100.0

[a] Round trip cost from Ann Arbor to airport of desination

[b] Per diem and ground transportation from airport of destination to return

[c] Includes operator certification

[d] Initial/renewal, operator certification, and periodic inspections combined in inspection tour

for personnel costing, full details of which were neither available nor directly pertinent to the present analysis. The purpose of the present estimate is to indicate the approximate total magnitude of the charges which should be attributed to the proposed laboratory certification program, regardless of the details as to how these costs would be distributed internally by the EPA.

6.3.4 Organization of the Laboratory Certification Group

6.3.4.1 General Personnel Requirements

Table 6-13 summarizes the basic technical work areas as delineated in the work sequence analysis (Section 5) and as utilized in the staffing, schedule, and cost estimates of Section 6.3.3. Although there is a clear functional distinction between the office and field responsibilities, it is recommended and assumed in all analyses in Section 6.3.3 that each inspector on the laboratory certification staff participates, on a rotating or as needed basis, in both office and field work areas.

In addition to the inspectors, per se, the laboratory certification group would require an administrative head, with line management responsibility, and some form of clerical assistance. In time, the clerical burden should increase due to the need to process, file, and retain such items and records as:

a. Application forms

b. Communications between laboratory certification group, laboratories, and operators

c. Certificate issuance records

d. Facility inspection reports

e. Results of operator written and practical tests

f. Measurements of EPA gas cylinder "unknowns" transmitted to EPA

g. Results of "naming" laboratory calibration gases

Table 6-13. Technical Work Areas

- IN OFFICE
  - / DEFINITION OF GENERAL AND SPECIFIC CERTIFICATION PROGRAM REQUIREMENTS
  - / ESTABLISH APPLICATION FORM REQUIREMENTS
  - / PREPARE APPLICATION FORMS
  - / PROCESS AND RATE APPLICATIONS
  - / PREPARE WRITTEN EXAMINATIONS
  - / GRADE WRITTEN EXAMINATIONS
  - / PREPARE PRACTICAL TESTING PROCEDURES
  - / PROCESS CERTIFICATIONS

- IN FIELD
  - / GIVE WRITTEN EXAMINATIONS
  - / GIVE PRACTICAL TESTS
  - / GRADE PRACTICAL TESTS
    - REVIEWED BY OFFICE STAFF
  - / MAKE FACILITY INSPECTIONS

6.3.4.2 Initial Organizational Structure

Since the initial laboratory certification program manpower requirements consist principally of seven or eight inspectors plus one supervisor, it would appear more utilitarian and effective to initially organize the group as a section or branch within an existing branch or division of the Office of Mobile Source Air Pollution Control (OMSAPC). This would enable the neophyte laboratory certification group to utilize existing lines of management control and clerical services. At the same time, it would permit the total energies of the group members to be centered on their task efforts and not divert their time to nonproductive activities which often are associated with the formation of a totally new organizational structure. As and if the manpower requirements of the group increase (e.g., as new or additional laboratories and operators request certification), then consideration should be given to a more formal and structured organizational form, as described below.

6.3.4.3 Longer-Term Organizational Structure

In the longer-term, the basic functional task requirements of the laboratory certification group should be similar to that of the near term (above); however, it is expected that there will be an increase in the number of personnel assigned to the group in accordance with an increased number of certified laboratories covered by the program.

There is an additional operational difference which concerns the development of written and practical tests for operators. In the near-term structure (first 2 years or so), this task has been assumed to be performed for EPA by an outside contractor. After this period, EPA will have an option in this regard. One is for EPA to assume this task. This is the procedure used by the FAA (e.g., aviation mechanic written examinations) and the AEC (nuclear power plant operator written and practical tests). Exercise of this option would probably require additional EPA personnel.

An alternative approach would be for EPA to continue to contract for this task. This is the method used by the California Department of Public Health for written examination preparation for clinical laboratory technologists. In either event, it would be a responsibility of the laboratory certification group to ensure that requirements associated with operator retesting (both for failed tests and for certification renewal) are met. These requirements, described in Figure 5-24 of Section 5. 3, deal with examination upgrading, record retention, and avoidance of excessive repeat questions to the same operator on successive tests.

Because of the factors of (a) increased number of staff members, (b) increased clerical work load, and (c) examination development requirements, it may be advisable in the longer term to provide a more formal organizational structure for the laboratory certification group. One such option is delineated in Figure 6-1. Here, the "laboratory certification group" is pictured as a branch of an OMSAPC division in Ann Arbor. Three sections are included in accordance with the three principal functional task areas: office technical work, field work, and clerical work. The Certification Processing Section is charged with responsibility for assuring that all in-office certification activities are accomplished in a timely and effective manner. In this regard, then, the principal function of this section is coordination of application processing. Corollary functions would include (a) the development of examinations for operators, and (b) changes and updating of the regulations pertaining to laboratory and operator certification, as well as any necessary changes in the application forms. When the inspectors were not on laboratory field inspections, then, their in-office efforts would be available to this section for completion of the necessary work.

The Operations Section would be charged with responsibility of conducting all field activities, including the scheduling of the inspectors for each trip and the coordination required between the laboratory and the laboratory certification group with regard to inspections and other on-going

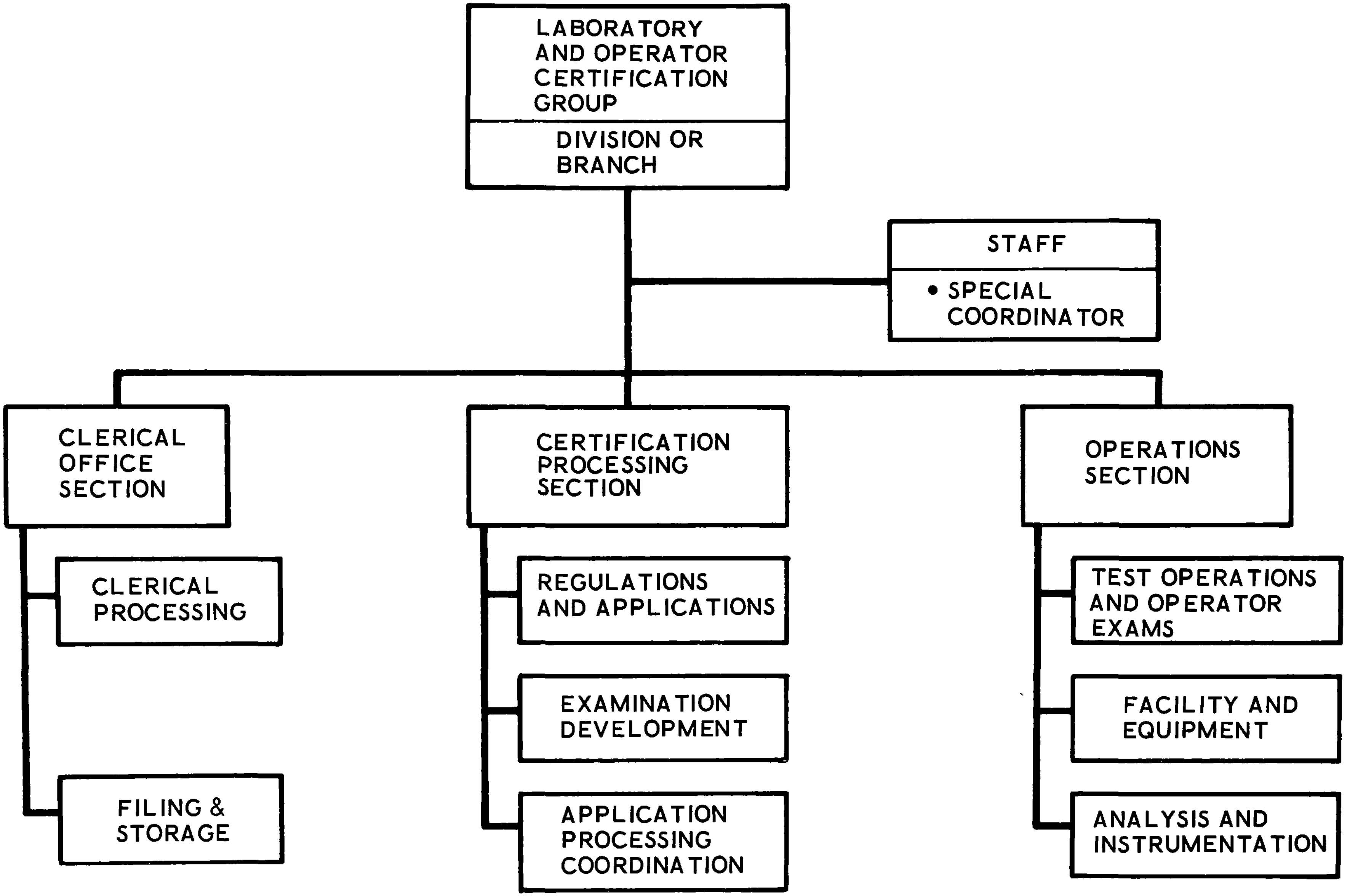


Figure 6-1. Organization of Laboratory Certification Group—
A Long-Term Option

quality control activities. As noted in Figure 6-1, if the number of inspectors on the staff were large enough, it might be advisable to further segregate the inspection staff into areas of special expertise or proficiency, as indicated.

The third section, Clerical, would be charged with all paperwork processing, filing, and information storage functions. In the long term, if a sufficiently large number of laboratories and operators apply for certification, a separate Clerical Office Section may be essential for efficient operation of the laboratory certification group. This is particularly true because the individual inspectors are assumed to be engaged in field work for a high percentage of the time.

6.4 MANAGEMENT PLAN OPTIONS

The current organizational structure of the Office of Mobile Source Air Pollution Control is depicted schematically in Figure 6-2. By inspection, there are four obvious, potential ways of incorporating the laboratory and operator certification group into this structure. Each such approach is discussed below in terms of advantages and disadvantages.

6.4.1 Option A

Figure 6-3 depicts the laboratory and operator certification group as having divisional status within OMSAPC. The advantages of such an arrangement include:

a. Provides a single direct line of responsibility to OMSAPC

b. Provides direct management control over the assigned responsibility (the division director's time is not diluted by other functions)

c. Provides a single and direct focal point of contact with independent testing laboratories and operators

d. Provides the opportunity to organize the required division personnel in the most efficient manner to accomplish the required tasks, as there would be no existing branches to avoid overlap with

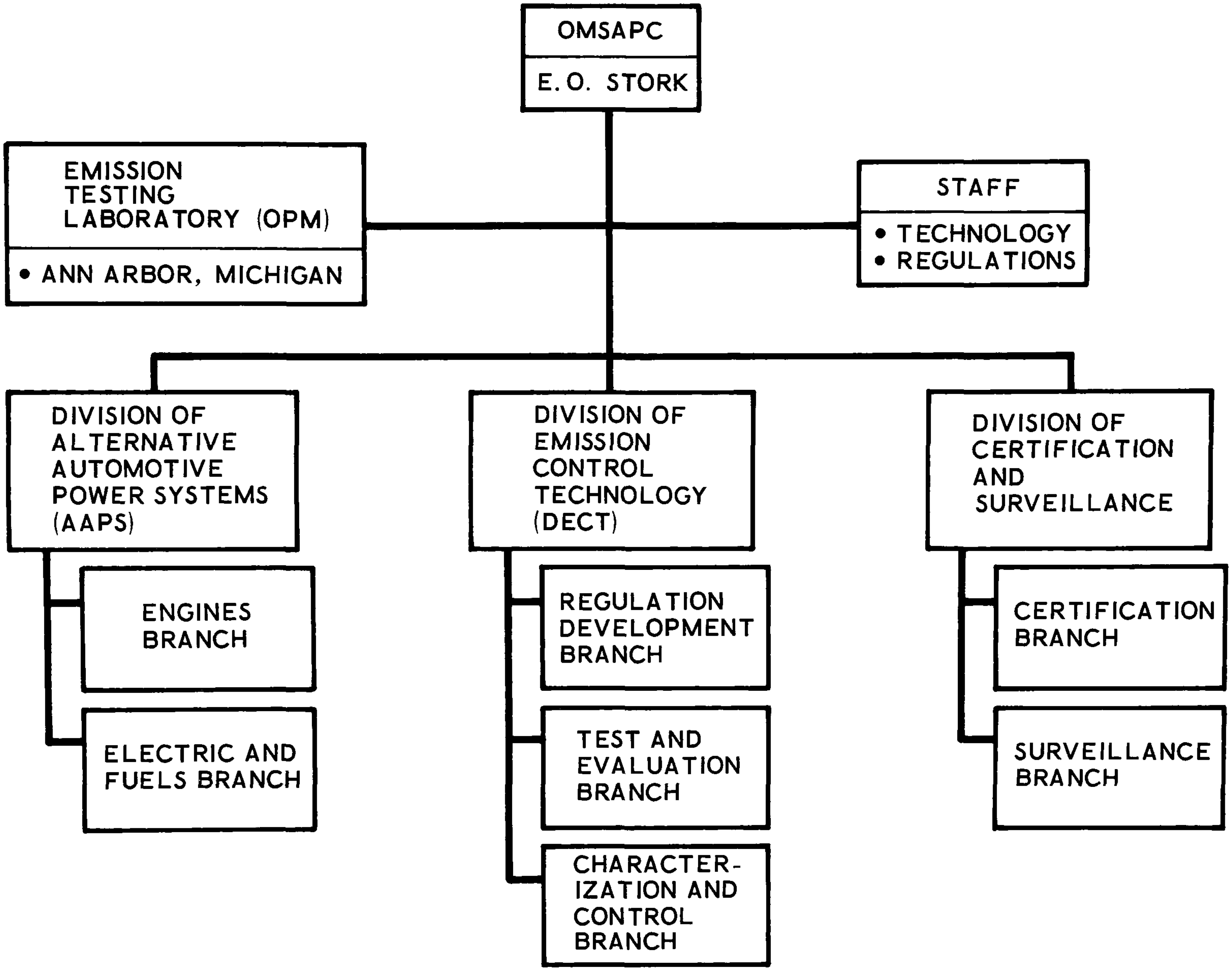


Figure 6-2. Current Organizational Structure

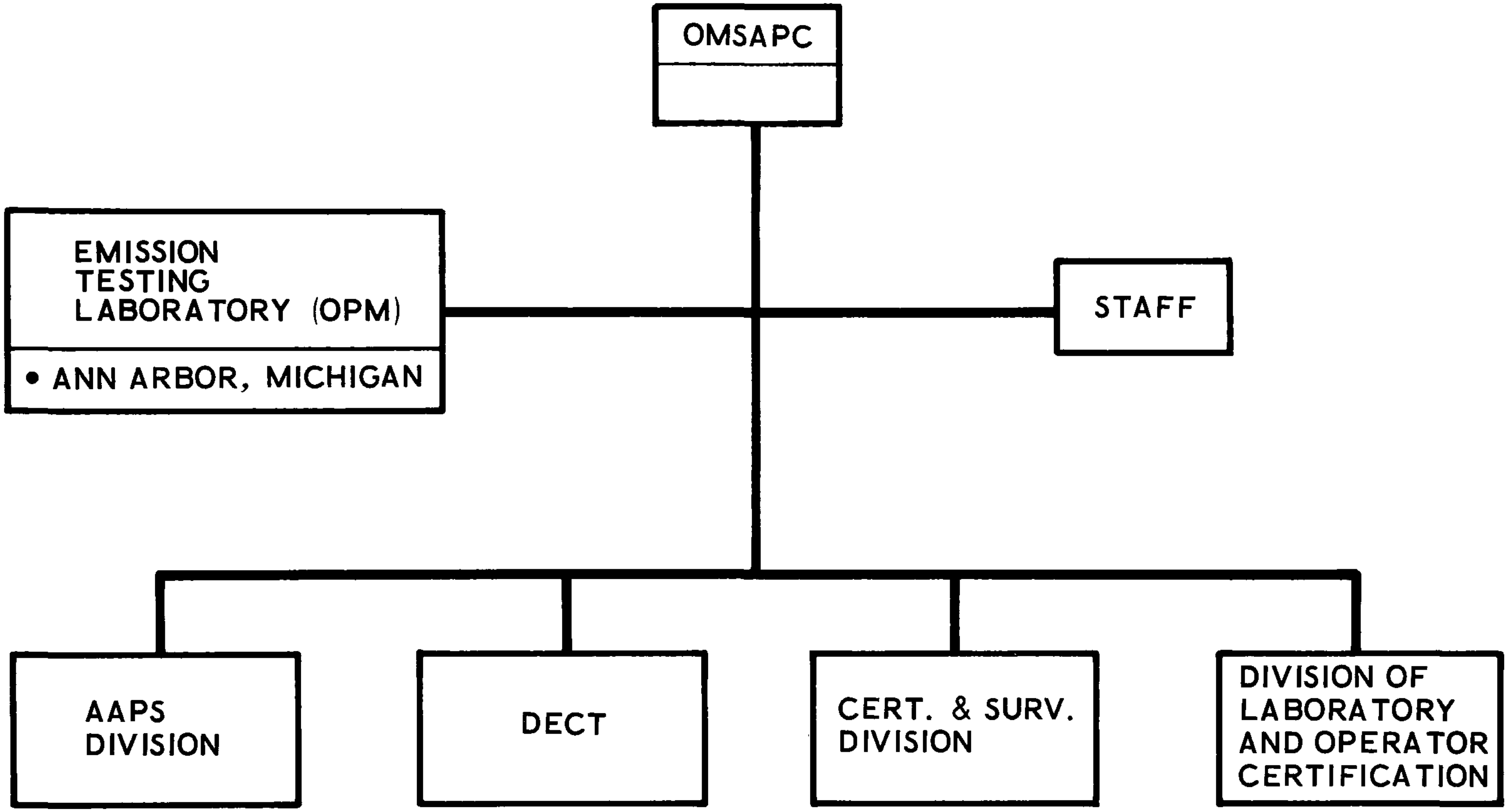


Figure 6-3. Option A Organizational Structure

On the other hand, this arrangement has several disadvantages, including:

a. It may not enable efficient use of manpower if the number of certified laboratories and operators is small.

b. It requires a complete staffing of a new division.

c. It requires extensive interfacing with other OMSAPC activities, including:

   1. Certification branch of Certification and Surveillance Division -- for review of certified test data sent in by the laboratory

   2. Emission Testing Laboratory (OPM) -- for coordination of facility, equipment, and operational procedures

   3. Division of Emission Control Technology (DECT) -- for coordination of test and evaluation procedures

6.4.2 Option B

Figure 6-4 shows the laboratory certification group as a branch of the Ann Arbor Emission Testing Laboratory (OPM). The possible advantages of such an arrangement include:

a. It places the inspectors of the laboratory certification group in close working contact with facility, equipment, and operational requirements

b. It may be possible to draw on laboratory personnel who are experienced with regard to facility inspection requirements, as well as operator written and practical test requirements.

Disadvantages of this organizational approach include:

a. It may conflict with the principal mission of the laboratory (i.e., it would no longer be a "pure" testing facility).

b. It would drain the laboratory of experienced personnel if they were used to initially staff the laboratory certification branch.

c. Interfacing with other OMSAPC activities would still be required:

   1. Certification Branch of Certification and Surveillance Division -- for review of certified test data sent in by the laboratory

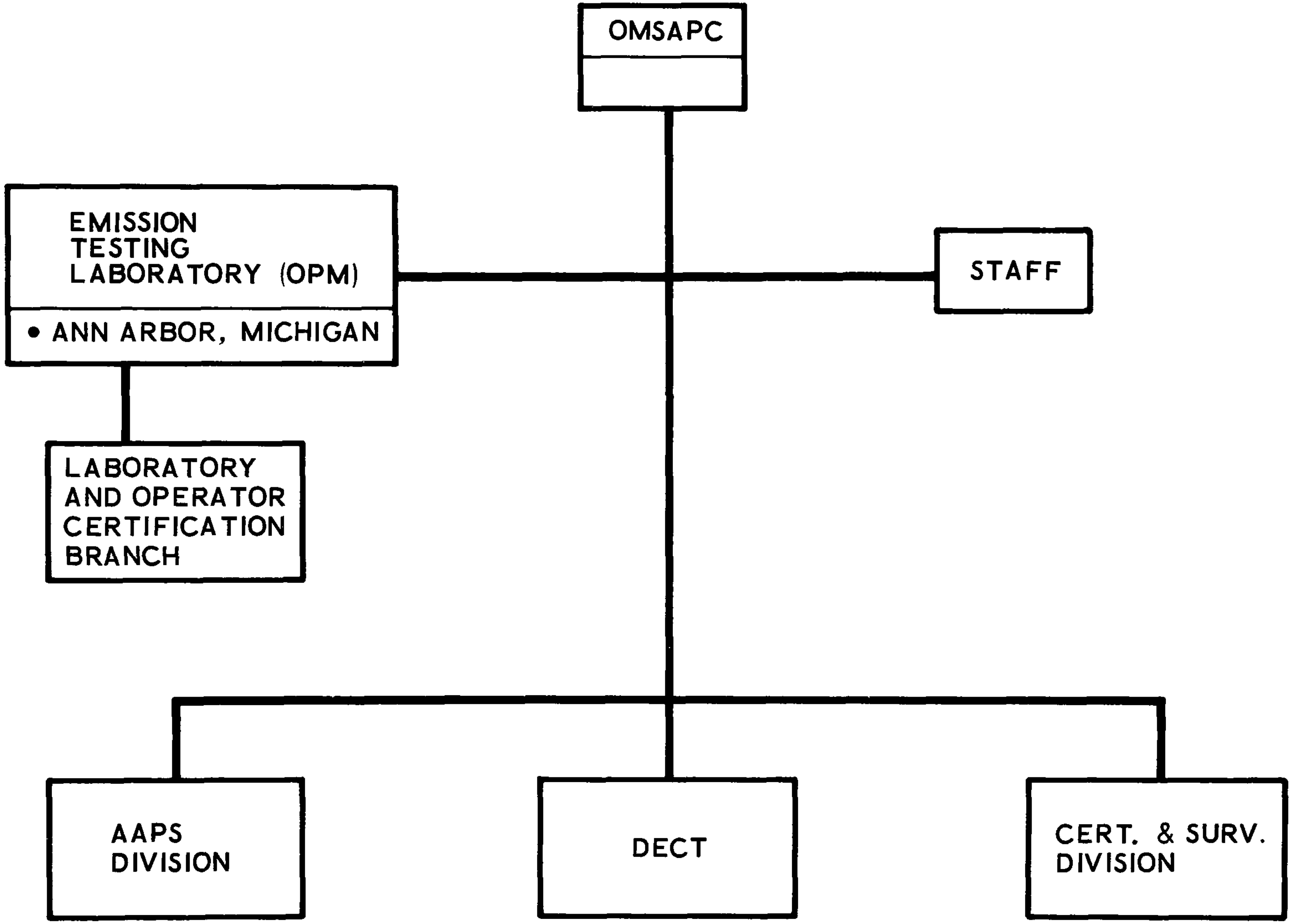


Figure 6-4. Option B Organizational Structure

2. DECT -- for coordination of test and evaluation procedures, especially for after-market or retrofit tests

d. It adds to the management responsibilities of the OPM director.

6.4.3 Option C

Figure 6-5 depicts the laboratory and operator certification group as a branch within the Certification and Surveillance Division. The possible advantages of this arrangement include:

a. It places all "certification" functions (vehicles, laboratories, operators) in the same division.

b. Personnel familiar with the quality control aspects of certification testing may be available to initially staff the new branch.

Disadvantages of this approach include:

a. It may be in conflict with a principal mission of this division (i.e., the certification of emission test vehicles in conjunction with the emission test laboratory).

b. It would require replacement of any personnel used for initial staffing of the new branch.

c. Interfacing with other OMSAPC activities would still be required:

   1. Emission Testing Laboratory (OPM) -- for coordination of facility, equipment and operational requirements

   2. DECT -- coordination of test and evaluation procedures, especially for after-market or retrofit tests

d. It adds to the management responsibilities of the division director.

6.4.4 Option D

Figure 6-6 shows the laboratory certification group as a branch of DECT. The possible advantages of this arrangement include:

a. It places the laboratory certification group personnel (i.e., inspectors) in close working contact with: regulations development personnel, test and evaluation personnel, and after-market or retrofit device personnel.

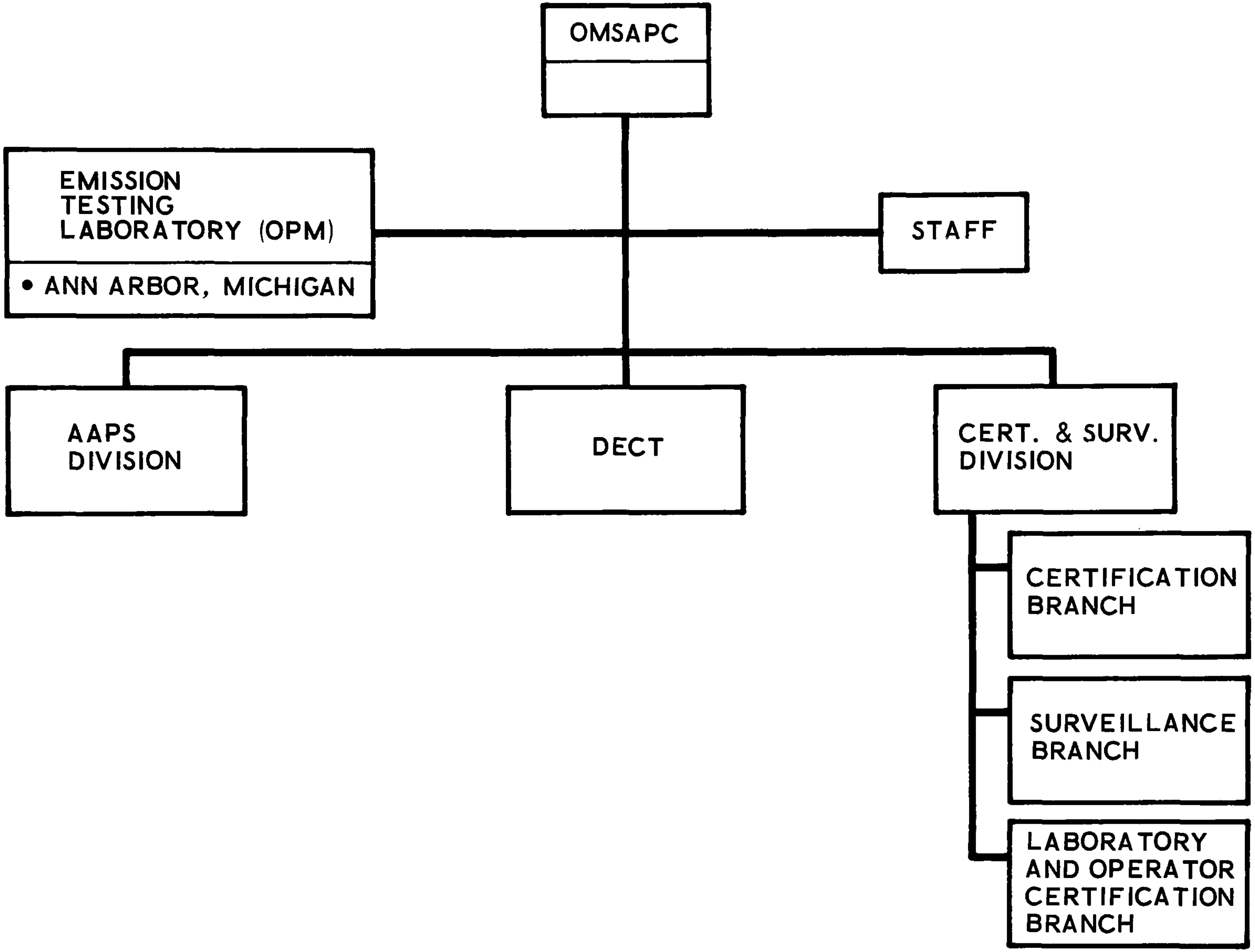


Figure 6-5. Option C Organizational Structure

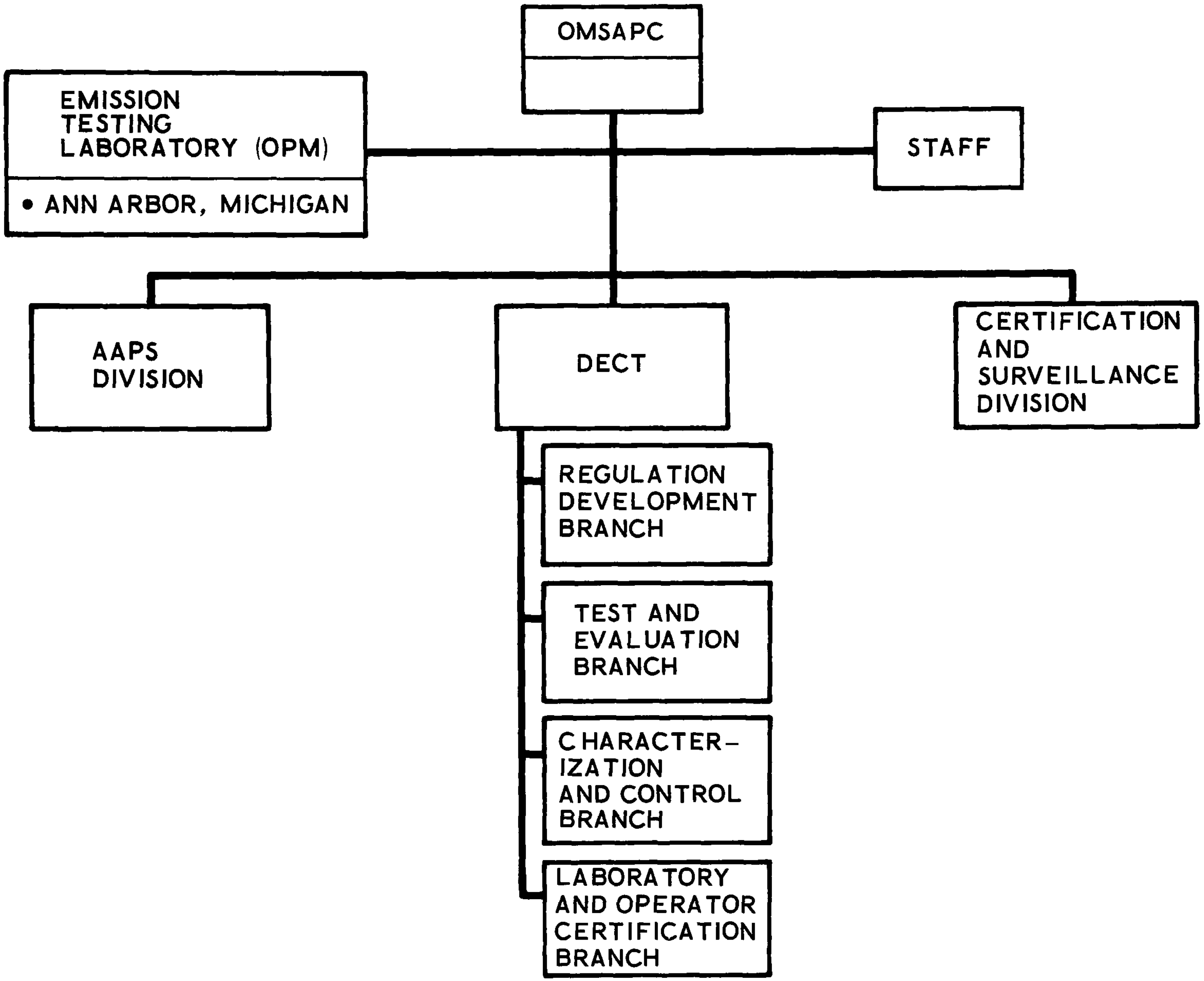


Figure 6-6. Option D Organizational Structure

b. The personnel involved in formulating the laboratory and operator certification program are located in this division and may be available to help staff the new branch.

Disadvantages include:

a. It may conflict with the principal mission of this division of regulations development.

b. It would require the replacement of any personnel diverted to staff the new branch.

c. It would require interfacing with other OMSAPC activities:

   1. Emission Testing Laboratory (OPM) -- for coordination of facility, equipment, and operational requirements

   2. Certification and Surveillance Division -- for review of test data sent in by the laboratory

d. It adds to the management responsibilities of the DECT director.

6.4.5 Overview Comments

As the preceding sections have noted, each of the four options has certain desirable features and certain undesirable features from an overall management organization viewpoint. Chief among these are:

a. All options require either initiation or continuation of interfacing with existing OMSAPC activities.

b. All options except A increase the responsibilities of a division director.

c. All options require drawing on at least some experienced EPA personnel to initially staff the new laboratory and operator certification group, whether it has branch or divisional status.

d. Option A provides the clearest line responsibility for the new function; it could draw on all existing divisions for initial staffing and thus spread the restaffing load over a broader base.

e. Option A would appear to require a certain minimum level of certification activity to justify divisional status.

f. Options B, C, and D all have a logical basis for effectively carrying out the laboratory certification program. The group could be advanced to divisional status at a later date if the work load warranted.

g. Options B, C, and D may present conflicts with the primary assigned functions of the division concerned.

It would seem premature to exercise option A initially, since the anticipated work load during the early stages may not justify divisional status. Therefore, the choice should be between options B, C, and D. The selection of the appropriate option should consider the possible functional conflicts noted in g above, as well as the possibility of best matching available talents in the various OMSAPC divisions with the personnel requirements of the laboratory certification group. At present there is no clear-cut preference for any of these alternatives.

This analysis is intended to outline some of the obvious merits and problems with various organizational concepts. The selection of the actual organizational form may consider other factors not addressed in this discussion.

6.5 SPECIAL PROBLEMS

This section considers in more detail certain problem areas that were mentioned in earlier sections but were not discussed fully at the time since they were corollary to the principal analysis activity.

6.5.1 Inspector Training

It was emphasized in Section 6.2 that recent "hands-on" experience with emissions test equipment should be a prerequisite for assignment to the position of inspector. It is unlikely that a sufficient number of personnel will be available initially who meet this requirement and who also satisfy the other requirements for appointment as an inspector. Accordingly, a training program would have to be instituted prior to full-scale implementation of the certification program.

This training program should most likely operate in the following manner. It would be applicable only to personnel whose background indicates that they would be suitable for assignment as an inspector. The program would consist of working in the EPA Testing Laboratory (OPM) at Ann Arbor, under the direction of normal laboratory line supervision. The work should entail basic instrument and equipment operation, calibration, maintenance, and trouble-shooting. For a person with no prior experience in these specific areas, but who possesses the proper technical background and good motivation, it is estimated that about 3 months full-time work under these conditions would be required to establish the necessary knowledge and skills. It would be good practice to require each trainee to successfully take the regular written and practical operator's exams at the end of this program.

In addition to this formal initial training program, it would appear very desirable to have every inspector receive an annual briefing or check out given by personnel from the Ann Arbor Testing Laboratory. This would cover latest developments in technique, equipment, and instrumentation, and would include such hands-on work by each inspector as may be required to familiarize him with these new procedures.

6.5.2 Program Start-Up

The subjects of concern here are the possible conflicts that might arise on program start-up, due to initial overloading of the capabilities of the laboratory certification group. For example, consider the worst case occurrence and assume that all 17 laboratories of the near-term scenario were to apply immediately upon announcement by EPA of implementation of the certification program. The questions to be investigated then become: (a) how long would it take to complete the initial application processing and inspection of all 17 facilities, and (b) how can the resulting asymetrical renewal schedule (24-month cycle) be adjusted to distribute the certification work load uniformly over each calendar year.

The information generated in Section 6.3.3.2 was used to construct bar charts representing the calendar time required to perform each phase of initial application processing and inspection. An analysis was performed for the most conservative case (man-hour factor of 2.0 in all office work phases) with two three-man teams working on the processing of the application. Each team was assumed to work on two applications concurrently. The analysis resulted in an estimate of 11.6 months required to complete the processing of all 17 initial applications. This time allotment accounts for all unannounced and periodic inspections which come due during the 11.6 months for those laboratories that receive early certification. For the purpose of this analysis, unannounced inspections at each facility were assumed to be spaced at 6-month intervals, starting about 3 months after award of certification. The seventh man on the inspection staff was assumed to be required to maintain a continuous complement of two three-man teams, and to administer the operator tests during the inspection visit.

Similar analyses were performed with man-hour factors for the office work phases of 1.5 and 1.0, respectively. The computed time periods to complete the certification of 17 laboratories were 9.1 and 6.8 months, respectively.

The situation may arise in which it is desirable to temporarily augment the inspection staff during the start-up period by borrowing personnel from other branches or divisions of OMSAPC. This case was investigated by assuming that enough additional personnel were available to permit continuous activity by three three-man teams. An average case man-hour factor of 1.5 was assumed, resulting in a time requirement of 5.7 months to complete the processing of all 17 applications.

In summary, under the assumed worst-case condition of simultaneous application of 17 laboratories, the initial certification process can be completed in between 6 months to 1 year, the exact value depending on the degree of technical complication encountered in application processing, and on the availability of temporary support personnel for the laboratory certification staff. This does not appear to be an unreasonable schedule, and it gives a good indication that in actual practice the start-up process should not present any major roadblocks to efficient program implementation.

It is seen, however, that a likely result of the initial certification schedule would be to produce an undesirable, asymetrical certification cycle. That is, there would be a preponderance of renewal applications and inspections coming due within a period of a few months to a year. This can be avoided if EPA retains the discretionary option of extending the certification period of selected facilities. This device can be used to smooth out the certification cycle and produce a more uniform work load for the laboratory certification group. An approach of this sort would in any event be necessary to achieve the proposed certification schedule for the European laboratories described in Section 6.3.3.3. During any such period of certification extension, all other control activities (periodic and unannounced inspections, and quarterly measurement of EPA "unknown" gas cylinders) would continue at the normal, or perhaps even an accelerated schedule.

6.5.3 Inspection Travel Schedule

In Section 6.3.3.3 the computed inspection travel time was shown to be 72 days per year per inspector (with possible reduction to 68 to 69 days in actual implementation). This corresponds to 30 to 32 percent of total time spent in travel. This is a high number; accordingly, it is of interest to compare this with the travel schedule of other certifying agencies, and also to investigate what options are available to decrease this figure, should it prove to be unsatisfactory.

The only valid comparison is that with the AEC Office responsible for licensing of operators for nuclear power plants. This activity has a single national office, with scheduled visits to nationwide facilities. It has nearly the same central staff as that computed for the EPA Laboratory Certification Program. The staffing of this AEC office is: one supervisor, three group leaders (these are senior examiners, and they participate in field work to the same extent as examiners), five examiners, and two clerical. Plus 21 consultants nationwide who participate in administering exams. Their average work load is about 1/5 that of the examiner position.

Based on an effective examiner staff of $8 + \frac{21}{5} \approx 12$, the field load (defined as the total on-site inspection/test time per field level staff position) of the AEC office is estimated to be closely comparable to that for the proposed EPA staff. Each of the eight examiners from the AEC national office makes an average of one trip per month. Each trip normally lasts 1 week, for an average of 60 days on the road per year per examiner, which amounts to about 27 percent of total time spent in travel. Considering the comparable field loads of the two activities, it is seen that the lower AEC travel burden is attributable to the use of the 21 consultants to reduce the number of trips required of the central staff. Taking this into account, the travel time for the EPA staff is in line with its field load.

Notwithstanding the above conclusion, it is of interest to examine what alternatives may exist to reduce this total travel time per inspector. At one extreme is the FAA structure described in Section 2.2.2, with its management chain of command extending from a single national office to 12 regional offices, with each of the latter having jurisdiction over a number of district offices of relatively small geographical coverage. All actual certification activity is executed at the district office level, thereby eliminating inspector travel time as a significant consideration. This is an example of a mature certification program which has a very widespread base of application. It is clear that such a structure is beyond the scope of EPA laboratory certification activities.

The AEC office represents an intermediate case, in which the consultants perform a somewhat analogous function as that of the FAA district office. This is an example of a less mature (but well established) certification activity, applied to a much smaller base than that of the FAA, but one which is still considerably larger than that of the proposed EPA activity (in terms of number of facilities concerned). This approach is not considered practicable for EPA needs, for the following reasons.

First, there may not be an external group of qualified persons to act as consultants or part-time staff. There may, in certain cases, be EPA regional offices in the vicinity of a certified laboratory, but it is unlikely that qualified personnel would be available here. It is likely that the certified laboratory program would have to be in operation for more than a few years before this approach could be implemented. Finally, even if the approach could be implemented immediately, it would not appear desirable to do so for some years, at least. During the formative stage of a new activity such as this, it is essential that all the staff be under central direction, and there should be no communication barriers among the various staff members. The day-to-day operational procedure must evolve as a result of feedback at both the office and field levels concerning the daily aspects of program implementation.

A reduction in the number of inspections could be attained at the expense of certification control, however, this is considered to be unacceptable. Accordingly, the only feasible way to reduce inspector travel load would be to increase the size of the inspection staff. Adding an eighth inspector would reduce the annual travel time to about 60 days per inspector; that is, identical to that of the AEC office. This may well be a desirable step to take, although it should be noted that, in all other respects (including the inspector rotation requirements discussed in Section 6.3.1) an inspector staff of seven appears adequate to meet all program requirements for the near-term scenario of 17 certified laboratories.

6.5.4 Extension of Analysis Results to Longer-Term Implementation

As mentioned in Section 6.3.2, it is considered likely that some 26 independent laboratories could be involved in this program after a few years. It is therefore of interest to estimate the adjustments in the laboratory certification group required to handle this increased work load. A review of the analysis details used to obtain the results for the near-term scenario of 17 laboratories leads to the conclusion that, to a good approximation, both personnel staffing and travel expenses would be increased in direct proportion to this increase in the number of certified laboratories. That is, a factor of about 1.5 should be applied, giving a staff requirement of 11 to 13 inspectors, which would probably require a total of two or three supervisory or administrative positions. Annual travel expenses (at present rates) would be approximately $94,000.

6.6 COMPARISON WITH COST OF EPA-OPERATED CERTIFICATION TEST FACILITIES IN EUROPE AND JAPAN

An alternative to certification of independent foreign testing laboratories would be for EPA to own and operate an emission testing laboratory in Europe and in Japan, to perform certification testing in those areas. A cost estimate was performed for such an arrangement, for comparison with the proposed laboratory certification program for foreign laboratories and also for comparison with existing certification costs at the EPA Ann Arbor Testing Laboratory. The estimate was performed for one laboratory in Europe and one in Japan, to handle near-term vehicle testing rates of 360 and 210 certification tests per year, respectively. The cost estimate for these foreign facilities was structured to the same format as that used by EPA to determine cost of certification testing at Ann Arbor. These cost estimates do not represent official EPA figures, however. They are estimates prepared during this study based on general guidance from EPA.

The workload and staffing estimates for these laboratories are shown in Table 6-14. The organization structure upon which these numbers are based is described below.

It would appear to be essential that there be one full-time, professional level EPA employee responsible for each dynamometer test cell. It is the responsibility of this person to ensure that all quality control

Table 6-14. EPA Laboratory in Europe and Japan; Workload and Staffing Estimates

Test, Facilities, and Staff	Europe	Japan	Combined
Number of Certification Tests per Year	360	210	570
Number of Dynamometer Test Cells	2	1	3
Staff			
Supervisor	1	1	2
Emission Test Specialist	2	1	3
Manufacturer Liaison	3	2	5
Subtotal, EPA Staff	6	4	10
Operators[a]	7	4	11
Total Personnel[b]	13	8	21

[a]Possibly local nationals, provided on contract basis
[b]Exclusive of clerical

aspects of the test cell are properly followed. This includes equipment and instrumentation operation, calibration, maintenance, and record keeping. This person must monitor all these activities, and be able to verify at all times that everything in the test cell is ready for a certification test, or if not, what must be done to put it in that condition. This position is denoted in Table 6-14 as "Emission Test Specialist."

The "manufacturer liaison" classification is somewhat self-explanatory, in that these personnel must coordinate certification testing with the manufacturers' schedules, and work on other details concerned with certification paperwork. One of these persons must witness each certification test and sign it off as being a valid and properly conducted test. These people are also U. S. citizens and EPA staff employees.

The test operators may also be U. S. citizen EPA employees, but would most probably be local nationals working under the supervision of the EPA staff, and could be supplied on a contract basis from a local organization or agency. These same comments apply to the clerical workers.

The cost estimates for this laboratory structure are shown in Table 6-15. A brief description of the basis on which each type of charge was computed is given in the following discussion.

Table 6-15. Cost Estimates for EPA Laboratories in Europe and Japan

Cost Category	Cost Estimate, in dollars		
	Europe	Japan	Combined
Staff Burden	280, 000	172, 000	452, 000
Computer Charge	36, 000	21, 000	57, 000
Facility Rent	200, 000	140, 000	340, 000
Program - Support Fund	24, 000	14, 000	38, 000
Equipment Depreciation	20, 000	10, 000	30, 000
Total	560, 000	357, 000	917, 000
Cost per Certification Test	1560	1700	1610

The staff burden was based on a fixed dollar rate salary for each position (exclusive of clerical). The salary rate used was chosen to be 10 percent higher than the comparable figure used in conjunction with the EPA Ann Arbor testing laboratory. Computer-related costs were assumed to be fixed at $100 per test. In practice, data reduction procedures and costs may vary considerably for a small laboratory at a foreign location. The fixed rate assumed here is intended to reflect one reasonable alternative. The estimate for facility rental was arrived at on the basis of a comparable dollar figure per test cell, as that allocated at the Ann Arbor facility. The program support fund is an overhead related item, and it was based on an equivalent rate as that allocated to the Ann Arbor testing function. The equipment depreciation value applies primarily to emissions test equipment and instrumentation, and was again selected on a comparable basis to that attributed to the EPA Ann Arbor testing laboratory.

It is seen that, by this method of accounting, the total cost to perform 570 certification tests in these two foreign laboratories is approximately $917, 000, or $1610 per certification test. The equivalent figure for EPA Ann Arbor testing (using a similar accounting system) is approximately $1000 per test to perform about 3100 certification tests annually. The higher cost per test of the foreign laboratories is a result of the inherently lower personnel and equipment utilization efficiency in a small facility compared to that of a much larger one. The analysis performed herein indicates that not until the volume of testing can justify at least three or four test cells per test laboratory that costs per test could become significantly closer to the Ann Arbor level.

The cost of the laboratory certification program for 17 independent laboratories (including four in Europe and one in Japan) may be estimated for a staff of seven inspectors plus one supervisor at an annual burden rate of $50, 000, plus travel costs of approximately $61, 000 per year, to yield a total annual cost of approximately $461, 000.

The cost of certifying just the four European and one Japanese independent laboratories as part of the overall laboratory certification program is estimated to be approximately $156, 000 per year. Thus, the proportionate share of staff burden attributable just to the foreign laboratories is approximately 30 percent, or an annual burden of approximately $120, 000. The travel cost allocable to the foreign laboratories is approximately $36, 000 per year.

APPENDIX A

SIGNIFICANT MEETINGS AND COMMUNICATIONS

(Telecons except as noted. Many follow-ups with information by mail, not separately recorded.)

Part 1 - Federal Aviation Agency

Date	Office and Function	Personnel Contacted
4 April and 9 April 1974	National Office, Flight Standards Division Management Branch	Leo Clark David Custiss
March - May 1974	Western Regional Office, Flight Standards Division Los Angeles, California Meeting on 4 April plus several telecons	John Winder Joe Hornsby Ben Wells
March - May 1974	Santa Monica General Aviation District Office Santa Monica, California Visit of 12 March plus several telecons	W. L. Hawk C. C. Sargent Helen Jacobs
6 March and 2 April 1974	Long Beach General Aviation District Office Long Beach, California	E. V. Curry W. Spooner
March - April 1974	Records and Testing Branch, General Aviation Section Oklahoma City, Oklahoma Separate offices contacted for: written exam preparation, flight ratings, exam grading, exam printing	Mr. Phipps Stewart Robinson Robert O'Neil W. P. Duer John Freeman
9 April and 15 April 1974	National Office for Training of Aviation Technicians Oklahoma City, Oklahoma Telecon plus meeting at Los Angeles	Keith Teasley
9 April and 10 April 1974	Northrop Institute of Technology Aviation Technician School Telecon plus visit	Anthony Vai

APPENDIX A, Part 1 (Continued)

Date	Office and Function	Personnel Contacted
12 April 1974	Los Angeles Trade-Technical College (Part of L. A. Community College System) Training of aviation maintenance technicians	Office Staff
18 April 1974	Attended annual meeting of ATEC (Aviation Technician Educational Council) at Los Angeles	Presentation by Dr. David Allen, U.C.L.A., re survey for FAA on occupational status of aviation technicians

Part 2 - Other Agency Contacts

19 April 29 April 31 July 1974	Atomic Energy Commission Office for Licensing of Operators for Nuclear Power Plants Bethesda, Maryland	Paul Collings, Chief
March - May 1974	California Bureau of Automotive Repair Sacramento, California	A. Winston, Manager Mary Jeters Howard Posner
5 March and March - May 1974	California Department of Public Health Laboratory Field Service Licensing of clinical laboratories and clinical laboratory technologists Los Angeles Office and Berkeley (main) Office	Charles Lange Barbara Ralston Jean Puffer Rodney Hamblin
1 April 1974	Pennsylvania State Police Headquarters Harrisburg, Pennsylvania Enforcement of Vehicle Safety Inspection Program	Capt. Robert Dunham
April - May 1974	Pennsylvania Department of Transportation Bureau of Traffic Safety Harrisburg, Pennsylvania Administration of Vehicle Safety Inspection Program	Mrs. Z. Luft, Assistant Chief

APPENDIX A, Part 2 (Continued)

Date	Office and Function	Personnel Contacted
22 March 14 June 1974	New Jersey Department of Education Trenton, New Jersey Handling vocational instruction of auto mechanics for New Jersey Department of Environmental Protection	Tom McKenna
4 March 1974	California Air Resources Board El Monte, California Contact was in relation to former CARB laboratory certification activity.	Gerhard Haas

APPENDIX B

APPLICATION FOR INITIAL LABORATORY CERTIFICATION

Sub-Part Rating: A (light duty vehicle, gasoline fueled)
Test Procedure: 1975 Model Year Vehicle

There are many requirements which a certified laboratory must meet, specified in Part 85 of Title 40, Code of Federal Regulations (40 CFR 85), sub-parts A and N. These requirements are all incorporated by reference in this application. It is the responsibility of the applicant to be familiar with the current promulgations of each sub-part. Certification, if granted, is based on the postulate that the laboratory follows these procedures of 40 CFR 85 exactly, except as may be described otherwise in this application.

Accordingly, it is imperative that the applicant laboratory describe any such procedural differences in the application. If there is no part of the application form which covers a particular variance, the applicant should describe the variance on a separate sheet and attach to the completed application. Failure to comply with this requirement may result in denial or suspension of certification.

A. <u>General Laboratory Operation</u>

1. a. Name of laboratory (exactly as desired on certificate)

   b. Address

2. Ownership

   a. Type (corporation, institute, association, governmental entity, etc.)

   b. Exact name of corporation, institute, association, etc., owning or controlling laboratory

   c. Name and title of person(s) authorized to represent laboratory in all transactions with the Administrator.

   d. List names of all members of board of directors, or other controlling group

3. Business Activity

   a. Brief history of lab. This should be one, or at most a few paragraphs, delineating the main steps in the origin of the laboratory and its major evolutionary changes (if any) to its present state

   b. Enclose financial statement, or other information, showing basic financial status of laboratory. This may consist of information normally distributed for this purpose to directors or shareholders

   c. Describe approximate level of emissions measurement activity for

      (i) facility for which this application is made

      (ii) all laboratory operations of parent organization (if applicable)

4. General Facility

   a. Brief description of physical plant, and its location

   b. Provide approximate overall inventory of emission test equipment, such as number of dyno test cells suitable for certification testing of the sub-part rating applied for

   c. Approximate number of personnel at the facility for which this application is made

   d. Does local law, or laboratory policy, or any other condition, forbid or render impractical, the right of entry of EPA inspectors as described in 85.1306(b)?

      Yes ☐

      No ☐

      If answer is yes, describe the nature of the law or other hindrance to this right of entry

B. Certified Personnel

List all operators certified by the Administrator for certification testing of the sub-part rating for which this application is made

Name	Certificate Number	Date of Certification Expiration

In the following equipment sections of the application, each item applies to all of the equipment of that type to be used in certification tests. Thus, the section on CVS pump calibration must cover all the CVS pumps which the applicant proposes for use in certification testing. The applicant must utilize some form of in-house identification numbering (I. D.) system in each case. The purpose of this I. D. system is to provide a simple unambiguous designator for each key equipment item as requested in the application form. This I. D. number is to be used in all further correspondence between the laboratory and the Administrator, and forms part of the certification conditions. The I. D. number must be traceable, in laboratory records, to manufacturer, model number, and serial number, or any other designation required to completely define a specific piece of equipment. This in-house numbering system may, for example, be keyed to each separate dynamometer test cell.

C. Exhaust Emissions Measuring Equipment

1. Exhaust Gas Handling System

a) Provide schematic drawings patterned after Figures A 75-1 and A 75-2 of 40CFR85, for each test cell, if applicable. Show and label all of the following components used:

valves (schematic must indicate type of valve, i.e., flow control, flow selector, check, relief, etc.)

filters
pumps
blowers
flow meters
pressure gages and manometers
temperature probes
sampling probes
quick disconnect fittings

Two schematics are required:

i) Exhaust Gas Sampling System, which must show all components from vehicle tailpipe, to exhaust of CVS pump to atmosphere, including dilution air inlet and bag samples.

ii) Exhaust Gas Analysis System, which must show all components from the sample bag to the sample vent to atmosphere from each analyzer. It must also show valving arrangement for admitting zero, span, and calibration gases to each analyzer.

If either or both schematics of (i) and (ii) are identical in every respect to those of figure A 75-1 and A 75-2, respectively, this may be so stated, and that schematic deleted. In this case, all components of the deleted schematic must be numbered in accordance with Figure A 75-1 or A 75-2.

b) Itemized Component List

List each item of paragraph a), showing

part number on schematic

type of component (i.e., valve, needle; pump, bellows; etc.)

manufacturer

model number, including in-house I.D. for CVS pump

materials of construction for all parts which contact the sample stream prior to analysis, including "o" rings, valve seats, filter material, etc.

specify materials used for all tubing, hoses, and ducting

c) CVS Pump Calibration

i) Is procedure of Appendix III, Part 85, Sub-part A followed exactly ?

Yes ☐

No ☐

If answer is no, describe method used, giving schematics, equipment list, and detailed procedure

ii) Enclose most recent calibration curve, including a tabulation of the coordinates of each calibration point.

d) CVS System Verification

i) Procedure used

(1) propane injection ☐
(2) CO injection ☐
(3) Critical flow device ☐
(4) Other ☐

If blocks (3) or (4) checked, describe detailed procedure used, including schematics and equipment list.

ii) Enclose results of most recent verification

2. **Gas Analysis Instruments**

a) **Instrument Inventory**

i) List each instrument to be used in certification tests, giving

1. type of gas analyzed
2. manufacturer
3. model number
4. in-house I.D.
5. any significant in-house modifications of sample train or electronics

ii) Refer to Reference A, which is a listing, by manufacturer and model number, of all analyzers approved by EPA for certification use. Only instruments listed in Reference A may be used in certification tests

iii) Enclose most recent calibration curve(s) for each analyzer listed in sub-paragraph 2. a) (i). This must include a tabulation of the coordinates of each calibration point.

3. Calibration and span gas inventory

a) List each gas used in conjunction with any analyzer which is to be utilized in certification tests

This listing should show analysis gas, diluent, manufacturer, manufacturer's reported analysis and tolerance, concentration measured by EPA (if applicable), cylinder size, and in-house I.D.

Indicate those cylinders which are primary NBS reference materials, or traceable to within 1% of NBS reference materials

b) Procedure used for naming gases

Appendix VIII, Subpart N ☐

Other (describe on separate sheet ☐

4. Data Link

a) Identify manner in which the analyzer response (calibration, zero and span, and sample measurement) is recorded in a permanent form

recorder ☐

digital printer ☐

computer printout ☐

other (specify) ☐

Provide manufacture and model number of equipment used

b) If a computer printout is used :

i) provide functional block diagram of signal path from analyzer to computer printout. This should be in sufficient detail to define the number and kind of signal processing steps involved, i.e., A/D conversion, digital data transmission, multiplexing, etc. A brief written description should accompany the diagram, to prevent ambiguity in following the signal processing.

ii) describe procedures for calibrating and/or verifying proper functioning of the data link, and the frequency at which these procedures are performed

D. Dynamometers

1. Inventory

List each dynamometer to be used in certification tests. This should include

a) manufacturer and model no. and in-house I. D.

b) basic design or performance parameters

i) roll and frame

roll diameter

roll axial spacing

maximum vehicle axle weight

ii) power absorption unit

type (water brake, etc)

power absorption range - preferably include curves of maximum and minimum absorbed power vs dyno speed

iii) inertia simulation unit

type (flywheel, etc.)

range of vehicle inertia simulation list incremental inertia selection values, if applicable

c) describe any significant in-house modifications

2. Calibrations in each case, give calibration schedule; describe detailed procedures including schematics, plots, and equipment list, as appropriate

a) torque readout

b) roll speed

c) dyno friction

If procedure of Appendix II, Part 85, sub-part A is followed exactly, this may be so stated with no additional description required

E. Evaporative Emissions Measurement

1. Canister. Provide dimensioned schematic drawings of the activated carbon traps in use. If the canister is identical to that of 85-075-21, this may be so stated and the drawing deleted

2. Balance (for weighing activated carbon trap)

    manufacturer

    model no.

    calibration procedure and schedule

F. Vehicle Preparation

1. Driving Schedule (for 1 hour pre-test drive) show route, mileage, typical speeds, proximity to lab

2. Temperature controlled soak rooms

   Give free floor space, available for test vehicle soaking, which is temperature controlled as specified in 85.075-12 and -13.

G. Fuels Handling

1. Storage

   a) specify the delivery unit in which fuel is received from the supplier, i.e., 55 gallon drum, tanker truck transfer to holding tank, etc. If more than one delivery unit is used, specify for each type the approximate percentage of total annual fuel received

b) specify the storage unit from which fuel is routinely drawn for lab use, if this is different from the delivery unit defined above

2. Temperature and Venting Control of Storage Vessels:

   Specify for each type of storage listed in G 1. a) and b), for each of the following conditions

   a) long term storage between withdrawals

   b) short term, prior to and during withdrawal

3. Provide a detailed schematic of fuel plumbing from delivery unit to dispensing point in lab

4. Describe procedures used to clean and/or purge fuel supply system in the case of a change in fuel type

APPENDIX C. INDEPENDENT TEST LABORATORIES DATA

Table C-1. Emission Test Capability of Independent Laboratories

Part 1 - Information acquired from domestic independent laboratories

Date	Organization	Personnel Contacted	Location of Laboratory	Emission Test Capability[1]	Facility Classification[2]
18 July 1974	Automotive Environmental Systems, Inc.	Jim Sachtschale	7300 Bolsa Ave. Westminster, Calif. 92683	1 dyno, 1 CVS, 1 gas analysis	A
			10723 Indianhead Blvd. St. Louis, Mo. 63132	1 dyno, 1 CVS, 1 gas analysis	A
18 July 1974	Automotive Research Associates	Larry Smith	5404 Bandera Road San Antonio, Texas 78238	2 dyno, 2 CVS, 1 gas analysis (used in common to both test cells)	B
18 July 1974	Automotive Testing Laboratories	Douglass Liljedahl	19900 E. Colfax Denver, Colorado	2 dyno, 2 CVS, 2 gas analysis	C
19 July 1974	General Environments Corp. (formerly General Testing Laboratories)	John Kochis	6840 Industrial Road Springfield, Virginia 22151	2 dyno, 1 CVS, 1-3/4 gas analysis	C
			Hartwood, Virginia	1 dyno, 1 CVS, 1 gas analysis	A
18 July 1974	Olson Laboratories, Inc.	Jerry Coker	421 E. Cerritos Blvd. Anaheim, Calif.	3 dyno, 3 CVS, 1 mass gas analysis (used in common to all test cells) plus 1 volumetric gas analysis	D
			11665 Levan Road Livonia, Mich. 48150	2 dyno, 2 CVS, 2 gas analysis	C
			216 - 14th Street, NW Atlanta, Georgia	1 dyno, 1 CVS, 1 gas analysis	A
			1601 A Harmer Levittown, Penna.	1 dyno, 1 CVS, 1 gas	A

Part 2 - Laboratories not contacted during this program; information on emission test capability obtained from other sources

Organization	Location of Laboratory	Emission Test Capability[1]	Facility Classification[2]
Southwest Research Institute	8500 Culebra Road San Antonio, Texas 78284	1 dyno, 1 CVS, 1 gas analysis	A
MIRA (Motor Industry Research Association)	Nuneaton, England (80 air miles NW of center of London)	2 dyno, 1 CVS, 2 gas analysis	C
UTAC (Technical Union of Automobile, Motorcycle, and Cycle Industries)	Montlhery, France (18 miles S. of Paris)	1 dyno, 1 CVS, 1 gas analysis	A

Notes to Parts 1 and 2

(1) Emission test capability applies only to LDV testing. The equipment referred to is that suitable for 1975 FTP, sub-part A; either presently in use or attainable from equipment and instrumentation on hand.

Many of these laboratories have extensive supporting and auxiliary equipments which are not listed here.

(2) These are standardized facility classifications used in determining EPA certification workload. See Table 6-1 for definitions.

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

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16. ABSTRACT

An analysis was made of the work task activities that would be required of an EPA group in the process of implementing a program whereby independent testing laboratories (and their test operators) would be certified as to their capability to perform vehicle exhaust emission tests. The results indicate that a laboratory certification group consisting of seven inspectors and one supervisor is adequate to perform the certification activities for 17 laboratories and 34 operators (two operators at each laboratory) which were assumed to be early applicants to the proposed certification program. These laboratories were composed of 12 in the continental U.S., 4 in Europe, and 1 in Japan. The work task activities examined included all functional tasks required for initial and renewal certifications as well as on-going quality control of both laboratories and operators. The total annual cost of such a laboratory certification program was estimated to be approximately $460,000 (including travel costs).

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Pollution	Air Pollution Control	05 A
Test Laboratories	Emission Testing	13 B
Test Operators	Certification Functions	14 B
Certification	Staffing Requirements	
Costs	Management Organization	

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